CACTUS HILL, RUBIS-PEARSALL AND BLUEBERRY HILL: ONE IS AN ACCIDENT; TWO IS A COINCIDENCE; THREE IS A PATTERN – PREDICTING "OLD DIRT" IN THE NOTTOWAY RIVER VALLEY OF SOUTHEASTERN VIRGINIA, U. S. A.

Submitted by Michael Farley Johnson to the University of Exeter
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I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

Signature…………………………………………………..

Abstract

This thesis covers more than thirty years of the author's research into the Paleoamerican period of the Middle Atlantic Region of North America, including the last 19+ years of focused work on the Cactus Hill site (44SX202) and replication of the Paleoamerican occupation discovered there. Using a landform and geology based predictive model derived from the Paleoamerican occupation at Cactus Hill, the author directed preliminary archaeological testing in three other areas of the same Nottoway River Valley, where Cactus Hill is located. These areas were the Barr site, located 11 miles (18 km.) downriver from Cactus Hill; the Chub Sandhill Natural Resource Conservation Area, located 19 miles (30 km.) downriver from Cactus Hill; and the Blueberry Hill site (44SX327), located approximately 1,000 feet (300 meters) east of Cactus Hill. The latter two produced OSL dated, pre-Younger-Dryas landforms, as predicted. The Rubis-Pearsall site (44SX360), located in the Chub Sandhill preserve also produced a buried Paleoamerican, Clovis age cultural level confirming the model. In addition to the OSL dates, Blueberry Hill also produced a distinct and apparently discrete activity surface with a possible pre-Clovis age Cactus Hill point at the same depth as the Paleoamerican levels at Cactus Hill and Rubis-Pearsall.

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List of Abbreviations

AB/BA = transition soil between A and B soils (E?)
AMS = accelerator mass spectrometer
Ap = plough disturbed soil
ASV = Archaeological Society of Virginia
BBH = Blueberry Hill (site)
BC = B and C soil mix
Bw = mineral (iron) stained soil
Bt = argillic soil
C = sediment
C-14 BP = Radiocarbon years before present
CH/JA = chert/jasper
CJDE = chert or jasper debitage
CPSA = sand tempered pottery
cal BP = calibrated years before present (using OxCal)
D.C. = District of Columbia
E = eluvial (soil)
FCR = fire cracked rocks
Ft. Fort (as in Ft. Nottoway point)
g = glayed soil (clay paleosol)
LGM = last glacial maximum
NAGPRA = Native American Graves Protection Act
NC = North Carolina
NRS = Nottoway River Survey
OCR = oxidizable carbon ratio
OSHA = Occupational Safety and Hazard Administration
OSL = optically stimulated luminescence
OTDE = other (unidentified) debitage
PB = coarse sand/pebbles
ppm = parts per million
PS = poorly sorted (sand)
QUDE = quartz debitage
QZDE = quartzite debitage
QZFR = quartzite fire cracked rock
rcbp = radio-carbon (years) before present (as quoted)
R-P = Rubis-Pearsall (site)
Sav. R. = Savannah River point type
USGS = United States Geological Survey
VA = Virginia
VPS = very poorly sorted (sand)

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Foremost, thanks to Gail, my wife of 44 years, who for 20 years put up with my research on the Cactus Hill model, which was done over and above my full time job as Fairfax County Archaeologist. She also was the force driving me to complete the PhD. Also thanks go to my son, Scott, who walked this primitive technologist through many of the simple Microsoft procedures that were well beneath my level of incompetence. The following acknowledgements, in chronological order, do not reflect any priorities. First, I owe more than words to Joyce Pearsall for assisting with the McCary Fluted Point Survey, which led to the rediscovery of Cactus Hill and everything that followed. Throughout most of the work at Cactus Hill she also managed the field paperwork and bag control. I owe a lot to Joe McAvoy, who agreed to work in tandem with our crew during the early days at Cactus Hill. He also provided insights into the archaeology of southeastern Virginia and working in sand. Russell Darden, (no longer with us) of Union Camp was instrumental in maintaining access to Cactus Hill and in getting it designated an archaeological preserve. He also provided constant lessons in local history while supporting our work. His wife, Pam provided the best in Southern cuisine. Dave Rubis (also no longer with us), a water chemist and faithful crew member, invented the "Rubis Hydro-Level," which served as our main level control throughout the Cactus Hill excavation. It is as good as a transit, costs a lot less, and can be left in the field. Stu Fiedel, a leading Clovis First proponent and good friend, was a constant reality check. If Cactus Hill could stand up to Stu then the pre-Clovis age of the site could stand up. Thanks also go to Marshall Payn, whose generous, unsolicited contribution, in response to a personal tour of Cactus Hill, helped pay for the six OSL dates that sealed the pre-Younger-Dryas age of the nearby Blueberry Hill site landform. Special thanks go to Leigh Watlington, who has spent some 15-17 years as chief lab crew on all of the sites discussed here. With Leigh, Rick Koestline (also no longer with us) and the other lab crew members who she trained, there are useable data to support this thesis. Milan Pavich and Helaine Markewich of the USGS provided soil analysis and OSL results that dated the Rubis-Pearsall landform, corroborating the potential for older cultural deposits. Dan Wagner's critique of our 2002 results was critical to the final evaluation of Blueberry Hill in 2010. Dave Thulman of the Archaeological Research Cooperative, Inc. provided outstanding and essential field, technical and liaison support for re-testing Blueberry Hill. Besides slaving away in the hot sun, Dave oversaw and produced the transit mapping used in this thesis; arranged OSL dating of the landform and X-ray refraction testing of the crinoid bead, and always provided stimulating political challenges. Last but in no way least, I wish I could personally thank each and every one of the hundreds of professional and avocational volunteers, who spent thousands of hours and a lot of their own money helping to reveal this exciting chapter in our common cultural heritage. This thesis is a dedicated to all of them.

Preface

All existence (and non-existence) has context even in a multi-dimensional universe. All items in the natural world, thoughts (mind), life, death, other dimensions (real or theoretical) and even gods (true or invented) have context. Controlling their context(s) is the key to understanding their reality. "Contextual existentialism" comes closest to describing this philosophy. If objective reality exists the closest humans can come to defining it is through subjectively controlling its context(s).

For example, if a tree falls in the woods and no one is there to hear it, does it make a sound (or as George Berkeley (1710: 573) originally put it, "the trees therefore are in the garden…no longer than while there is somebody by to perceive them.")? It depends. Falling trees probably did not make sounds on Mt. St. Helens when it exploded, even for those there to hear them. However, in the controlled context of normal atmospheric conditions, trees hitting the ground would make sound every time, whether I or a blind squirrel is there to hear them. The problem with the statement is not the objective reality of sound made by a tree hitting the ground in the forest (as heard by even a blind squirrel in the tree) but rather our not being there to hear it. From a practical context, subjective reality is the limiting factor.

Theoretically, realities may be beyond our capacity to define outside of their contexts. However, for humans to survive in the natural world it is imperative that their world is somewhat predictable. Subjectively, maybe one cannot know objective reality. However, to survive in our natural world, reality must be one's objective. This thesis is about prehistoric hunter-gatherers, who clearly were attempting to adjust to changes in the dynamic patterns of their observable world.

We may never be able to fully understand the cognitive processes behind the behaviors we perceive in the archaeological record. However, for our interpretation of the archaeological record to be fully complete and revealing, the cognitive aspects behind the adjustments should be our objective.

For archaeologists to describe/explain prehistoric culture through the limited context of archaeological data, we must recognize contextual patterns to which the hunter-gatherers we study were adapting. Thereby we produce hypotheses about how artifacts and their modern contexts help us reveal adaptations by the people who made, used and discarded those artifacts.

Prehistoric culture was produced by competing drives unique in their proportions to humans: the normative (group) and the cognitive (individual) (Young and Bonnichsen 1984: 5). Archaeologist's try to, first, describe and then explain what hunter-gatherers attempted to achieve (norm) and what they actually achieved.

Operationally, a model is the norm: what we think they were trying to achieve. Data are clues to what they actually achieved. The physical and psychological differences between individuals, which are manifested in artifact patterns, represent cognitive variation. Both are critical to explaining archaeologically revealed human behavior.

Culture operates in at least five dimensions: the three physical dimensions, time and mind. Archaeologists can observe the remnants of the first three and measure the fourth. However, the fifth - human decisions - must be inferred. It is the "our not being there to hear it" part. The more data discovered to support a model the stronger will be the inferences about the cognitive (and eventually normative) aspects of the model.

Chapter 1 – Introduction

Author's notes: (1) In 1993, when the author agreed to work in tandem with Joseph M. McAvoy at the Cactus Hill site, he methodologically shifted from metric to feet and inches. This was to ensure that the context for the author's data was consistent with that used by McAvoy, who had been working in the Nottoway River Valley for the previous 18 years. In order to maintain consistency throughout the author's 20 years of follow-on research, all subsequent work was done in the same methodological format. Therefore, measurements in the following thesis are in feet and inches, with metric equivalents shown, where possible.

(2) Calendar year calibrations were obtained, using OxCal 4.2 to approximately 68.2% probability.

1.1: Background

This thesis title is, "One Is an Accident; Two Is a Coincidence; Three Is a Pattern" – Predicting 'Old Dirt' in the Nottoway River Valley of Southeastern Virginia." It is the result of more than 30 years of research on the Paleoamerican period in Virginia and the Middle Atlantic Region of the United States.

This particular line of research began in 1982, with a graduate paper by the author, exploring the use of historic caribou hunters in Canada and Alaska as an analog for Clovis age hunter-gatherers in the sub-glacial Northeast and \middle Atlantic Regions of the United States. That paper was later expanded into two book articles (Johnson 1989, 1996). In 1982 it was well accepted that Clovis age (11,000 C-14 BP) (approximately 13,000 years ago) people were the earliest inhabitants of the Americas.

As a result, the research was not about the, already answered (sic), big question of who got here first and when? It was about what the author thought was the second most important archaeological question concerning the initial peopling of the New World. That was, what was holding Clovis age technology (and theoretically, culture) together over the vastness of the then unglaciated North American continent. Although the question raised by that paper is not relevant to the following thesis, the question, with expanded implications, will be returned to at the end of Chapter 5.

The paper later evolved into two book articles on the lithic technology and material culture of the "First Virginians" (Johnson 1989, 1996). As a result of the first article, the author was given oversight of the Dr. Ben C. McCary Virginia Fluted Point Survey (Johnson and Pearsall 1991a: 55), which involved recording Clovis age fluted points reported by artifact collectors, and professional and avocational archaeologists. The author, assisted by Joyce E. Pearsall, changed the focus of the McCary Survey from merely recording points and the local counties where they were found to also recording and reporting Clovis age sites. The purpose was to help develop settlement pattern models that might be reflected in the distribution of those sites across Virginia.

While recording two fluted points from a sand quarry along the Nottoway River in the Coastal Plain Physiographic Province of southeastern Virginia (Figure 1.1) (Johnson and Pearsall 1995: 19-20), the author and his co-author identified the potential for a stratified Clovis age occupation at the Cactus Hill site. The authors also noted that the site was threatened by an active sand quarrying operation. Knowing that a local archaeologist, Joseph M. McAvoy had spent more than fifteen years doing research and excavations on Clovis age sites in the Nottoway (McAvoy 1992), the author contacted McAvoy with a proposal to do a joint emergency excavation at Cactus Hill. It was agree to conduct two independent excavations at the site. The details of the early phases of those excavations are contained in a major technical report published by the Virginia Department of Historic Resources in 1997 (Johnson 1997; McAvoy and McAvoy 1997) and will not be repeated here.

This thesis largely grew out of the discoveries of two potential pre-Clovis age components, discovered, first by the McAvoy's and later by the author's teams. At the conclusion of the author's fieldwork in 2002 the author was faced with two choices: (1) move on to other research; or (2) pursue the pre-Clovis age and other related topics. The second choice was taken, largely because the author knew that he had learned so much from McAvoy, and the nine years of fieldwork at Cactus Hill. Therefore, it would have been a disservice to the archaeological profession not to apply that knowledge.

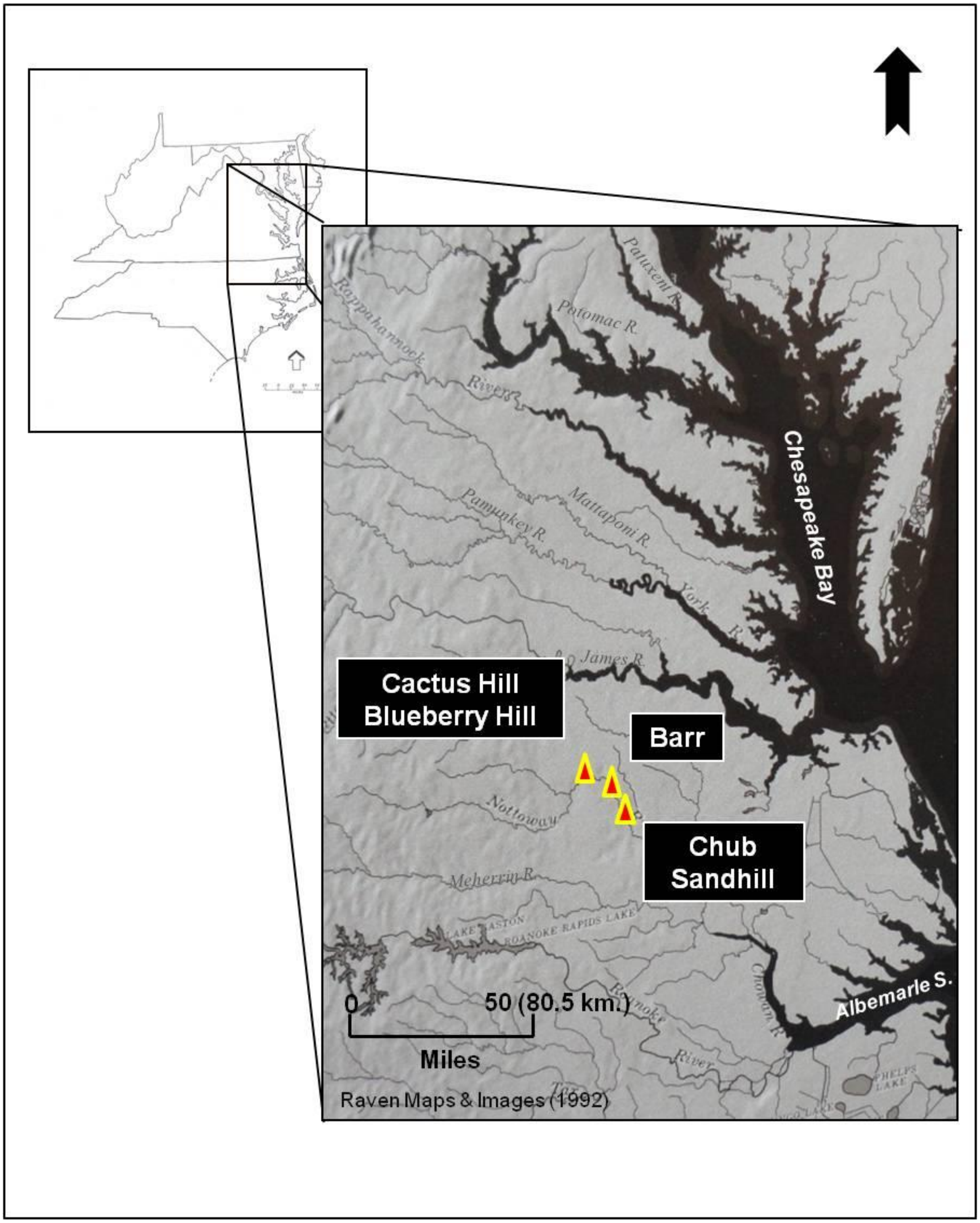


Figure 1.1: Modern geographical context for the Archaeological Society of Virginia Paleoamerican research in the Nottoway River Valley of southeastern Virginia (base map reproduced with permission of Raven Maps and Images).

The author chose predicting and finding other Cactus Hill-like sites in comparable settings in the Nottoway River Valley. Making a contribution to replicating a potential pre-Clovis age site was determined to be the most effective way of refuting or supporting the results from Cactus Hill.

1.2: Research context

As mentioned above, the foremost unanswered questions about New World archaeology is: who got here first and when did they arrive? Prior to the mid-1990s, the dominant theory was that people first arrived in the Americas from Siberia across the Bering Land Bridge, exposed by lowered sea levels during the last glacial maximum (LGM). Clovis age technology was theorized to have come from Siberia, through Alaska and an “ice free corridor” in central Canada, arriving around 13,500 CYBP (11,500 C-14 year ago). A prevailing theory held that once south of the glaciers they spread rapidly, like a wave, throughout the Americas from north to south (Martin 1973).

The dates for Clovis age artifacts cluster around 13,000 cal BP (11,000 C-14 BP) (Water and Stafford 2007). The temporal proximity of the post LGM opening of the "ice free corridor" and 13,000 cal BP central age for Clovis age technology in North and Central America causes problems for the “Clovis First” model:

1. Little evidence exists for Clovis age technology in Alaska and Siberia at the appropriate age (Stanford and Bradley 2012: 67-88). Clovis age technology involved highly specialized (structured) biface/uniface oriented stone tools, requiring specialized knapping skill. However, the appropriately aged Beringian tool kits were mostly micro-blade based (Stanford and Bradley 2012: 71-88). Pre-Clovis age biface technologies were present but bear little resemblance to complex Clovis age technologies.

2. Conservative estimates are that Clovis age technology lasted fewer than 500 years, possibly more like 200-300 years (approx. 13,200-12,900 years ago) or about ten generations (Waters and Stafford 2007). This is probably not enough time for a band of initial immigrants to spread out and populate all of sub-glaciated North and Central America, much less adapt to all of the varied environments from the Atlantic to the Pacific Oceans, and the Isthmus of Panama to Nova Scotia and Pacific Northwest. This

does not even come close to accounting for the contemporary occupation of all of South America by groups not using Clovis technologies. However, these dates are based on a limited data set and therefore even Clovis age occupation of the New World may be more temporally and spatially complex.

3. Although most genetic projections support single or multiple initial migrations from East-Central Asia after the opening of the Ice Free Corridor (Mulligan et al. 2004; Perez et al. 2009; Ray et al. 2009; Schurr 2004), they have one serious flaw. None test DNA from Clovis age populations. Therefore, they fail to account for the possibility that some or all of those earliest populations may have failed to survive to be counted, or have yet to be identified.

For example, three 5,000 year old individuals (pattern!), producing haplogroup M, were recently excavated in a cemetery in British Columbia (Malhi et al. 2007). With this example in mind, all such tests can only be considered valid for the ancestors of the individuals being tested, which prior to the discovery of haplogroup M, included only groups A, B, C, D and X (Perez 2009: 2). How many definitive statements have been made about the initial peopling of the Americas without including haplogroup M? Obviously, it is not relevant to resolving this problem that M also came from Asia.

A major problem with DNA projections for the Americas is that there were at least two, dramatic and highly relevant DNA "funnels." The first occurred approximately 12,900 years ago around the onset of the Younger-Dryas, when more than 25 major genera, including many large mammals died out (Meltzer and Mead 1985: 149). The second occurred during the 14th through 19th centuries, when whole regions of Native North and South America were depopulated by disease and warfare brought on by the European invasion.

The nature of these two DNA funnels also biases the data toward western North America. Both the Younger-Dryas and the European invasion likely had their most dramatic impacts on human populations living in the eastern half of North America. As a result, if

Stanford and Bradley's (2012) hypothesized initial colonization of the Americas from the east is accurate then the modern DNA evidence is inherently biased against that model.

The modern loss of archaeological samples due to Native American Graves and Repatriation Act (NAGPRA) means that the problem, especially with respect to early DNA samples, will not be easily remedied (United States of America 1990). Carl Sagan's (1996: 213) famous statement, "Absence of evidence is not evidence of absence," easily fits DNA projections. That does not mean DNA projections are not valuable but one must be cautious, because they only relate to the samples tested.

4. Clovis age technology had to come from somewhere. Tool kits, whether western, eastern or contained within other Clovis age variant technologies were specialized and, with exceptions, relatively uniform. No precursor analogues to that technology are yet recognized in the Americas or eastern Asia. Clovis age technology was too uniform and sophisticated to have leaped from the technological womb fully grown.

Isolated, widely dispersed sites, possessing dated, distinctly non-Clovis age technologies in relatively good stratigraphic context have been known for more than 30 years. However, in spite of good archaeological contexts, the two most credible sites, Meadowcroft in Pennsylvania (Carlisle and Adovasio 1982) and Monte Verde in Chile (Dillehey 1989; Dillehey 1997) remained controversial (Fiedel 1999a, 2012).

In the 1990s several new sites emerged that also challenged the prevailing model. Cactus Hill in Virginia (Figure 1.1) was foremost among these (Johnson 1997; McAvoy and McAvoy 1997). Two teams, one led by Joseph M. McAvoy and one led by the author (Johnson 1997, 2009), discovered artifact concentrations stratigraphically below Clovis age “living surfaces” in different areas of the site (Johnson 1997: Addendum; McAvoy and McAvoy 1997). McAvoy’s team also obtained an 18,274±160 cal BP (15,070±70 C-14 BP) date (BETA 81590) directly below a Clovis age surface containing two fluted points: one in three pieces (McAvoy and McAvoy 1997: 105). The artifacts associated with the date did not fit the Clovis age tool kit (see Chapter 2).

In 1996, in another area of the site, the author's team excavated four prismatic blade-like flakes; a small, parallel sided, heavily reworked, point midsection in two pieces, and a small unifacial core-like artifact from well below a broken fluted point preform and other specialized tools (Johnson 1997: Appendix G, Addendum). All of these artifacts were stratigraphically on the exact same plane. These discoveries and the author's attempts to model and replicate them in the Nottoway River valley is the core of this thesis.

Meadowcroft Rockshelter, Monte Verde and Cactus Hill discoveries have led to increasing numbers of high quality, credible sites supporting Pre-Clovis age technologies in the Americas, e.g. Gault (Collins and Bradley 2008), Friedkin (Waters et al. 2011), Schaefer and Hebior mammoths (Overstreet 2004), Miles Point (Lowery et al. 2010), Paisley Cave (Gilbert et al. 2008) and Cinmar (Stanford and Bradley 2012) in North America. However, neither clear "objective reality" nor extra-site context have been achieved at any site, including Cactus Hill.

This thesis defines an explanatory model (norm) based on data from Cactus Hill that is designed to provide that extra-site context. It will demonstrate the model's predictive strengths and weaknesses through data (cognitive reality) recovered from nearby contexts.

1.3: Research question

"One is an accident; two is a coincidence; three is a pattern" is as much admonition as statement. The fundamental question arising from Cactus Hill is: Where is the rest of the pre-Clovis age settlement pattern (extra-site context)? Geographical contexts suggest Cactus Hill was occupied during warmer months (late Spring, Summer and/or early Fall). If similar contexts could be located in the Nottoway River Valley then, hypothetically, similar cultural expressions should be present.

No proposed pre-Clovis age site has yet been placed in local/regional settlement patterns. They are all widely scattered over vast areas of the Western Hemisphere. To date, each one is an isolated site, although efforts are undoubtedly underway to replicate many of them. Evidence of how rapidly new discoveries are being made, Bruce A. Bradley (personal communication 2012) indicated that Miles Point may have been replicated by Lowery in the Chesapeake. Discovering appropriately dated settlement contexts of one of these sites will go a long way toward resolving the pre-Clovis age question.

This research involved using a model, based on the geology ("old dirt") at Cactus Hill, first to predict other buried Paleoamerican (pre-12,900 years ago) landforms. Once identified, then archaeological testing was used to determine if the older landforms actually were culturally occupied during Clovis and pre-Clovis times.

Extensive archaeological testing also was performed on adjacent landforms that were indicated by the model to be too recent. This was done to check the validity of the model. If proven effective, this research should further stimulate the application of model building, geological context reconstruction and archaeological testing, in that order, to the all-important task of replicating pre-Clovis age discoveries in other parts of the Western Hemisphere.

If archaeologists can increase the quality and quantity of early sites, they can focus more on the "who?" and "how?" rather than "when?" and "if" of pre-Clovis. Breaking down "Clovis First" has opened the debate on the alternative "who" (genetics) and "how" including alternative pre- or mid-Wisconsin, Pacific Coast and Atlantic Ocean entry routes. If this approach proves effective, then the necessary archaeological data will have a better chance of being found.

Modeling underwater Paleoamerican sites has been around for many years but is fraught with numerous problems, most obviously, merely getting to them (Anderson et al. 2010; Fedje et al. 2004; Hemmings and Adovasio 2012; Johnson and Straight 1992; Sonnenburg et al. 2011). The recent discovery of the Cinmar mastodon and associated large Solutrean Laurel Leaf-like bi-point (knife?), dredged up from 250 feet (76.2 meters) of water, 50 miles off the Virginia Capes, and resultant submerged landform modeling, demonstrates that although the problems may be daunting, overcoming them may be worth the effort (Hemmings and Adovasio 2012; Stanford and Bradley 2012: 102-103).

1.4: Method/methodology

Excavations at Cactus Hill involved large blocks with detailed horizontal and vertical control of data recovery (Johnson 1997; McAvoy and McAvoy 1997). Following the recovery by the author's team of a pre-Clovis age feature in Block A, 5x5-foot (1.52x1.52 meter) sub-squares; 1/2-inch (12.7 mm.) sub-levels; three dimensional piece plotting of all potential artifacts, including individual pieces of charcoal; and systematic partial 1/16-inch (1.6 mm.) window screening were employed for maximum quality and quantity data retrieval.

Based on the results from the Cactus Hill excavations, the author developed a warm season model for the Paleoamerican occupations there (see section 2.3). This model was enhanced by several landform and soil factors that were critical to its potential success.

Since the Cactus Hill excavation methods would be too cumbersome to be used on a site identification survey, the follow-on research into other potential site locations involved methodological approaches more suited to locating and evaluating previously unidentified sites. However, the approach was complicated by the fact that the target site components were expected to be ephemeral and located in deeply buried contexts. Economically isolating ephemeral site in such contexts was the first major hurdle. Detecting them would require more than widely spaced, shallow shovel testing, employing 1/4-inch (6.3 mm.) mesh screen samples.

A four phased approach was determined most effective:

1. The first phase involved identifying landforms and macro-soil conditions in the Nottoway River floodplain, which were comparable to those at Cactus Hill.

2. The second phase involved identifying comparable geological features and micro-soil conditions within those landforms.
3. The third phase involved identifying the buried cultural stratigraphy of the targeted parts of the landforms.
4. The fourth and final phase was to test excavate sites that could possibly produce Clovis or pre-Clovis age, Cactus Hill-like components. (Artifact producing areas in the vicinity of those components that were predicted not to contain Clovis or pre-Clovis age components were tested with equal rigor in an attempt to negate the model.)

The choice to explore downstream from Cactus Hill was made to avoid conflicting with McAvoy's (1992, 1997) primary research areas. Fortunately, the author was able to obtain rough copies of the field maps from a recent, unpublished, United States Department of Agriculture soil survey of Sussex County, Virginia, where Cactus Hill is centrally located. The soil survey was critical to identifying similar soils to those at Cactus Hill (phase 1 above).

With respect to phase 2, the author determined that the most efficient and economical approach, which he had employed informally in 1978 (Johnson 1979: 19) and in 2001 in locating the nearby Blueberry Hill site (see section 4.2.1), was to use three-inch (7.6 cm.) bucket auger sampling on a relatively tight interval grid. That could be used to economically obtain preliminary information on deeply buried soil features and landforms.

With respect to phase 3, the horizontal size differences between a one-foot (.305 meter) square shovel test and a three-inch (7.6 cm.) diameter auger test for recovering archaeological data was overcome by using 1/16-inch (1.6 mm.) window screen to sift the auger samples, rather than the 1/4-inch (6.3 mm.) hardware cloth commonly used with shovel testing. Although the comparison was not statistically evaluated the author assumed it would suffice for phase 3 (archaeological survey). The author has almost 40 years' experience at knapping stone, with an almost sole focus on Clovis age technology. The amounts of sub-1/4-inch (6.3 mm.) shatter and debitage produced from lithic reduction are massive by comparison to debitage larger than1/4-inch (6.3 mm.). This approach and rationale were verified with the initial discovery of the Rubis-Pearsall site (see section 3.4.1).

Once the auger testing detected a potential buried activity surface in the desired context, the phase 4 assessment would be employed. That involved selectively oriented 5x10-foot (1.52x3.05 meter) trenches, positioned as to optimize recovery of potential diagnostic artifacts from the targeted depths.

As mentioned above, auger testing had been used to locate the Blueberry Hill site, downstream from Cactus Hill. That site was also tested using 5x10-foot (1.52x3.05 meter) trenches. These trenches were initially excavated in four-inch (10.2 cm.) levels from the bottom of the plough zone. However, that testing encountered a deeply buried, potential Paleoamerican, activity surface. The author thought that the method used there was not rigorous enough for the implications of the model being tested. Therefore, with only minor exceptions, the author divided the 5x10-foot (1.52x3.05 meter) trenches into 5x5-foot (1.52x1.52 meter) sub-squares and 2-inch (5.1 cm.) levels below the plough zone. In more sensitive areas the 2-inch (5.1 cm.) levels were excavated in 1-inch (2.5 cm.) sub-levels.

Artifacts larger than a United States 25-cent piece (one inch or 2.5 cm.) were two-dimensionally mapped in the levels. The soil/sediment matrix was sifted initially through1/4-inch (6.3 mm.) mesh. However, on Rubis-Pearsall and Blueberry Hill that was eventually changed to 1/8-inch (3.2 mm.) mesh. The shift to 1/8-inch (3.2 mm.) was done, because, as will be repeatedly stressed, small (usually <1/4-inch) (<6.3 cm.) artifacts and charcoal have a tendency to percolate down in the soils/sediment contexts of these sites. Due to tree harvesting debris and modern historic material the plough zone was sifted through 1/4-inch (6.3 mm.) mesh. The 1/8-inch (3.2 cm.) mesh was chosen a check on that un-quantified assumption. It was later to prove prophetic, when a crinoid bead was recovered in the fine screen residue from the deepest recognized cultural level during testing on Blueberry Hill.

All artifacts/geo-facts were recovered by provenience and returned to the lab. Nothing but modern flora and fauna were discarded in the field. From 1996 onward, in the author's excavations at Cactus Hill and elsewhere in the Nottoway River Valley, maximum data recovery was employed within the context of the appropriate method (survey, testing and excavation).

From a methodological standpoint, admittedly, there are obvious weaknesses and flaws employed here. Far more could have been done with soil and other scientific data. Most of these failings were due to financial constraints. Since time was not a constraint – the whole Cactus Hill to Blueberry Hill field project took 18 years – much of the potential weaknesses in the finished analyses was partially overcome by excessive data recovery. Sophisticated analyses were not warranted at the model testing stage.

Methodologically, phases 1 through 4 were adequate to demonstrate that the model did work, at least in part. Even in the areas where questions remained, the testing opened the possibilities that those questions could be answered by full-scale excavations of the remaining parts of the sites.

The discovery of one positive deeply buried Clovis age site and one possible deeply buried pre-Clovis age site on landforms where there were minimal indications that sites were even on the landforms, demonstrates beyond question the efficacy of the model and method. This will be demonstrated below.

Chapter 2 - The Cactus Hill Model

Terrestrial, archaeological, model building and testing have been current for a long time, at least since the mid-1970s (Anderson 1996; Judge 1973; Judge and Sebastian 1988; Thomas 1973). Even the methods used in this research are not new (Mandel and Bettis 2001: 181-182, 184-187). Therefore, their uses would in-and-of-themselves not be noteworthy. However, in the rarified context of breaking down the once dominant "Clovis First" paradigm, using a model driven approach to discover pre-Clovis age settlement patterns anywhere in the Americas would be noteworthy.

As a result, a basic question must be answered before this line of research can be demonstrated. Is there enough evidence to hypothesize that Cactus Hill is a pre-Clovis age site?

2.1: Lines of evidence

Cactus Hill has a number of lines of evidence, each of which, when taken in the context of the simplest explanation, supports the site's hypothesized pre-Clovis age. When taken individually, each line might have alternative interpretations (see section 2.2 and Chapter 5), but the likelihood that all or most of them support an alternative hypothesis is highly improbable. As a result, the following discussions focus on conclusions of the various researchers, most of whom were not under the supervision of this author.

2.1.1: Geomorphology

Multiple studies done on Cactus Hill's soil have determined that the soils in areas A and B (Figure 2.1) are mainly eolian (Jones and Johnson 1997; Lund 1999; MacPhail and McAvoy 2008; McAvoy and McAvoy 1997; McAvoy et al. 2000; Perron 1999; Wagner and McAvoy 2004) and therefore not mainly alluvial. However, as will be shown below, the author demonstrates a potentially significant and patterned alluvial component to the depositional history of the Nottoway dunes. A primary eolian character of the dunes is consistent with Pleistocene and Holocene dunes throughout the southeastern Atlantic

Coastal Plain (Markewich and Markewich 1994: 23; Moore and Daniel 2011: 1-5 through 1-8). Consistent with the two detailed micromorphological studies (Perron 1999; MacPhail and McAvoy 2008), Wagner and McAvoy (2004: 311) also concluded that,

> Identification of buried surface horizons and vertically separated subsoil forms leave no doubt that the sand deposits of the primary locus were amassed through multiple and distinct depositional episodes, which almost surely were of an eolian nature.

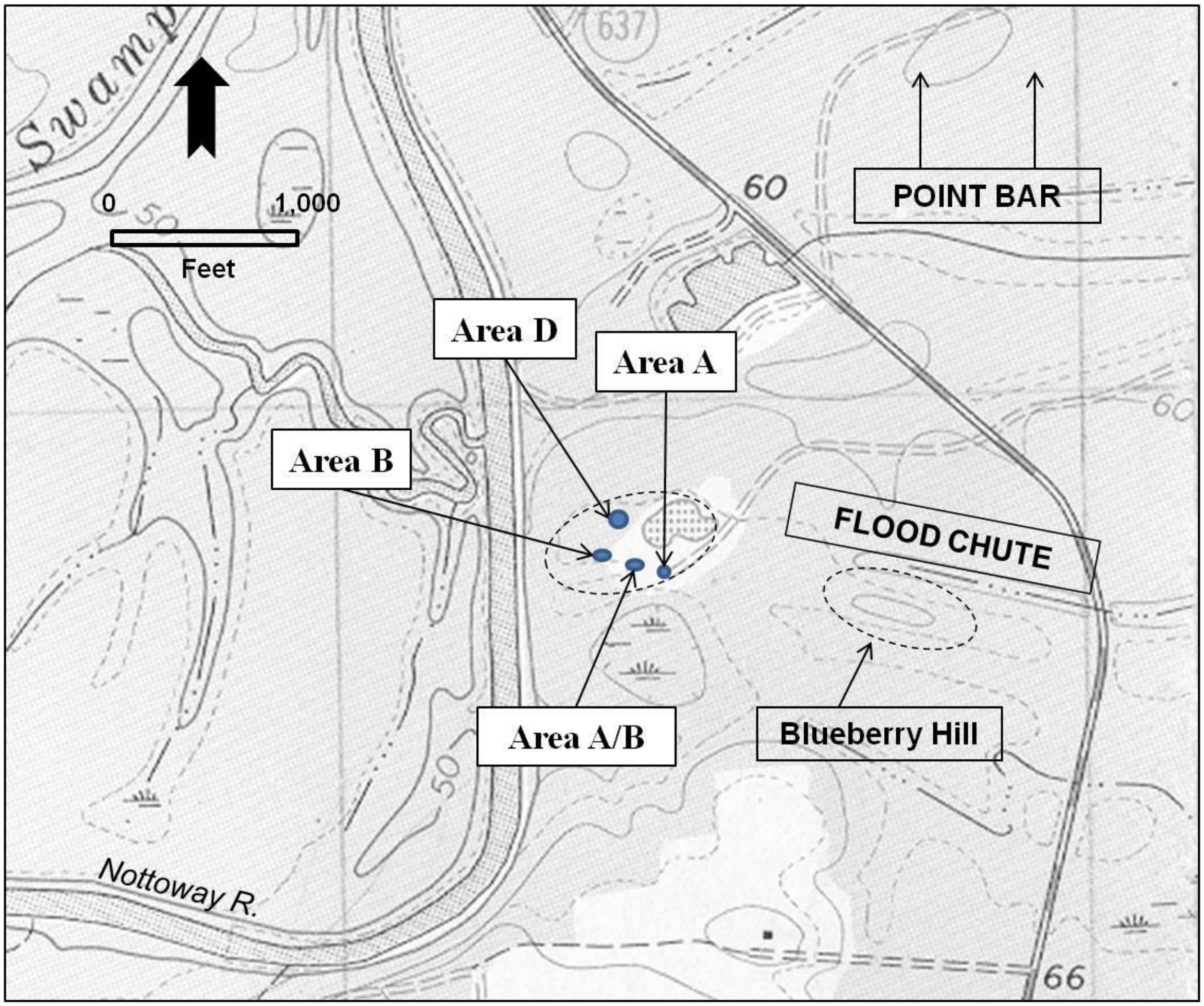


Figure 2.1: Local context for the Cactus Hill site (USGS 7.5 min. series, Sussex, Va.).

They go on to state, with respect to Area A/B and B (Figure 2.1),

> The buried surfaces attest to a minimum of at least three major periods of deposition in building the ridge that constitutes the primary locus. The earliest of these is marked having the widespread 3Ab horizon of Soil III, which establishes the beginning of the sand accumulation prior to 19,540±70 ^{14}C yr B.P. This culturally sterile layer sits atop the much older Pleistocene paleosol (Soil IV) . . . Subsequent to an interval of relative stasis that allowed for the Soil III surface horizon development, a second period of sand deposition provided the protective burial of this surface and eventually established the Blade and Clovis occupation surface(s) of Soil II. Because the Clovis and Blade artifacts are typically 7-20 cm apart, another minor period of sand deposition may be indicated… Regardless of the mechanism that separated Clovis and Blade artifacts, at least one period of sand accumulation occurred after Clovis, thereby producing the overlying mantle (Soil I parent material). . . (Wagner and McAvoy 2004: 313)

Bioturbation has also contributed to the post- and possibly also pre-Clovis age accumulation, since ants and other small burrowing fauna have moved sand from deeper levels to the surface over thousands of years. This process is discussed in detail in later chapters.

Previous to the Wagner and McAvoy analysis, Frink (2000) evaluated the soil in area A. Based on his Oxidizable Carbon Ratio (OCR) method (Frink 1994), he determined that a buried A soil horizon existed in the profile at a depth that dated to approximately 17,500 years ago. His analysis produced consistent date estimates on other depths. The OCR dates generally appeared older than the stratigraphic occurrences of diagnostic points from the squares adjoining his soil profile (Figure 2.2). However, the fact that the OSL dates are older than the artifacts is consistent with OSL dates and artifacts from one and possibly two other sites discussed in this thesis (see Chapters 3 and 4). The OCR analysis is presented here, because it was done and the fact that striking consistencies occurred between the dates and associated diagnostic artifacts, which were recovered independently. The method has not been universally accepted (Killick et al. 1999).

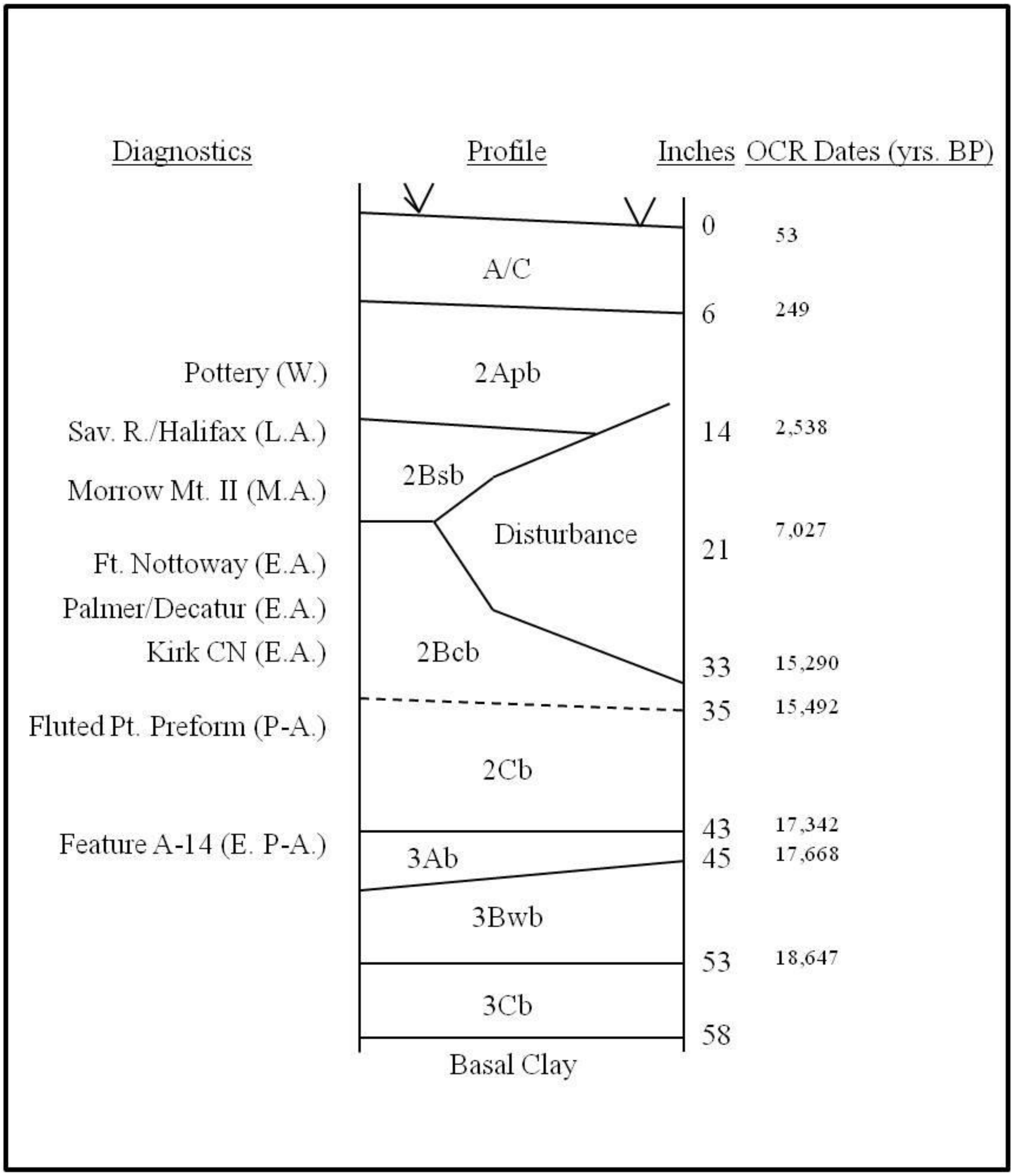


Figure 2.2: Profile from 15 inches (38.1 cm.) east of the east wall of sub-square 28B in Cactus Hill Block A by Frink (2000) showing associated stratigraphic positions of diagnostic artifacts to the left and OCR dates to the right.

Wagner and McAvoy (2004: 300, 306, 308-309, 312) determined that the soil in area D, north of the sand pit (see Figure 2.1), was alluvial. An independent analysis (by the author and Michael R. Waters of Texas A&M University of a profile along the edge of the sand pit adjacent to McAvoy's 1994 excavation of Area D confirmed the alluvial nature of the C horizon under Area D (Figure 2.3). The soil above the C horizon was dated to 10,316±66 cal BP (9,140±50 C-14 BP) (BETA 83012), which was supported by artifact typology (McAvoy and McAvoy 1997: 178; Wagner and McAvoy 2004: 310).

With respect to bioturbation, "Specifically, although some bioturbational mixing of cultural materials occurred, profiles providing ordered separations of cultural periods are at least as common. Such profiles satisfy the major conditions suggested as favoring artifact burial by sedimentation rather than pedoturbation (Wagner and McAvoy 2004: 314)." This was supported by MacPhail and McAvoy (2008).

2.1.2: Bioturbation

The author observed that bioturbation has moved smaller items like small debitage and charcoal down through the profile. In Area A the author ran accelerator dates on several small pieces of charcoal from a square and level adjacent to the probable pre-fluted point square and level. It produced Middle Woodland AMS dates of 1,346±33 cal BP (1,450±40 C-14 BP) (BETA-109609) and 1,448±49 cal BP (1,550±40 C-14 BP) (BETA 109610). The sample was taken from an area approximately 1-2 feet (.305-.61 meters) from a rodent disturbance that had been mapped from the top of the profile. The charcoal was tested because it was identified as pine and oak (Lucinda McWeeney, personal communication 1997). A later excavation of deeper elevations in an adjacent square identified a small rodent or toad burrow extending horizontally out from the bottom of another burrow that had been mapped from above the probable pre-Clovis age level.

However, the consistency of the cultural diagnostics, coupled with numerous re-fitted artifacts within levels across the site, especially in the earliest levels also indicate low bioturbational impact on moderate to large sized artifacts (Johnson 1997: Appendix G, Figure 42; McAvoy and McAvoy 1997: Figure 5.67 and Addendum, Figures 17 and 19). Specifically,

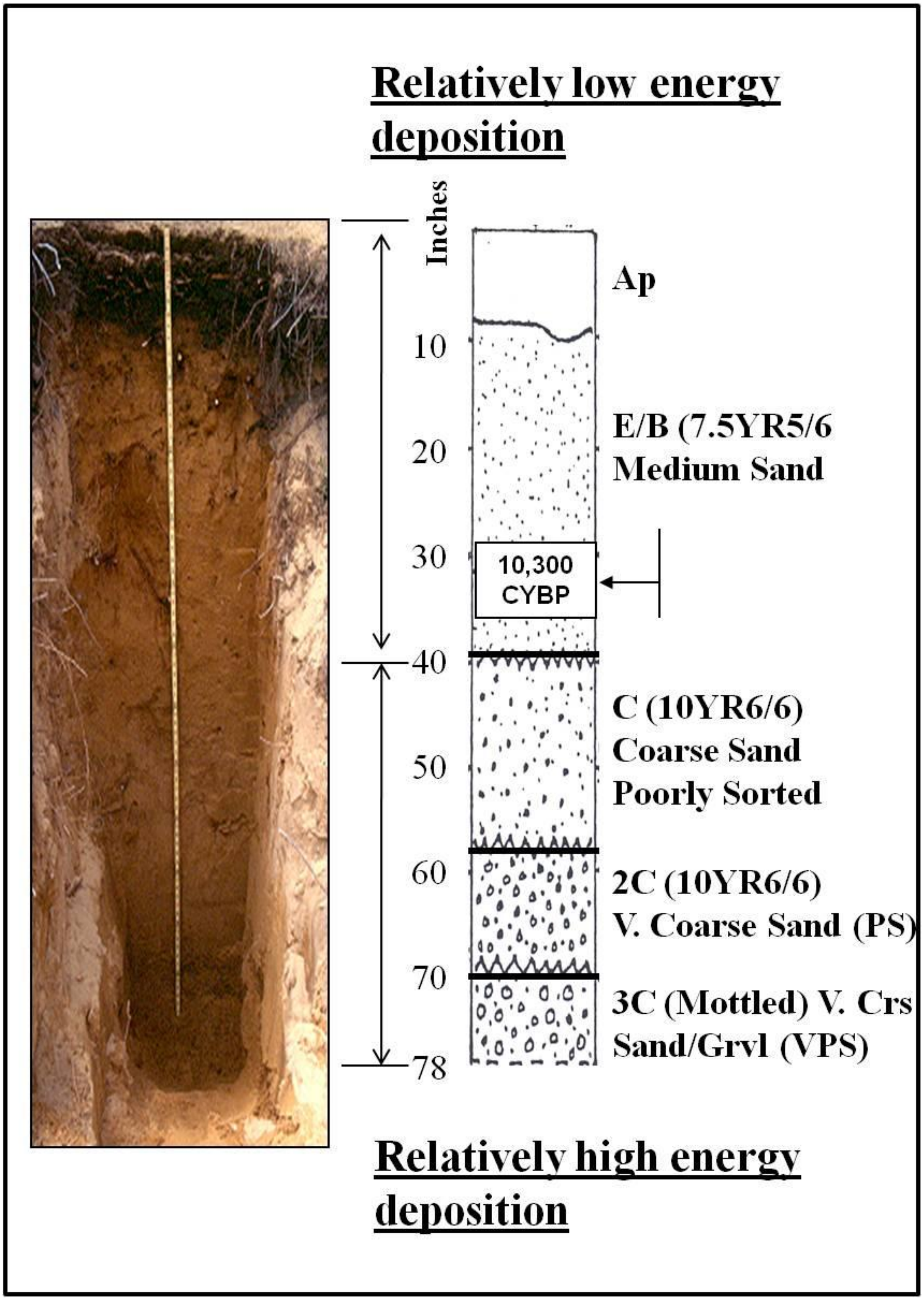


Figure 2.3: Waters and Johnson profile of Area D (photo by author).

> Although at present there is only evidence of small-scale biological working, thus implying little disturbance of the archaeological layers for probably millennia (a finding that is consistent with both the radiocarbon and OSL dating), analog studies of open sites indicate that it is likely that the original cultural deposits were affected by scavenging and burrowing fauna. This has led to the probable precontemporaneous broad horizontal and vertical dispersal of artifacts and associated soils from each cultural period.
>
> . . According to this analysis and other independent investigations of this part of Cactus Hill, the site appears intact with only minor disturbances affecting the long-term integrity of the stratigraphy (MacPhail and McAvoy 2008: 691-692).

2.1.3: Stratigraphic consistency of diagnostic artifacts

One of the more striking lines of evidence is that in most instances the vertical/stratigraphic positions of diagnostic points and pottery are consistent with their chronological sequences. This line of evidence is also consistent horizontally. As a result, the most important line of evidence supporting the pre-Clovis age occupation at Cactus Hill is that points similar to the Cactus Hill point types (Figure 2.4) found below the Clovis age levels in both areas A and B were not recovered above the Clovis age levels. Had these point types been transported down through the profile by any means, why has a donor population of similar points not been identified? Fiedel (2012) takes issue with some of the assessments concerning exceptions. This is discussed below.

Two noteworthy exceptions to the general stratigraphically consistency of the points occurred in Block A, subsequent to the original McAvoy and McAvoy (1997) report. Fortunately, after 1995, the author's Archaeological Society of Virginia (ASV) team began mapping all artifacts, charcoal, concretions and pebbles encountered during

Figure 2.4: Early Paleoamerican Cactus Hill points from NRS excavation in Area B (McAvoy and McAvoy 1997:111) (photo by author of casts made by Peter Bostrom, Lithics Casting Lab, courtesy of the Virginia Department of Historic Resources).

troweling. Feature A16 in square A27, which was first identified in a Middle Archaic level as a charcoal concentration was mapped from that level down into Early Archaic levels, where it disappeared. A Middle Archaic Morrow Mountain II point was recovered at the bottom of the feature. In Square A25, which had been truncated at the top by sand quarrying, the ASV team mapped Feature A28, which consisted of a moderate concentration of medium sized quartzite flakes, extending from the disturbed surface down through and well below the Clovis age level. A Middle Archaic, Morrow Mountain I point was recovered from the bottom of that feature. These examples are evidence that pit features are present and detectable.

2.1.4: Cultural integrity

In both areas A and B (including area A/B) cross-mends were identified within but not between the Clovis and pre-Clovis age levels. Of particular note is the cross-mend in area B between three pieces of the same black metavolcanic fluted point (Figure 2.5) (McAvoy and McAvoy 1997: 108). That point was recovered from the same square and level as a small clear quartz fluted point (Figure 2.5), both being from an activity surface,

Figure 2.5: Cast of a refitted (three pieces) black meta-volcanic fluted point (a) and the author's in situ photo of the clear quartz fluted point (b), both from the same occupation surface, square and level in area B (McAvoy and McAvoy 1997:108) (photos by author: top photo is of cast made by Peter Bostrom, Lithics Casting Lab, courtesy of the Virginia Department of Historic Resources).

four inches (10.2 cm.) above the charcoal feature that yielded the 18,274±160 cal BP (15,070±70 C-14 BP) date (BETA 81590) (McAvoy and McAvoy 1997: 105). The author was present at the time of the discovery of the points. In Area A/B, square W170N105, level 11 the McAvoy team recovered a large cross-mended blade-like flake from the blade level (McAvoy and McAvoy 1997: Addendum, Figure 19). McAvoy and McAvoy (1997: 178) also recovered a Clovis age date of 12,830±260 cal BP (10,920±250 C-14 BP) (BETA 81489) on southern hard pine from an area of associated unifacial blade tools.

The two pieces of the point in Figure 2.6 (c) recovered by the ASV from Block A, eight

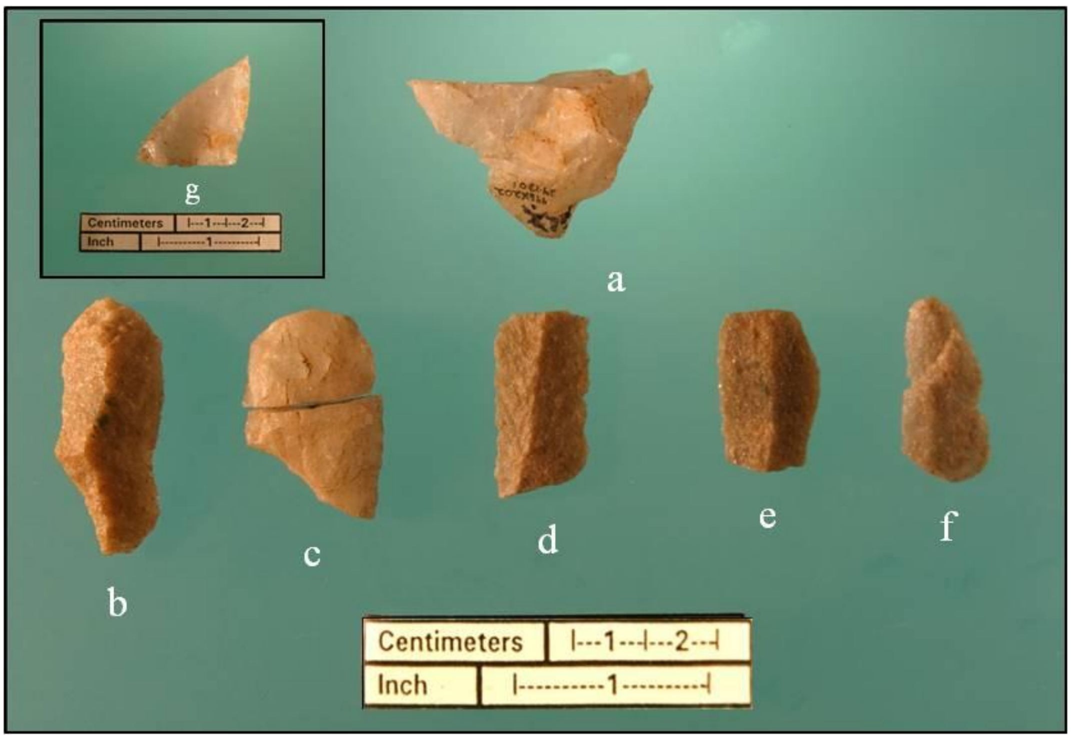


Figure 2.6: Paleoamerican and Early Paleoamerican artifacts excavated by the ASV from artifact feature A-14. Top: (a) unifacial core-like artifact. Bottom row: (b) corner blade-like flake; (c) two pieces of refitted point mid-section, and (d-f) three blade-like flakes. Inset: (g) quartz fluted point preform (photos by author).

inches (20.3 cm.) below a fluted point preform (Figure 2.6g) in artifact Feature A14 in block A also was a cross-mend. The two fragments were recovered from within five inches (12.7 cm.) of each other on the exact same level, 48 inches (121.9 cm.) below datum (Johnson 1997: Addendum). The fact that the tip of the tip half of the point was burinated is noteworthy and will be discussed below.

Feature A14 was only one of many stone features recovered from area A. Most were tight clusters of fire cracked rocks located in the Middle and Late Archaic levels. The tops and bottoms of each rock in each feature were measured. This was done to determine the cultural slope, which at that time was not discernible from the soil. The features, which were on the south side of the buried clay bank under Areas A, A/B and B, were consistently on the same slope which was down toward the south (Johnson 1997: Figures 2-1, 2-2, 2-5 and 2-6). As noted above, at least two pit features with chronologically diagnostic points in their bottoms were also mapped in area A. These latter two features were mapped after publication of the 1997 report.

The three-inch (7.6 cm.) separation in area B (McAvoy et al. 2000: 2); four-inch (10.2 cm.) separation in area A/B, and the eight-inch (20.3 cm.) separation in area A between the Clovis and pre-Clovis age levels are consistent with the east-west slope of the sand ridge (Johnson 1997: Addendum; McAvoy et al. 2000: 3-5). The sand ridge slopes down from the high point in area B eastward toward area A (see Figure 2.1). Deflated sand from the top of the ridge should have accumulated at the lower elevations around it, whether the result of eolian or sheet wash transport.

The vertical and horizontal consistencies of dates and cultural stratigraphy between areas A/B and B, and the consistency of correspondingly consistent cultural stratigraphy between areas A, and A/B and B is one of the stronger arguments for the general integrity of the pre-Clovis age component(s).

2.1.5: Raw material differences

McAvoy et al. (2000: 3-4) noted the striking differences between the stone artifacts in the Clovis age and pre-Clovis age occupation levels. With respect to raw materials, the Clovis age levels were dominated by chert, quartz and quartzite, with the black metavolcanic point (three pieces) representing the rare occurrence of that stone. The pre-

Clovis age levels were dominated by quartzite, and gray and greenish patinated metavolcanic stone.

In area A the one positively identified Clovis age artifact was a white quartz fluted point preform recovered from square 9, level 9/10 (Figure 2.6g). The pre-Clovis age artifacts were made of quartzite (Figure 2.6b, 2.6d, 2.6e, and 2.6f), quartz (Figure 2.6a), and an unidentified mylonite-like stone, of which the mended point fragments were made (Figure 2.6c). The Paleoamerican artifacts in area A were too few to determine any raw material pattern.

2.1.6: Stone tool differences

In addition to the differences between points from the Clovis age and pre-Clovis age (Cactus Hill point) levels in areas A/B and B, noted above, McAvoy et al. (2000: 5) reported tool type differences from units W165N105 and W170N105 in area A/B. From the Clovis age levels he noted:

> The fluted point tradition artifacts were recovered in small clusters, within remnants of working surfaces in this area of the site. Such artifacts included end scrapers, a graver, a limace, a spokeshave, a chisel-graver, and several small fragments of unifacial tools. All of the fluted points are manufacturing failures of local quartzite, or from Fall Zone chert quarries located within 30 miles of the site. Most of the small trim flakes were of jasper, yellow Mitchell quarry chert, or blue Williamson quarry chert (McAvoy 1992: 25). Non-local fine grained lithics characterized the fluted point tradition tool assemblage except for some limited use of the finest local blue-gray or brown cobble quartzite (McAvoy et al. 2000: 5).

The artifact raw material type differences from the blade levels were also noteworthy:

> The blade level feature from excavation units W165N105 and W170N105 contained a cluster of seven quartzite blade flakes, four small core preparation flakes, a number of small trim flakes, and one large flake with a single use edge. Some of the flakes appear to have been burned. There was a single cross-mend of an edge-used quartzite blade flake, one piece of which had been burned. All of these artifacts were recovered in a

> single band or strata of sand no more than 1-1.5 inches thick and sealed between thick iron-clay lamellae (McAvoy et al. 2000: 5).

Feature A14 from Area A consisted of one quartzite corner blade-like flake (Figure 2.6b), one medial quartzite blade-like flake (Figure 2.6d), two proximal end quartzite blade-like flakes (Figure 2.6c-d), one small expended unifacial quartz core (Figure 2.6a), and the two pieces of the point mid-section, mentioned above (Figure 2.6c). With the exception of the quartz core, which was located approximately three feet (.91 meters) to the north and as would be expected slightly higher, all of the other artifacts were recovered from a roughly six-foot (1.83 meter) long line in the same plane. Top and bottom elevations were taken on each artifact in the line and all touched 48 inches (121.9 cm.) below datum: approximately 12 inches (30.5 cm.) above the original surface, which had been mechanically altered. Other than a very small (< 1/4-inch) (<6.3 mm.) Nottoway River chert trimming flake from approximately two feet (.61 meters) to the south and a small quartzite flake at the east end of and in the same plain as the Feature A14 artifacts, no other artifacts were recovered from that level.

The very small Nottoway River chert trimming flake offers a potential problem for the pre-Clovis age interpretation of Feature A14. It is made of what appears to be the same material as one of two Clovis age fluted points (Johnson and Pearsall 1995: 19-20, 23, 28) reported to have come from the sand quarry adjacent to Area A. However, as will be discussed in subsequent chapters, the stratigraphic context of isolated small items of the size (<1/4-inch) (<6.3 mm.) of the small chert flake should be treated with caution. Specifically, its context should be treated with greater caution than the stratigraphic contexts of the fluted point preform 8-9 inches (20.3-22.9 cm.) above the larger artifacts in Feature A14.

2.1.7: Radiocarbon dates

McAvoy's team obtained several radiocarbon dates from various levels and squares in Areas A/B and B. Dates in good cultural and geological contexts are shown in Table 2.1.

Two of the dates are of particular note. The first date of, 18,274+160 cal BP (15,070+70 C-14 BP) (BETA 18590) was from Area B (McAvoy 1997: 169). The date was on white pine charcoal and came from a discrete blade level, in the same square, three inches (7.6 cm.) below a Clovis age activity surface, which included the clear quartz fluted point, and three pieces of the cross-mended, black metavolcanic fluted point (McAvoy 1997:169).

McAvoy's team recovered a second early date of 20,102+855 cal BP (16,670+730 C-14 BP) from a pre-Clovis age level in area A/B (Wagner and McAvoy 2004: 297). This charcoal was also from a stratigraphic association with probable pre-Clovis age blades.

As can be seen in Table 2.1, these dates were consistent with the other carbon dates recovered from above and below (Feathers 2006: 170). They were also consistent with the suite of OSL dates recovered by Feathers (Feathers et al. 2006)

2.1.8: Luminescence dates

In order to provide an independent chronology of sedimentation to compare with the carbon date sequence, James K Feathers (Feathers et al. 2006) recovered a series of luminescence (OSL) dates from various locations in areas A/B and B. The highest quality dates as interpreted by Feathers (et al. 2006) are shown, along with calibrated radiocarbon dates, in Table 2.1.

These dates show a remarkable consistency with the radiocarbon dates. This fact is enhanced by the large number of dates from various stratigraphic levels included in the study. They also support the pre-Clovis age occupation.

OSL Sample	OSL result	C-14 Sample	C-14 result; cal BP 1-Sigma (ka)	Cultural association
UW435m	8.0±0.6			Archaic level
UW436m	10.3±0.6			Archaic level
		B70127	9.7-10.2	Ft. Nottoway
		AA15027	9.9-10.2	Ft. Nottoway
		B81589	12.7-13.2	Clovis age
UW697m	11.8±0.8			Sterile/upper part of blade level (pre-Clovis)
UW698m	12.5±.06			Sterile/upper part of blade level (pre-Clovis)
		B81590	18.2-18.6	Pre-Clovis age
		B97708	19.0-20.6	Pre-Clovis age
UW617c	19.3±1.0			Lower blade level (pre-Clovis)
UW699m	17.3±1.6			Lower blade level (pre-Clovis)
UW700m	19.8±3.8			Lower blade level (pre-Clovis)
UW701m	18.3±1.4			Lower blade level (pre-Clovis)
		B128330	20.0-20.2	Below Pre-Clovis age levels
UW618c	20.6±0.9			Below pre-Clovis age levels
		B152731	21.6-22.0	Cult. and geol. sample from lamellae: from top of Clovis to 30cm below
		B163608	23.1-23.6	Buried A (paleosol): 30 cm below cultural levels
		B156517	22.6-23.2	Buried A (paleosol): 50 cm below cultural levels
		B155334	22.4-22.6	Buried A (paleosol): 50 cm below cultural levels
		B128331	23.4-23.8	Transition to C horizon: 70 cm below cultural levels
UW438c	25.4±1.7			Base of dune
UW438 (kf)c	27.9±2.2			

c: central age model; m: minimum age model; kf: potassium feldspar; all other OSL dates were on quartz.

Table 2.1. OSL and Radiocarbon dates from areas A/B and B at Cactus Hill as compiled from Feathers et al. (2006: 170, 185; McAvoy and McAvoy 1997; McAvoy et al. 2000; Wagner and McAvoy 2004). Radiocarbon ages were calibrated using OxCal 3.10.

2.1.9: Phosphate analysis

Hodges and Baker also removed soil samples for chemical analysis (McAvoy et al. 2000:11). They included both a column from the cultural area and a control sample from a non-cultural area.

> A minimum of two sets of phosphate samples for each level was analyzed. Phosphate varied from a low range of 192.6 ppm to 248 ppm for sterile zones, to a high range of 263.2 ppm to 347.3 ppm for occupation levels. Sterile zones and occupation levels were initially identified based upon significant decreases or significant increases, respectively in cultural (anthropogenic) materials such as lithics, burned bone and charcoal.
>
> While the variations in phosphate content from occupation levels to sterile zones were not as great as had been anticipated, such variations were still significant. This area of the Cactus Hill site did appear to demonstrate discernible anthropogenic modification of the soil in the form of increased phosphate in the occupation levels (McAvoy et al. 2000: 11).

2.1.10: Phytolith analysis

Paleoethnobotanist, Lucinda J. McWeeney also analyzed similar soil samples for phytoliths (McAvoy 2000: 11-12). Her analysis was based on work by Powers-Jones (Powers-Jones et al. 1989: 27). That methodology "indicated that occupation levels could be recognized and separated from non-occupation levels based upon differential phytolith values" such as weight (McAvoy et al. 2000: 11-12)

According to McAvoy et al. (2000: 12) "McWeeney's work at Cactus Hill in unit W109N97.5 clearly shows an increase in phytolith weight in levels of heavy occupation as compared with levels of lighter occupation and sterile zones." The phytolith correlation is even more striking than the correlation between phosphate and cultural material.

2.2: Cactus Hill Pre-Clovis age critique

The only detailed critique of the Pre-Clovis age cultural occupation at Cactus Hill that the author could find was a Stuart J. Fiedel (2012) draft chapter in an upcoming book on the Paleoamerican period in Eastern North America (Gingerich 2012: 656-660). Fiedel and Gingerich were gracious enough to provide the author with an advance copy. Fiedel focuses on, but does not limit his critique to, the most important line of evidence: the artifacts and their vertical patterns. Essentially, the theme of Fiedel's (2012: 657-658) critique is that

> The pre-Clovis assemblage has been constituted by informed subtraction of those elements that are recognizably diagnostic of later periods. However, blades, cores, and bifaces similar to those found below Clovis are also reported from overlying Early Archaic-age strata, e.g., the unnotched Hardaway biface (McAvoy and McAvoy 1997: 156), the small lanceolate found above a Clovis point in salvage Unit B (McAvoy and McAvoy 1997: 128), the lanceolate shown as part of the Decatur assemblage (McAvoy and McAvoy 1997: 64), and a conical blade core in the Fort Nottoway assemblage (McAvoy and McAvoy 1997: 59, Figure 5.25, no. 11).

Interestingly, the later artifacts that resemble those recovered from below Clovis age artifacts do not appear in similar or greater quantity in Clovis or above. If the process were episodic as implied by Fiedel, rather than uniformly accretional as will be demonstrated in Chapters 3 and 4 (below), in a disturbed scenario one would expect that with normal down drift of large artifacts in the loamy sand on Cactus Hill, there would be more of the hypothesized pre-Clovis items left in the Clovis age and higher levels than in the deeper pre-Clovis age levels. In other words, if the pre-Clovis age artifacts were the result of down drift from later (higher) cultural levels one would expect there to be more than single similar or no examples remaining in the donor levels. Without the presence of a trap, such as the top of a Bt horizon or paleosol, it is also not likely that down drifted artifacts would have stopped at the same level/depth below the Clovis age level, rather than drifting down into multiple deeper levels.

2.2.1: "Absence" of Late Paleo occupations

Fiedel (2012: 658) also states that “the virtual absence of Late Paleoindian occupation in the Cactus Hill sequence (McAvoy and McAvoy 1997: 177)” should be a factor mitigating against the cultural integrity of the Paleoamerican data. “Virtual absence” is a slight exaggeration in light of Fiedel’s arguments that the material below Clovis age levels are likely related to Late Paleoamerican Hardaway phase, which was recovered from above Clovis by both the McAvoy and the author’s teams. Hence the late Paleoamerican period is not "virtually absent" at Cactus Hill.

2.2.2: Sedimentation issues

2.2.2.a: Clovis-Early Archaic age sedimentation gap

In that regard, Fiedel (2012: 658) states, “Thus, there appears to have been no significant occupation of the site, and no accumulation of sediment between approx. 12,500 years ago and the Palmer occupation dated to approx. 10,400 cal BP (9250 rcbp).” The paucity of dates from Areas A, A/B, and B, when contrasted with the full range of Early Archaic period (approx. 11,500-8,500 cal BP) points, tools and debitage in relatively large quantities, suggests that Fiedel's end date is probably too recent by more than 1,000 years. The end of the Younger-Dryas at approx. 11,645±200 cal BP (Fiedel 1999b: 96), coincides roughly with the beginning of the Early Archaic in the Middle Atlantic region.

First, the Younger-Dryas was a dramatic climatic reversal into conditions more like those of the last glacial maximum (LGM) than the Bolling Alerod, which immediately preceded it. It is clear from the stratigraphy at the Shawnee-Minisink site (Dent 1985:153-154) and Area D at Cactus Hill that dramatic scouring and channel filling were occurring during that climatic period. This also was likely accompanied by increased erosion and possibly eolian reworking of dunes.

Second, Late Paleoamerican occupations (Dalton and Hardaway) are notoriously rare north of North Carolina, especially along the eastern North American seaboard. The stratified Paleoamerican Thunderbird (Gardner 1970), Shawnee Minisink (McNett 1985), and Cactus Hill (Johnson 1997; McAvoy and McAvoy 1997) sites as well as most surface Clovis age sites have light (Thunderbird and Cactus Hill) or no reported (Shawnee Minisink) Late Paleoamerican Dalton or Hardaway expressions. One likely explanation is the Younger-Dryas, which drove many large animals in Eastern North America to extinction, also had a dramatic impact on human populations as well. That impact was probably greater in the Northeast and Middle Atlantic, which were closer to the area of highest Younger-Dryas impact.

2.2.2.b: Variable sedimentation rates

Fiedel (2012: 659) questions the variable rates of eolian deposition on Cactus Hill "in the late Pleistocene (1 inch [2.5 cm.] per 126 years from approx. 23,500 to 20,000 cal. BP), terminal Pleistocene (1 inch [2.5 cm.] per 1700 years from 18,000 to 13,000 cal. BP), and the Holocene (1 inch [2.5 cm.] per 430 years) (see McAvoy et al. 2000: Figure 2.5)." The Pleistocene and late Pleistocene were characterized by dramatic climate changes with resulting dramatic impacts on riverine sediment systems along the Eastern Seaboard, much of which have only recently been studied in detail (Leigh 2008; Markewich et al. 2009; Markewich and Markewich 1994). As mentioned above, the effects of dramatic climate changes during the Pleistocene-Holocene boundary are evident from several well documented soil profiles.

Areas A and B appear to have been protected by the underlying clay paleosol from scouring during the Younger-Dryas onset. However, that does not mean it was not partially deflated during the scouring. By the same token, because of its elevation above the apparent scour channel, underlying Area D and the modern sand quarry, it would have been protected from the subsequent sediment filling that underlies Area D.

2.2.3: Hardaway "blade" comparison

Fiedel (2012: 658) points out that "the McAvoy's themselves observed (1997: 179) that the 'pre-Clovis' points from Cactus Hill resemble the Hardaway 'blades' recovered from the deepest levels of the Hardaway site in North Carolina (Coe 1964: 64-65)." That is a justifiable question raised by Fiedel. The author cannot address the typological similarities and differences between Hardaway "blades" and Cactus Hill points, because he has never examined Hardaway "blades." It is a question that is included in the author's latest research design for expanding the results of this thesis (See Chapter 5). However, as will be discussed below, there is a distinct difference between Fidel's assessment of Hardaway "blades," which appear to have been point preforms (Coe 1964: 64-66) and the Cactus Hill points recovered by the McAvoys (see Figure 2.4).

A point (sic) not addressed by Fiedel is the cross mended point midsection possessing a rare burinated tip, recovered among a series of four blade-like flakes in Cactus Hill, Area A. It was excavated from eight inches (20.3 cm.) below a fluted point preform and ramped endscraper by the ASV team. It does not resemble Cactus Hill, Clovis, Dalton, Hardaway blade, or Hardaway points, or any other point from Cactus Hill. As will be seen from the final chapter of this thesis, the evidence is mounting that the pre-Clovis period in North America was temporally and spatially complex. This would be expected if the evidence for more than 10,000 years (24,000-13,000 cal BP) of pre-Clovis age cultural presence in North America is valid.

2.2.4: Cactus Hill points as "preforms"

Referencing Daniel's (1998: 63-63) assessment that Hardaway blades from the Hardaway site may have been preforms for the Hardaway points recovered from higher in the site, Fiedel (2012; 658) also implies that the Cactus Hill points on the site could be down drifted preforms for post-Clovis age points. He also references various preforms reported by the McAvoys (1997: 59, 64, 128, 156, 180) from various temporal contexts above Clovis age artifacts as being potential donor contexts for his down-drift contention (Fiedel 2012: 657). He does not address the expended, lanceolate point, mid-section from eight inches (20.3 cm.) below a fluted point preform and endscraper in Area A, which has no apparent analog on the site. The glaring problem with the preform argument is that the three points from pre-Clovis age contexts are categorically not preforms, all three having been reworked to exhaustion and were probably discarded at the site. The pre-Clovis age points from below Clovis age artifacts are at the ends of their use lives, not the beginnings. The assessment by Fiedel (2012) that Hardaway "blades" were possibly preforms for Hardaway side notched points would put Hardaway "blades" at the beginning, rather than end, of their use life category, which they are not.

Fiedel makes a very important comment that raises serious questions about the temporal relationship between Hardaway blades and notched Hardaway points. He states, “In a curious parallel to the situation at Cactus Hill, Coe (1964: 64) observed that 10 of the 14 Hardaway blades had somehow worked their way down, through no-longer visible cracks, 4-6 inches (10.2-15.2 cm.) into the basal clay of the Hardaway site” (Fiedel 2012: 658). Although the implication is clear, he does not elaborate on this important point.

An obvious question is raised by this: If Hardaway blades are preforms for and therefore contemporary with notched Hardaway points, why did the majority of the Hardaway blades drift down through the cracks in the clay and not a comparable number of notched Hardaway points? An alternative explanation is that maybe the two are not contemporary. The implication is that, since the Hardaway site produced no evidence of Clovis age occupations or dates on either of the Hardaway components, could Hardaway blades also date to before Clovis age points?

As tenuous as that possibility might be, there is no evidence for it other than at the Hardaway site. The author’s pending research at Smith Mountain Gap is partially designed to address that question (see section 5.3).

2.2.5: "Appomattox" point question

Fiedel (2012: 658) also mentions, “Notably, artifacts from the same drainage, resembling those from Cactus Hill, were originally ascribed to a post-Clovis Appomattox complex (McAvoy 1992: 9, 37, 141)." It is noteworthy that Fiedel uses “a” rather than “the” to preface “post-Clovis Appomattox complex.” Fiedel clearly recognizes that (prior to Cactus Hill) there was no dated Appomattox point or complex.

During his ten-year involvement with the McCary Fluted point survey, the author recorded numerous Cactus Hill-like points from surface contexts. He had originally considered them also to be “post-Clovis age” (“Appomattox”) points (see section 2.3). This distinction was based merely on an apparent technological change from Clovis age sophistication to a less sophisticated technology, which one could assume if the prevailing model was accurate that fluted points were first. However, at no time were these points considered Hardaway or “Hardaway Blades.”

Neither McAvoy’s (1992: 9, 97, 141) nor the author’s earlier assessments (derived from McAvoy) of the Cactus Hill (Appomattox) points were based on stratigraphic or dated contexts. Their discovery in dated pre-Clovis age contexts at Cactus Hill clearly superseded the earlier un-substantiated typological assessment. Ironically, what was thought to be a degradation of sophisticated Clovis age technology appears to have been a less sophisticated precursor technology, which is equally as logical from a purely technological perspective.

2.2.6: Artifact down-drift

Fiedel (2012: 657) points out that “later diagnostic artifacts, including Kirk and Morrow Mountain points, (were) scattered unpredictably among the Clovis diagnostics, and also within the lowest zone.” They were not unpredictable in area A, where, as discussed above, Middle Archaic diagnostic points were recovered from the bottoms of previously identified and plotted pit features. Intrusive pits are not unusual on Middle Archaic or later stratified archaeological sites, so it should be no more a problem on Cactus Hill than elsewhere. That does not mean that intrusive diagnostics from above can be ignored, which they were not. They were treated merely as weaker alternative hypotheses and, in the case of the two examples from Area A, as mapped intrusive artifacts.

2.2.7: Spurious C-14 dates

Fiedel does not take issue with most other scientific lines of evidence except the presence of a spurious Early Archaic date associated with the Clovis age date recovered by

McAvoy (McAvoy and McAvoy 1997:167) (Fiedel 2012:657). The Clovis age date is associated with the Clovis age level, which contained multiple cross mends of artifacts. Cross mends are also present among the pre-Clovis age artifacts but not between Clovis and pre-Clovis artifacts. Therefore, it is not likely that the Clovis age artifacts date to the Early Archaic because a "spurious" Early Archaic date came from that level. The fact that there were no Clovis or pre-Clovis age dates above Clovis indicates that the Early Archaic date is a product of down drift as contended by McAvoy.

Furthermore, on Cactus Hill, with all of its apparent pit features, there were no recognizable Clovis age artifacts recovered from the Early Archaic levels or above. However, as will be shown below (see section 4.2.4), it is not impossible for Clovis age-like artifacts to show up in apparently higher levels. Fiedel's point is well taken. Such occurrences must be accounted for, which they were at Cactus Hill.

2.2.8: Debitage pattern

Fiedel's (2012: 659) final critique concerns the small amounts of stone debitage ("shatter") apparently produced by pre-Clovis age knappers relative to later period knappers. He contends that "overall population density does not suffice to explain these cases of strangely sparse debris at the scale of individual activity." With respect to Cactus Hill, the Clovis debitage is also significantly sparser than the Early Archaic debitage above it. The Early Archaic debitage is noticeably sparser than the Middle or Late archaic debitage above it, too. All of that, in part, could be but is not necessarily due to changes in population densities, as stated by Fiedel, but is more directly related to occupation intensity.

With the Blueberry Hill site (see Chapter 4), located about 1,000 feet (305 meters) to the east of Cactus Hill, a large gap in debitage (quantity and weight) existed between the deepest activity surface, which produced a Cactus Hill-like point, and the more recent occupations, containing Clovis, Late Archaic and Woodland (pottery) age diagnostics, beginning approximately ten inches (25.4 cm.) above. On that site, clear evidence of the Middle Archaic period was noticeably absent, along with debitage. Since Woodland and

Middle Archaic levels at Cactus Hill contain large quantities of debitage, Fiedel is correct about the relationship between population and debitage counts (patterns?), but for the wrong reasons.

A simple explanation, independent of population (although not ruling population out), for the apparent low levels of debitage in pre-Clovis age levels at Cactus Hill exists: that is bone. Pre-Clovis and Clovis age environments were rich in large mammals and the concurrent availability of bone and ivory for tools. It appears that the Clovis age culture represented an initial explosion in highly specialized stone tools, involving elaborate bifacial and unifacial core and preform technologies. Based on the very limited results from sites like Cactus Hill, a far less elaborate lithic technology is emerging for pre-Clovis age cultures. Hypothetically, their technologies could have involved far greater reliance on flaked bone tools. This is suggested by light or no stone artifact occurrences on several well-documented, potential, pre-Clovis age sites, including the Burnham bison site (Wickoff et al. 2003); Fenske, Mud Lake, Hebior and Schaefer mammoth sites (Overstreet 1993, 2004; Overstreet et al. 1995; Overstreet and Stafford 1997); Norwalk (Ohio) ground sloth (Redmond et al. 2012); the Lovewell Reservoir mammoth site (Holen 2007) in mid-continental North America, and Saltville in southwestern Virginia (McDonald 2000). With so many credible, well dated, pre-Clovis age megafauna sites, containing minimal associated stone artifacts, a strong argument can be made that a paucity of stone debitage is not a strong argument against any hypothesized pre-Clovis age site.

An example from the historic period in Virginia is relevant. After 32 years doing archaeology in Northern Virginia, the author found that, in the 18th and 19th centuries, although slaves and lower class farmers far outnumbered contemporary wealthier inhabitants, lower class and slave sites are rare. This is clearly because much of the material culture remaining on the socio-economically poorer sites does not survive.

Furthermore, in Area A the systematic fine screening, and mapping of artifacts, including all visible sizes, showed a marked increase of small charcoal, debitage and shatter on top of the clay at the bottom of the profile. As will be demonstrated, the process of down drift due to bioturbation appears to have altered how small debitage relates to the larger artifacts, which are internally consistent. More research is needed to define the nature of the impact.

However, the author strongly agrees with Fiedel's (2012: 659) statement that, "It would be admittedly the simplest (author's emphasis) explanation of the stratigraphic situation to accept a sparse pre-Clovis occupation horizon, lying some 3 to 6 inches (7.6-15.2 cm.) below Clovis," which had been made to him by the author numerous times, during our many discussions about the validity of Cactus Hill's pre-Clovis age components In fact, it is uncertainty, not certainty that led to the following research.

2.3: Developing the model

Shortly after it was established that Cactus Hill was a prime candidate for a pre-Clovis age site, and irrespective of much of the above analysis by McAvoy and the author, it was clear that for the pre-Clovis age component to stand the test of time and inevitable scrutiny it had to be replicated. During the 1990s, as senior author of the McCary Fluted Point survey in Virginia (Johnson and Pearsall 1991a; 1991b; 1993; 1995; 1996; 1998; 1999), the author had identified a number of other Cactus Hill-like ("Appomattox") points, including one from a disturbed context associated with the site (Figure 2.7). All of these points had come from surface contexts. Although they lacked stratigraphic provenience, their quantity and consistent raw material, namely greenish patinated metavolcanic rock (apparently from the Uwharries Mountains of North Carolina) indicated a potentially well-established settlement pattern.

Based on Joseph M. McAvoy's preliminary technology based assessment, the author agreed that they probably were "Mid Paleo" points as defined by Gardner (1974: 38-38A; 1989: 10). As mentioned above, the term used by McAvoy was "Appomattox points." The author was more familiar with the term used by Gardner, "Mid-Paleo," indicating they preceded "Late Paleo" Dalton and Hardaway points. It is not been confirmed that Gardner's "Mid-Paleo" point phase actually existed in the Middle Atlantic Region. The fact that they have little resemblance to Cactus Hill points is relevant, because at the Thunderbird site they were recovered from a post-Clovis age context (Gardner 1974: 15).

Figure 2.7: Largely unifacially worked Cactus Hill-like point recovered from a disturbed context at the Cactus Hill site by local collector, Ronald Ponton (Annette Barr, personal communication 1993) (photo by author).

Several early attempts in the 1990s by the author to expand on the research at Cactus Hill involved testing outlying areas near the site. These included three test pits, one to the immediate southeast of Area A, and another more than 1,000 feet (305 meters) east of Area A (see Figure 2.1). These pits, which will be discussed in detail in Chapter 4 below, failed to produce either soil or artifact evidence supporting a potential pre-Younger-Dryas (12,900 cal BP) occupation. However, they did indicate a possible eastern boundary for the Paleoamerican components at Cactus Hill.

Annette Barr who had reported the Cactus Hill site to the author and Joyce Pearsall in 1993 (Johnson and Pearsall 1995: 19-20), also reported another (abandoned) commercial sand quarry further down the Nottoway, where she and her family had observed artifacts. The author and Barr visited the quarry in 2000 and, based on surface topography, and orientation, determined it to be a prime candidate. There we observed Nottoway River chert and quartzite artifacts in an artifact hunter pit in the quarry wall. The site was named the Barr site and reported to the State of Virginia, which gave it the registry number, 44SX319.

The key variable then being used was that the site should have a north to northwest aspect like Cactus Hill. This aspect at Cactus Hill led the author to hypothesize that, during the terminal Pleistocene, Cactus Hill was probably occupied during the warmer months, when intense winds off the glacier (Markewich et al. 2009) may have helped keep down biting insects. The northern, climatic related, biting insect problem and mammalian avoidance pattern was based on analysis done by the author on historic North American caribou hunters, serving as a Paleoamerican analogue (Burch 1972; Johnson 1979, 1989, 1996).

The site was on the well-drained soil of an exposed sand ridge with a flood chute on the side away from the main river channel (Figure 2.8). This meant the site, like Cactus Hill, would have been dry and have possibly maximum exposure to winds from multiple directions, particularly the north.

In 2000, after obtaining landowner permission, the author organized two expeditions to test the Barr site. The first involved a one-day visit. A single, informal, three-foot (.91 meter) square test square (B1) in an area near the sand pit was excavated. Test square B1 was shovel excavated in 6-inch (15.2 cm.) levels, using 1/4-inch (6.3 mm.) mesh dry sifting. In addition to a moderate amount of debitage and fire cracked rocks, it produced a relatively consistent sequence of diagnostic pottery and points (Figure 2.9).

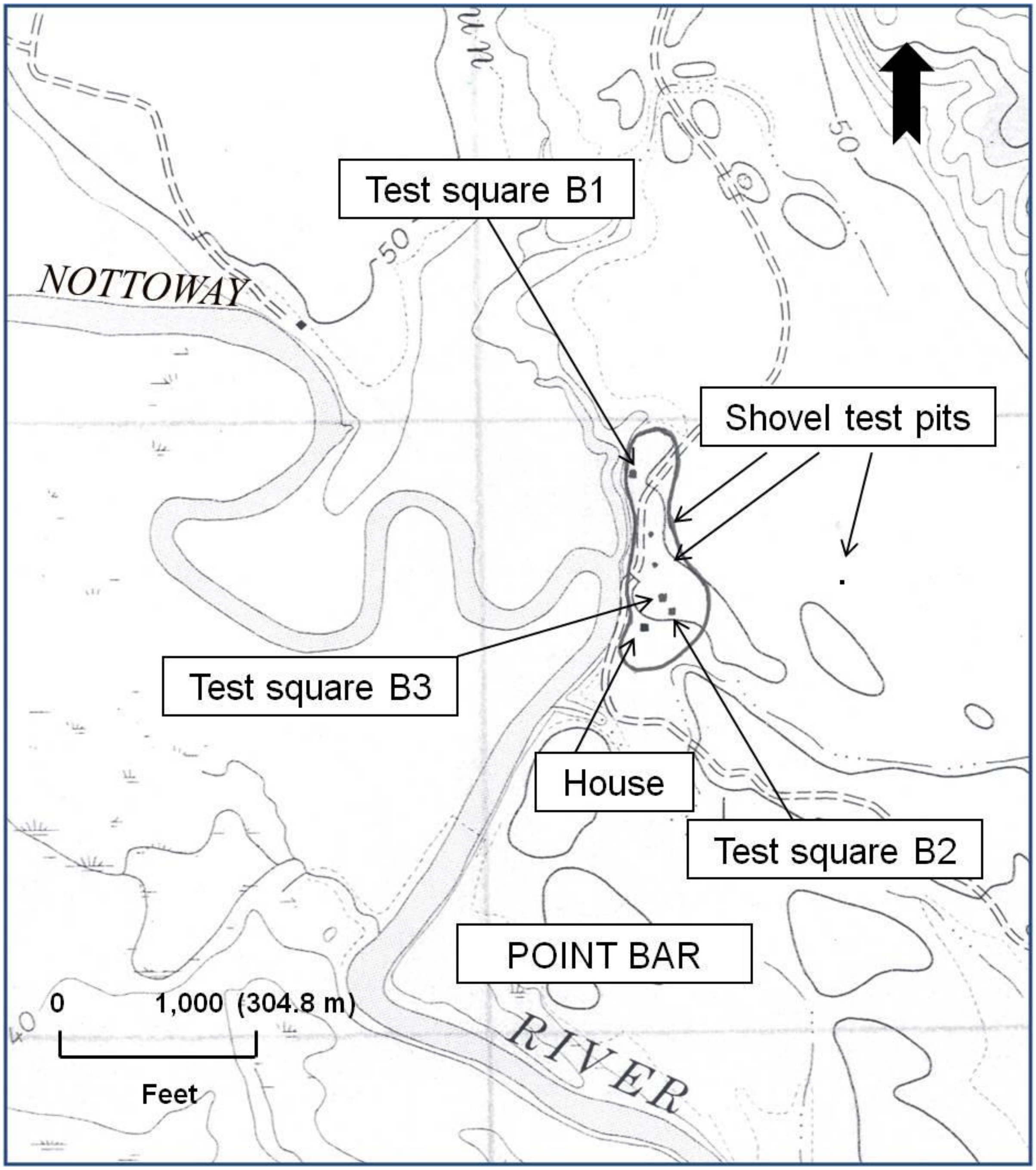


Figure 2.8: Barr site context showing testing pattern (USGS 7.5 min. series, Littleton, Va.).

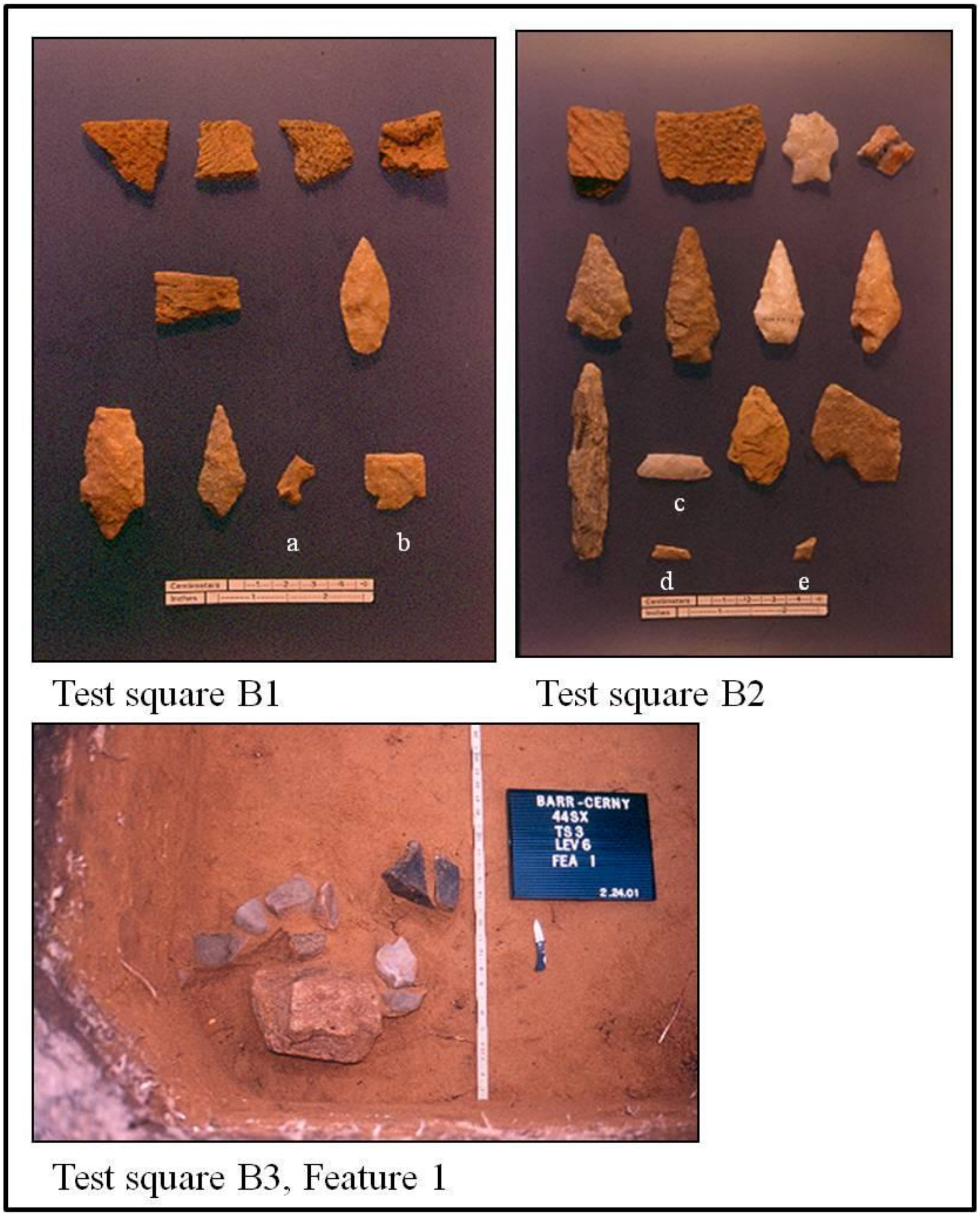


Figure 2.9: Stratigraphic point sequence positions from test squares B1 and B2, and Feature 1 from test square B3 at the Barr site (photos by author).

Several weeks later more formal test excavations were conducted on the sand hill adjacent to the Nottoway River and approximately 100 feet (30.5 meters) south of B1 and the sand quarry. Two 5x5-foot (1.52x1.52 meter) test squares (B2 and B3) were laid out on the highest part of the sand hill. They were flat shovel excavated in 4-inch (10.2 cm.) levels and the soil was dry sifted through 1/4-inch (6.3 mm.) hardware cloth.

Test squares B2 and B3 produced a consistently moderate amount of debitage and tools down to approximately 2.5 to 3 feet (.76-.91 meters) deep, where the artifacts dropped off dramatically after a distinct soil change. In both squares the soil changed to a medium to coarse sand that was lighter in color at 30 inches (76.2 cm.) deep (Figure 2.10). There

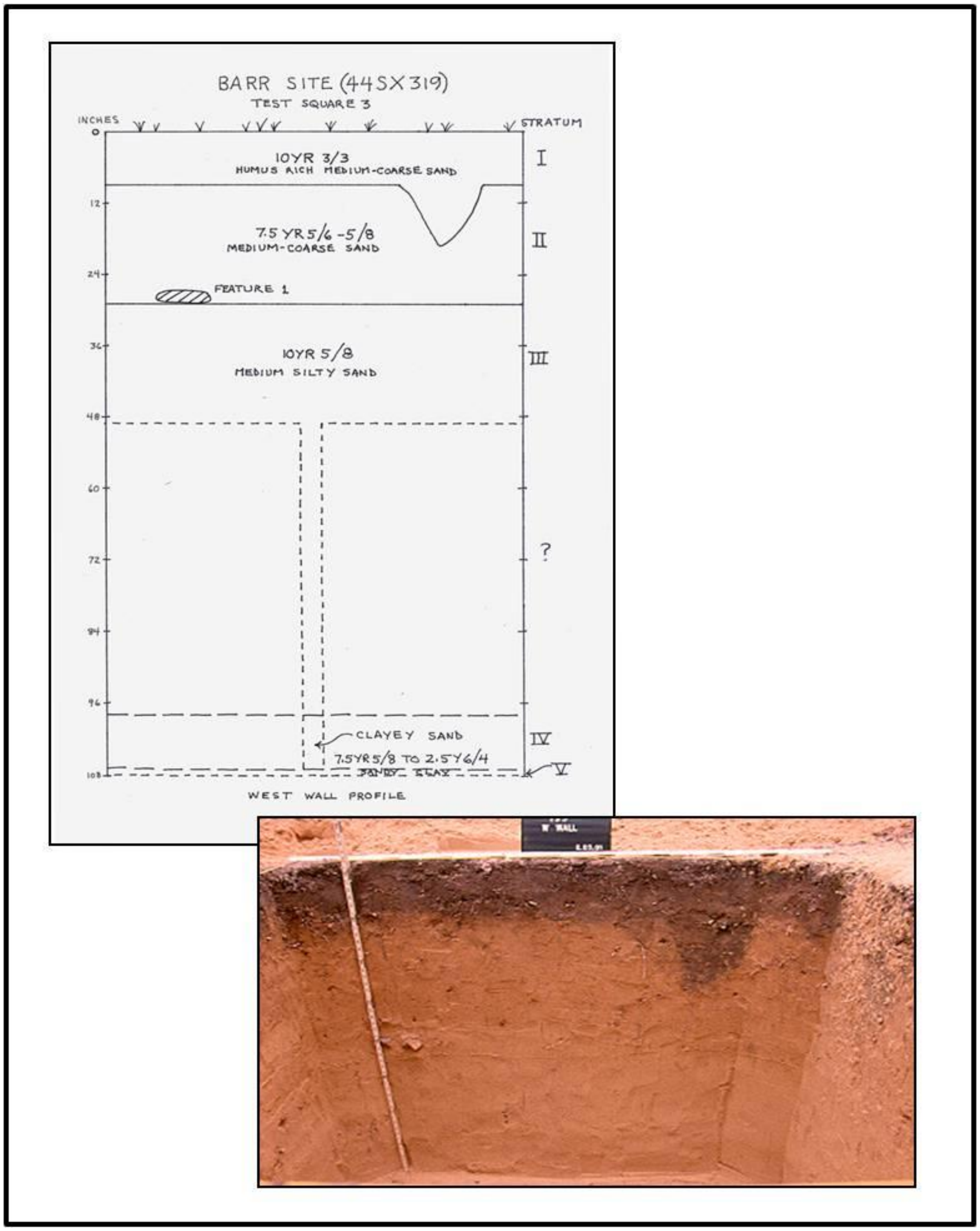


Figure 2.10: West wall profile of Barr site test square B3 (photo by author).

were no lamellae and the square was underlain by clay at a depth of 107 inches (2.72 meters). Although B3 was not archaeologically excavated to that depth a 3-inch (7.6 cm.) auger core was excavated in the bottom of the sand.

Chronologically diagnostic artifacts indicated a roughly consistent cultural stratigraphy. However, the 4-inch (10.2 cm.) thick excavation levels could have resulted in mixing of adjacent cultural levels. An important recovery involved hearth-like Feature 1 just above the soil boundary at the bottom of the cultural material (see Figure 2.9). The feature contained multiple cross-mends indicating that the site had similar integrity to that of Cactus Hill.

Most significantly, the earliest chronologically diagnostic artifacts went back to the Early Archaic. Two Early Archaic point fragments (see Figures 2.9a and 2.9b) were recovered from B1 and three more (see Figures 2.9c, 2.9d and 2.9e) were recovered from the deepest cultural levels in B2.

Several other informal, 1x2-foot (.305x.61 meter) deep, shovel test pits were dug around the sand hill but were inconclusive. The one to the east in an old flood chute produced pottery in the upper levels and nothing deep. Two other sites were identified on the lower sand hills further downstream but these two sites contained coarse, alluvial sand and only light artifact scatters with late diagnostics in the upper levels.

It was at this point that the author recognized what was missing. It had become evident that, although the entire Cactus Hill landform had been occupied, only the area over the clay bank dated to Clovis age and earlier (Figure 2.11). Area A, A/B and B soil was largely eolian from the surface to the buried clay. It had been dated to more than 19,000 years ago. Area D, which was off the clay bank and in what appeared to be an ancestral Nottoway Channel, had a solid chronology dating back only as far as the Early Archaic. It was underlain by alluvial sand that appeared to fine upward toward the top of the C horizon (see Figure 2.3).

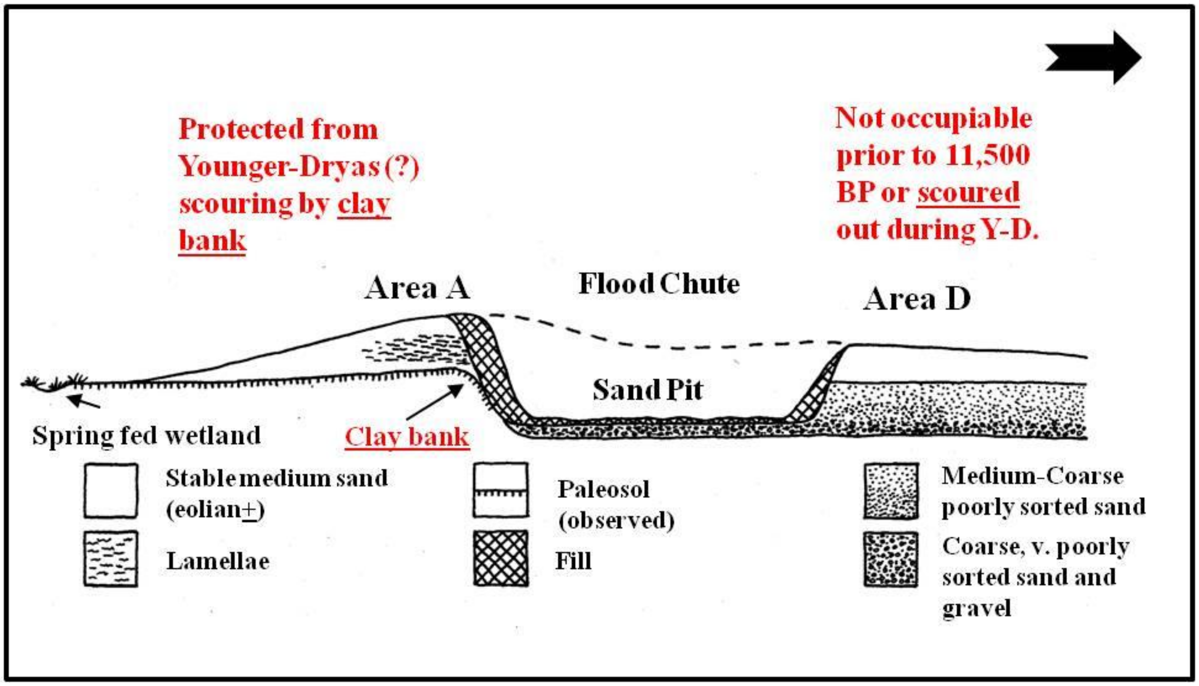


Figure 2.11: Geomorphology of Cactus Hill (note: soil unit below the coarse sand and gravel under the sand pit and Area D is presumed to be clay).

The Younger-Dryas lasted from about 12,940±260 years ago until approximately 11,645±200 years ago (Fiedel 1999b: 96), which conveniently fit the cultural gap between the Clovis age horizons over the clay bank and the Early Archaic, Palmer horizons in area D. The area D pattern was replicated at the Barr site.

Comparable evidence for Younger-Dryas flooding is present in the deeper profile at the Shawnee Minisink site in the Delaware River Water Gap in eastern Pennsylvania (Figure 2.12) (Dent 1985; McNett 1985). The author did his Masters level field school at Shawnee Minisink, which helped with the association. The oldest Early Archaic cultural horizons at Shawnee Minisink are separated from the deeper Clovis age horizon by approximately three feet (.91 meters) of sterile sand, probably associated with a major Younger-Dryas fill event (Dent 1985: 153-154). Fortunately, the Paleoamerican component (eastern fluted point) was protected from probable scouring, preceding the

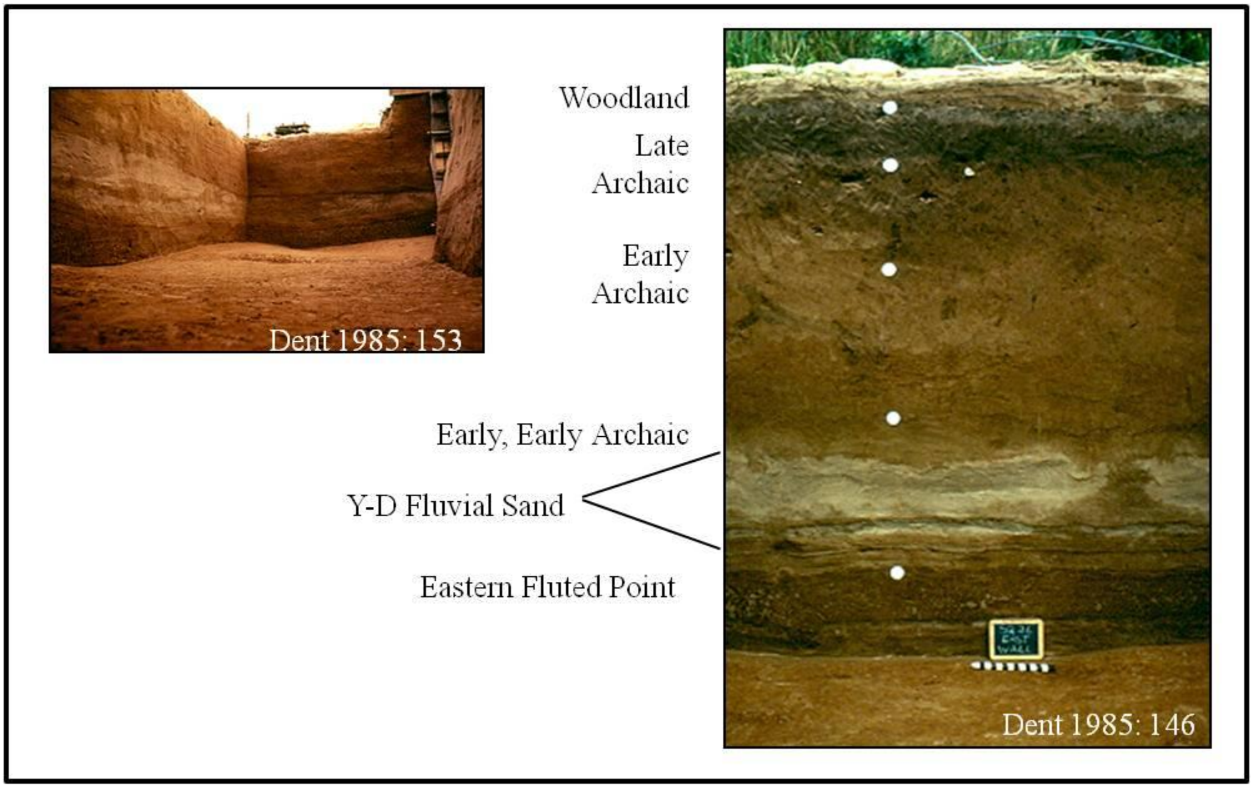


Figure 2.12: Upper Delaware Valley, Shawnee Minisink site profile (right) and undulating sub-strata (left) (photos by Richard J. Dent).

sand deposition, by a thin layer of clay loam (Bt horizon?). A similar massive Younger-Dryas depositional event appears to be represented by the apparently upward fining coarse sand deposit below 40 inches (1.02 meters) in the area D profile of Cactus Hill (see Figure 2.3).

It became clear that to locate buried Clovis age and earlier components one had to find soil old enough so that it had not been scoured by apparent Younger-Dryas flooding. The author was reminded of a comment made by George Frison (1999) at the 1999 Clovis and Beyond Conference in Santa Fe, New Mexico: "If you want to find old sites you have to find old dirt." That became the mantra for the following research.

2.4: The model

The model has several criteria. They are organized under four premises.

2.4.1: Well-drained living surface

The first premise was that, because Cactus Hill is on extensive, deep, well-drained sand deposits, it would provide a relatively dry camping area. Since Cactus Hill and most of the other Paleoamerican sites identified previously by McAvoy (1992) were located on Tarboro loamy sand, mapping the distribution of Tarboro soil was the first criterion used in targeting other potential sites.

2.4.2: Exposure to strong (north) winds

The second premise was that Cactus Hill was open/exposed to winds off the glacier, which would have made the site freer of flying, biting insects. As a result, the areas within Tarboro soil would have to possess a northward aspect to fit. This was the basis for the assumption that Cactus Hill was occupied during the warmer months prior to the pre-Younger-Dryas. It is not likely Cactus Hill would have been occupied in the winter.

2.4.3: Flash flood threat

The third premise was that, although well-drained soil was important, it needed to be high enough not to have been exposed to flash flooding. Because of the results from Cactus Hill Area D, peripheral areas to Cactus Hill, and the testing at the Barr site, it was clear that Tarboro covered terraces below 15 feet (4.57 meters) high contained evidence of only post-Younger-Dryas cultural occupations. As a result, areas 20 feet (6.1 meters) and higher above the adjacent Nottoway River Channel, like Cactus Hill and Blueberry Hill, were considered within the prime testing criteria. It should be noted that in one area - Chub Sandhill - the opportunity arose to further test sites that did not fit this and other parts of the model. This additional control testing only added to the reinforcing results from peripheral testing in and around Cactus Hill and the Barr site.

2.4.4: Younger-Dryas scouring

The fourth and most critical premise was that the Younger-Dryas onset caused significant scouring of the Nottoway River floodplain. Therefore, one had to find residual pre-Younger-Dryas landforms to find evidence of pre-Younger-Dryas cultural occupations.

Based on work at Cactus Hill and preliminary testing at nearby Blueberry Hill, the best places to find surviving pre-Younger-Dryas "old dirt" was predicted to be in Tarboro soil areas; with northerly aspects; on top of deeply buried, horizontally truncated paleosols (clay banks); paralleling old river channels. It appeared that the buried clay banks served to prevent the older soil/sediment deposits immediately above them from being scoured away by the Younger-Dryas, as was evident from control testing at Cactus Hill and Barr.

Chapter 3 - Chub Sandhill

3.1: Overview

3.1.1: Regional paleoenvironmental context

The factors that favor the lower Nottoway and Maherrin Rivers (Chowan) over most other major river valley floodplains in the Coastal Plain of Virginia include the fact that those floodplains have not been inundated by Post-Pleistocene sea level rise that inundated the Chesapeake Estuary (lower ancestral Susquehanna River watershed) and Albemarle Sound (lower Roanoke River watershed) (see Figure 1.1). Pavich et al. (2008) have proposed a macro-geological model that helps to explain this circumstance. They propose that, during the Wisconsin glaciation, the weight of the North American glacier produced a fore bulge through the Chesapeake Bay-Albemarle Sound region that could have been as much as 70 meters (230 feet) above current elevations. Milan J. Pavich (personal communication 2008) stresses that the 70-meter estimate is a maximum and it may have varied, depending on the location. When compounded by sea levels being more than 300 feet (91.4 meters) lower, the land through this region would have been elevated as much if not more than 500 feet (152 meters) above current elevations above sea level. Even if the fore bulge was half the Pavich maximum estimate, the relative elevation difference could have been more than 450 feet (137 meters).

That would have dramatically increased river discharge velocities between the Piedmont and Atlantic Ocean. The impact would have been enhanced by greater volume, due to increased precipitation and melting snow, especially during the Spring. Significant down/back cutting of major rivers and their tributaries would have resulted, especially in the softer sediments of the Atlantic Coastal Plain (Figure 3.1). Erosion from adjacent uplands also should have created relatively substantial valleys around these deeply cut river systems.

Post-Wisconsin subsidence and sea level rise would have drowned these newly eroded valleys more rapidly than surrounding uplands, producing the current Delaware,

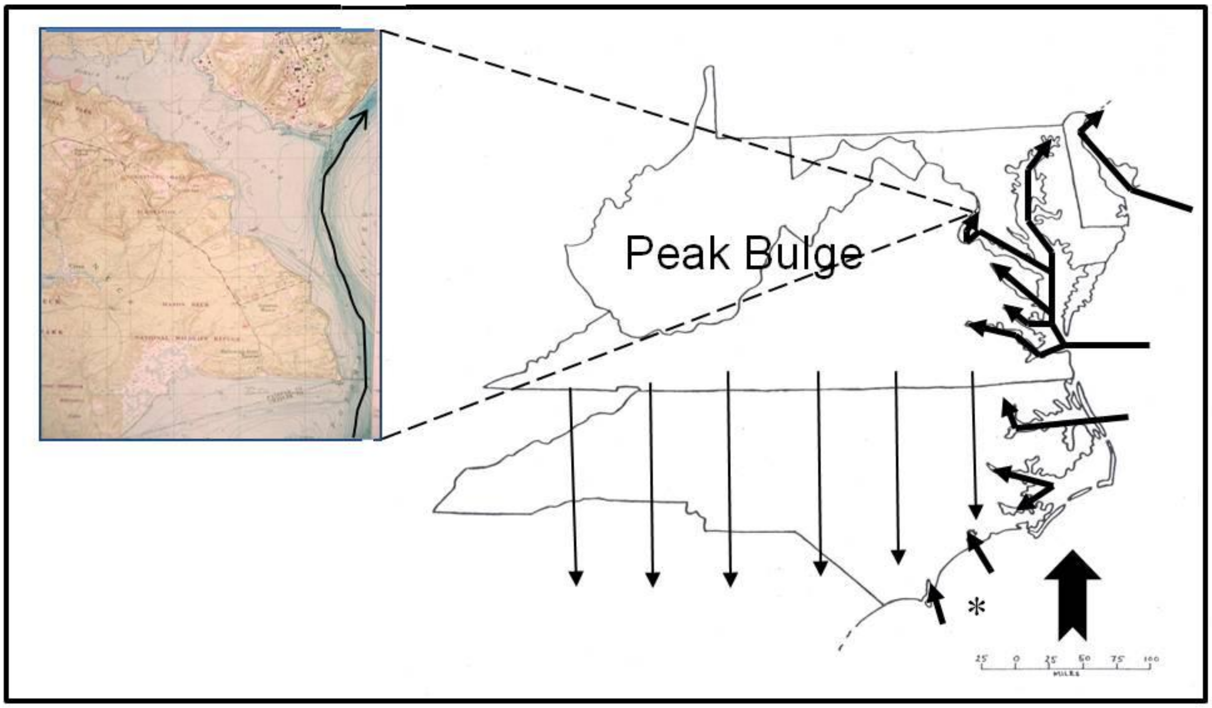


Figure 3.1: Idealized model of Middle Atlantic, river channel incising (down/back-cutting) during the Wisconsin maximum, and subsequent Holocene river valley inundation resulting from continental rebound, compounded by sea level rise. Section of USGS 7.5 minute series (Ft. Belvoir, Va.-Md.) map of relic Wisconsin channel off Mason Neck below Washington, D.C. is shown in upper left.

Chesapeake and Albemarle Sound estuaries. Current excessive erosion of the Chesapeake shoreline with respect to eustatic (World-wide) sea level rise, due to the most recent climatic warming period, may be the result of post-glacial plate subsidence still taking place in the Middle Atlantic region (Pavich, personal communication 2008). Note (*) in Figure 3.1 that the inundation has not been as great south of Cape Hatteras, indicating that uplift and subsidence may have been less of a factor to the south, as would be expected.

Fortunately for archaeologists, the Middle Chowan (Nottoway and Maherrin) Valley has not been drowned like those of the James, Rappahannock and Potomac Rivers. As can be seen from Figure 3.2, the Coastal Plain portions of the York River Valley also have not been inundated, which means that the Pamunkey, Mataponi and Anna Rivers offer opportunities for intact buried pre-Younger-Dryas occupations. The Pautuxent River Valley in Maryland also fits the Nottoway-York pattern.

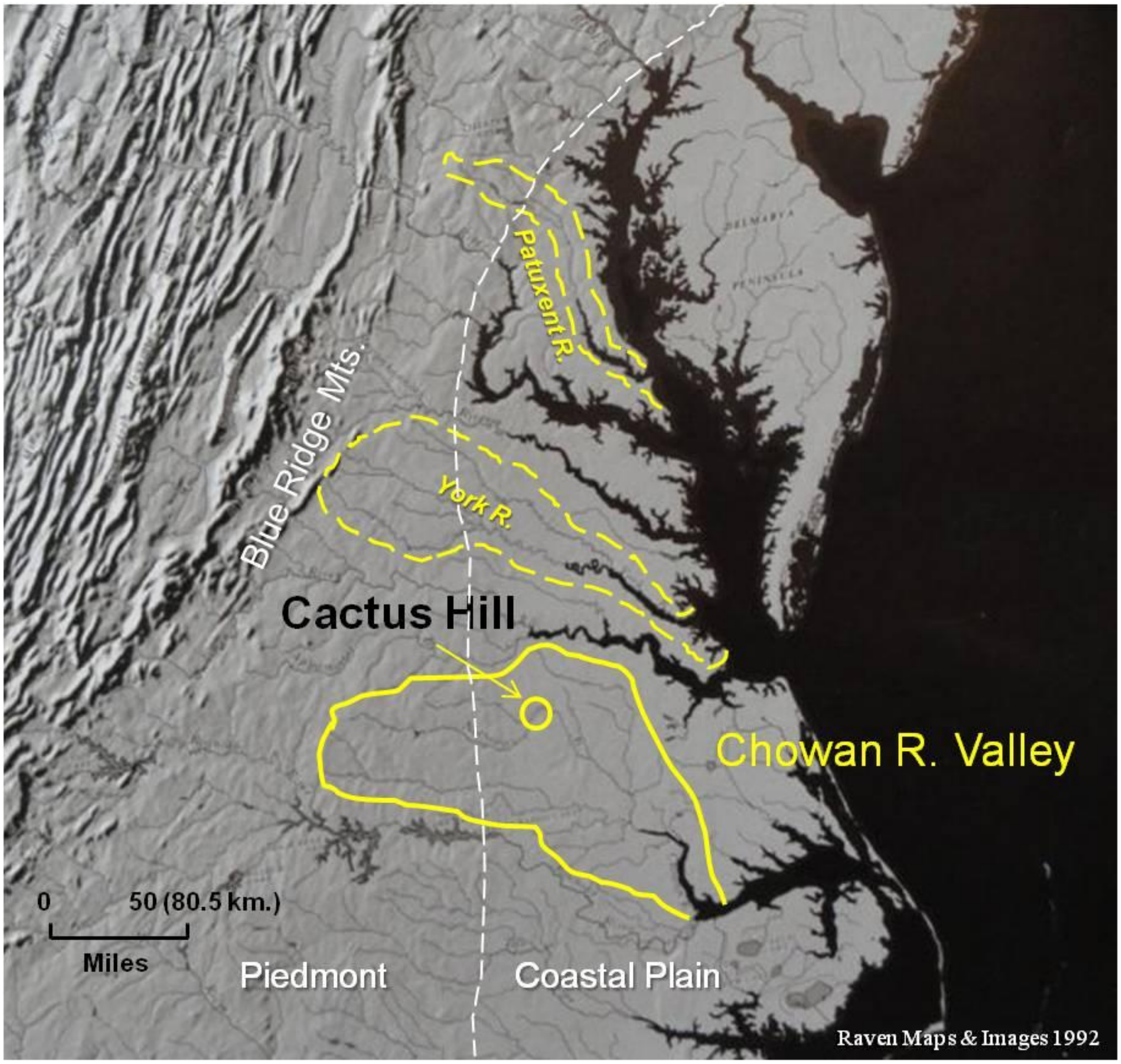


Figure 3.2: Map of the Middle Atlantic region showing three watersheds that are ideal for replicating stratified pre-Younger-Dryas archaeological sites like Cactus Hill (Map reproduced with permission of Raven Maps & Images).

Pleistocene discharge volume appears to have been the consistent variable that separates the larger river valleys from the smaller river valleys in the area of the hypothesized fore bulge and, therefore, may reveal the processes causing reduced inundation in the latter. The headwaters of the larger river valleys are in the Blue Ridge and Appalachians. The smaller river valley headwaters are in the Piedmont, east of the Blue Ridge Mountains (see Figure 1.1).

During full glacial conditions there would have been significant winter snow pack and possibly alpine glaciation in the Appalachian and Blue Ridge Mountains. Spring and possibly summer melting would have produced significant fresh water discharge into the river valleys exiting the mountains. The discharge into the Chowan (including Nottoway), York (including Pamunkey, Mattaponi and Anna) and Pautuxent River Valleys should have been significantly reduced, due to hypothetically less snow in the lower elevations of the Piedmont. This lower discharge volume would have been further reduced by the fact that the headwaters of those rivers cover far smaller horizontal areas.

The Atlantic Coastal Plain surface consists mostly of unconsolidated sediment (clay, silt, sand and gravel). Unlike the Piedmont, which is comprised of near-surface crystalline bedrock, excessively rapid down-cutting of river beds is possible in the Coastal Plain. On the macro scale that process would have been directly related to discharge rates.

The United States Geological Survey (USGS), 7.5 minute series, Fort Belvoir quadrangle section shown in Figure 3.1 (inset) graphically illustrates the currently inundated, pre-Younger-Dryas, Potomac River channel. Down-cutting that produced such a deep channel also would have fostered increased down-cutting of its tributaries, as well as lateral erosion of the river and stream banks of the adjacent uplands. With lower overall discharge rates in the smaller river valleys, at least their Inner Coastal Plain channels appear not to have been deeply incised.

As a result of isostatic rebound, compounded by post Wisconsin sea level rise, the estuarine drowning process has penetrated all the way to the Piedmont-Coastal Plain boundary in the James, Rappahannock and Potomac Valleys (see Figures 1.1 and 3.2). In the Chowan, York and Pautuxent the drowning has been limited to the Outer Coastal Plain (see Figure 3.2).

It appears that deep incising of the greater Roanoke drainage, of which the Chowan (including the Nottoway) are tributaries, may not have progressed inland much beyond the Outer Banks of North Carolina (Boss et al. 2002; Leigh 2008). However, the deeper auger cores from preliminary testing of the Chub Sandhill Nature Area encountered a possible buried channel off the clay bank along the western edge of the Rubis-Pearsall site. This indicates that possibly some down cutting or entrenching had occurred up-river as far as Rubis-Pearsall. In the Rubis-Pearsall area it appears that the old channel has been buried by sediment. Whether it was more pronounced at that location then than today is not known.

These factors have contributed heavily to the increased potential for research in the Paleoamerican period in the Nottoway and, hypothetically, in other non-inundated floodplains in the Inner Coastal Plain. Due to inundation, comparable research is impossible in the Coastal Plain portions of the James, Rappahannock and Potomac Valleys. However, stratified sites may remain on eolian dune covered uplands, not yet impacted by inundation, such as the river's edge at Flowerdew Hundred on the James River. A Clovis age fluted point was reported by professional archaeologist, Scott Speedy, to have been recovered from 3-4 feet below the surface in a fence post hole dug in sandy soil (Johnson and Pearsall 1991b: 160).

However, as mentioned above, one would possibly expect to still observe some evidence of down cutting in the lower parts of the lower tributaries of the smaller rivers. Therefore, all Pleistocene down-cutting may not be evident on current surface maps.

3.1.2: Local paleoenvironmental context

As indicated above, independent analyses by the ASV (Johnson 2004) and Nottoway River Survey (NRS) (Wagner and McAvoy 2004) strongly support a significant reworking of the Nottoway River floodplain during the Younger-Dryas. The key stratigraphic profile that unlocked the model of Younger-Dryas scouring was that of area D at Cactus Hill. That profile showed that post-Younger-Dryas occupations were in medium, low iron content sand (possibly eolian) on top of a deep, poorly sorted, coarse sand deposit (see Figure 2.11).

That is contrasted with the situation at areas A and B. In those areas the upper medium sandy loam was relatively iron rich, in comparison with area D. Also, the soils in areas A and B were well sorted, medium textured with the soil farthest away from the Nottoway Channel resting on an old clay bank, which was not present under Area D (see Figure

2.11). Hypothetically, during the Younger-Dryas, this clay bank prevented the Nottoway from scouring out the pre-Younger-Dryas cultural deposits. Locating a similar clay bank at Chub Sandhill was the preliminary objective of the research design.

3.1.3: Archival analysis

Photocopies of field results from the most recent soil survey of Sussex County were obtained from the United States Department of Agriculture field office in Richmond. A list of soil types was provided with the mapping, which actually consisted of 45, annotated, aerial photographs containing USGS 7.5 minute series topographic overlays.

The soil types were reviewed for primary sand deposits as opposed to other soils. Since the Cactus Hill and Barr soils were both Tarboro loamy sand (44), sandy loams were rejected and loamy sands were selected for possible investigation.

Elevation was used an important criterion for selection. The Paleoamerican portion (Areas A, A/B and B) of the Cactus Hill site was within the 60-foot (18.3 meter) contour, while Area D was below the 60-foot (18.3 meter) contour. Blueberry Hill is within the 65-foot (18.3 meter) contour (See Chapter 4). Since the 60-foot (18.3 meter) contour at Cactus Hill and Blueberry Hill probably would not apply at different elevations of the Nottoway along its downstream course, an arbitrary 15 feet (4.57 meters) above the current riverbed was selected as the minimum cut-off for potential early sites. Landforms 20 (6.1 meters) and 25 feet (7.62 meters) above the river were considered high probability. Applicable USGS 7.5 minute series maps (photo reduced by 50%) were annotated with the Tarboro soil to help relate the Tarboro soil to landforms.

The USDA soil analysis for Tarboro has problems. For example, the Tarboro classification at Cactus Hill included Areas A, B and D, as well as Blueberry Hill. It also included Barr, about five miles downstream. It is clear that Tarboro soil overlays both eolian and alluvial sand and is internally variable across the landscape.

The northern, upstream end of the Chub Sandhill Nature Preserve, located on the USGS Sebrell quadrangle, was selected for testing. This area contains extensive deposits of Tarboro loamy sand with varied topography, including numerous high spots (Figure 3.3). The area ranges from 20-30 feet (6.1-9.14 meters) above the current riverbed and, therefore, is the highest floodplain Tarboro soil deposit, relative to the Nottoway River, in Sussex County. Like the Cactus Hill and Blueberry Hill geological contexts, the Chub Sandhill Tarboro deposit is on the inside of a large point bar and the upstream end of the bar is exposed (open) to the north.

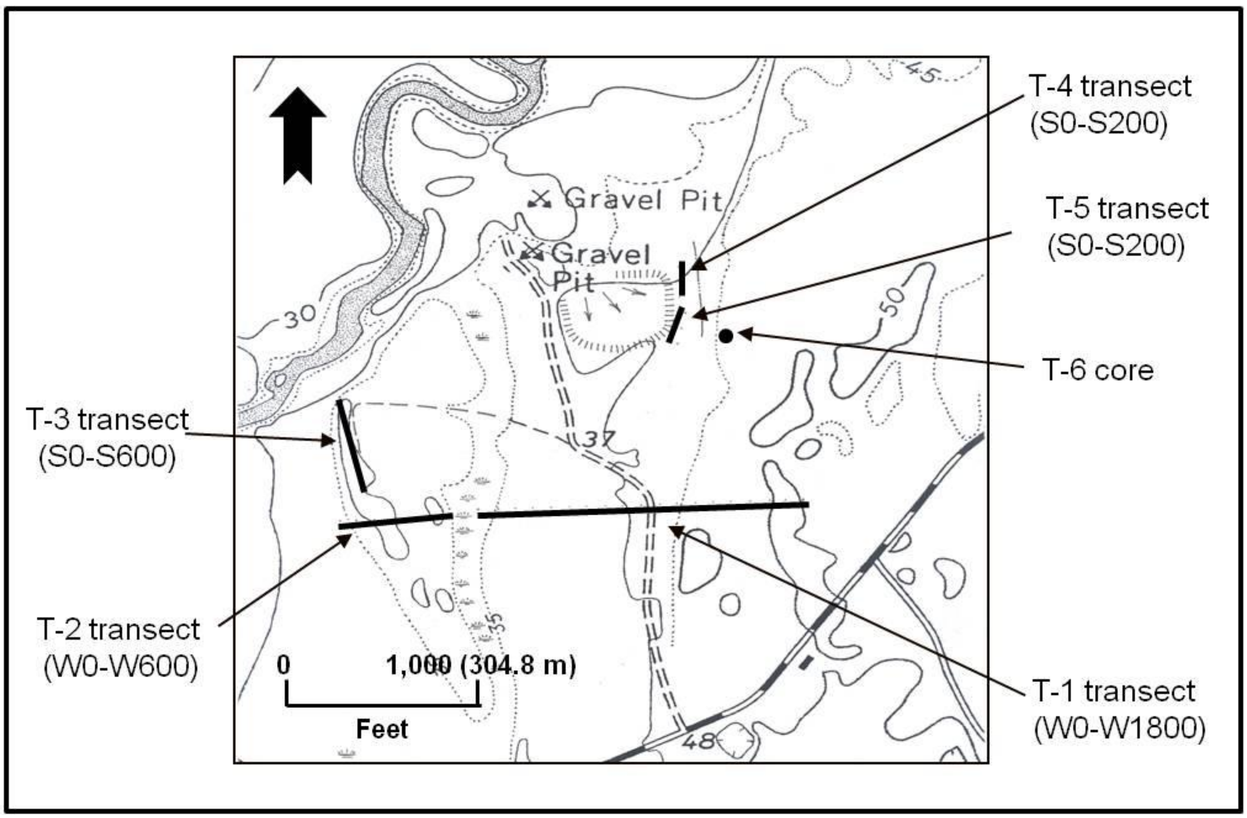


Figure 3.3: Transects for Chub Sandhill auger test transect interval samples (USGS 7.5 min. series, Sebrell, Va.).

3.1.4: Soil analysis

The first phase of the research design involved a simple macro-geological reconstruction of the Chub Sandhill point bar to see if it were similar in cross section to the Cactus Hill point bar. Next to elevation, the following two factors from Cactus and Blueberry Hill seemed most important: (1) the presence of medium, well-sorted sand approximately four feet (1.22 meters) thick or greater; and (2) the presence of ancient, deeply buried clay banks, indicating a natural edge environment along a river or flood shoot channel, probably of pre-Younger-Dryas age.

The preliminary soil analysis phase on the Chub Sandhill Preserve involved evaluating systematically recovered soil samples. The first step involved laying out east-west transects (T-1/T-2), generally parallel to the point bar centerline (Figure 3.3). Auger core sample locations were flagged at 100-foot (30.5 meter) intervals along each transect. Subsequent north-south transects (T-3, T-4/T-5, and T-6) were sampled to supplement the geological data and identify potential cultural deposits (Figure 3.3).

The sampling phase involved excavating 3-inch (7.6 cm.) diameter bucket auger cores at each sample location. Core samples (one bucket full), generally 5-8 inches (12.7-20.3 cm.) long, were visually and physically analyzed for texture, color, consistency, and degree of sorting. Full series of soil samples were recovered from selected cores for later objective analysis, if needed. The samples were laid out in order of excavation on plastic sheeting to observe each bucket sample within the overall stratigraphic context (Figure 3.3). In selected areas on the T-3 and T-4/5 transects and T-6 core soil columns were sifted through 1/16-inch (1.6 mm.) mesh screen for artifacts and geofacts. The data were recovered by core (bucket) sample and stratigraphic context.

Twenty-six, 3-inch (7.6 cm.) diameter bucket auger cores were examined along the T-1/T-2 transects, which cut through the approximate centerline of the Chub Sandhill point bar (Figure 3.3). The two transects were separated by a water-filled flood chute at the end of the T-1 and beginning of the T-2 transects. Surface sandy sediments feathered into clay in the flood chute on both sides.

The T-3 and T-4/T-5 transect interval samples were laid out along sand ridges north (upstream) of the T-1/T-2 transects. These were done to evaluate the stratigraphy of areas with high potentials for buried archaeological levels.

Since the samples along these transects were designed to assess archaeological potential, soil analysis samples were dry sifted through 1/16-inch (1.6 mm.) mesh. All artifacts were recovered and recorded by bucket auger sample.

A final isolated core (designated T-6) was taken from the farthest east sand ridge, the third terrace (Figure 3.3). It was located adjacent to the eastern boundary of the Chub Sandhill Nature Area. It too was sifted for artifacts.

Figure 3.4 shows the stratigraphic profiles of the T-1/T-2 transect interval samples. They are not to scale. The horizontal distance represents more than 2,700 feet (823 meters), while the deepest core was only 163 inches (4.45 meters) deep.

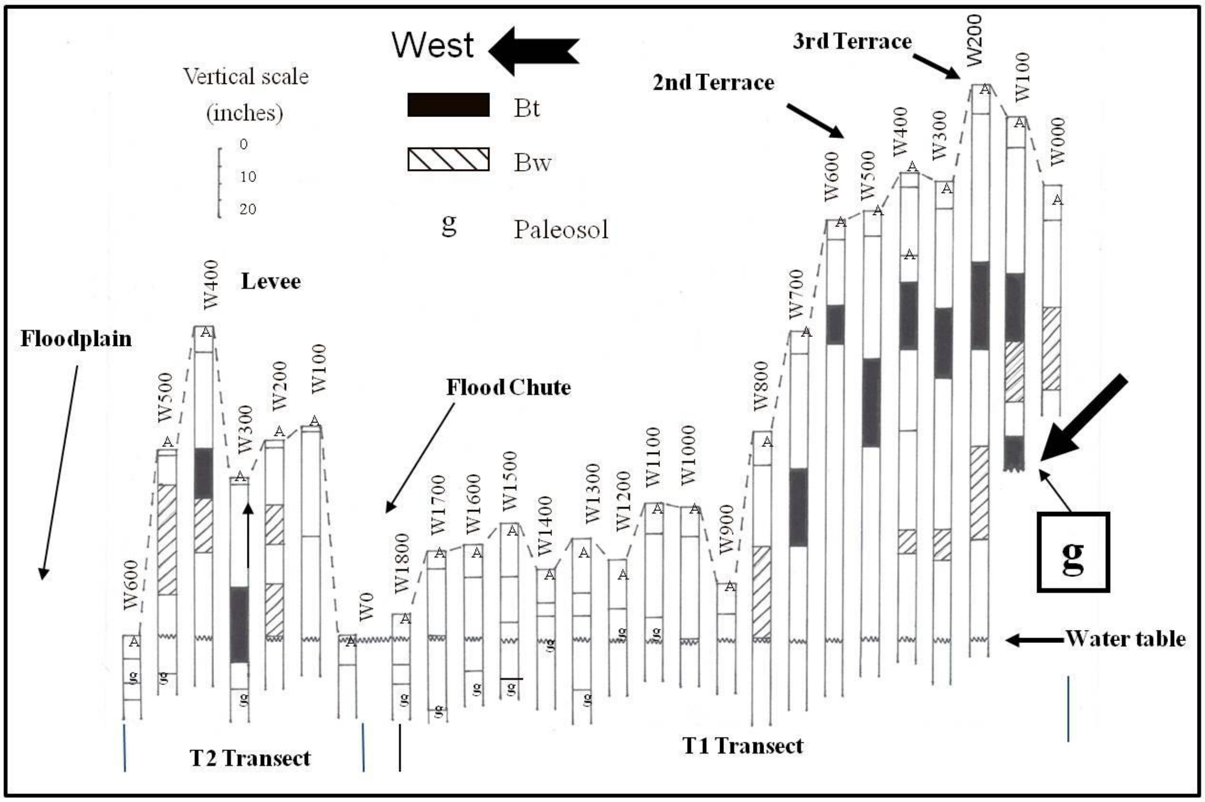


Figure 3.4: Auger sample results from soil analysis from the T-1 and T-2 transects (horizontal scale distorted).

In order to provide relative surface contour relationships between the tops of cores and various soil horizons, all but the easternmost two cores were tied to the water table. The tops of the T-1/W0 and T-1/W100 soil column graphics are positioned based on approximate surface elevations relative to the top of the T-1/W200 core. They did not bottom out on a water table but a paleosol.

Figure 3.4 indicates the presence of a levee and terrace system across the point bar, with the levee (T-2/W100 through T-2/W500); hereinafter called terrace 1, and two older terraces (T-1/W100 through T-1/W400 and T-1/W400 through T-1/W700) referred to here as terraces 2 and 3. All three terraces are underlain by relatively well-developed paleosols.

The only paleosol (g) detected above the water table was in T-1/W100. It was relatively iron rich and mottled (10YR5/6 and 10YR7/2). The fact that it was dry indicates that the water table under the rest of the point bar to the west is derived from the river. The T-1/W100 buried clay probably represents an ancient clay bank, similar to but significantly more deeply buried than those under the Cactus Hill and Blueberry Hill archaeological sites.

The T-6 core was excavated as an afterthought, when the third terrace, not evident on the USGS mapping (see Figure 3.3), was observed to the east of the T-4/T-5 transect. The terrace is located at, what was then, the eastern edge of the State property with most of it being on privately owned land. One complete core was dug, sampled and sifted.

The core's depth was one of several surprises. Although the core extended to 158 inches (3.96 meters) deep, no deeply buried clay (g) horizon was encountered. The bottom two core samples were comprised of very coarse, poorly sorted sand. As will be indicated below, the more extensive auger testing of this landform later demonstrates the probable cause of this deeper deposit on the western edge of the third terrace.

The most intriguing aspect of this core is archaeological. The core failed to locate potentially intense artifact concentrations. Fine mesh sifting the core produced a small amount of charcoal from 25-50 inches (64-127 cm.) below the surface. The core also produced one small quartzite flake from the 37-43 inch (94-109 cm.) deep sample.

3.2: Koestline Site (44SX332)

3.2.1: T-3 auger transect

Figure 3.3 shows that the T-1/T-2 transects were located well downstream from the head of the point bar. Evidence from the Cactus Hill excavation and Blueberry Hill test excavations show that for model purposes the prime site locations should be at the upstream ends of the levee/terrace system on the point bar. Of course, the null-hypothesis warranted testing. However, the purpose of this research design was to first establish that Cactus Hill and Blueberry Hill do, in fact, belong to a broad cultural land use pattern with sufficient age to produce stratified Paleoamerican occupation levels.

In 2004 Koestline was auger tested with four core samples at 200-foot (61 meter) intervals starting at the north end and extending south along the spine of the levee (first terrace). Fine (1/16-inch mesh) (1.6 mm. mesh) sifting of the 2004 auger test samples indicated that the archaeological manifestations of the site were within the top 23 inches (58.4 cm.) of the surface. Based on the auger test results (see Appendix I: Table 3.1) the extent of the site was estimated at between 400 (122 meters) and 600 feet (183 meters) long with the most intense occupation area at the north end of the transect (Johnson 2004:36).

Later in 2004, two 5x10-foot (1.52x3.05 meter) test trenches (K1 and K2) were excavated in four-inch (10.2 cm.) levels below the plough zone (Ap) to test Koestline (Figure 3.5). Test trenches were placed at the north end of the T3 transect adjacent to the T3-S000 auger test (K1) and at the T3-S200 auger test (K2) (Johnson 2004: 26). Each test trench was excavated using flat shovels. The plough zone was chunked out as level 1. The bottom of the plough zone was pinned in the walls and subsequent levels were four inches (10.2 cm.) thick. Each test trench was dug to alluvial sand. The test trenches were terminated at the appearance of coarse poorly sorted, sterile sand, which matched the archaeological and soil analysis from adjacent auger tests.

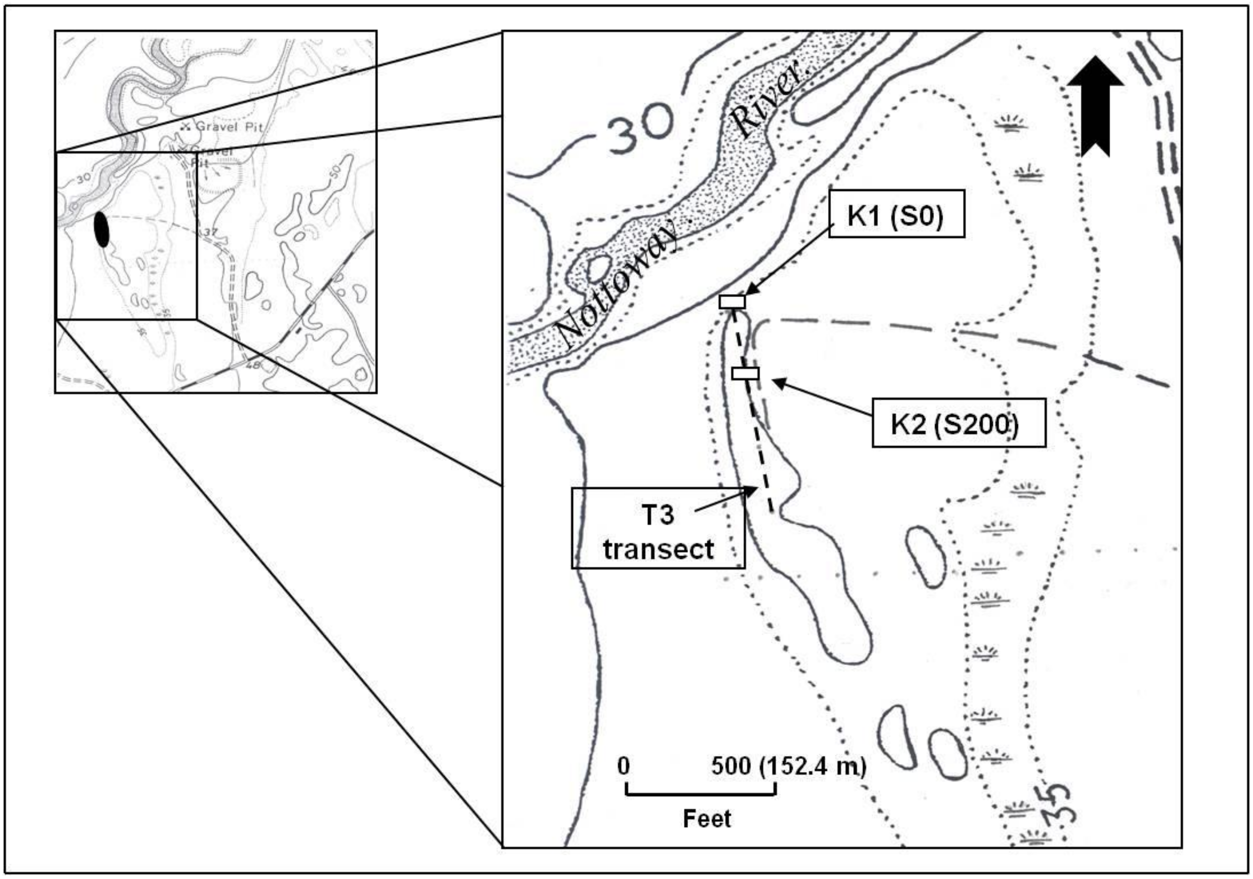


Figure 3.5: Koestline site test trench context (test trench sizes are not to scale) (USGS 7.5 min. series, Sebrell quadrangle).

3.2.2: Test trench K1

Figure 3.6 shows diagnostic artifacts by level and depth below the surface from both the K1 and K2 trenches. As can be seen, level 1 from K1 produced diagnostic artifacts dating from a small Late Woodland triangular point (Figure 3.6b) (probably late pre-European contact) back through a Late Archaic Savannah River point (Figure 3.6c) (approx. 3,800-4,500 years ago). Although potsherds (Figures 3.6a, 3.6d and 3.6j) were recovered from each level down through level 4, the bulk in both quantity and size were recovered from the plough zone (see Appendix II: Table 3.2).

Darren Loomis (personal communication 2005), Chub Sandhill Natural Resource Area

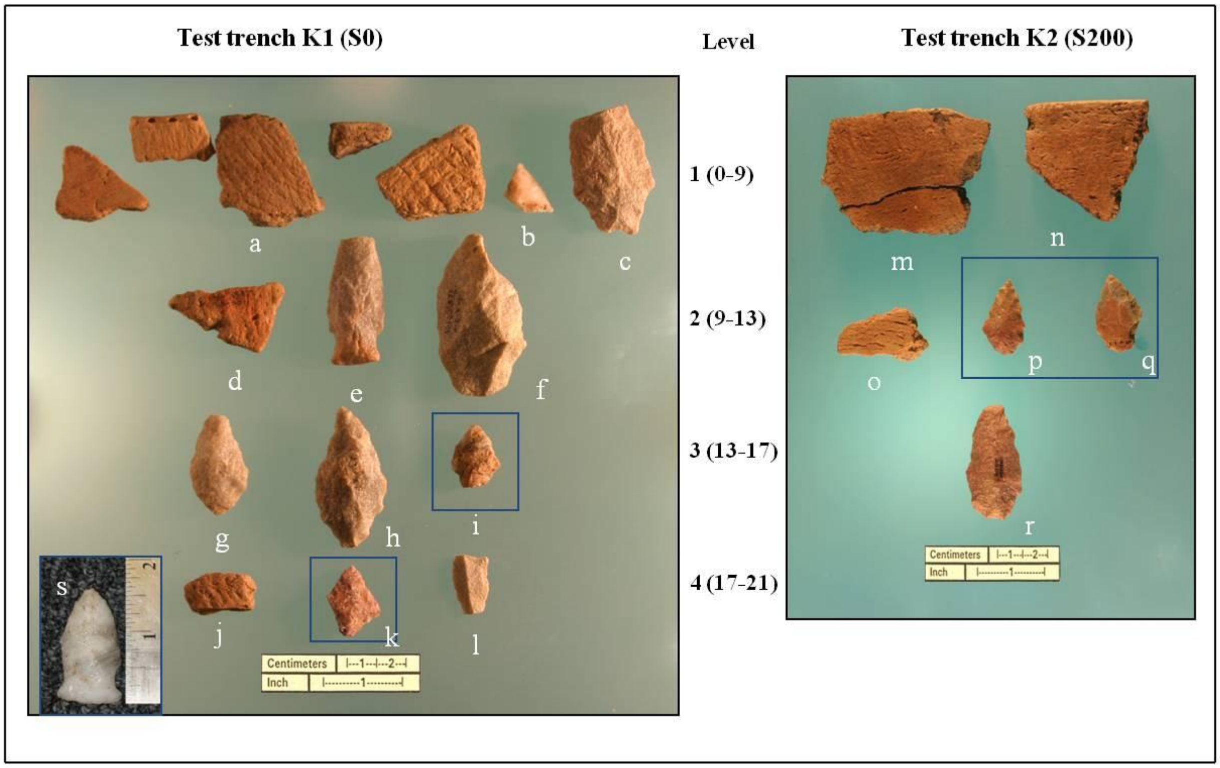


Figure 3.6: Sample of diagnostic artifacts by level from test trenches K1 and K2. Inset quartz Halifax-like point is surface find from near K1 (photos by author).

Manager, reported finding the quartz Halifax point (approx. 5,000-5,500 years ago) shown in the inset (Figure 3.6s) on the surface near K1. Some earlier earth moving in the form of push piles was evident around the abandoned logging road near the trench. The context for the point's recovery was not clear so it is not evident how it got to the surface.

Artifacts from the 2005 test excavation of K1 were recovered primarily from the upper 22 inches (55.9 cm.) of the profile (plough zone through level 4) (see Appendix II: Table 3.2). They rapidly dropped off in quantity below that.

The fact that potsherds were recovered from each level down through level 4 (18-22") (45.7-55.9 cm.), demonstrates that the trench had encountered some natural or cultural induced down-drift of artifacts. The weakly bonded, sandy nature of the soil precluded visual identification of older soil features. Piece plotting artifacts and charcoal, as was successfully done in Area A at Cactus Hill, might have rectified this problem.

Level 2 (10-14") (25.4-35.6 cm.) produced another Halifax point of quartzite (Figure 3.6e). It also produced the highest quantity of quartzite fire cracked rocks (QZFR) of any level, indicating a possible rock lined or platform hearth. The elongated quartzite biface (Figure 3.6f) is consistent with Middle Archaic Morrow Mountain and Late Archaic Savannah River phase technology.

Probably the most significant distribution is with the crypto-crystalline (chert/jasper) debitage (CJDE). The noticeable increase in those materials corresponds with the Middle Archaic Lanceolate (Figure 3.6g) and small Morrow Mountain-like points (Figure 3.6i and 3.6k) in levels 3 (14-18") (35.6-45.7 cm.) and 4 (18-22")(45.7-55.9 cm.), suggesting an association. The elongated biface with slightly contracting base (Figure 3.6h) is consistent with a Morrow Mountain preform.

The distribution of water rolled pebbles and very coarse sand grains, hereinafter referred to as pebbles (PB), is of particular note (see Appendix II: Table 3.2). The counts represent those pebbles that were recovered from sifting soil through 1/4-inch (6.3 mm.) mesh hardware cloth. All pebbles were recovered from the sifting and later counted. Pebble quantities should be directly proportional to increased or decreased flooding intensity across the levee surface through time.

Note that pebble quantities are actually and proportionally the lowest in the plough zone, indicating an environment that has been relatively free of intensive floods throughout the modern climatic episode, corresponding to the Late Archaic through Woodland periods. Pebbles make a moderate jump in quantity between levels 3 (n = 70) and 4 (n = 222). Inexplicably they drop in quantity in level 5 (n = 162).

Below level 5, pebble quantities are uniformly high. Note particularly that in levels 8 and 9, only the eastern one-half and one-fourth, respectively, of the trench were excavated. This was done to avoid coarse, alluvial sands (C horizon) encountered in the western part of the levels (Figure 3.7), which is closest to the Nottoway River. The C horizon sands were significantly coarser and more poorly sorted.

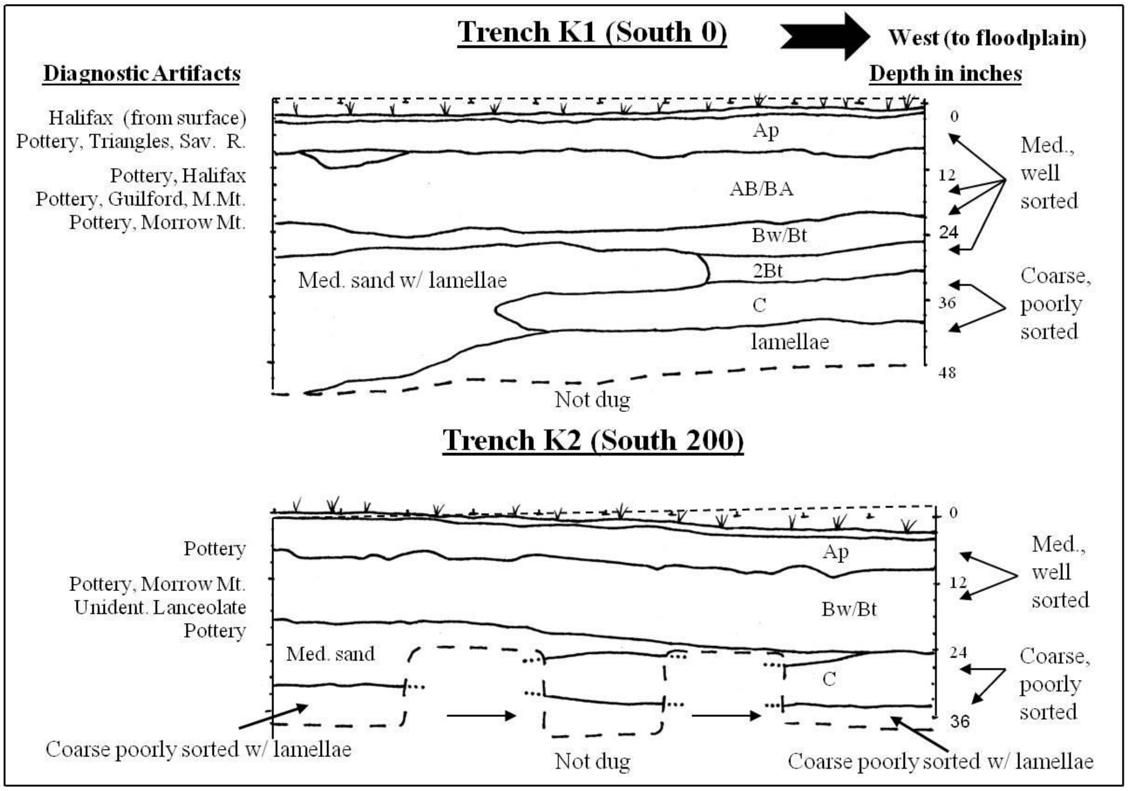


Figure 3.7: Koestline test trenches K1 and K2 field profiles.

Additional evidence of post-Morrow Mountain period stability is shown by the formation of clay lamellae below 40 inches (1.02 meters) in the C horizon. This assumes that the source for the clay would have been percolation from relatively more iron-rich soils of the upper soil horizons rather than saturation fronts from elevated groundwater tables. However, a combination of the two processes is also possible.

All of the diagnostic artifacts and the bulk of the total artifacts occurred in the plough zone (Ap) and AB/BA (possible E) soil horizons (Figure 3.7). The deepest small Morrow Mountain-like point (see Figure 3.7k) corresponds to the first jump in pebbles in level 4. Clearly, the upstream end of the levee was subjected to significantly higher flood activity below level 5. Based on the distribution of diagnostic artifacts, this period of more frequent flooding possibly ended sometime between approx. 7,000 and 8,000 years ago.

The inverse quantity relationship between the larger volume artifact classes, such as quartzite debitage (QZDE), quartzite fire cracked rocks (QZFR), quartz debitage (QUDE) and quartz fire cracked rocks (QUFR), and pebbles (PB) (see Appendix II: Table 3.2) suggests that the primary occupations on the site were influenced by flood potential.

However, the chert/jasper debitage (CJDE) quantities have a direct quantitative relationship with the pebbles. Because of the relatively low gross quantities of chert/jasper debitage, this probably reflects cultural preference during the earlier periods rather than a relationship to cultural avoidance of the terrace's inundation potential. The fact that two of the four earliest points, the small Morrow Mountain points (see Figures 3.6i and 3.6k) from K1, are made of chert and jasper suggests that preference.

3.2.3: Test trench K2

Figure 3.5 shows that K2 was located slightly more than 200 feet (61 meters) south (downstream) from the head of the levee. The T3-S200 auger test produced intermittent artifacts down to 20 inches (50.8 cm.) below the surface (see Appendix I: Table 3.1) (Johnson 2004: 36).

Fifteen potsherds were recovered from 1/16-inch (1.6 cm.) mesh sifting the 4-9 inch (10.2-22.9 cm.) core sample of that auger test (see Appendix I: Table 3.1). No more than one other artifact was recovered from any auger sample below that sample.

Figure 3.6 also shows the diagnostic stone artifacts and a sample of the pottery by level and depth below the surface from the K2 trench. Level 1, which consisted of the 0-9-inch (0-22.9 cm.) deep plough zone, produced significant amounts of pottery, including large, probable Middle Woodland, mendable potsherds (see Figure 3.6m), some with undecorated rims (See Figure 3.6n). Five sand tempered potsherds (CPSA) occurred in level 2 (9-13") (22.9-33.0 cm.) and one sand tempered sherd was recovered from level 4 (17-21") (43.2-53.3 cm.) (see Appendix II: Table 3.3). This indicates that, as with K1, either natural or cultural disturbances have caused some down-drift of artifacts.

The apparent integrity of the K2 trench is indicated by the two very similar small Morrow Mountain points (see Figures 3.6p and 3.6q) recovered from level 2 (see Appendix II:

Table 3.3). They were recovered from the same 10x10x1-inch (25.4x25.4x2.5 cm.) shovel *schnitt*, which strongly indicates that they were from excellent context.

The thick, lanceolate, quartzite biface (see Figure 3.6r) from level 3 could represent either a damaged Guilford point or a Morrow Mountain preform. The edge is not finished, indicating that it was a preform.

Like K1, most artifacts occurred in the upper four levels (see Appendix II: Tables 3.2 and 3.3). Level 5 (22-26") (58.4-66.0 cm.) produced enough material to suggest that it could have contained living surfaces. Of particular note is the relatively substantial amount of quartz debitage (QUDE) and other debitage (OTDE).

Water rolled pebbles (PB) show an approximate quantitative doubling in each level as one goes deeper in the profile. This indicates a steady decrease in flood impacts over time. Figure 3.7 (above) shows a similar but less well developed and complex natural stratigraphy in K2, as compared to K1. In both trenches the C horizon is most evident on the western, current river channel, half of the profile. It is not clear why there is no evidence of an AB/BA (E?) soil horizon, unless the plough zone contains both the A and AB/BA (E?) horizons. If this is the case then it is possible that this part of the site has been subjected to persistent but mild deflation. However, the low number of pebbles indicates that it is not manifested by significant scouring and alluvial redeposition.

The apparently dramatic change in the Nottoway River hydrology appears to have had a profound impact on horizontal distribution of cultural occupations of the Chub Sandhill point bar. This will be discussed further (below).

3.3: Watlington Site (44SX331)

3.3.1: T-4/T-5 auger transect

In 2004 the Watlington site at the upstream (north) end of the second terrace was auger tested along two transects (see Figure 3.3). These transects, T-4 and T-5, were of necessity placed along the inland (east) side of the northernmost or upstream end of the terrace. Although the USGS 7.5 minute series, Sebrell quad, topographic map, edited in 1990 showed a large terrace, by the time of this research much of the terrace had been lost to the expanded sand quarry. In fact the sand quarry was overgrown, which indicated that it had been abandoned for several years prior to the beginning of the ASV research.

The transect locations were not fully determined by natural topography. They paralleled the eastern edge of the sand quarry (see Figure 3.3). The exposed banks of that quarry were systematically examined for artifacts, which helped direct the auger transect placement.

Only the quarry's eastern flanks produced a moderate amount of "grab-bag" artifacts, including fire cracked rocks, debitage and stone tools of various materials (see Appendix I: Table 3.4). No pottery was recovered. One Middle Archaic Morrow Mountain II point was recovered from about one-foot (30.5 cm.) below the quarry lip. Table 3.4 in Appendix I shows artifacts recovered from the quarry edge and 1/16-inch (1.6 mm.) mesh screening of the T-4/T-5 and T-6 cores.

The artifact distribution along the quarry edge indicated that the site had been significantly larger with much of it having been removed by the quarry. Essentially all that was left was the eastern edge, consisting of possibly less than 25% of the original site. The surface sloped, generally, gently downward to the east (away from the quarry), indicating that the terrace apex had been removed. This was faintly evident along the southeast wall of the quarry.

The T4 transect began at the upstream (north) end of the sand pit edge, closest to the current Nottoway River floodplain. It was extended south at 100-foot (30.5 meter) intervals to S200 for a total of three core samples. The T5 transect started near the T4-S200 core sample and extended another 200 feet (61 meters) to the south-south west. This change in direction was designed to keep the transect as close to the sand pit edge as practical.

Hypothetically, the prime cultural areas on the second terrace (as indicated by the T-1 auger transect) should have been to the upstream end of the terrace adjacent to the ancestral stream channel. The old channel was thought to have been along the western edge of the terrace, much of which had been removed by the sand quarry. The soil and archaeological data recovery methods were identical to that used on the Koestline site

The northernmost core bottomed out on clay at 103 inches (2.59 meters) below the surface. The shallow deposition above the clay, relative to other cores on Watlington, is not surprising at the northernmost core, because the top of the core was downslope from the other cores. The other cores that were extended to their maximum workable depths bottomed out with wet sand at 124 (3.15 meters), 130 (3.25 meters), 141 (3.58 meters) inches deep. Although surface measurements were not taken, depths roughly corresponded to the depths of the adjacent sand banks above the quarry bottom.

No diagnostic artifacts were recovered from the auger cores. However, the contexts provide solid evidence for stratigraphic archaeological material within the site. Stone artifacts were recovered to a maximum depth of 42-46 inches (1.09-1.17 meters.) deep in T-5/S0 (see Appendix I: Table 3.4).

The integrity of parts of the site also showed signs of having been vandalized/destroyed by artifact hunters. This was manifested by several old pot holes east of the quarry pit edge near the intersect of the T-4 and T-5 transects; a large spoil pile on the sand pit edge, and an abandoned wooden screen frame on the quarry floor adjacent to the spoil pile. These were sad reminders of the damage artifact hunters had done to much of Cactus Hill.

As stated above, the northern (upstream) end of the landform was also lower in elevation with a gradual rise southward to the T-4/S200 core location. This was based on field observation. Cactus Hill had a similar surface topography (Johnson 1997; McAvoy and McAvoy 1997). As with the T-3 transect, the fieldwork was driven by archaeological concerns. As a result, not all cores were taken to the bottom.

Between 2004 and 2006, six 5x10-foot (1.52x3.05 meter) test trenches were dug in two blocks (Figure 3.8). Auger test results from the T4 and T5 transects determined the area of testing. The trenches were combined into two blocks (A and B) with block A being the southernmost of the two. The auger results indicated that the southern, rather than the northern end of the auger transects contained the deepest artifact deposits (see Appendix I: Table 3.4).

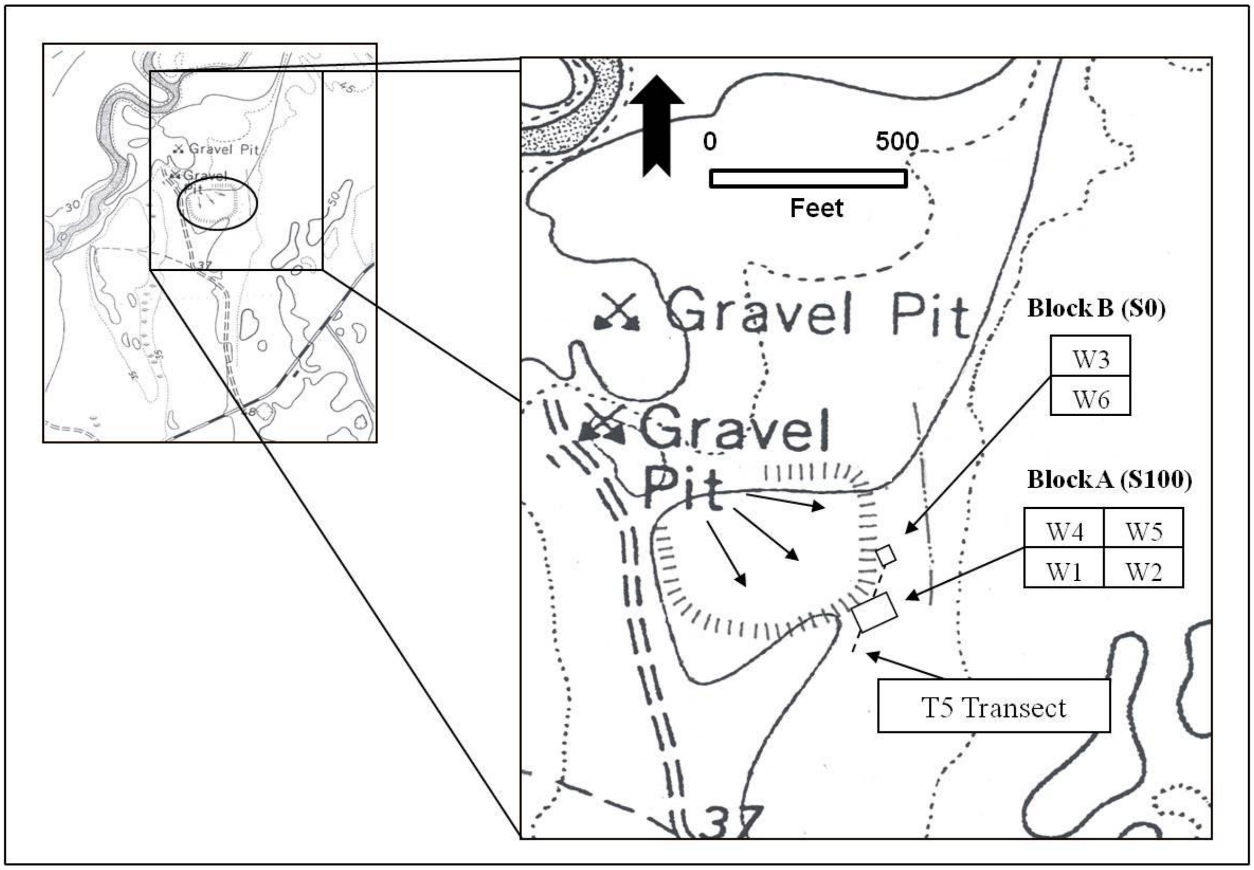


Figure 3.8: Watlington site, T5 transect, test trench context (block and test trench sizes are not to scale) (USGS 7.5 min. series, Sebrell, Va.).

Test trench numbering was based on excavation sequence. This was the result of the flexible research design employed on the project. The results of earlier trenches produced data gaps that were partially and eventually filled by subsequent test trenches. All of the test trenches except the last, W4 were excavated in the same manner as was done on Koestline.

3.3.2: Block A

Figure 3.8 shows Block A adjacent to the southeast edge of the expanded sand pit at the South 100 (S100) auger test along the T5 transect. The S100 auger test was located in the center of the boundary line between trenches W1 and W2, which were excavated in 2005.

Trenches W4 and W5 were laid out along the northern edge of the first two trenches. Trench W5 was excavated in 2006. It was excavated in order to take the block down an additional four levels (16 inches) (40.6 cm.) to assess the deepest charcoal bearing levels detected by the fine screened auger samples in 2004 **(**Johnson 2004: 39**)**. W4 was later dug, using two-inch (5.1 cm.) sub-levels designed to recover a more refined cultural stratigraphy and take a second look at the deepest potential artifact levels.

Fine screen sifting of the S100 auger test samples produced stone artifacts down to 39 inches (99.0 cm.) below the surface (Johnson 2004:39). Most notably, that auger test showed potential for discrete occupation levels separated by sterile levels. Stone artifacts were recovered from the 0-8 (0-20.3 cm.), 14-20 (35.6-50.8 cm.), 20-26-inch (50.8-66.0 cm.), and 33-39-inch (83.8-99.0 cm.) cores (Johnson 2004: 37, 39). Charcoal also was recovered from the 51-57-inch (129.5-144.8 cm.) core (see Appendix I: Table 3.4). As a result, the T5-S100 core was a prime candidate for test excavation.

Figure 3.9 shows diagnostic artifacts for the four contiguous test trenches. They and the general artifact distribution (see Appendix I: Tables 3.5-3.8) indicate that all but the deepest separation between artifacts found in the auger test may be a function of the very small horizontal sample size provided by the 3-inch (7.6 cm.) diameter auger core.

Only one indicator of a diagnostic artifact, an unidentifiable point tip, was recovered from above 17 inches (43.2 cm.) below the surface (3.8a). Sufficient quantities of non-diagnostic debitage and fire cracked rocks were recovered from between the surface and 17 inches (43.2 cm.) (see Appendix I: Tables 3.5-3.8) to indicate that later occupations were possible on the site but were probably relatively ephemeral. Significantly, no ceramics were recovered from any of the four test trenches or from the extensive eroded areas along the sand quarry edge (Johnson 2004: 39).

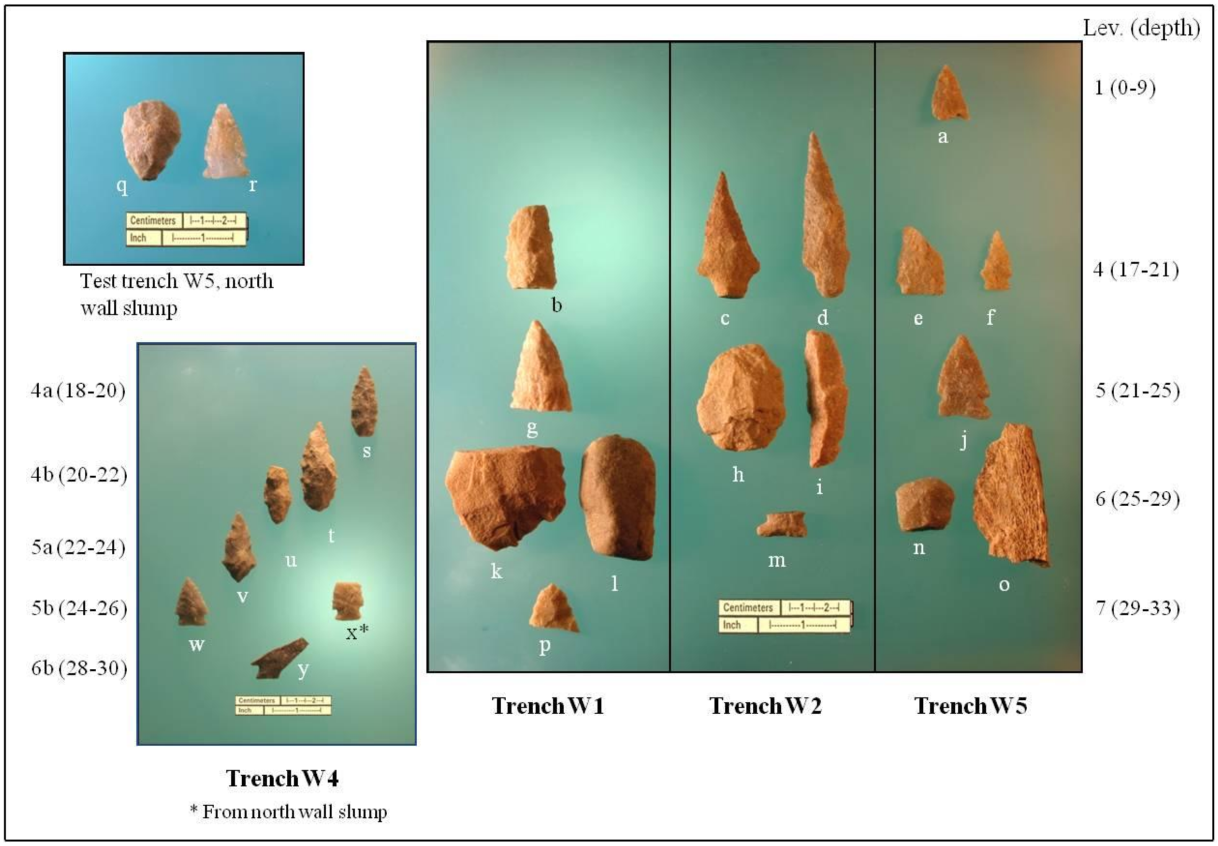


Figure 3.9: Sample of diagnostic artifacts by level from trenches W1, W2, W4 (left) and W5 (Block A) (photos by author).

The latest identifiable diagnostic artifact from Block A was a Guilford-like point from W4 (Figure 3.9s). Another unidentified quartzite lanceolate point-like biface (Figure 3.9t) was recovered from level 4 in trench W4. It has a straight base, but, except for at a knot-like knapping problem on one face, it does not have the thick cross section common to Guilford points.

Trench W5 produced two diagnostic Palmer-like points (Figures 3.9e and 3.9f) from level 4. These are anomalous in a Morrow Mountain II context. The metavolcanic Palmer-like point (Figure 3.9e) has only one, shallow corner notch. It is heavily ground on the base and in the notch, and lightly serrated which are consistent with Palmer points. The other (Figure 3.9f) is merely an edge shaped flake and is of questionable utility as a projectile point or utility knife/saw. Considering the fact that the points were recovered from the screens, it is possible that they came from the bottom of level 4 and the Morrow Mountain II points from the top. Otherwise they indicate mixing between the Middle and Early Archaic horizons in trench W5. The two-inch (5.1 cm.) levels used in W4 were designed to address this problem.

The next diagnostic is a relatively broad point tip (Figure 3.9g) from level 5 in trench W1. Because of its width it could be either a Middle Archaic Morrow Mountain I or Stanly point, or a Late Early Archaic Fort Nottoway point. Considering the obvious Early Archaic point base in the next level and Palmer-like points from levels 4 and 5, any of the three types is possible. They are all in the sequence between Morrow Mountain II and Early Archaic Kirk/Palmer/Decatur points. The tip does not resemble either bifurcate or Kirk Stemmed technologies, which could also be in the sequence. The ovoid biface (Figure 3.9h) and blade-like flake (Figure 3.9j) from level 5 are consistent with the earlier part of the Archaic period.

Level 6 produced a heavily ground quartzite point base (Figure 3.9m) in trench W2 that could either be from a Fort Nottoway or an earlier Palmer point. The base is somewhat more robust than a typical Palmer base, which would indicate Fort Nottoway. The large Quartzite biface (Figure 3.9k) from trench W1, level 6 is also consistent with Fort Nottoway.

The large, quartzite, ramped endscraper (Figure 3.9l) with cobble cortex in trench W1, level 6 is also consistent with Fort Nottoway, rather than Palmer. Palmer endscrapers generally more closely resemble the smaller Clovis endscrapers. Artifact Figure 3.9n from trench W5, level 6 is a broken, ramped endscraper with a spur on the left corner of the bit. This scraper resembles Clovis age scrapers from the Middle Atlantic Region (Johnson 1989: 106-108) but could also be of Palmer age.

The large item (Figure 3.9o) from level 7 in trench W5 is a bone fragment from a very large vertebrate. A large section of a fossilized Miocene shark (*Charchirodon megalodon*) tooth was piece plotted in good Early Archaic context in Area A at Cactus

Hill and a small mastodon tooth was reportedly recovered by a front-end loader operator from either the Cactus Hill or Cub Sandhill quarries (Russell Darden, personal communication 2001). As a result, it is unusual but not impossible for fossilized mega-fauna remains to be recovered from sand hill contexts, including cultural, in the lower Nottoway Valley. The bone fragment has not been analyzed and could be fossilized.

The distal end of a quartzite point (Figure 3.9p) from level 7 in trench W1 is relatively thin and has relatively broad, parallel, flake scars. It also expands markedly from the tip toward the proximal (base) end of the point. These attributes are more characteristic of Paleoamerican points like Hardaway, Dalton, or Clovis. It lacks any indication of serrations common to Early Archaic points and is thinner than normally found with Fort Nottoway point tips familiar to the author.

However, calibration of C-14 dates (Fiedel 1999) has resulted in a dramatic increase in the time span between the end of the Clovis age and beginning of Palmer. The cultural diagnostics defining this expanded gap need to be better understood before a leap from the above point tip to a fluted point can be made.

Excavation of the deeper levels of trench W5 produced three wall slumps: two along the north wall and one on the east wall. These were removed in bulk and sifted through 1/4-inch (6.3 mm.) mesh. The artifacts are recorded separately with the trench W5 data although they are from adjoining contexts (see Appendix I: Table 3.8). Most notable, the north wall slumps produced a technologically early, quartzite endscraper (Figure 3.9q) and a clear quartz Palmer point (Figure 3.9r**)**. Fortunately, the Palmer point was observed in bulk context before being shoveled into a sifter. It came from the lower part of the slump and probably was not from a previously disturbed context.

Trench W1 produced a significantly greater quantity of quartzite debitage (QZDE) than trench W2 by as much as 4 or 6 to one (see Appendix I: Tables 3.5 and 3.6). By contrast trench W2 (see Appendix I: Table 3.6) produced a 2 or 3 to one greater quantity of quartz debitage (QUDE) than trench W1. Both quartzite and quartz debitage cluster between levels 3 and 6 in both test trenches. However, level 7 in trench W1 did produce 101 quartzite debitage and level 7 in trench W5 produced 141 quartzite debitage (see Appendix I: Table 3.8), which cannot be discounted, especially considering the possible early point tip from the same test trench and level. These are proportionally greater with respect to level 6 than the quartzite debitage (n = 11) in trench W2, indicating that the levels may have horizontal integrity.

Level 4 in trenches W1, W2 and W5 contain the highest amounts of metavolcanic debitage when compared to most of the other levels. The exception is in trench W1, where both levels 4 and 6 contain five pieces of metavolcanic debitage. These roughly correspond to the metavolcanic Morrow Mountain points in levels 4b and 5a of trench W4. However, the metavolcanic debitage in the main artifact producing levels of W4 show no pattern.

The sudden, relatively large quantity of chert and jasper from level 6 in trench W1 should be significant. Level 6 in trench W5 also contained the highest amount (n = 6) of chert debitage in any level in that trench. It is noteworthy that no chert or jasper was recovered from level 6 in trench W2. The highest amount of chert/jasper in trench W4 was also in level 6b. Additionally, level 6 contains the highest number of bone fragments in trenches W1 (n = 11), W2 (n = 5) and W4 (n=6). Level 6 in trench W5 produced only 1 bone fragment, while levels 4 and 5 produced five and seven fragments, respectively. All of the fragments were too small for identification.

If the point data are accurate, these data indicate a possibly early occupation between 25 and 29 inches (73.7 cm.) deep in Block A. These data also strongly suggest the site has detectable horizontal and vertical artifact integrity in its deepest levels. Sorting these contexts would require comprehensive piece plotting similar to that used in Area A at Cactus Hill after 1995 (Johnson 1997: Addendum).

Trenches W4 and W5 were taken down to 62 and 61 inches (157.5 and 154.9 cm.), respectively, below the surface to evaluate the potential cultural material (charcoal) occurring in the 51-57-inch (129.5-144.8 cm.) deep auger core, T5-S100 (see Appendix I: Table 3.4) from 2004. Two small quartzite flakes were recovered from level 13b (56-

58") (142.2-147.3 cm.) in trench W4 (see Appendix I: Table 3.7). Three small quartzite flakes and one quartz flake were recovered earlier from levels 13 (53-57") (134.6-144.8 cm.) and 14 (57-61") (144.8-154.9 cm.) respectively in trench W5 (see Appendix I: Table 3.8). These data are potentially very significant, because these artifact producing levels are separated by 15 inches (38.1 cm.) in W4 and 12 inches (30.5 cm.) in W5 from the next higher artifact producing levels. However, there is an alternative hypothesis to a cultural one to explain the occurrence of these artifacts at that depth (discussed below).

As mentioned above, the term pebbles (PB), used here, merely refers to all naturally polished coarse sand grains large enough to be recovered by the1/4-inch (6.3 mm.) mesh hardware cloth screens used during the excavation. Most fit the category of large sand grains.

The pebble data show a clear pattern across the block. The pebble counts show gradual increases from top down to levels 5-7. Pebble counts drop dramatically in level 7 in both trenches W1 and W2. Pebble counts are relatively low below level 7 in trenches W4 and W5 until they dramatically increase again in level 14. This strongly suggests level 14 marks a more active fluvial environment. Since level 14 was the deepest excavated, it is not clear if the level 14 pebble count marks the beginning of a general pebble increase that extends deeper or reflects an isolated fluvial period.

Pebble and quartzite debitage quantities generally correspond throughout the profiles in all four trenches. However, the pattern is in stark contrast with those from Koestline, where there is an inverse relationship between pebbles and quartzite debitage quantities (see Appendix II: Tables 3.2 and 3.3). However, the quantities on Watlington are much lower in the quantitatively highest pebble levels. Those levels are more consistent with the sparsest levels from Koestline, indicating comparable flood threats during the periods of occupation. It is likely that Koestline was only occupied (occupiable?) after the flood threat subsided to comparability to that of the Early and Middle Archaic on Watlington.

Figure 3.10 shows profiles from the south walls of trenches W1 and W2. Artifacts from Feature 1 in trench W2, level 5 consisted of a small fire cracked rock cluster containing one quartzite debitage, six quartzite fire cracked rocks, including one cross-mend consisting of four pieces, three quartz fire cracked rocks including one cross-mend consisting of two pieces, and a small amount of mixed wood and nut charcoal (see Appendix I: Table 3.6).

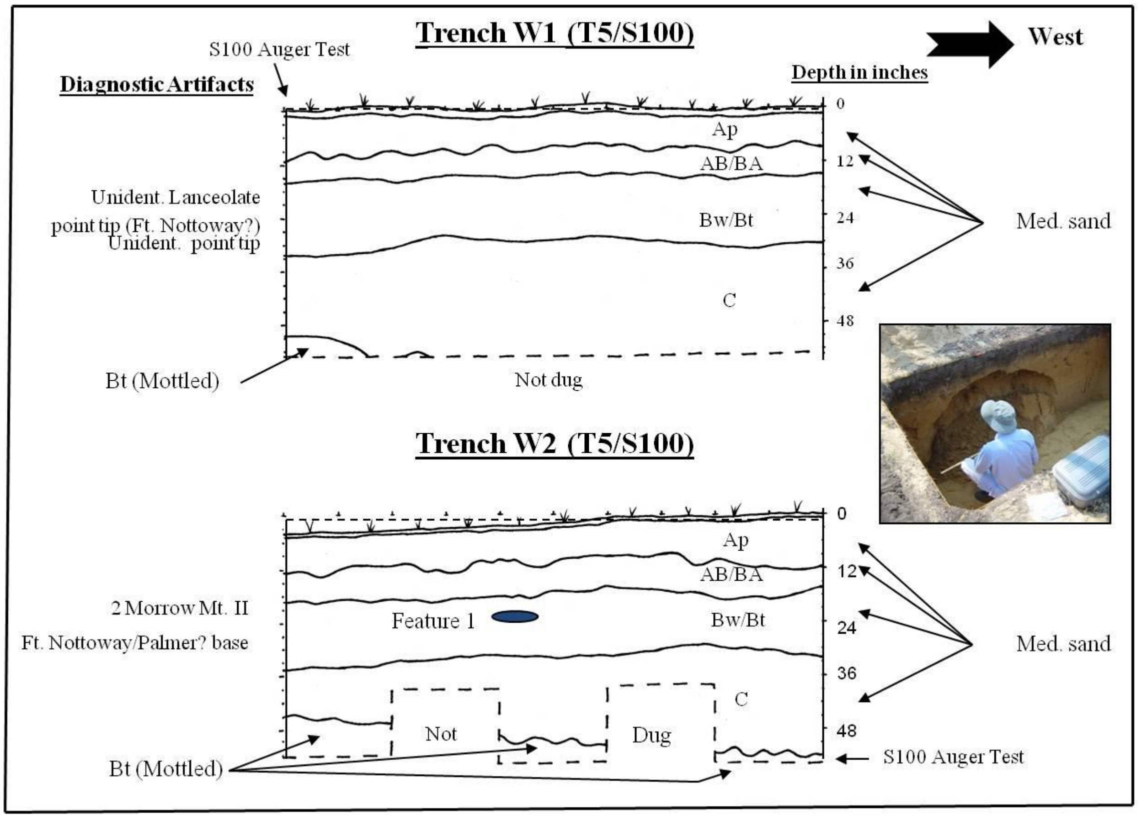


Figure 3.10: Block A, trenches W1 and W2 profiles (photo by Ann Wood).

As noted above, charcoal was recovered from the T5-S100 auger core sample at the 51-57-inch (129.5-144.8 cm.) depth (see Appendix I: Table 3.4). This was separated from the next deepest artifact/charcoal producing auger sample by 12 inches (30.5 cm.) of well sorted, relatively light colored, medium sand. As indicated above, trenches W4 and W5 produced artifacts in the deepest corresponding levels.

As can be seen from Figure 3.10, the 51-57-inch (129.5-144.8 cm.) deep auger core sample corresponded with the boundary between the “C” and deeper Bt soil horizon. Because the site is loamy sand, it is possible that down drifting charcoal was trapped at the top of and in the more resistant Bt horizon.

This phenomenon was quite evident in the lower levels of Area A at Cactus Hill, where significantly increased amounts of small pieces of charcoal were mapped at the top of the paleosol, well below the lowest cultural horizons. There too, there was a distinct gap in charcoal quantities between the lowest artifact producing levels and the top of the paleosol. Since, after 1995, all pieces of charcoal were individually mapped in Area A at Cactus Hill, the sudden increase was well documented across the block.

The deeper, relatively thin Bt horizon detected during the excavation of trenches W4 and W5 was not detected in the T5-S100 auger core. It is possible that was because the core was terminated too soon.

The fact that the pebble concentrations peak in both B horizons is of interest. This indicates that, during those periods of deposition, fluvial activity in the Nottoway River involved sufficient flooding to periodically cover the site.

The T5-S000 core was the deepest core excavated on any of the upstream ends of the Chub Sandhill terrace complex. It was excavated to approximately 14 feet (4.27 meters) with no Bt horizons or paleosols detected. The profiles shown in Figure 3.10, with their significantly better contexts, indicate that there are finer gradations in natural stratigraphy than detected by the bucket auger cores on any of the sites found.

The cultural material seems to cluster in the upper Bw/Bt horizon, where oxidized iron has accumulated. The small flakes located on and in the top of the deeper Bt horizon probably were trapped there after percolating through the poorly cemented “C” horizon between the two B horizons.

The “C” horizon was the most poorly cemented soil and the initiation stratum for the wall collapses (Figure 3.10 inset). This was a constant problem whenever that stratum was fully exposed for any length of time. The collapses were probably initiated when the “C” horizon dried out sufficiently to destroy moisture bonds between sand grains. That stratum was noticeably low in iron rich clay that characterized the B horizons that bracketed it. This was also a characteristic of profiles at the Barr site, where wall collapses were common. No such wall collapses occurred during the nine years of excavation at Cactus Hill, Area A or the Blueberry Hill site (see Chapter 4).

3.3.3: Block B

Figure 3.8 shows the locations of the W3 and W6 trenches (Block B) located approximately 100 feet (30.5 meters) north of the Block A. Block B was centered on the T5-S000 auger test. That was mid-way on the wall separating the two Block B test trenches.

The T5-S000 auger test produced artifacts down to the 36-42-inch (91.4-106.7 cm.) depth with the highest intensities between 15 and 35-inch (38.1 and 88.9 cm.) depths (see Appendix I: Table 3.4). The deepest artifact cluster from the auger samples, which included two quartzite flakes, was separated from the next higher by seven sterile inches (17.8 cm.)**.** As with trenches W1 and W2 trench in Block A, in 2005, W3 was not excavated deep enough to evaluate the deepest artifact cluster recovered from the auger samples. This was rectified in 2006. However, the tendency in Block B is for quartz debitage quantities to peak in levels 6 and 7. In Block A the quartz debitage generally peaks in levels 4 and 5.

Trench W3 shows a distinct quantitative peak in metavolcanics in levels 5 and 6 (see Appendix I: Table 3.9). Trench W6 shows no corresponding peak in metavolcanics (see Appendix I: Table 3.10). However, trench W6 shows a comparable peak in chert/jasper in those levels that is not matched in trench W3. The chert/jasper peak in level 6 of trench W1 in Block A (see Appendix I: Table 3.5) corresponds in part to the W6 chert/jasper distribution. Again, these data from both blocks strongly suggest that discrete, horizontal and vertical, early activity areas could be sorted out with a fine enough scaled method, such as piece plotting.

Beyond identifying two LeCroy bifurcate points (Figure 3.11a and 3.11g) that stratigraphically bracket a C-14 date recovered from Feature 2 (Figure 3.12), the 2006 excavation of trench W6 did not resolve the complex chronological picture of the Early and Middle Archaic in the Block. The resulting data from reopening

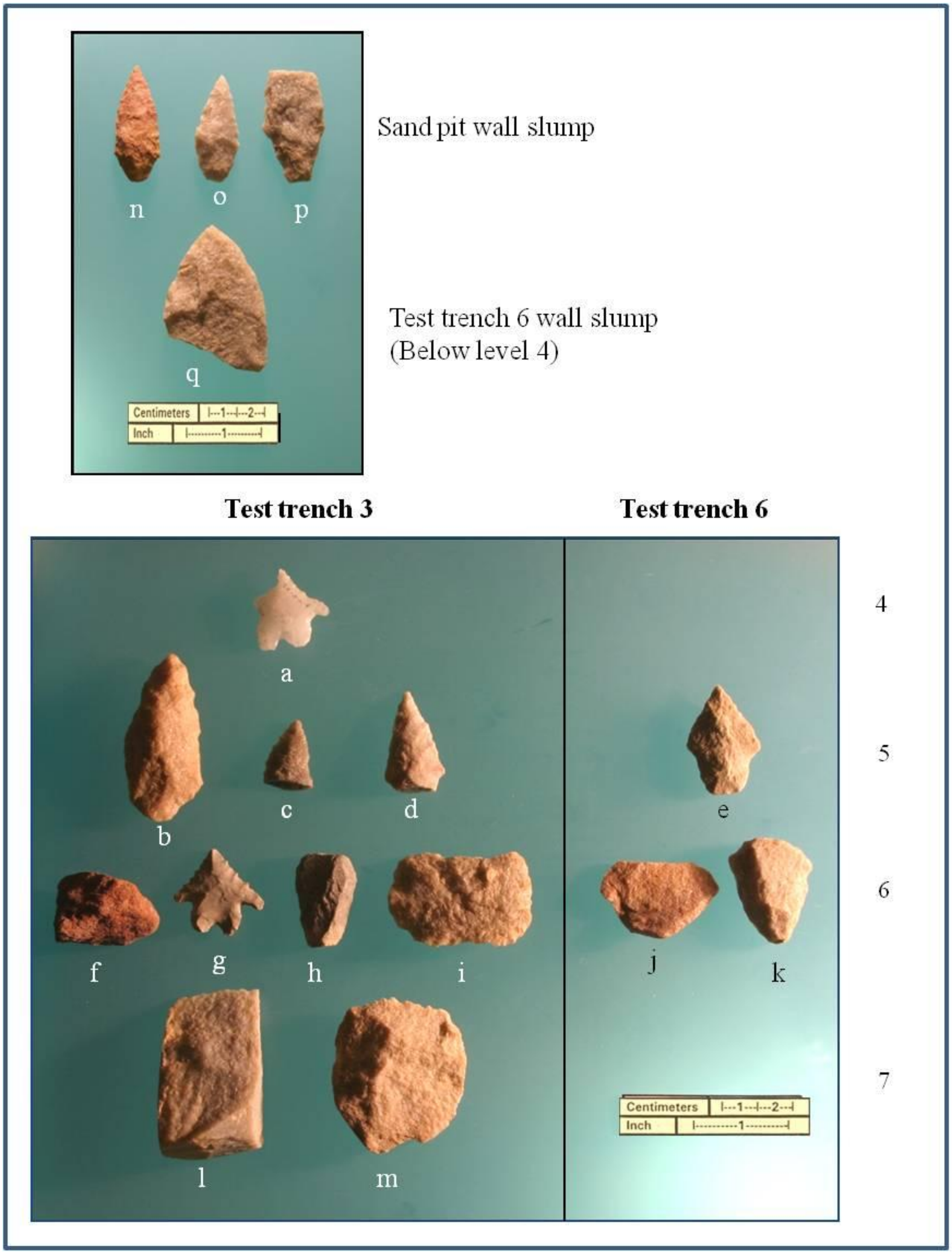


Figure 3.11: Watlington, trenches W3 and W6 selected diagnostic artifacts by arbitrary level (photos by author).

and taking trench W3 deeper in 2005 proved inconsistent with the hypothetical deeper cultural level indicated by the T5-S000 auger sample (see Appendix I: Table 3.4). Only one small quartzite flake was recovered from the three additional levels dug (see Appendix I: Table 3.9).

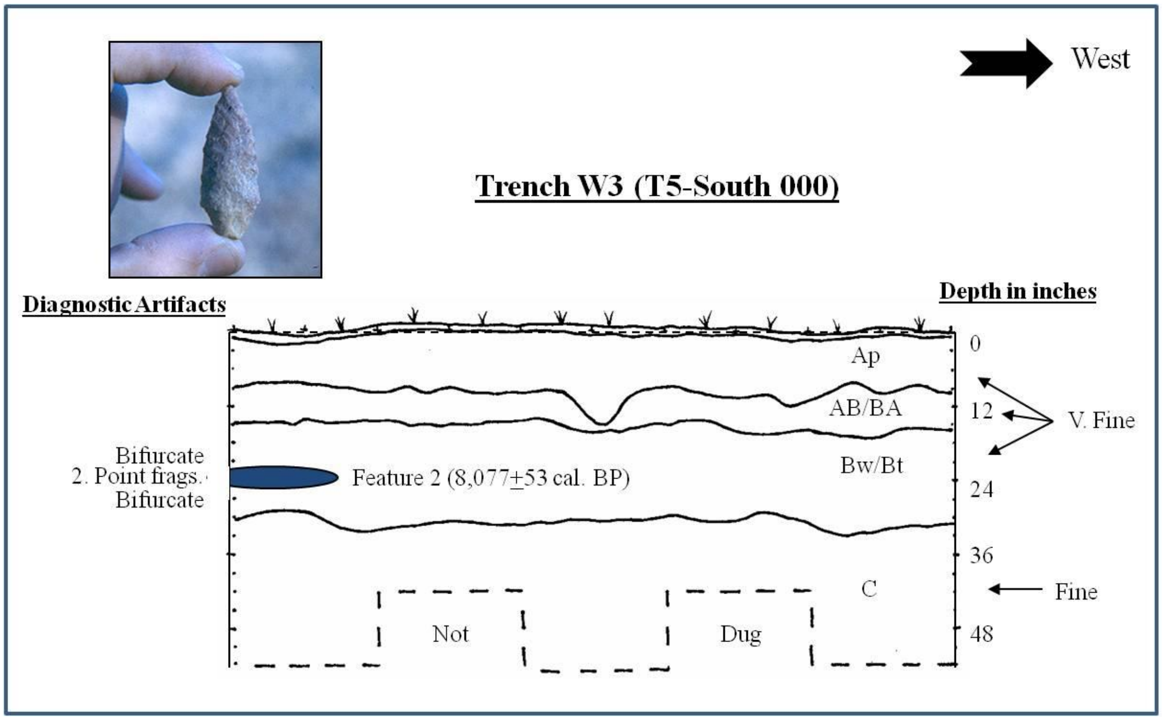


Figure 3.12: Block B, trench W3 profile (photo by author).

The pebble data on Watlington was in stark contrast to those from Koestline. Pebble quantities were uniformly lower in both blocks on Watlington. Also the quantitative pattern of pebbles through all but the very lowest levels of the profile on Watlington was in direct relation to the major artifact classes rather than the inverse. Artifact quantities on Watlington generally increased as pebble quantities increase and decreased as pebble quantities decreased. The full implications of these contrasting patterns warrant further study.

With the exception of the Ap soil horizon (level 1) the pebble (polished clasts) distributions are similar between Blocks A and B. Pebble quantities at the top of the two profiles are distinctly higher (n = 124 and 33) in Block B than the four profiles in Block

A (n = 3, 4, 2 and 5). Additionally, as with trenches W4 and W5, the bottom level (level 12) in trench W3 showed a marked increase in recovered pebbles (n = 41).

Considering the consistent difference between level 1 (Ap) pebble counts between the two blocks, it is likely that they were caused by different levels of flood intensities sometime before modern times and after the Guilford phase, some 6,000 years ago. With the blocks being only 100 feet (30.5 meters) apart but the elevations being similar, the fluvial dynamics at that time were probably complex.

Figure 3.11 shows selected functional and all of the chronological diagnostic artifacts by level from Block B. Trench W6 was dug in 2006 to help resolve the obvious chronological mixing recovered from trench W3 in 2005. The effort was unsuccessful.

As can be seen in Figure 3.11 almost identical LeCroy-like bifurcate points (Figures 3.11a and 3.11g) were recovered from levels 4 and 6. Level 5 produced a Morrow Mountain-like biface (Figure 3.11b) and two point tips (Figures 3.11c and 3.11d) which were not easily identified but which could be from either reworked Morrow Mountain points or Palmer points. The sidescraper (Figure 3.11f) and endscraper (Figure 3.11h) in level 6 of trench W3 and similar side and endscrapers (Figures 3.11j and 3.11k) from level 6 in trench W6 would be consistent with the Early Archaic. The large, flat, biface fragment (Figure 3.11i) most closely resembles Early Archaic Fort Nottoway technology, which dates to approx. 8,950-8,750 B.P. (McAvoy and McAvoy 1997:15, 183**)**. The wedge (Figure 3.11l) and denticulate (Figure 3.11m) from level 7 of trench W3 also are consistent with Early Archaic.

The large point tip (Figure 3.11q) is more consistent with Fort Nottoway technology than any other noted in this Block. It came from a wall slump from trench W6 into trench W3. It would have come from below level 4, which is the floor of where the excavation was, when the wall collapsed.

Feature 2 partially resolves the chronological problem. Its stratigraphic context in level 5 is shown in Figure 3.12. Horizontally, it extended from trench W3 into trench W6 and further into the east wall of both test trenches. The feature consisted of a general scatter of relatively intense hickory nut charcoal surrounding a smaller cluster of large stone artifacts. The artifacts consisted of a large quartzite biface, quartzite fire cracked rock and pitted cobble. The latter artifact probably was used as a hammer or pecking stone. Since the core of the feature in trench W3 was fine screened, sufficient charcoal was recovered to provide a tight radiocarbon date. Only the largest, most easily identified charcoal was selected for dating. That sample consisted of large pieces of hickory nut. A much larger quantity of smaller pieces of charcoal has been retained for future analysis, if warranted. The charcoal from Feature 2 dated to 8,077±53 cal BP (7,250±40 C-14 BP) (BETA 214934), which is of possible late Bifurcate (LeCroy) or early Morrow Mountain age (Inashima 2008: 198, 217-218, 224, 236-238) .

As stated above, stratigraphically, Feature 2 is bracketed by LeCroy points (see Figures 3.11a and 3.11g). However, the reworked Morrow Mountain II (see Figure 3.11e) point from level 5 in trench W6 is consistent with a Morrow Mountain II presence at that level in the Block.

The common occurrence of burned hickory nut shells in association with Late Early Archaic and Middle through Late Archaic occupations indicates the importance of both the nut meat (indirect) and the shells (direct) in those periods. Hypothetically, burned hickory nut shells do not indicate that charring the un-opened nuts was a part of the process of nut meat or oil extraction. It is more likely that a process less destructive to the nut meat/oil would have been used to extract the food part of the nut. The burned nuts more likely reflect the use of the nut shell waste from the food extraction process in producing either heat or flavor in other processes, such as warmth, cooking and/or smoking material like food or hides.

3.4: Rubis-Pearsall (44SX360)

3.4.1: Auger sampling

As stated above, work on this site was initially hampered by ownership issues. The eastern boundary of the Chub Sandhill Nature Area transected the western (river side) edge of the upstream end of the third terrace. In 2004 one selected auger test was done in the fire road that formed the boundary. This was done to get an idea of what might be expected there.

The Rubis-Pearsall site, like Blueberry Hill (see Chapter 4) had no surface artifacts indicating the presence of a site. Surface visibility at Rubis-Pearsall was limited but present in the fire road bed, adjacent bank cuts and around tree throws. Koestline had surface artifacts and Watlington produced artifacts, including a Morrow Mountain II point, on the eroded edges of the sand quarry. However, like Rubis-Pearsall and Blueberry Hill, no artifacts had been observed on the surface of Watlington outside of the quarry edge.

The fine screen from the 2004 auger test (T-6) produced one small quartzite flake from the 37-43-inch (94.0-109.2 cm.) auger sample and charcoal from the 25-30-inch (63.5-76.2 cm.) and 30-37-inch (76.2-94.0 cm.) auger samples. Subsequent auger testing involved a 50-foot (15.2 meter) interval, transect interval sample grid, which was selectively in-filled at 25-foot (7.62 meter) intervals (Figure 3.13).

Selective core samples were sifted through 1/16-inch (1.6 mm.) mesh during back-filling. After the site boundaries had been largely determined, additional auger tests were done to better define the edge of the buried clay bank edge. Those were not sifted. Data from the sifted auger tests are shown in Appendix I: Tables 3.11a-3.11g. Not all samples were sifted to the bottom of each core. Most were sifted at least to 50-60 inches (127.0-152.4 cm.) deep, which was the practical limit of test pit depths.

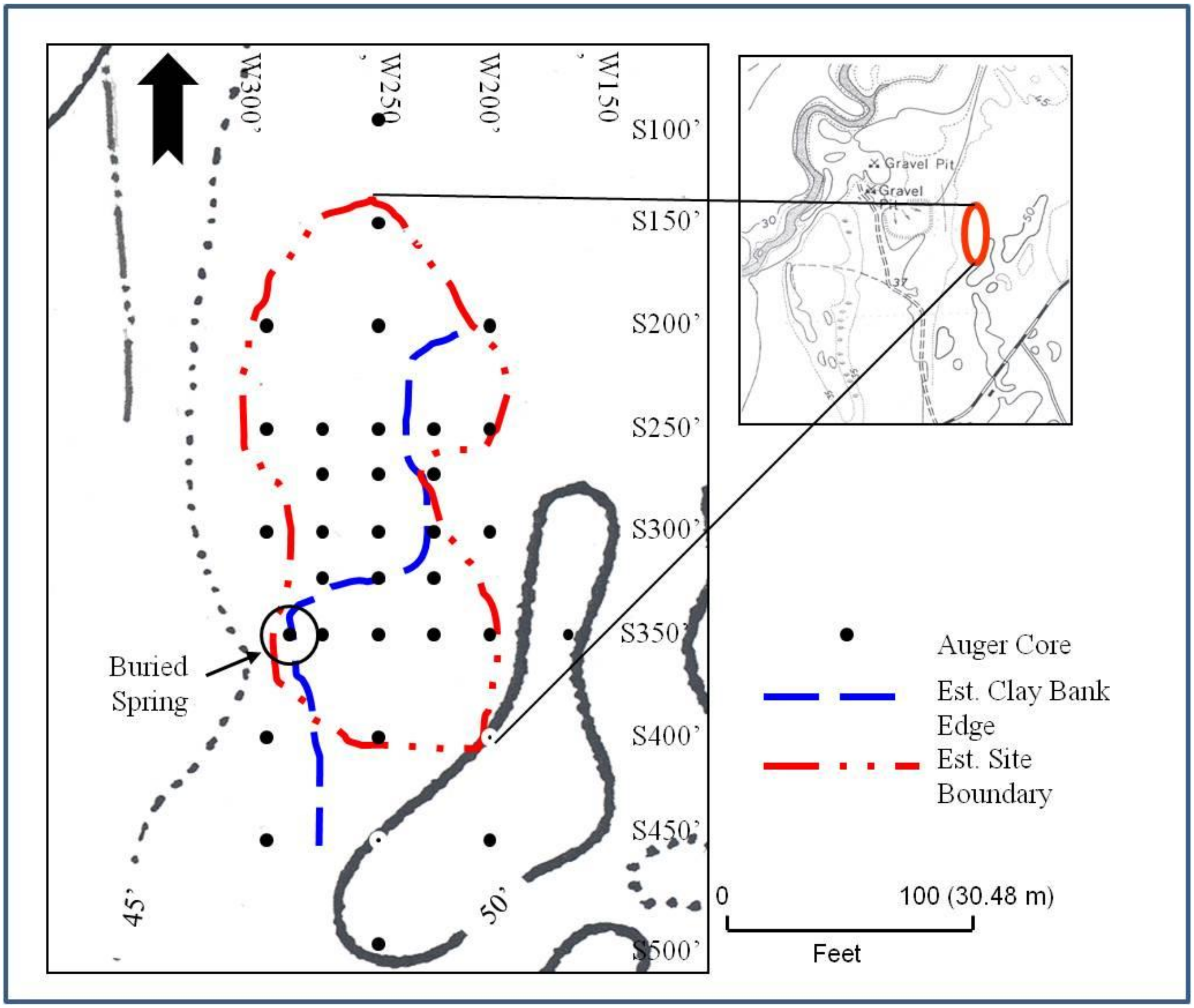


Figure 3.13: Rubis-Pearsall auger core grid pattern, including estimated site and clay bank edges (USGS 7.5 min. series, Sebrell, Va.).

Figure 3.13 also shows the estimated horizontal extent of the site as determined by the presence or absence of stone artifacts in the auger cores. The horizontal results in Figure 3.13 are not vertically keyed. As can be seen from Appendix I: Tables 3.11a-3.11g, artifacts range in depth from the plough zone down to as much as 133-137 inches (337.8-338.0 cm.) deep in the S300W250 core (see Appendix I: Table 3.11c). Only cores S150W200 (74-79") (188.0-200.7 cm.) and S350W225 (80-85") (203.2-215.9 cm.) also produced anomalously deep artifacts (see Appendix I: Tables 3.11a and 3.11e, respectively). However, the isolated nature of deep artifact producing samples could be the result of not having sifted most cores below 50-60 inches (127.0-152.4 cm.) deep.

The presence and absence of charcoal were recorded. However, smaller pieces of silt/clay covered charcoal fragments may have been missed, especially when taken in the context of moderate to light quantities of sand grains not passing through the 1/16-inch (1.6 mm.) mesh screens. Screens were visually examined in the field with only stone artifacts, and larger pieces of charcoal from deeper cores being recovered. Smaller charcoal fragments were merely recorded as present. Water screening and lab sorting clearly would have improved recovery quality, especially with respect to charcoal. Screens were examined thoroughly for stone artifacts with even possible flakes and shatter being recovered for lab sorting. These methodological inconsistencies should be rectified in future testing on this site.

Core S350W300 encountered perched water at the bottom (60-63") (152.4-160.0 cm.). When measured after the core was completed, water filled the core up to 16 inches (40.6 cm.) above a strong brown clay unit with gray mottling. It is labeled "buried spring" in Figure 3.13.

The spring's presence, if available on the surface during the Archaic and Paleoamerican periods offers one hypothesis to account for the site being so far from the current river. The auger core above the spring produced one of the highest artifact concentrations (n=6) recovered from the auger testing. That indicates either horizontal artifact drift (unlikely); that the spring was exposed further to the west (downslope) during later site occupation; or that the spring had no influence on later occupations in the sand above the spring. Note that it is at the apex of a "V" in the 45-foot (13.7 meter) contour interval, indicating a relationship between surface topography and earlier erosion caused by the spring (Figure 3.13).

Although it would have been desirable to take test trenches deep enough to investigate deeper data, the instability of trench walls prevented excavation below 50-60 inches (127.0-152.4 cm.) deep without shoring or stepping. As will be seen, percolation of artifacts in several test trenches indicates that the deeper auger sample artifacts and charcoal, as with Watlington, also could be due to percolation. However, with the deepest artifacts, that cannot be assumed and should be tested. To reiterate, the possibility should be examined, using only the most rigorous methods, involving piece plotting. As will be shown below in the discussion of RP2, percolation of artifacts through many levels of a profile can be detected

The results also should be looked at from the perspective of terrace geomorphology. It must be remembered that on the horizontal plane the auger samples were only 3 inches (7.6 cm.) in diameter. As was recognized at the time, the small sample size was only sufficient to give a gross indication of artifact presence or absence and therefore rough estimates of the vertical and horizontal extent of the site. No great interpretive leaps should be made with respect to either. All one needs is to compare the auger core results from the S200W250 (see Appendix I: Table 3.11a), which produced a small quartzite flake in core sample 08, with the adjacent trench, RP1, which produced 1,227 stone artifacts (see Appendix I: Table 3.12).

Generally, the auger core results indicated a scattered, light occupation near the surface with more intense evidence for occupation between 15 and 45 inches 38.1-114.3 cm.) below the surface. These latter mid-depth results were the focus of subsequent testing. Deeper occupations are possible but, due to federal Occupational Safety and Hazard Administration (OSHA) related technical problems, must await future investigations.

3.4.2: Test trench overview

Figure 3.14 shows the configuration of 5x10-foot (1.52x3.05 meter) test trenches excavated to determine if the core data from fine mesh screening of the auger core samples could contain Paleoamerican occupation levels. With the exception of trench RP1, which was a preliminary test of the area near the small flake recovered from the T6 auger test, the other trenches were excavated with the clay bank location in mind.

Trenches 2-6 were designed to deal with the heaviest concentrations of artifacts. Hopefully they would provide chronological context for the rest of the testing and even negate the model. Trenches RP2-4 were located on the west side of the fire road and buried clay bank near the perched water table (buried spring) (Figure 3.14). Trenches

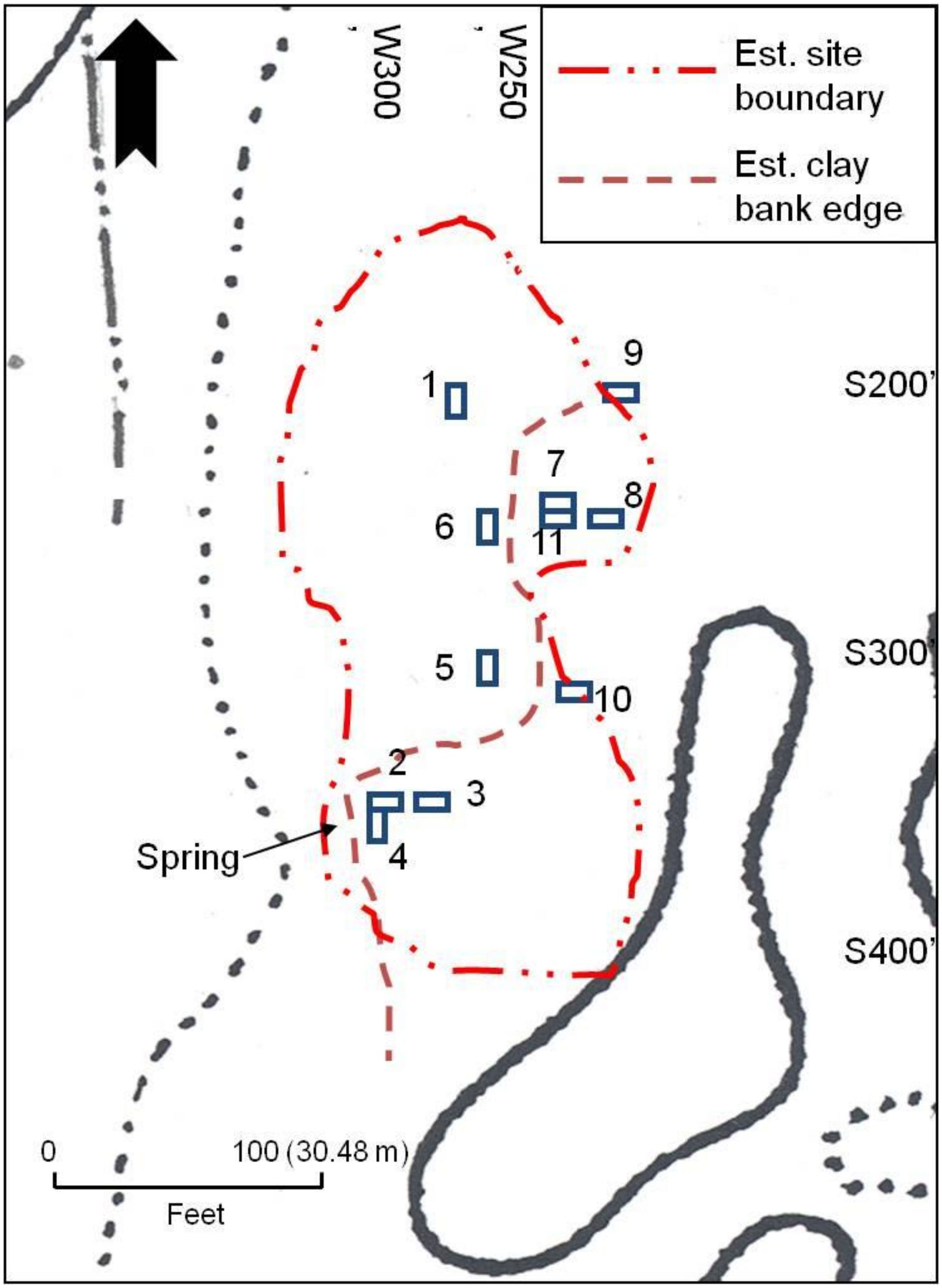


Figure 3.14: Rubis-Pearsall test trench plan (USGS 7.5 min. series, Sebrell, Va.).

RP2-4 were also between two of the more artifact rich auger cores, S350W275 (n=8) and S350W300 (n=6) (see Appendix I: Tables 3.11e and 3.11f, respectively).

Trenches RP5 and RP6 were placed in and oriented with their long axis parallel to the fire road at approximately equal spacing between RP1 and the S350 auger transect. These also were designed to provide additional context for future tests to the east of the fire road. Trenches RP1-4 had only provided indication of Early Archaic, Fort Nottoway occupations. However, they did produce significant quantities of artifacts spread through numerous levels, indicating a potential for other occupations.

Trenches RP7 and RP8 were set perpendicular to the fire road and estimated clay bank edge to give the highest opportunity to detect a possible Paleoamerican occupation area. Based on evidence from Cactus Hill, hypothetically, the clay bank was a product of pre-Younger-Dryas down cutting of the Nottoway with the/a Nottoway channel being immediately off its edge during Paleoamerican times.

The Paleoamerican occupation was identified in RP7 (see section 3.4.2.g). Trenches RP8-10 were excavated to help identify a boundary for the Paleoamerican component. They were planned as part of the testing pattern that involved RP7. They were positioned to cover the edge of the deeply buried, north-south running clay bank that was identified in the auger sampling (Figure 3.14). Their precise positions were determined by a combination of artifact results from the auger sampling and avoidance of hickory trees/tap roots and larger pine trees. At the time of excavation the part of site, located east of the fire road, was forested.

After identification of the Paleoamerican component, Pavich, a geologist with the United States Geological Survey (USGS), requested an opportunity to analyze the Paleoamerican soil at Cactus Hill if it were still open. It was not. So the profiles at Rubis-Pearsall offered the best available opportunity. The research was part of a USGS study covering the last 120,000 years (Pavich et al. 2008).

Trench RP11 was excavated next to RP7 to provide a fresh profile. Earlier, RP8 had been reopened to permit Pavich to evaluate a fresh, undisturbed profile and recover OSL samples (see section 3.4.2.h). Wall slumps in RP7 and RP8 had destroyed the integrity of most of those profiles.

Once the Paleoamerican component was identified, the methods were altered to address the finer scale methods required. The trenches were divided into east and west squares and the two-inch (5.1 cm.) levels below level 10 were trowel excavated. In those levels all recognized artifacts larger than a "dime" (3/4-inch) (19.0 mm.) and all pieces of charcoal larger than a "pencil eraser" (1/4-inch) (6.3 mm.) were piece plotted. All soil from RP11 was sifted through 1/8-inch (3.2 mm.) hardware cloth, rather than the 1/4-inch (6.3 mm.) mesh used on all other trenches.

3.4.2.a: Trench RP1

The northeast corner of RP1 was placed about three feet (.91 meters) west of the preliminary auger test, subsequently designated S200W250, which had produced one very small quartzite flake from 1/16-inch (1.6 mm.) mesh screening of the 37-43 inch (94.0-109.2 cm.) deep auger sample (Johnson 2004: 39). At the time this trench was called T6-1, because the site had not been named or recorded with the state.

As stated above, RP1 was dug, using four-inch (10.2 cm.) arbitrary levels below the plough zone (Ap). Trench RP1 was started in the road bed, in part, because the Ap horizon had been removed and, therefore, did not have to be excavated. This enabled the crew to finish it in one day. Levels were measured down from the road bed, which roughly conformed to the adjacent topography.

The vertical artifact distribution forms a “battleship curve” with the heaviest concentration generally occurring in level 7, 29-33 inches (73.7-83.8 cm.) below the estimated surface (see Appendix I: Table 3.12). The distribution is only slightly skewed toward level 8.

Figure 3.15 shows the three most noteworthy functional and chronological diagnostic artifacts from the trench. All three came from level 6. Quartzite blade-like flakes similar to Figure 3.15a do occur in Early Archaic contexts on this and other Nottoway River sites.

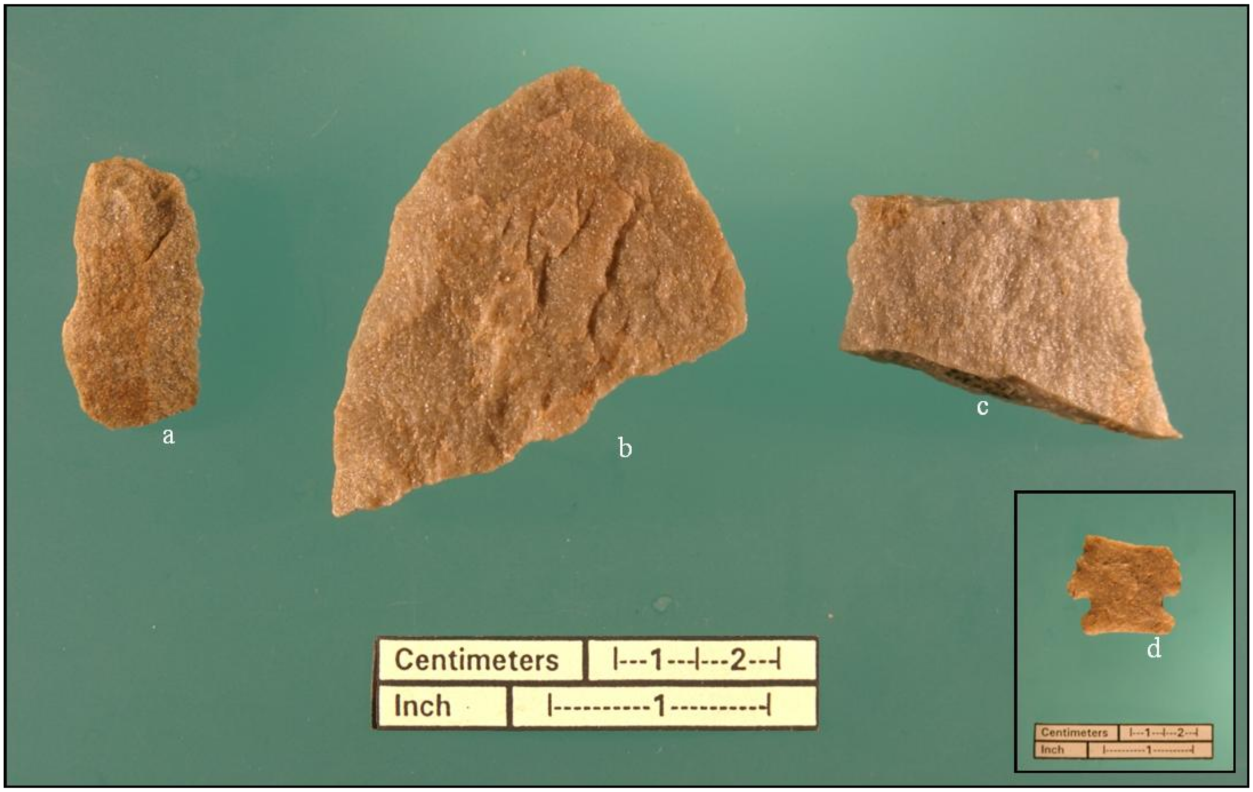


Figure 3.15: Selected functionally and chronologically diagnostic artifacts from trench RP1, including (a) proximal end of a quartzite blade-like flake fragment; (b) distal end of a late stage quartzite probable Ft. Nottoway biface tip; (c) mid-section of a large Ft. Nottoway point. Item d (inset) is a Ft. Nottoway point base excavated at Cactus Hill and is provided for context (photo by author).

Ft. Nottoway points tend to be large in their early use life and are subsequently worked down to smaller forms. Figure 3.15d is an example of the basal half of a Ft. Nottoway point from Cactus Hill.

Ft. Nottoway preform reduction involved large, broad, relatively flat bifaces as the apparent middle and late stage objectives. The distal ends of broken "overshot," flakes, which are characteristic of large flat biface technologies, most notably Clovis and Savannah River, were recovered from probable Ft. Nottoway contexts on Rubis-Pearsall (below). It is not clear if they were intentional or accidental. For thorough discussions of overshot flaking see Bradley et al. (2010: 68-79) and Callahan (1979: 109, 111-112, 147, 149-150). The large biface tip (Figure 3.15b) and point mid-section (Figure 3.15c) are typical of Ft. Nottoway biface technology.

3.4.2.b: Trench RP2

This test trench was laid out in sequence with RP3 as part of the selective sampling of the site. Auger test S350W250 was the focal point of the two trenches. That auger test produced one of the highest artifact totals from the auger sampling.

Trench RP2 was placed five feet (1.52 meters) west of RP3 and was on the same (north) side of the S350 transect. The spacing was to isolate the two trenches from one another, thus simplifying their sequential excavation. This was the first trench dug on Rubis-Pearsall with two-inch (5.1 cm.) levels.

The distribution of artifacts from RP2 is shown in Appendix I: Table 3.13. The distribution is significantly different from that in RP1 (see Appendix I: Table 3.12). The artifact quantities are dramatically lower and the material make-up of the debitage is weighted heavily toward chert rather than quartzite, although quartzite makes up a relatively significant proportion of the RP2 debitage.

Figure 3.16 shows a selection of artifacts from RP2. Although several quartzite tool-like artifacts are shown to the right in levels 13 and 15 (Figures 3.16b and 3.16c), the figure graphically shows that all of the chert in the profile came from what appears to be the same raw material and probably the same core or biface. Figure 3.16a in level 12 (29-31") (73.7-78.7 cm.) is a "two-tone" chunk of chert containing yellowish tan chert identical to that of the debitage. The other part of the artifact consists of a dark brown chert or jasper. Its source is not clear.

The inset is of a twin hickory tap root from RP4 which was located at the southwest end of RP2 (Figure 3.16). It is shown to illustrate the possible mechanism through which chert debitage from what appears to have been a single knapping episode was present in most levels below level 12, i.e. between 29 and 55 inches (73.7 and 139.7 cm.) below the surface (see Appendix I: Table 3.13).

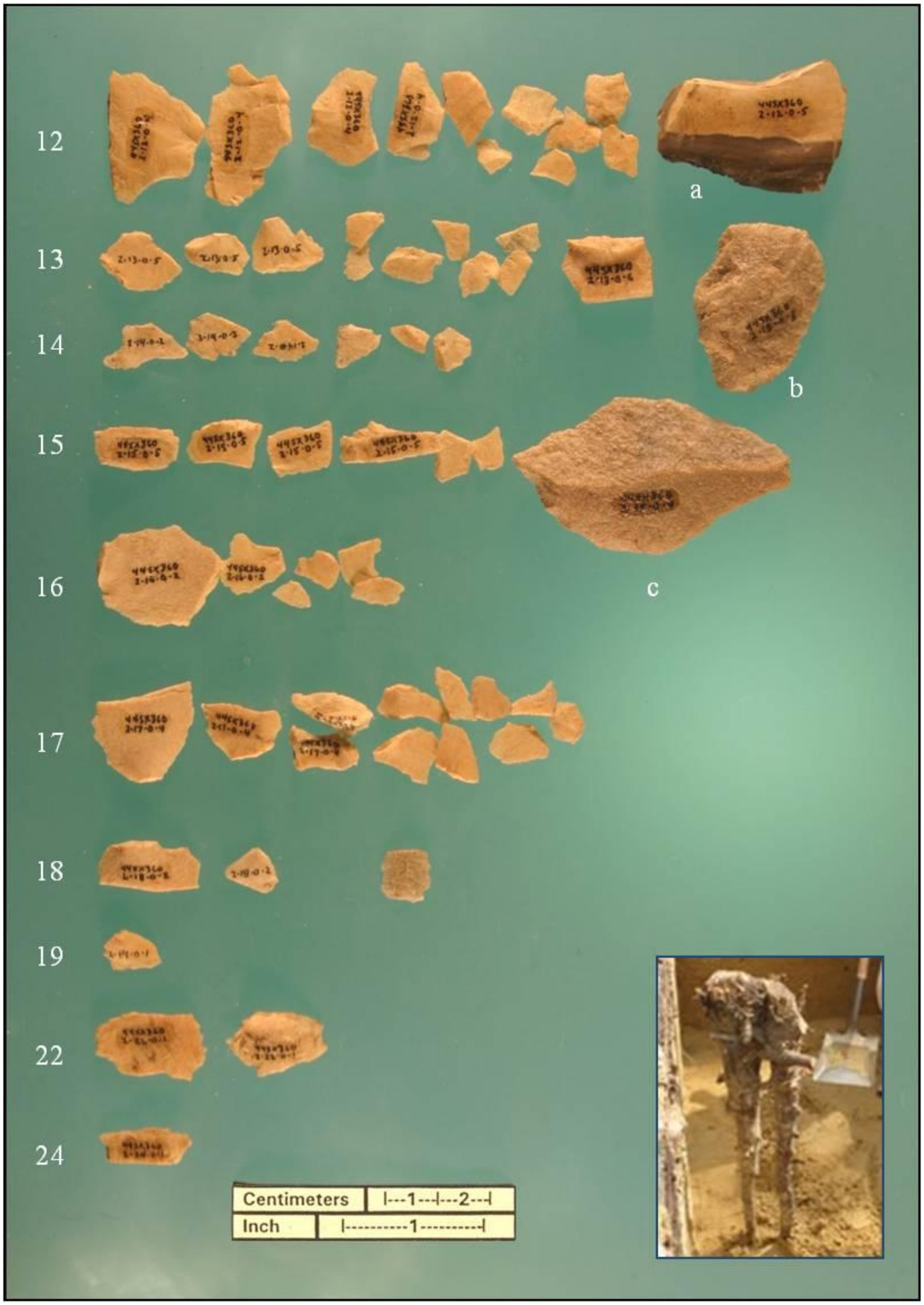


Figure 3.16: Selected artifacts from RP2 with levels shown to the left. Inset is of twin hickory taproots in the adjacent trench, RP4 (photos by author).

Artifact concentrations appear to be in two groups. The upper one centers on level 13 and the lower on level 17, which corresponds to the peak in the vertical distribution of pebbles.

It is likely that the chert knapping in RP2 took place at or immediately above level 12. It is not clear what caused the chert (and possibly quartzite) to collect at the same level as the pebble distribution peak. It is possibly due to pedogenic factors related to Bt soil formation, similar to that detected in the deeper levels of Block A at Watlington. There, the top of an ephemeral Bt (lamellae horizon) appears to have trapped small debitage and charcoal migrating down through a poorly cemented C horizon. Relative to Tarboro soil, this process is discussed in detail in Chapter 4.

3.4.2.c: *Trench RP3*

Trench RP3 was laid out on the north side of the S350 transect and five feet (1.52 meters) to the west of RP2. This was to avoid going through spoil from the fire road that was on top of S350W250.

The data from trench RP3 also differs dramatically from RP2. The shape of the quartzite distribution (see Appendix I: Table 3.14) resembles RP1 (see Appendix I: Table 3.12) more closely than the nearby RP2. Trench RP3 also produced a light amount of light yellowish tan chert (Figure 3.17a) similar to that from RP2. The highest quantity (n=3) also appeared in level 13, which corresponds to the upper cluster in RP2.

The vertical distribution of pebbles also is similar to RP2. However, quantities are about 50% less. This would be expected, since RP3 is further away from the river (source) and was probably slightly upslope.

Trench RP3 produced two overshot flake terminations (distal end) (3.16b and 3.16d). These may very well be associated with the Ft. Nottoway point base (3.16c) recovered from level 15 along with one of the overshot terminations.

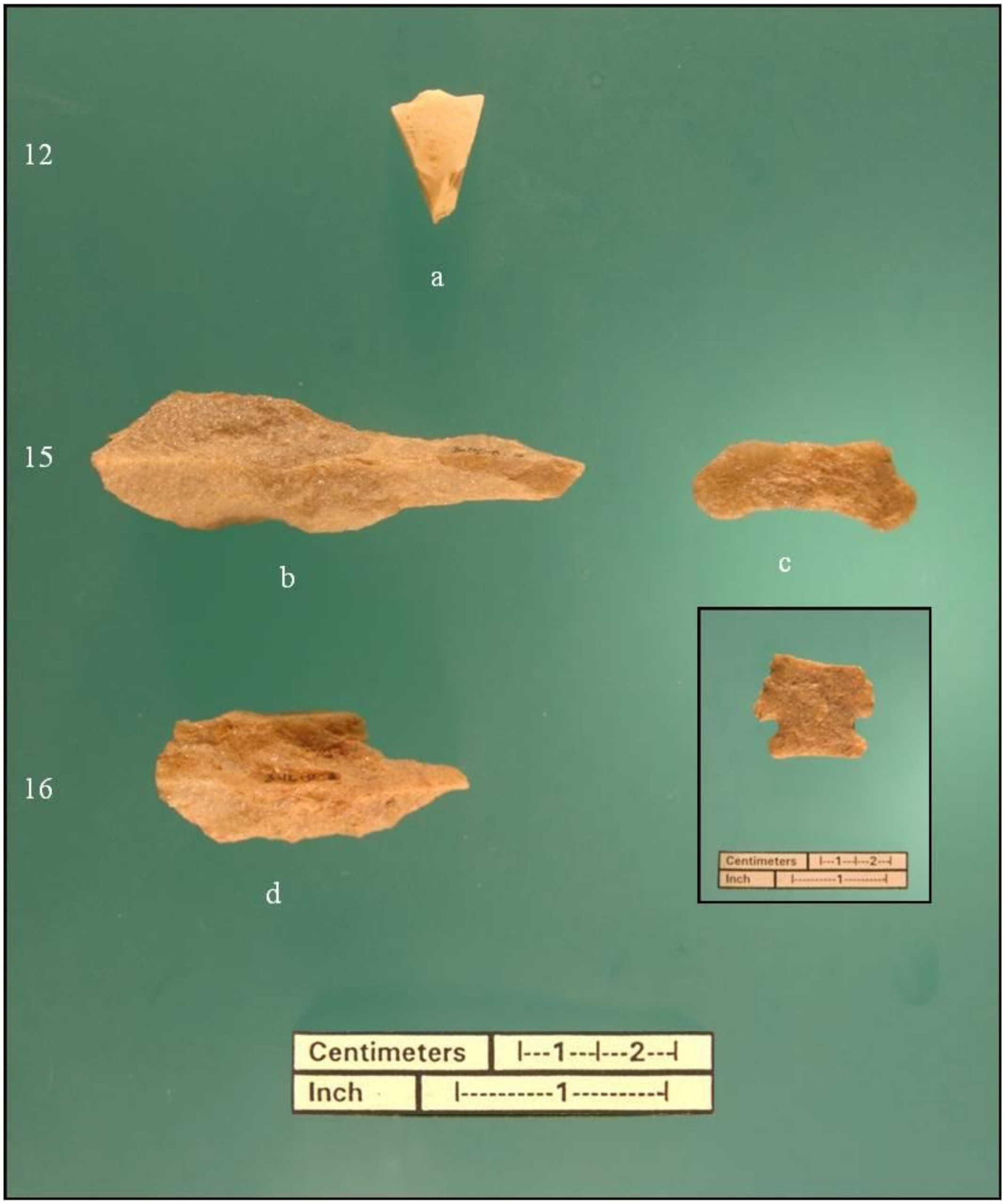


Figure 3.17: Selected artifacts from RP3 with levels shown to the left. Inset shows Ft. Nottoway point from Cactus Hill (photo by author).

3.4.2.d: *Trench RP4*

Here again there are noticeable differences between this trench and the other two (RP2 and RP3) in this area of the site (see Figure 3.14). Trench RP4 produced relatively high quartzite and quartz debitage counts. Not only are the quantities significantly greater than RP2 and RP3 but also their distributions are different.

Both quartzite and quartz peak in levels 7-9 (18-22") (45.7-55.9 cm.) in RP4 (see Appendix I: Table 3.15). In adjacent RP2 the minor quartzite peaks are in levels 13 (31-33") (78.7-83.8 cm.) and 17 (39-41") (99.0-104.1 cm.). Trench RP2 produced only two isolated quartz debitage. The chert distributions are strikingly different. All of the chert in RP4, which was different from that in RP2, was recovered from level 11 and above, while all of the chert in RP2 was recovered from level 12 and below.

Quantities in the peak quartzite levels of RP 3 are approximately 40% lower than in RP4. Peak quartzite levels in RP3 are 12-15 (29-37") (73.7-94.0 cm.). In RP4, quartzite peaks in levels 6-11 between 14-28 inches (35.6-71.1 cm.) deep. Current surface slope is down from RP3 to RP 4, so slope is probably not a factor in the peak level differences.

Trench RP4 also produced nine fire cracked rocks (FCR). They were widely distributed in the profile. So, although four were present in level 9, the quantities are too low to make distributional generalizations other than that they probably reflect a Middle Archaic or later presence (see section 3.4.2.k). With the exception of one in level 12 of RP3, FCR were absent from RP2 and RP3.

Pebble distributions are as expected. Their quantities are greater and they are concentrated slightly higher in the profile. This probably is a function of closeness to the source, the Nottoway River channel, as it was located at that time.

Figure 3.18 shows three blade-like flakes from levels 5, 6 and 8. These flakes have the characteristic of striking platform facets that are at nearly right angles to the flake center line. They also have distinct single dorsal ridges and single or multiple step fracture platform preparation on the dorsal surface. Isolated blade-like flakes were relatively rare but present, mostly in Early Archaic and Paleoamerican contexts in Area A at Cactus Hill. The ones shown here reflect the highest quantity recovered from any of the Rubis-Pearsall trenches.

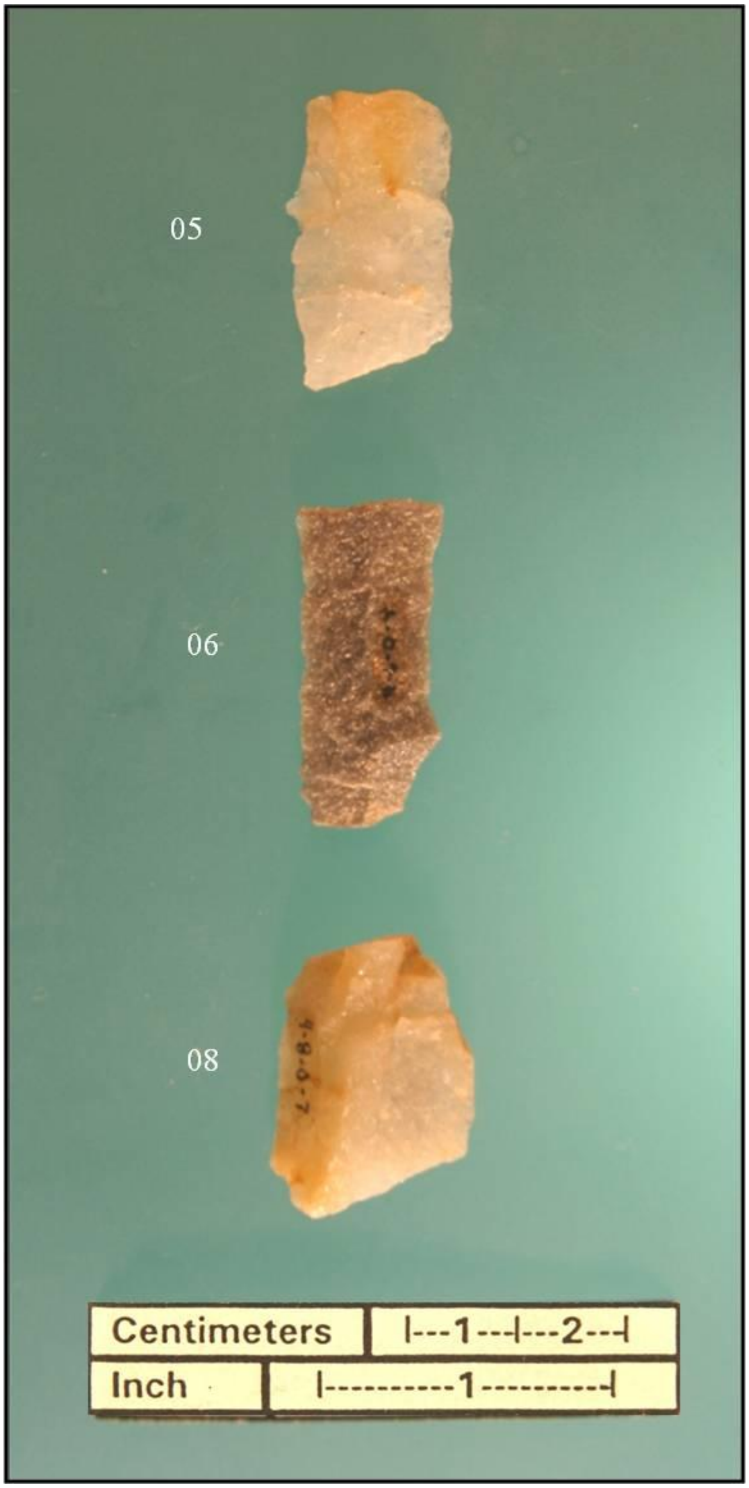


Figure 3.18: Blade-like flakes from RP4 with levels shown to the left (photo by author).

Most of the prepared flake platforms from Rubis-Pearsall reflect biface knapping. However, these three appear to have been struck from unifacial cores. Only one unifacial core was recovered from the site (see section 3.4.2.g).

3.4.2.e: Trench RP5

This trench was located in the fire road. It was placed off the edge of the projected underlying clay bank (see Figure 3.14). An estimated 6 inches (15.2 cm.) of plough zone appeared to have been removed. Considering that this trench was isolated, the artifact quantities should not be comparable to other trenches.

The light artifact quantities peak between levels 7 and 12 (18-30") (45.7-76.2 cm.) (see Appendix I: Table 3.16). Quartzite and chert dominated the raw material. One thermally altered, chipped quartzite adz-like tool was recovered from level 10. It is likely associated with the Early Archaic period.

Figure 3.19: Thermally altered, flaked, quartzite adz-like tool from level 10 of RP5 (photo by author).

3.4.2.f: Trench RP6

This trench also was in the fire road. It was located approximately half-way between RP1 and RP5 (see Figure 3.14). Like RP1 and RP5 it was located off the hypothesized edge of the clay bank. The entire plough zone, possibly including some of the AB/BA (E?) soil had been removed by the fire road.

A moderate amount of mostly quartzite debitage was recovered (see Appendix I: Table 3.17). The debitage concentrated between levels 12 and 16 (29-39") (73.7-99.0 cm.). A light amount of chert and metavolcanic debitage also was recovered from those depths. Pebbles concentrated in the lower part of the artifact concentration, specifically levels 14-16 (33-39") (83.8-99.0 cm.).

No noteworthy tool-like artifacts were recovered. However, one relatively large overshot flake termination (Figure 3.20a) was recovered from sifted wall slump (level 00). It likely dates to the Ft. Nottoway occupation. One proximal end of a small metavolcanic blade-like flake (Figure 3.20b) was identified in level 12 (29-31") (73.7-78.7 cm.).

3.4.2.g: Trench RP7

Whereas trenches RP1 through RP6 were designed to develop site cultural context, RP7 was the first trench designed specifically to identify any Paleoamerican occupations on the site. It was at the hypothesized upstream end of the site over the buried clay bank. Due to dense vegetation, this trench was located further back from (east of) the hypothesized clay bank edge than desired (see Figure 3.15). It was placed adjacent to the S250W250 auger test, where a chert flake was recovered in auger sample 5 (23-28") (58.4-71.1 cm.) and two quartzite flakes from auger sample 6 (28-34") (71.1-86.4 cm.) (see Appendix I: Table 3.11b).

The trench produced relatively small numbers of artifacts (see Appendix I: Table 3.18). Quartzite dominated the material, peaking in level 13 (31-33") (78.7-83.8 cm.). Considering the relatively high number of modified/worn artifacts (tools?), the small

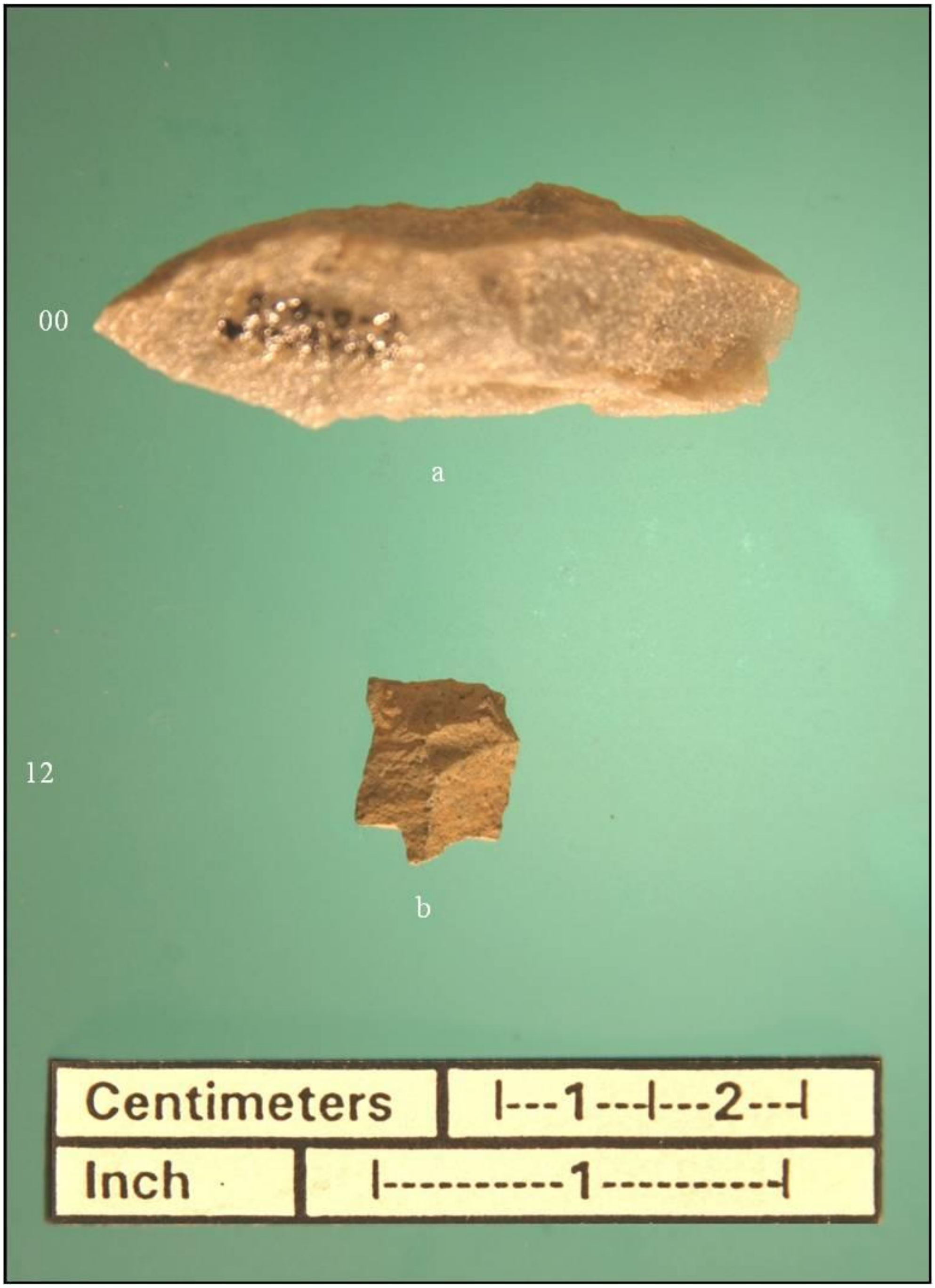


Figure 3.20: Selected artifacts from RP6 with levels shown to the left (photo by author).

amount of debitage was striking. It is the opposite relationship between possible tools and debitage found in all of the previous six trenches (see Appendix I: Tables 3.12-3.17).

Figure 3.21 shows selected artifacts from RP7 with appropriate levels to the left. Figure 3.21a is an unidentified biface fragment. Figure 3.21b is a very thin, heavily patinated,

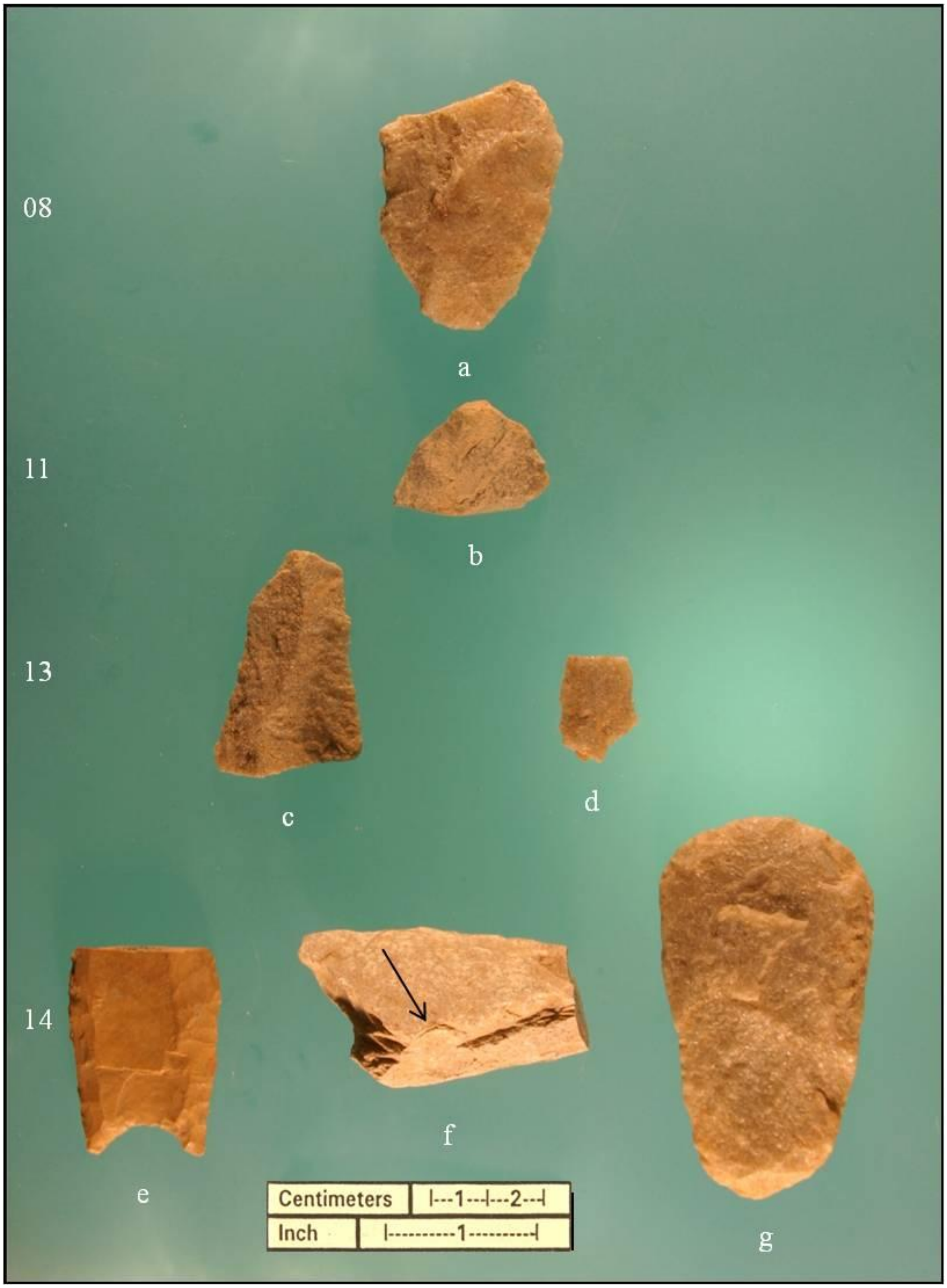


Figure 3.21: Selected artifacts from RP7 with levels shown to the left (photo by author).

metavolcanic point tip. Figures 3.21c and 3.21d are quartzite blade-like flake fragments. Figure 3.21e is a jasper fluted point base. Figure 3.21f is a jasper unifacial core. Figure 3.21g is a flaked quartzite adz.

The fluted point is fluted in the same way on both faces (Figure 3.22). The sequences involved: first, a long flute extending beyond the break; second, a shorter flute designed to remove the proximal end of the flute ridge on the right side of the face (flatten the hafting area); and, third, a short, broad flute probably designed to further thin and flatten the base. This technique is evident on Redstone variant, Clovis age points reported from the Carolinas (Goodyear 2006).

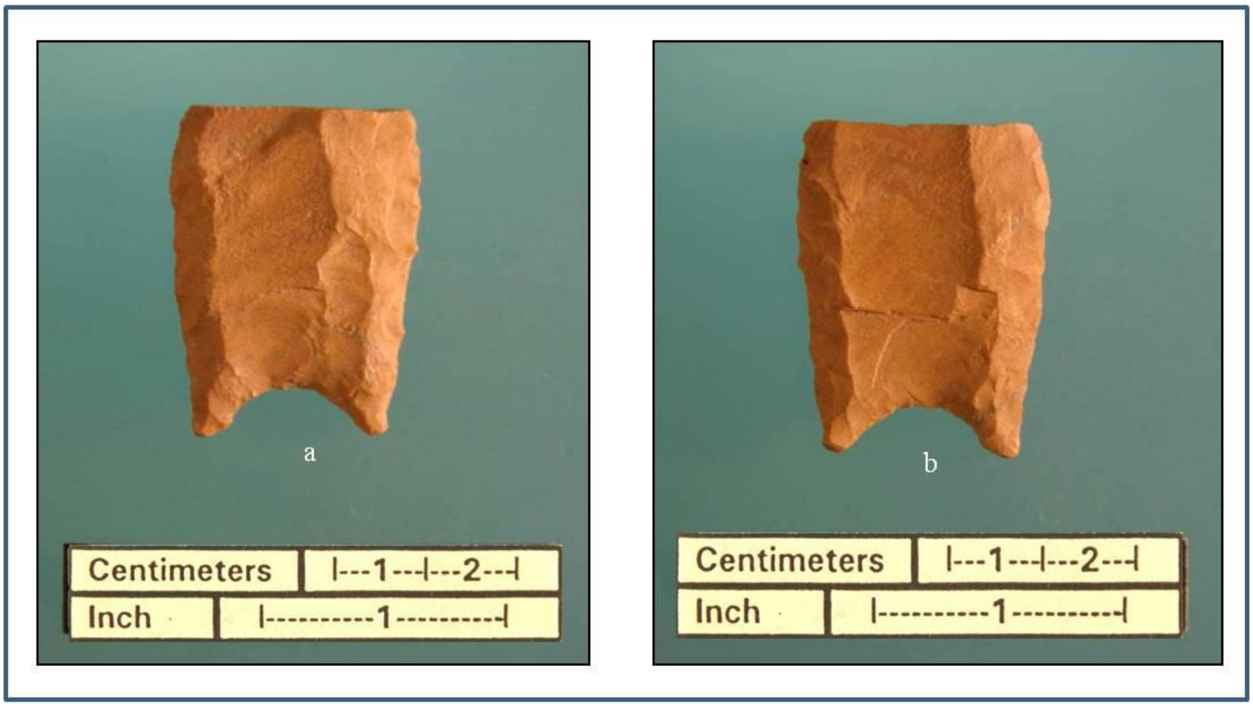


Figure 3.22: Fluted point base from RP7, level 14, showing identical basal thinning strategies on both faces (photos by author).

Due to demonstrated site disturbance noted in other trenches, particularly RP2 and RP10 (below), initially, it was not clear that the jasper core and quartzite adz were contemporary with the fluted point. However, the jasper flake in level 15 is from the jasper core in level 14. It has a platform that fits the top of the unifacial core (Figure 3.23). The interior platform edge does not perfectly fit the core edge because of secondary step fracture detachments on the reverse bulb scar on the core (3.19f arrow).

The damage was probably due to crushing caused by the high angle blow used to detach the flake.

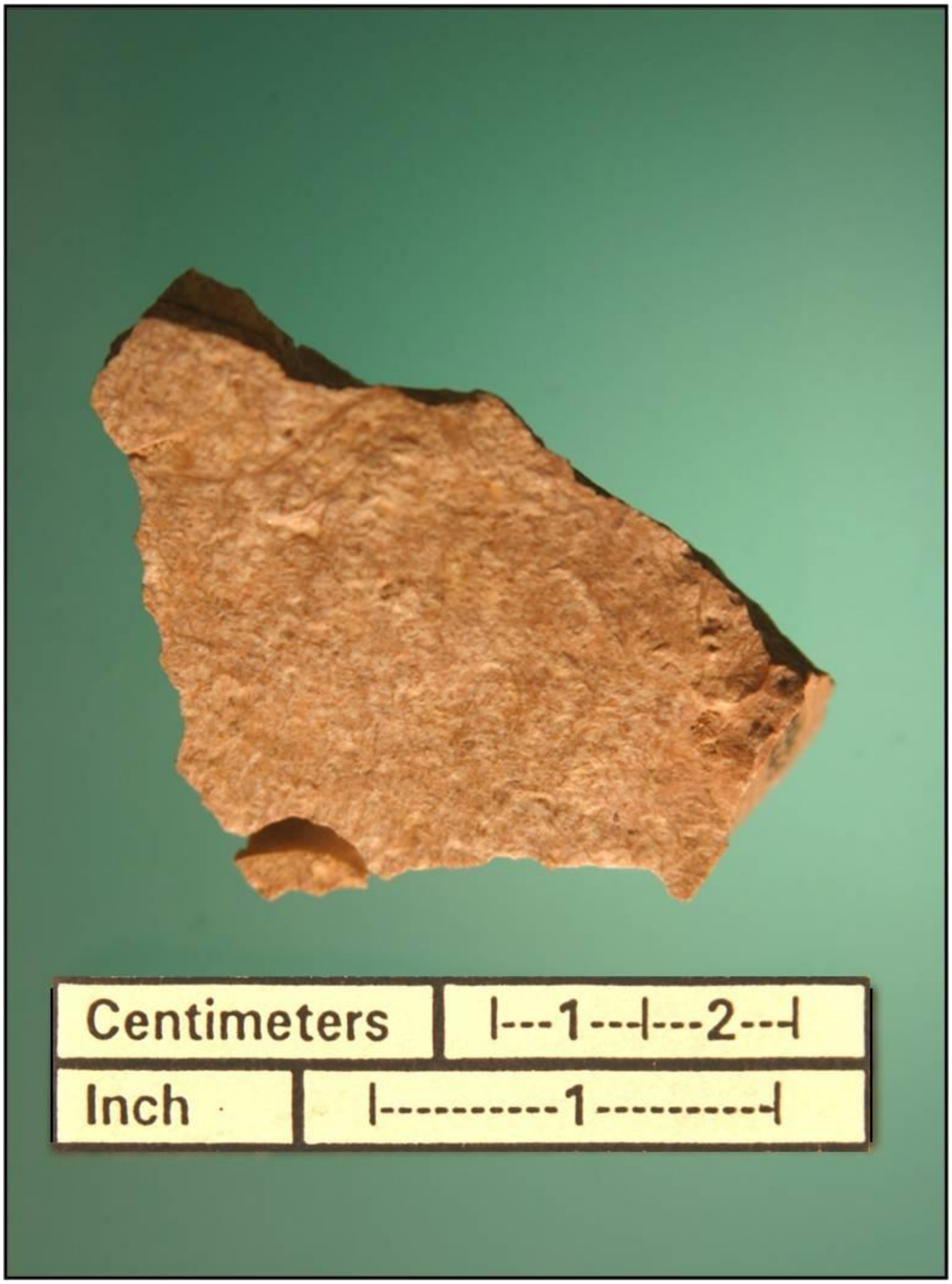


Figure 3.23: Trench RP7, level 14 unifacial jasper core with cross mended jasper flake from RP7, level 15 (photo by author).

Additionally, the fluted point was recovered from the interface between levels 14 and 15. These two factors support the hypothesis that the artifacts from these levels are contemporary. With respect to the adz, vaguely similar forms have been reported from Late Archaic Savannah River (Egloff 1989: 23-24) and Late Paleoamerican Dalton (Gramly 2008: 107, 116-118; Morse and Goodyear 1973) phases. They have also been recovered from excellent Clovis contexts in the West, notably East Wenatchee and Gault (Stanford and Bradley 2012: 57-58).

Recovery of the fluted point required a method change if the project were to continue. Paleoamerican sites are so sensitive that, unless immediately threatened, they require rigorous methods. The excavation procedures shifted to five-foot (1.52 meter) sub-squares, trowel excavation, and piece plotting all artifacts and charcoal larger than 1/4-inch (6.3 mm.). This method was used on levels 14-18 in RP7. Levels 19-26 were flat shoveled.

Additional trenches were excavated in 5x5-foot (1.52x1.52 meter) sub squares, initially by flat shoveling. At level 11 the method shifted to troweling and piece plotting.

3.4.2.h: Trench RP8

This trench was set up at the same time as RP7. It was placed adjacent to auger test S250W200 to investigate one quartz and one metavolcanic flake recovered from auger sample 7 (39-45") (99.0-114.3 cm.). The discovery of the Paleoamerican component caused the methodological revision explained above. This trench was placed parallel to RP7. It was also placed five feet (1.52 meters) to the east of RP7 in order to protect its west wall from weathering and collapse after the excavation of RP7.

With the exception of the concurrent peaks in quartzite debitage around level 13, the distribution of artifacts is very different between the two trenches (see Appendix I: Table 3.19). Quartzite debitage is quantitatively more than three times denser in RP8. Whereas metavolcanic debitage is almost absent in RP7 it is almost as dense as quartzite in RP8. Quartz is also quantitatively denser in RP8. All three materials peak in levels 11 and 12 with moderate quantitative drop offs down through level 14. The one crypto-crystalline (CH/JA) debitage from level 11 is chert.

Figure 3.24 shows an artifact selection from RP8. The heavily reworked, thermally altered, quartzite Palmer point (Figure 3.24a) from level 10 appears to be stratigraphically consistent with the fluted point from level 14 in RP7. The sample of metavolcanic debitage (Figure 3.24b), also from level 10, is consistent in color and degree of patination with most of the metavolcanic debitage from other levels of RP8. Some greenish and more heavily patinated metavolcanic debitage is present. The metavolcanic debitage was heavily concentrated in the eastern half of RP8, suggesting important site components can be expected to the east in an area not tested.

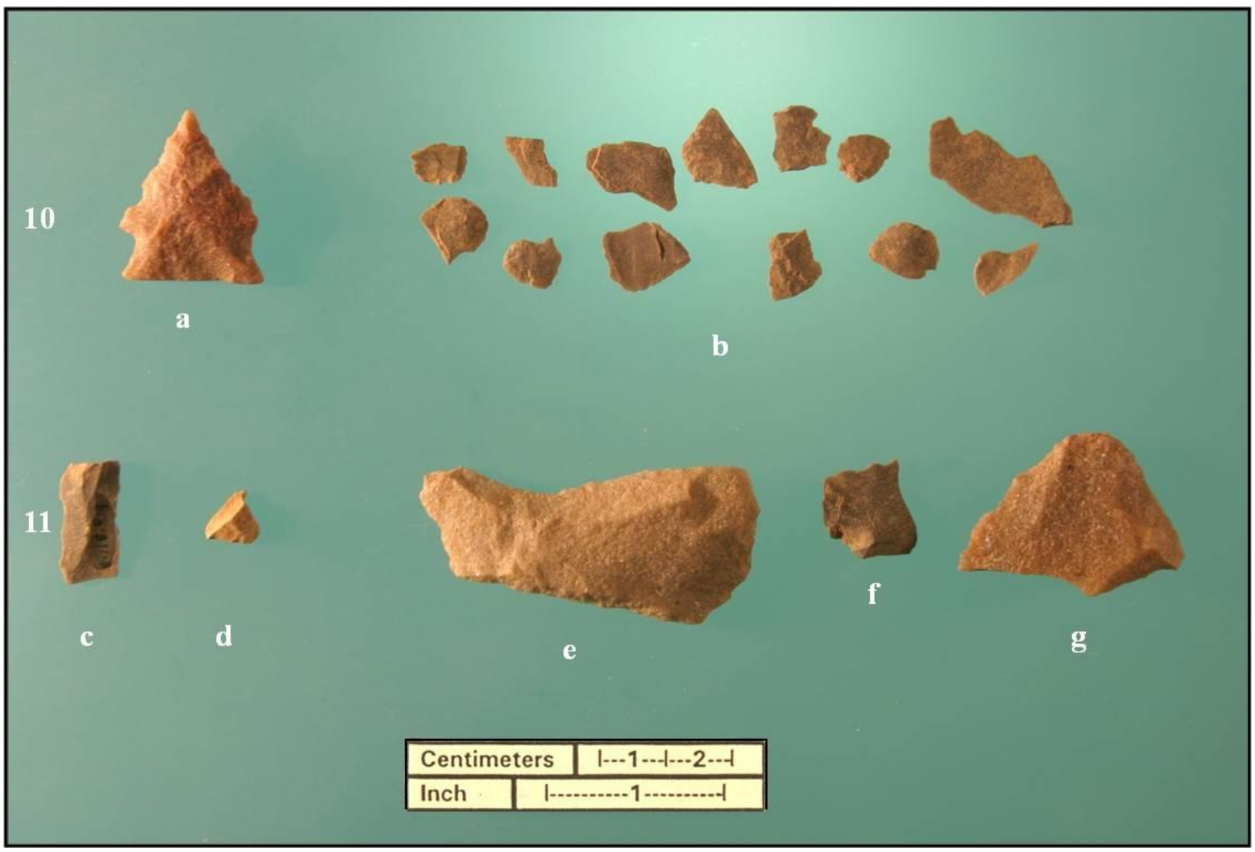


Figure 3.24: Selected artifacts from RP8 with levels shown to the left (photo by author).

Aside from the metavolcanic blade-like flake fragment (Figure 3.24c), quartzite spokeshave-like tool (Figure 3.24e), edge-worn black metavolcanic flake (Figure 3.24f), and quartzite biface fragment (Figure 3.24g), all from level 11, the small metavolcanic point fragment is the most diagnostic. It appears to have been a basal ear off of a notched point. Considering its context, raw material, and that the fact that it is lightly ground, the point fragment is consistent with Palmer or Kirk. It is also heavily patinated. The blade-like flake fragment and edge-worn flake are similar to the other dark metavolcanics in the trench.

Trench RP8 was re-excavated at a later date to allow Pavich to recover OSL samples on the Palmer and Clovis age levels (10 and 14). The resulting multiple aliquot, mean age dates were provided by G. A. Brooks of the University of Georgia. They are shown in profile in Figure 3.25. The sample 1 date was 20,500 $\pm$ 2,600 BP on level 10 (25-27") (63.5-68.6 cm.) that produced the Palmer point. The Sample 2 date was 18,900 $\pm$ 2,400 BP on level 14 (33-35") (83.8-88.9 cm.) that in the nearby trench RP7 produced the fluted point. The point's location was recovered approximately 12 feet (3.66 meters) to the west of the sample location.

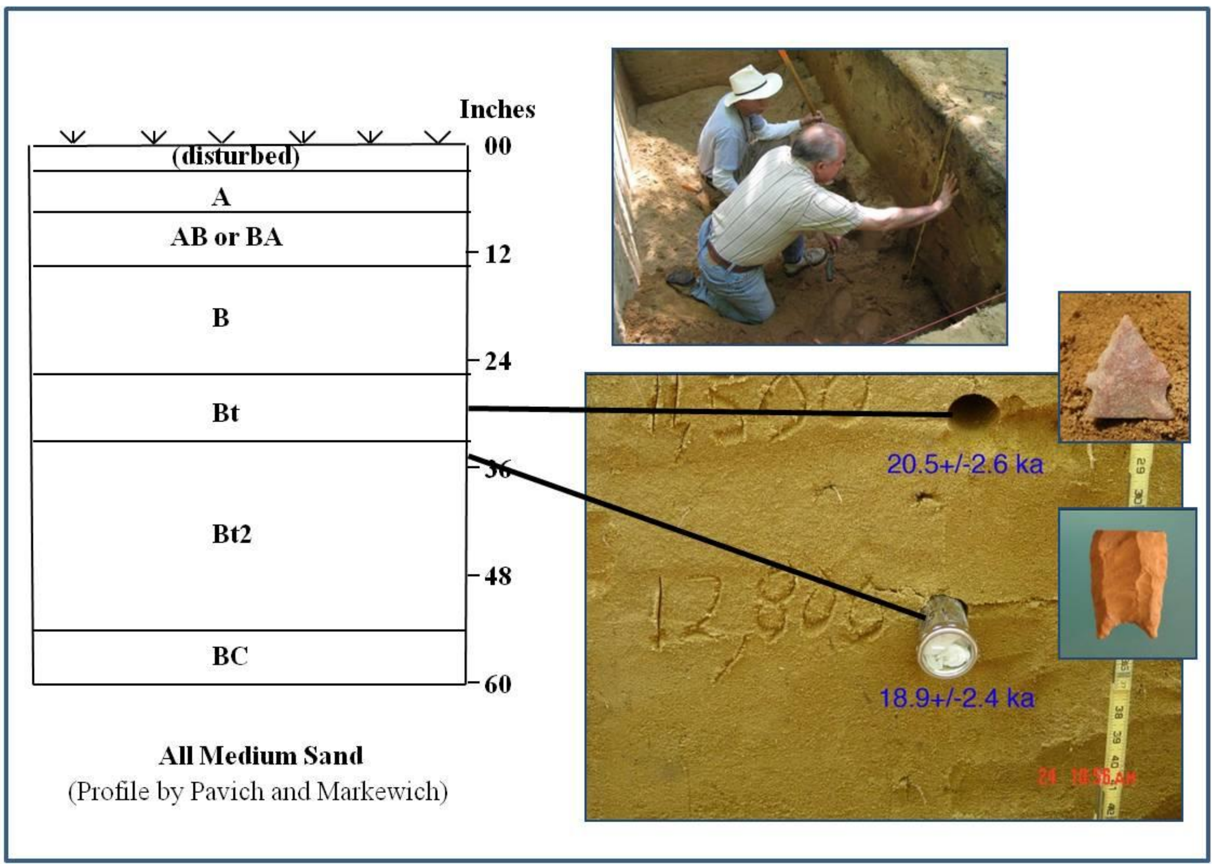


Figure 3.25: Trench 8, preliminary southwest wall profile, showing associated OSL dates by G. A. Brook (Univ. of Georgia) (photos by author).

Despite the fact that the two dates overlap within the first standard deviation, they are too old for the points. However, they date the soil context and further indicate possible percolation of artifacts down through the profile. However, they also indicate that the landform is as old as predicted and, therefore, contemporary with the pre-Clovis landform at Cactus Hill. With the primary Pre-Clovis date (15,070±70 C-14 BP) (BETA 81590) from Cactus Hill calibrating to 18,274±160 BP the Rubis-Pearsall OSL dates are roughly contemporary.

The cross-mend in levels 14 and 15 between the jasper core and blade-like flake suggest that there may be a stratigraphic problem with the source sand grains for OSL dates rather than the archaeological stratigraphy (see Chapter 4). Additional work would be required to address this inconsistency. However, that does not change the fact that the OSL dates and fluted point support a pre-Younger-Dryas age for the landform.

3.4.2.i: Trench RP9

Trench RP9 was set up approximately 50 feet (15.2 meters) north trench RP8 near the S200W200 auger test (see Figure 3.14). The auger tests indicated that the underlying paleosol was 12 inches (30.5 cm.) closer to the surface at 91 inches (231.1 cm.) deep than it was under RP8. It was not determined if this is a function of the thickness of the overlying loamy sand or that the paleosol was higher. Since the surface topography tended to slope down toward the north, it is likely that it is a function of overburden thickness. The presence of dense trees prevented location of this trench closer to RP7 and RP8.

The vertical distribution of quartzite debitage parallels that of RP8 (see Appendix I: Table 3.20). It peaks in levels 11-13 (27-33") (68.6-83.8 cm.) in RP9 and levels 12-14 (29-35") (73.7-88.9 cm.) in RP8. None of the materials are similar to either RP7 or RP8. Not much should be made of this considering the 50-foot (15.2 meter) separation.

Figure 3.26 shows selected diagnostic artifacts from RP9. Figure 3.26a from level 10 is a pyrite-like stone that has been ground smooth all around its edges. More significantly, when wet and held in sunlight, it sparkles like a thousand small stars. It is difficult to imagine that this was not an important reason why the stone was present on the site.

Figure 3.26b from level 11 is another large overshot flake termination. Unlike the others from the site, it was struck at an oblique angle to the edge that was removed (arrow). From the author’s experience this kind of overshot flake is often an accident. However, intentional diagonal overshot flaking appears to be present in the bifaces and points from the Paleoamerican Fenn cache (Frison and Bradley 1999: 10, 72-75, 84-97) and also a point from the Clovis type site, Blackwater Draw (Bradley, personal communication 2012).

Callahan (1979:109) has discussed his experience in routinely producing unintentional overshot flakes on quartzite bifaces. The author, who like Callahan, has extensive experience in knapping quartzite from the Middle Atlantic region, has also discovered that in attempting to produce large flat bifaces, unintentional overshot flakes are common, particularly in Middle Atlantic quartzite.

However, Figure 3.26b does represent the fourth overshot termination recovered from the site. All appear to have been from similar sized bifaces, which could indicate they were part of an intentional reduction strategy, possibly not too dissimilar from those practiced by Clovis and Solutrean knappers (Stanford and Bradley 2012:50, 138).

Figure 3.26c from level 13 is a triangular biface made of yellowish quartz. One edge (line) is ground or worn smooth. The high spots on the surface also exhibit polish indicating heavy wear or intentional edge dulling. Apparently, it had a function other than as a preform or projectile point.

ASV Area C at Cactus Hill also was between the upstream end of the Paleoamerican locus in Area B and the current Nottoway channel (Johnson 1997). ASV Area C at Cactus Hill produced no evidence of cultural material older than Fort Nottoway (Johnson

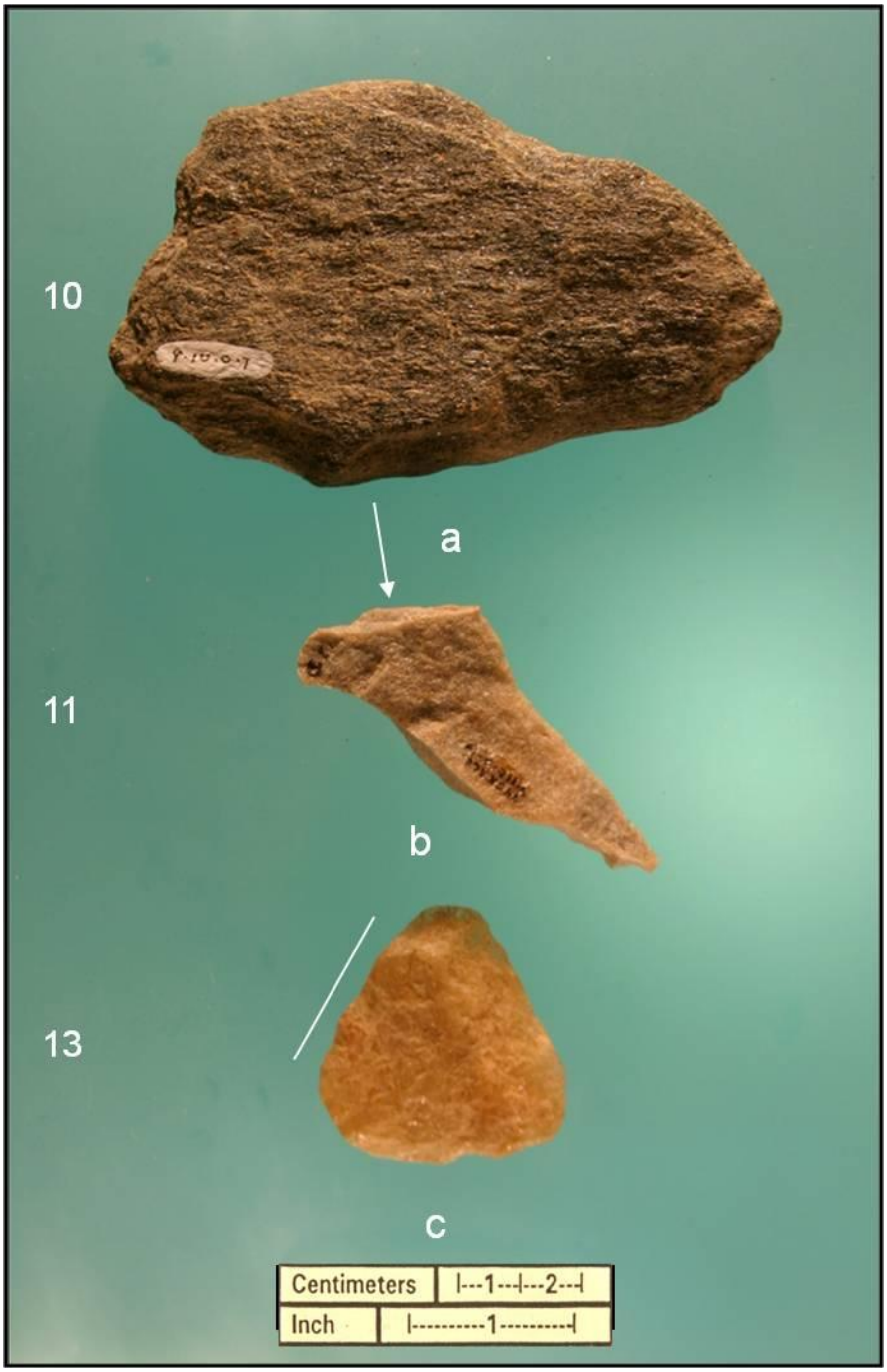


Figure 3.26: Selected artifacts from RP9 with levels shown to the left. Arrow indicates direction of blow that detached the overshot flake. White line on "c" indicated polished edge (photo by author).

1997:G31-G37). As with Watlington, a pattern seems to be evident on some of the earlier terraces in which older cultural areas are back from the extreme upstream end of the terrace. It is likely the immediate upstream ends of the terraces are more prone to flooding than higher elevations farther back from the river.

3.4.2.j: Trench RP10

This trench was placed approximately 50-60 feet (15.2-18.3 meters) south of RP7 and was designed to evaluate the potential early component's southern extent (see Figure 3.14). Here, as with many of the other pits, the precise location was dictated by the need to avoid trees. It would have been preferable to place this trench closer to RP7.

Trench RP10 contained the highest quantities of quartzite debitage of any trench on the site (see Appendix I: Table 3.21). The quartzite debitage was heavily concentrated in levels 13 and 14 with moderately high levels occurring in adjacent levels 11, 12, 15 and 16. This concentration brackets level 14, which produced the Paleoamerican component in RP7. Levels 9-16 also produced a light but consistent quantity of metavolcanic debitage.

Trench RP10 also produced the largest number of chronologically diagnostic artifacts. They give the impression not only of greater intensity of occupation but also of temporal breadth of site occupation. Figure 3.27 shows selected artifacts from the trench.

Figure 3.27a is the only prehistoric potsherd recovered from the second (Watlington) or third (Rubis-Pearsall) terraces. It is cord marked and sand tempered but too small to determine ware.

Figures 3.27b, 3.27d, 3.27e, 3.27i, and 3.27j are blade-like flake fragments. The quantity may merely reflect the increased amounts of overall debitage from the trench. Clearly, this area of the site was more intensely occupied.

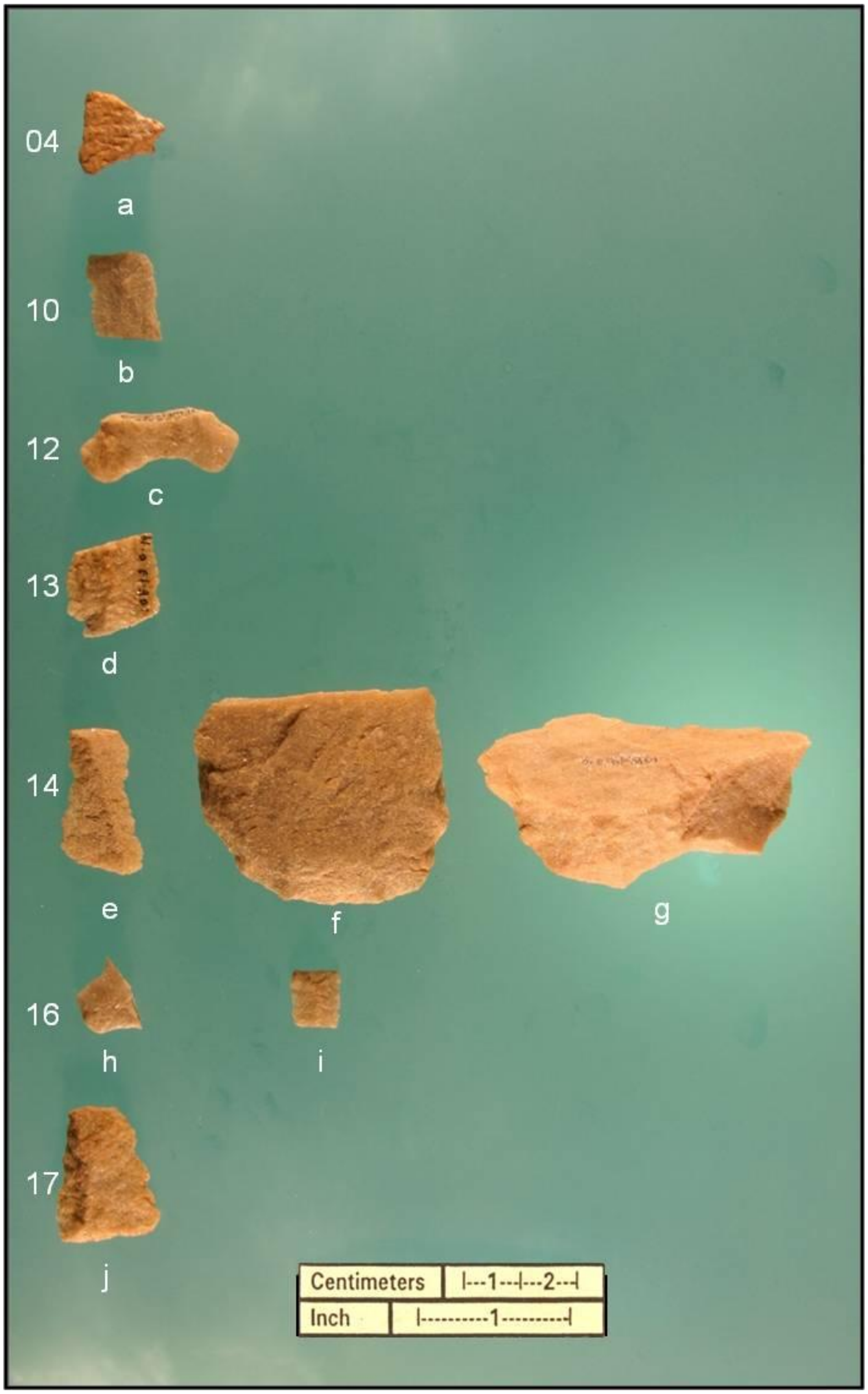


Figure 3.27: Selected artifacts from RP10 with levels shown to the left (photo by author).

Levels 12 (29-31) and 16 (37-39) produced Ft. Nottoway point fragments. Figure 3.27c is a base, broken in the notches, and Figure 3.27h is a basal corner. Being eight inches (20.3 cm.) deeper than the one in level 12, the fragment in level 16 suggests percolation of artifacts down through the RP10 profile. As demonstrated elsewhere, its relatively small size may have been a major factor favoring percolation.

Level 14 produced intermediate stage (Figure 3.27f) and early stage (Figure 3.27g) biface fragments. Their relatively poor quality would suggest that they are not a product of Ft. Nottoway technology unless they are expended bifacial cores. Considering the distance from and upslope relationship to level 14 in RP7 they should not be considered associated with the Clovis age occupation without further investigation.

3.4.2.k: Trench RP11

As stated above, this trench was excavated to expose a fresh profile. It was expressly done for Pavich and his USGS team to gather data for their paleo-climatic research. It was placed adjacent to RP7 also to give the best opportunity to gather comparable soil and tighter controlled archaeological data from the Clovis age component (see Figure 3.14).

Trench RP11 was laid out and excavated in 5x5-foot (1.52x1.52 meter) sub-squares. Level 1 (Ap soil) and level 2-5 (mixed) were flat shovel chunked out by sub-square. Levels 6-15 were trowel excavated. Levels 16-17 were carefully scraped, using dustpans as trowels. Levels 17-20 were chunked, using flat shovels. All stone artifacts and charcoal larger than 1/4-inch (6.3 mm.) were horizontally piece plotted in level.

The main methodological change involved sifting all excavated soil below level 2 through 1/8-inch (3.2 mm.) mesh. This was done to maximize charcoal recovery and to attempt to recover a better sample of small debitage from curated tools of exotic materials similar to the jasper in the fluted point, core and mended blade-like flake from levels 14 and 15 in RP7.

Appendix I: Table 3.22 shows the artifact distribution from a 1/4-inch (6.3 mm.) sample of the 1/8-inch (3.2 mm.) data. This was done to provide comparable data to those from the other trenches (see Appendix I: Tables 3.12-3.21). Appendix I: Table 3.23 shows the results from the 1/8-inch (3.2 mm.) sample, minus the 1/4-inch (6.3 mm.) data.

The 1/4-inch (6.3 mm.) sample resembles that from RP7 (see Appendix I: Table 3.18). However, there are several significant differences. Whereas RP7 produced no FCR, RP11 produced both quartzite and quartz FCR in multiple levels. These clustered in level 6 and levels 10-12 (Figure 3.28). The FCR contained several cross-mends, including Figures 3.28e and 3.28f, and Figures 3.28i, 3.28l and 3.28m, which are all from the same quartz cobble. The two FCR (Figures 3.28b and 3.28c) from level 6 do not mend but are from the same quartzite cobble. The large quartzite FCR from another cobble (Figure 3.28j) was recovered with two small fragments that could have been produced by a trowel, since they were relatively freshly broken. One burned pebble cross-mends between levels 9 (Figure 3.28d), 12 (Figure 3.28n) and 14 (Figure 3.28o).

Also RP11 produced no jasper or tools from levels 13-19, which produced four tools and a mended jasper flake and core from levels 14-15. The tools in RP11 clustered in levels 10-12. Most notable, level 10 produced a Middle Archaic, metavolcanic, Morrow Mountain I point (Figure 3.28g). Level 11 produced a large hammerstone (Figure 3.28h), and level 12 produced a large quartzite biface fragment (Figure 3.28k).

The 1/8-inch (3.2 mm.) sample debitage also clustered in level 11, with the hammerstone. The problem with the 1/8-inch (3.2 mm.) sample debitage is that there was so little of it. That means either there was not much knapping going on or most of it had percolated below the depth excavated. Considering the irregular distribution that concentrated in specific levels, it is likely that the distribution represents very light knapping activity in this area of the site. Future excavation on the site should employ finer mesh samples throughout.

Table 3.24 shows the results of Pavich and Markewich's analysis of the south, southeast wall profile of RP11. The profile is shown in Figure 3.25. With no apparent buried A horizons or chronological or stratigraphic relationship to the archaeological data, the soil

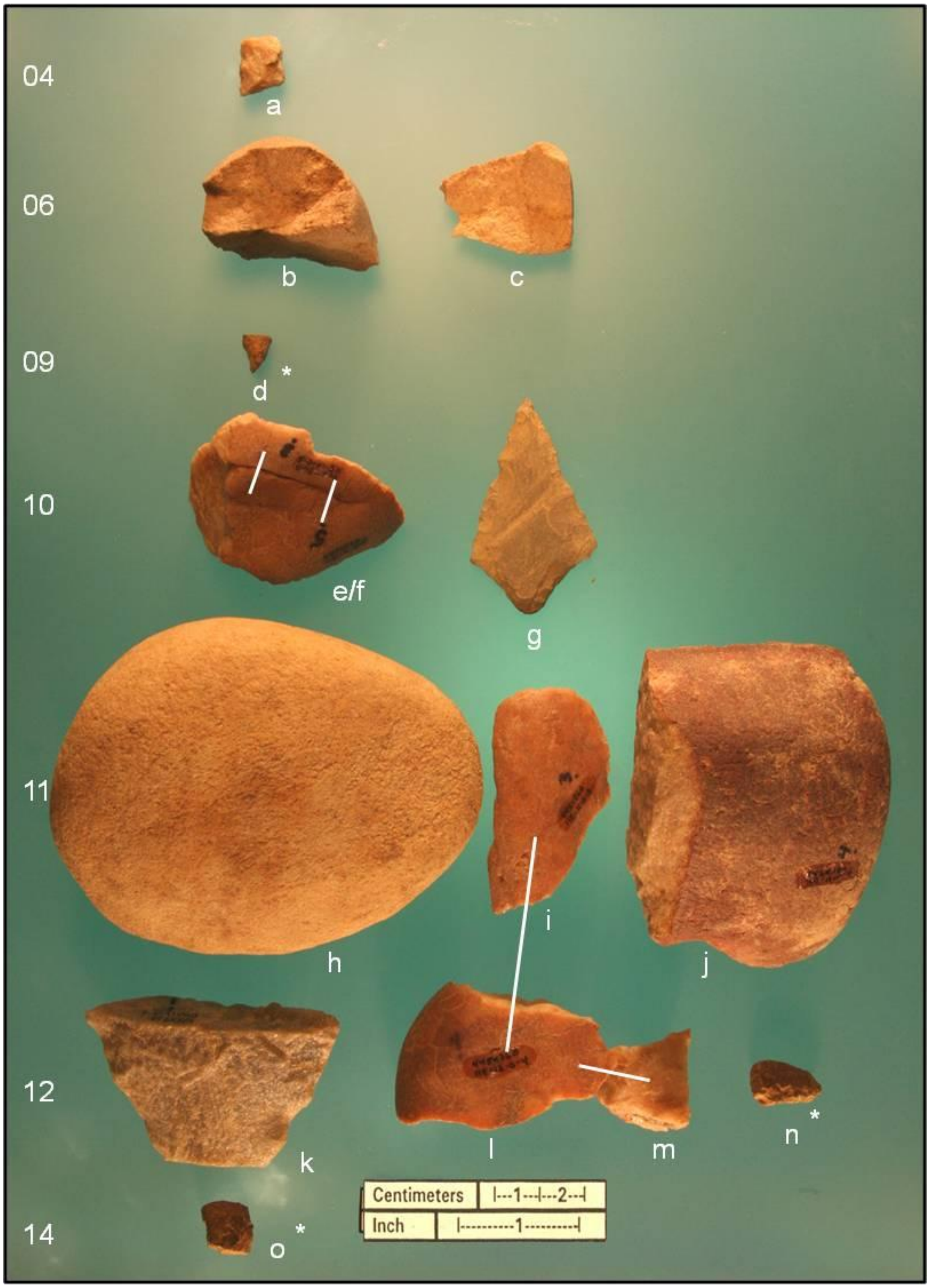


Figure 3.28: Selected artifacts from RP11 with levels shown to the left. White lines and "" indicate mends (photo by author).*

development clearly occurred after cultural occupation and appears to have only an incidental relationship to the cultural stratigraphy, i.e. the better developed B soil is older.

Parent material: primarily medium quartz sand with few percent potassium feldspar and heavy minerals; no visible mica in most horizons			
Site disturbed by precious activity			**Note:** Munsell colors are moist colors
top	**base**	**Design.**	**Horizontal description**
0	4	none	disturbed
4	8	A	10YR 4/3; texture; ; numerous >= 1/4 in (0.635 cm.) roots; very weak, medium to coarse subangularly blocky breaking to crumb and single grain; few to no coatings on grains, clear quartz grains; gradual wavy boundary
8	14	AB or BA	10YR 5/4-6; texture; weak crumb to single grain; numerous >= 1/4 in (0.635 cm.) roots; few clay coatings on grains; abundant charcoal (result of logging and burning?); gradual smooth boundary
14	26	B	7.5YR 5/8 (color or cambic B); texture; massive breaking to single grain; few clay coats on grains; gradual smooth boundary
26	33	Bt	7.5YR 5/8; transition horizon to lamellae; texture; very weak sub-angular blocky breaking to single grain; increase in percent clay coatings on grains, more resistant to knife penetration; faint lamellae, 1/16 in (0.159 cm.) thick, spaced 1/2 - 1 in (1.25-2.54 cm.) apart; gradual smooth boundary
33	56	Bt2	7.6YR 5/6; texture; lamellae-rich horizon; lamellae apparent as trench face dries, irregular and wavy (2-3 in; 5.08-7.62 cm amplitude), laterally discontinuous, 7.6YR 5/6 lamellae color, 7.5YR 5/8 inter-lamellae color, <= 3/8 in (0.95 cm.) thick, .25-1.5 in (0.635-3.81 cm.) apart; very-coarse sub-angular blocky; no ped-face coating but abundant coatings on grains; possible break at 46 in (116.84 cm.), numerous <= 1/4 in (0.635 cm.) roots above, none below, interpreted as top of seasonal water table; gradual smooth boundary
56		BC	7.5YR 5/6-8; texture; no visible roots; massive to single grain, caves upon drying; few widely spaced lamellae
56		BC	7.5YR 5/6-8; texture; no visible roots; massive to single grain, caves upon drying; few widely spaced lamellae

Table 3.24: Trench RP11, south wall (East half) profile by Milan Pavich and Helaine Markewich (USGS).

3.5: Summary and conclusions

After thoroughly researching soil maps from Sussex County, the Chub Sandhill Preserve, with its north aspect, large point bar feature and extensive Tarboro soil was identified as the prime candidate for a stratified Paleoamerican site. If successful, the investigations would take the model from accident (Cactus Hill) to coincidence (Rubis-Pearsall).

The approach at Chub Sandhill was modeled on the approach used to locate the Paleoamerican occupation at the Thunderbird Site (Foss 1974; Gardner 1974). That approach involved first assessing landform geomorphology to determine the location of buried soils that potentially dated to the Paleoamerican period. Those results were used to guide the archaeology.

For the purpose of this analysis, the Chub Sandhill point bar was determined to have three terraces: an outer levee separated by a flood chute from the second and third terraces. Based on results from 2004 auger testing, all three terraces were considered prime candidates for separate sites. Formal test excavations on the upstream ends of the three terraces confirmed the prediction.

3.5.1: Koestline

Data from Koestline indicated site occupations dating at the earliest to a hypothesized late Morrow Mountain Sub-Phase (Middle Archaic). This was based on small, thin contracting stemmed, Morrow Mountain-like points recovered from the deepest cultural levels. The chronology above Morrow Mountain occupations consisted of later Middle Archaic Guilford (?) and Halifax; Late Archaic Savannah River; Middle Woodland pottery; and probable Late Woodland pottery and a small triangular point (see Figure 3.6).

The stratigraphic context for the cultural levels indicated that the site was in an active fluvial environment prior to the Morrow Mountain occupation. This interpretation is based on the inverse relationship between the main debitage classes and pebbles recovered from the 1/4- inch (6.3 mm.) screening (see Appendix II: Tables 3.2 and 3.3).

The site produced no evidence of Early Archaic, Clovis or pre-Clovis age cultural presences. However, the site is stratified and offers excellent opportunities for studying later prehistoric cultures and culture change during those periods.

3.5.2: Watlington

Data recovery from Watlington came from four sources: the auger transects; the eroded edges of the abandoned sand quarry; Block A at the T5-S100 auger test; and Block B at the T5-S000 auger test. Points from the Watlington site excavations indicated that the site occupations dated at its latest to the Middle Archaic Guilford Phase based on the Guilford-like point recovered from trench W4 (see Figure 3.9s). Points from Block A were stratigraphically in proper chronological sequence (see Figure 3.9).

Additional points in chronological sequence included earlier Middle Archaic Morrow Mountain II, and Early Archaic LeCroy-like bifurcate points, possible Fort Nottoway points, Palmer/Decatur points and Palmer/Kirk corner notched points. A quartzite point tip from the bottom of the Ap horizon (level 1) indicates that the site may have an ephemeral occupation later than Guilford.

The high probability of late Bifurcate or early Morrow Mountain age, based on the one sigma, 8160-7970 cal. B.P. (BETA 214934) date range on hickory nut charcoal from Feature 2 in trench W3, is interesting beyond the fact that it could add another dated hickory nut use into the latter stages of the Early Archaic (Inashima 2008: 215). It also focused attention on hypothetical early hickory and other nut shell use. It is likely that the presence of burned nut shells was not a direct product of nut meat/oil extraction. Burned nut shells indicate recycling of the bi-products of nut meat/oil extraction, with the hardwood shells having been recycled in heating, cooking and/or smoking/flavoring.

Five small quartzite flakes and one small quartz flake, all <1/4-inch (<6.3 mm.), were recovered from level 13 in trench W4 (see Appendix I: Table 3.7) and trench W5 (see Appendix I: Table 3.8). Although the occurrence of these flakes at least 28 inches (71.1 cm.) below the last significant artifact producing level and 12 inches (30.5 cm.) below the last level producing any artifacts can be explained geologically, a cultural level at that depth cannot be discounted. They occurred in and slightly below a relatively thin Btb horizon, which could have served as an artifact trap for artifacts and charcoal percolating downward due to bioturbation.

Generally, it appears that a cultural shift occurred between the second and first terrace. With diagnostic artifacts on the second terrace (Watlington) ending with a Middle Archaic Guilford point (see Figure 3.9s) at more than 17 inches (43.2 cm.) below the surface and associated with no later chronological indicators, it is likely that the last major occupation on the second terrace was the Middle Archaic Guilford phase. The 8,077±53 cal BP (7,250±40 C-14 BP) (BETA 214934) on Feature 2, and the location of all of the other recognizable features being in level 4 or deeper are consistent with abandonment of the terrace as a primary occupation area sometime during the Middle Archaic.

Although the site has produced deep artifacts and charcoal, it is likely but not sure that these data are the result of percolating artifacts being trapped on a Bt soil. The remnants of the site, much of which has been destroyed by sand quarrying, are stratified and at least as old as the Early Archaic. The site is integral to understanding the prehistoric cultural reactions to the westward migration of the Chub Sandhill point bar.

3.5.3: Rubis-Pearsall

Preliminary, systematic auger testing identified approximate horizontal site boundaries of the buried component. It also indicated that stratigraphically the site concentrated between 15 and 45 inches (38.1 and 114.3 cm.) below the surface. The auguring also identified the possible edge of the all important clay (paleosol) bank and a probable spring (see Figure 3.15).

In order to find context for anything that would be recovered above the clay bank, the first six test trenches were placed west of the clay in what appeared to be more artifact rich areas of the site. Like the overall strategy of testing Koestline and Watlington first, the intent also was to first try to negate the model.

The first six trenches produced indications of Early Archaic, Ft. Nottoway biface reduction. The clear down drift of chert debitage in RP2 (see Figure 3.17) also suggested that parts of the site had been heavily disturbed vertically probably by tap roots. The presence of large quantities of hickory nut charcoal in Feature 2 on Watlington strongly suggests that a hickory tap root disturbance process on Chub Sandhill has been active for more than 8,000 years.

Trench RP7, the first trench to the east of the fire road and just south of the upstream end of the clay bank produced the first positive evidence for Paleoamerican occupation on any of the three sites. A fluted point base from level 14 (see Figures 3.21e and 3.22), 35 inches (88.9 cm.) below the surface, demonstrates a Paleoamerican presence on the site. A chipped quartzite adz and an apparently expended jasper unifacial core were also recovered from that level. The fact that a small blade-like flake from RP7, level 15 mended to the core (see Figure 3.23) suggested that the stratigraphy is more complex than indicated by the other evidence.

The other evidence for compromised integrity also included inverted OSL dates from adjacent trench, RP8. They were 20,500±2,600 BP on level 10, which had produced the Palmer point (see Figure 3.24a) from RP8 and 18,900±2,400 BP on level 14, which produced the fluted point from RP7.

Besides producing the only potsherd from the site, trench, RP10 also produced two Ft. Nottoway point fragments: one from level 12 and one from level 16 (see Figure 3.27c and 3.25h, respectively). Since RP10 was approximately 50 feet (15.2 meters) south and upslope from RP7 and RP8, the depth differences may not correspond.

Trench RP11, which was immediately south of RP7, produced cross-mended FCR between several levels (see Figure 3.28). It also produced a burned pebble that cross-mended between levels 9, 12 and 14.

The most obvious signs of disturbance, especially east of the clay bank, are with very small artifacts and coarse sand grains. It is likely that the larger artifacts have not been subjected to comparable levels of displacement. However, this does not explain the temporal disparity between the Paleoamerican diagnostic artifacts and OSL dates.

The impact of pedo- and bioturbational disturbances on OSL dates has been studied (Bateman et al. 2003; Leigh 2001: 284-286). Rubis-Pearsall offers a further opportunity to explore the relationship between bioturbation, OSL analysis and archaeological contexts.

Fundamentally, the Clovis age component recovered from RP7 supports the model. Its vertical context within the site, whether disturbed or not, is irrelevant to the fact that, along with the OSL dates, it demonstrates that the landform was occupied during the Paleoamerican period and the site has the potential to have been occupied during the Pre-Clovis phase, possibly as early as the Pre-Clovis occupation at Cactus Hill.

3.5.4: *Conclusions*

It is significant to note that pebble and quartzite debitage quantities generally correspond throughout the profiles in all four trenches of Watlington. That is a stark contrast with those from Koestline, where there is an inverse relationship between pebbles and quartzite debitage quantities (see Appendix II: Tables 3.2 and 3.3). However, the quantities on Watlington are much lower even in the quantitatively highest pebble levels. Those levels are more consistent with the quantifiably lowest levels from Koestline, indicating comparable flood threats during the periods of occupation. It is likely that Koestline was only occupied after the flood threat subsided to the level of Watlington.

Based on the cultural data, it appears that this shift occurred sometime after the "8,200 BP cold event." Fiedel (2006:4) argues that:

> The 8200 cal BP cold event is the biggest climatic event since the YD. It has been attributed to the final massive draining of glacial Lake Agassiz in the North Atlantic, an event that would have disrupted thermohaline circulation… The effects of the 8200 cal BP event may have lasted for about 400 years.

These data and the chronological differences between sites indicate that much of the point bar progression to the west on Chub Sandhill occurred during the Holocene. Figures 3.29 and 3.30 show idealized vertical and horizontal models of how the cultural occupations may have followed the progression of the Chub Sandhill point bar as it cut further to the west between 12,900 and 8,200 years ago. Leigh (2008: 103) indicates that for Georgia, the early Holocene after 11,000 years ago was, in fact, a period of "less lateral migration." However, Georgia is significantly further south than the Nottoway and may not be temporally analogous.

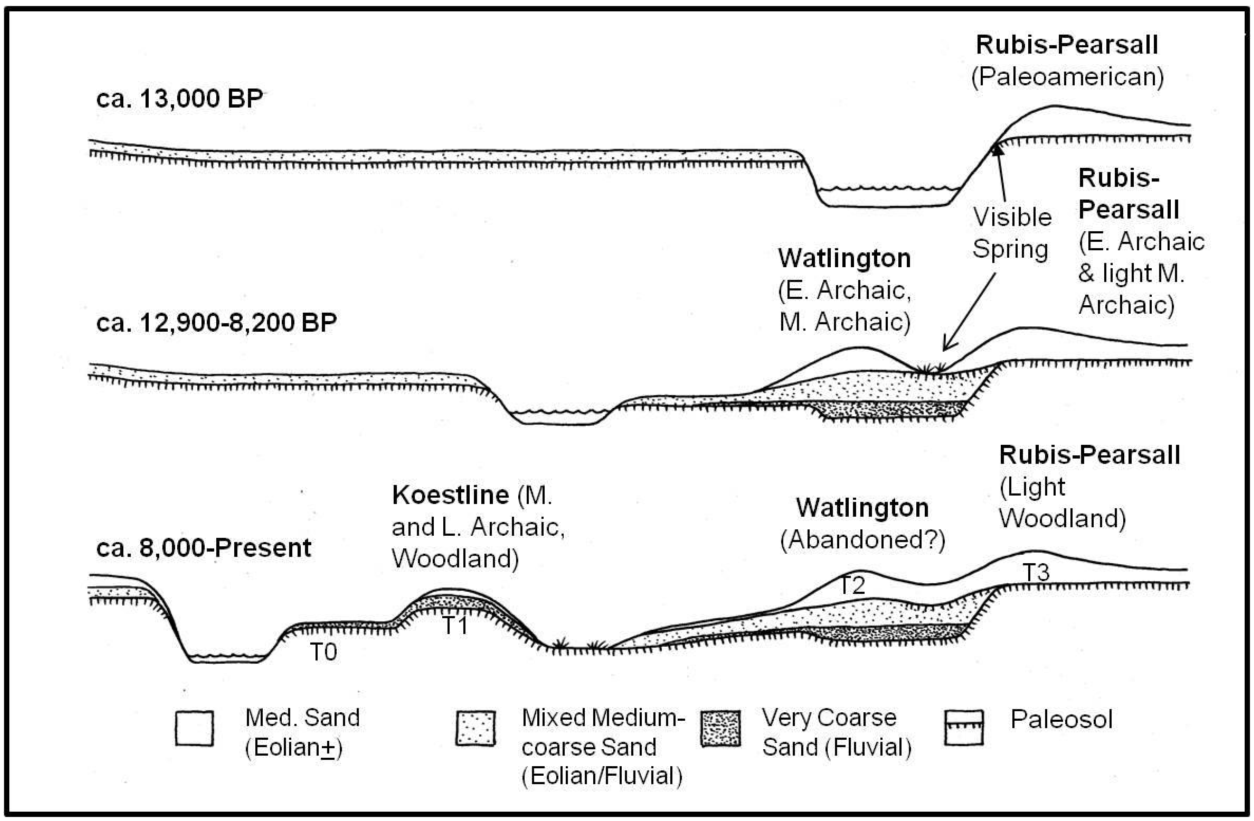


Figure 3.29: Idealized model of the westward progression of the Chub Sandhill point bar followed by movement of recorded primary prehistoric occupations from Rubis-Pearsall to Watlington to Koestline. (Note: base stratigraphic units are hypothesized)

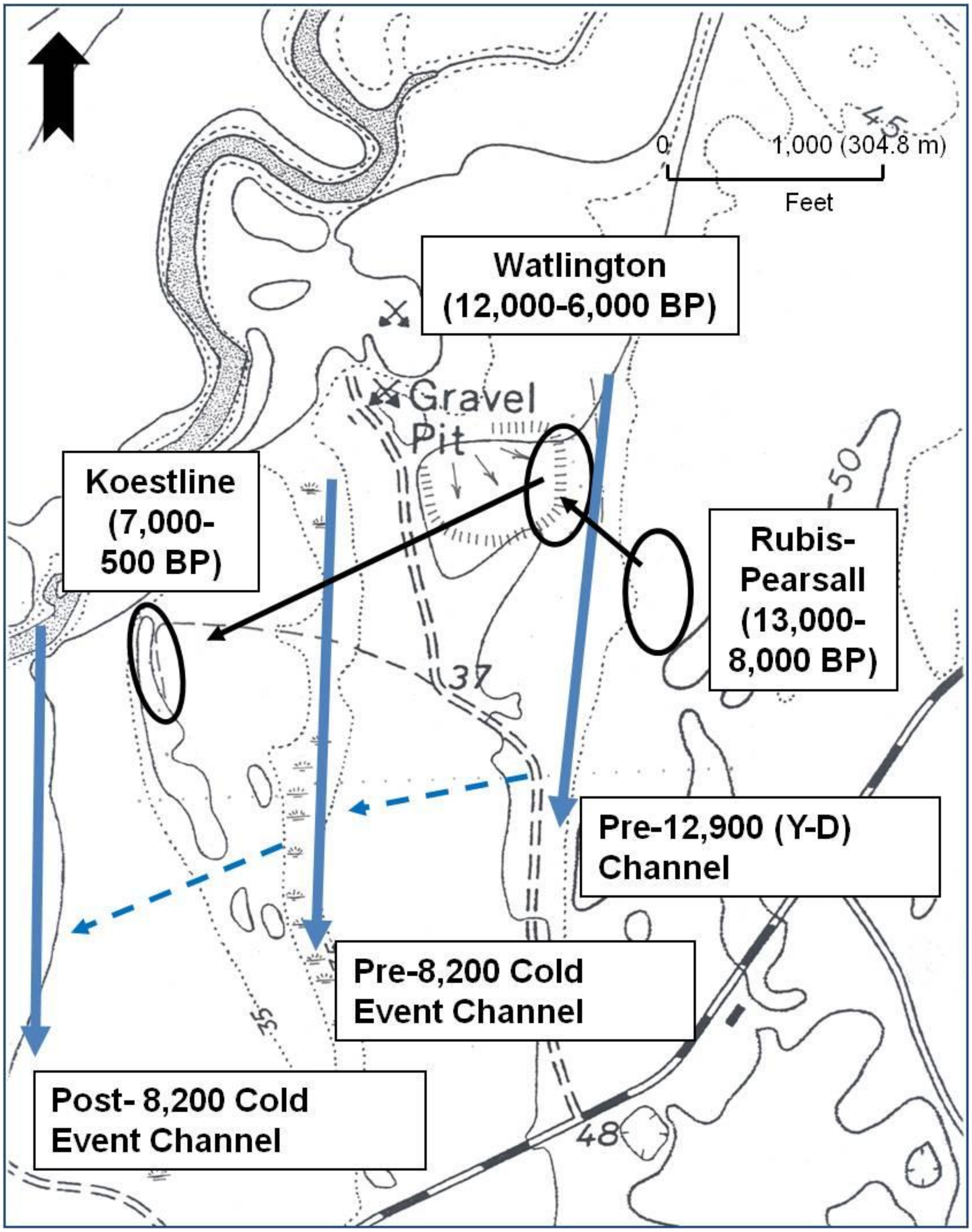


Figure 3.30: Idealized model of the progression of the Chub Sandhill point bar followed by movement of primary prehistoric occupations from Rubis-Pearsall to Watlington to Koestline (USGS 7.5 min. series, Sebrell, Va.).

Chapter 4: Blueberry Hill (44SX327)

4.1: Overview

Blueberry Hill was actually the second area selected to test the Cactus Hill model. It was first tested in 2002 and later tested in 2010. The first test produced apparent Clovis age and pre-Clovis age artifacts in relative stratigraphically consistent association. The 2010 test supported the stratigraphic position of those artifacts but added no new chronologically diagnostic artifact evidence to support the apparent early age of the deeper 2002 discoveries. However, the 2010 testing program did provide additional lines of evidence supporting the predictive power of the model.

On several occasions, Daniel P. Wagner (personal communication 2009) expressed reservation about the physical context for the purported age of the site. These reservations included:

1. His understanding that the site was at a lower elevation than Cactus Hill. Waters (personal communication 2001) also believed that elevation above the current river channel was a critical factor in predicting the locations of pre-Younger-Dryas period occupations. It was also a major factor, used by the author, in applying the Cactus Hill model to the Chub Sandhill area (see Chapter 3 above), which made this question particularly relevant. Wagner indicated that he had no direct evidence for his understanding.

2. His auger testing in the vicinity of the site had produced no lamellae, which are common in the older strata of Cactus Hill, Areas A and A/B. The presence or absence of lamellae are not direct indicators of the age of a stratum. Lamellae can form quickly (Bond 1986), and the more robust they are the longer it took for them to form. However, the lamellae on Rubis-Pearsall and Watlington were so ephemeral that they were not detected in the extensive auger testing on those sites (see Chapter 3). Still, with a similar Tarboro soil and both sites being on the same extended landform, the lack of strong

lamellae on Blueberry Hill, as Wagner contended, would be a line of evidence arguing against occupations earlier than the earliest at Cactus Hill.

3. Based on these two factors, he assumed that if the possible Clovis age and pre-Clovis age diagnostic artifacts were correctly typed then they would have been naturally re-deposited. Redeposition was not a viable option for the 2002 artifacts, because of their large size and the fact that the deepest ones were clearly on a cultural surface. The only negation that would stand up was that the landform was not old enough and therefore the artifacts were deposited by occupants on the site after the Younger-Dryas. Wagner raised valid questions that needed to be answered.

4.1.1: Local paleoenvironmental context

In an effort to better understand Cactus Hill's context, during the late 1990s through 2000, several selected test pits (E1, E2 and F1) were dug to the south and East of Area A. The general locations of these pits are shown in Figure 4.1. They were the result of sporadic attempts to provide geologic and horizontal context for Cactus Hill. All test trenches produced artifacts in varying degrees of intensity, indicating a broad scatter of artifacts over the entire vicinity of Cactus Hill and Blueberry Hill.

The first pit, test trench E1, was located on the slope above a spring that feeds the low wetland area to the south of the Cactus Hill sand ridge (areas A, A/B and B). The assumption for placing test pit E1 there was that if a spring had been there in Paleoamerican times, a location adjacent to such a surface feature would have been prime candidates for occupation.

The east wall profile of test trench E1 (Figure 4.2) was excavated to 60 inches (152.4 cm.) deep and an additional 24 inches (61.0 cm.) in the southwest corner. A second test trench, E2, was dug nearby but was not extended into the buried Bt horizon.

The E1 profile was strikingly different than any other excavated during the entire 18-year testing program in the Nottoway, including the auger test near the hypothetical spring at

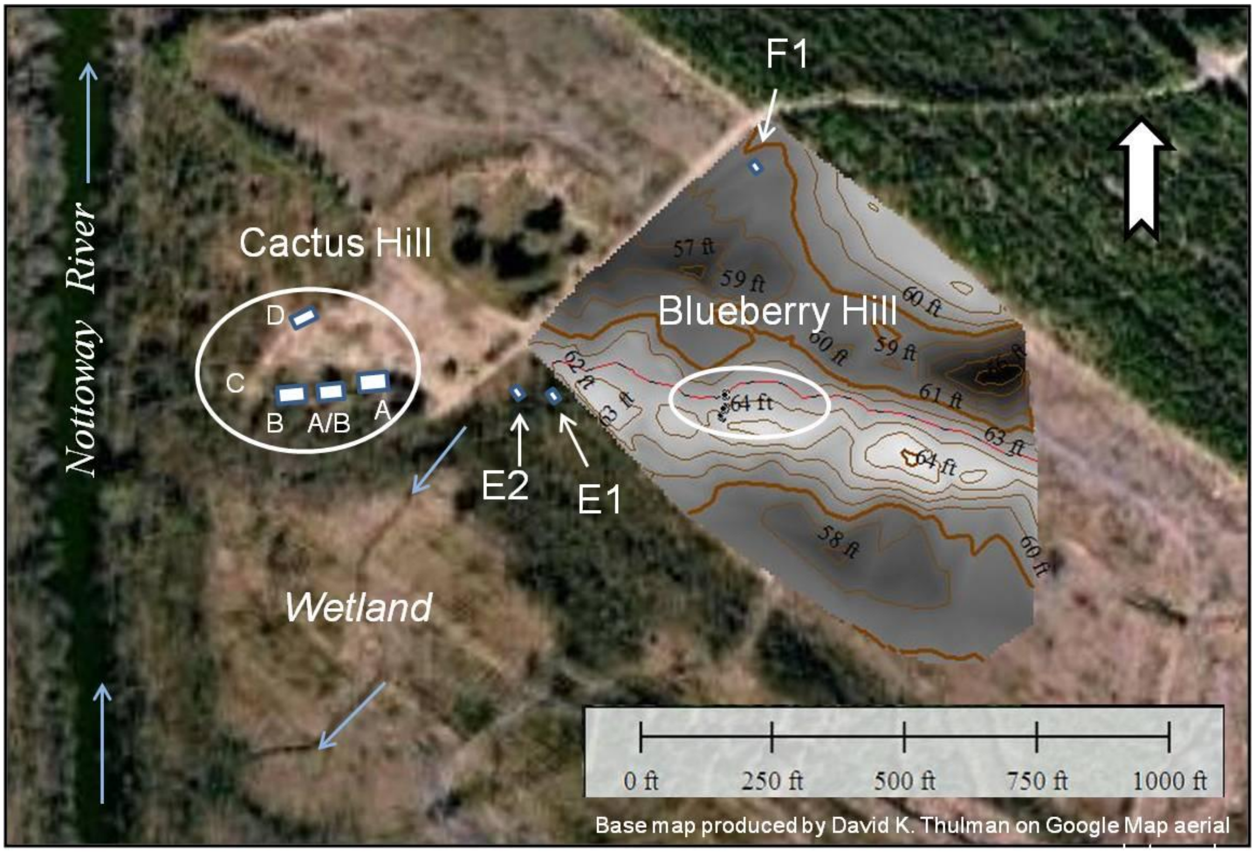


Figure 4.1: Overview map of the Blueberry Hill site (topographic overlay by and with permission of David K. Thulman over Google Map image).

the southwest edge of Rubis-Pearsall (see Chapter 3). The E1 profile consisted of a seven-inch (17.8 cm.) deep plough zone (Ap); over an ephemeral B horizon (7-14") (17.8-35.6 cm.); over what appeared to be an E or possible C horizon (14-30") (35.6-76.2 cm.); over an increasingly thick, well-developed, argillic (2Btb) horizon containing increasing amounts of coarse sand and gravel (30-46") (76.2-116.8 cm.); over a thick C/3B horizon consisting of medium sand that contained widely spaced lamella, which graded in the lower levels into very coarse sand, with the trench bottoming out in a water table.

Assuming that the clay sub-stratum in E1 was within two feet (.61 meters) of the bottom of the seven-foot (2.13 meter) deep extended profile, it is likely that the two Area E test trenches were over a perched water table feeding the to the west. This buried water table may have separated clay banks under Cactus Hill and Blueberry Hill. It is not clear if it was present before the Younger-Dryas or resulted from later scouring during the Younger-Dryas onset. The elevations of the various clay features below the

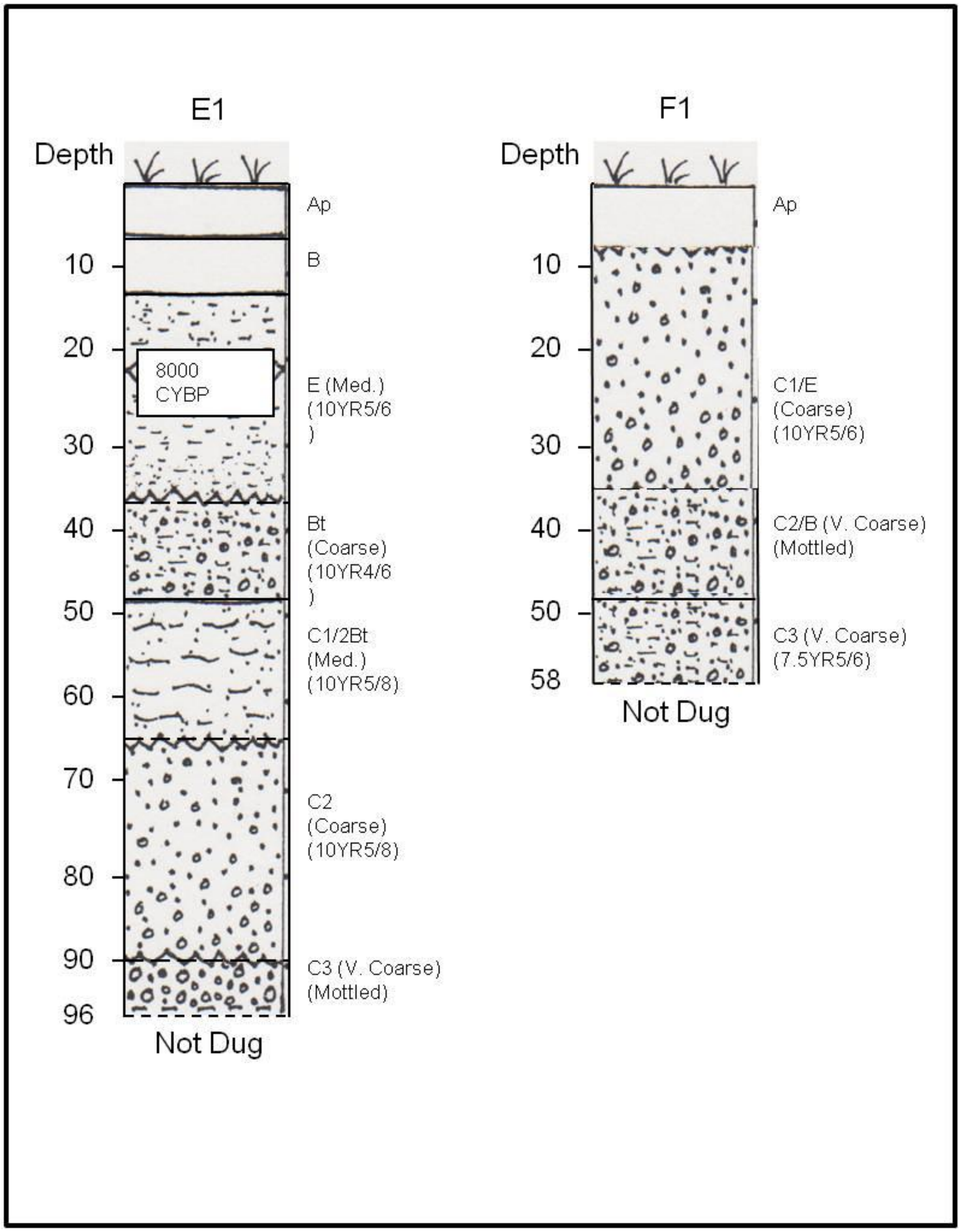


Figure 4.2: Test squares E1 and F1 profiles.

surface have not been precisely determined. However, the wetland south of Cactus Hill drains west (upstream), which may be a function of post-Younger-Dryas, lateral erosion caused by the main channel of the Nottoway having shifted to the west and down-cut.

Appendix III, Table 4.1 shows the artifact distributions by level and depth from E1. The distribution of chronologically diagnostic artifacts, which for the purpose of this thesis are all that are relevant, shows a Woodland pottery (CP) (Figure 4.3a) presence between

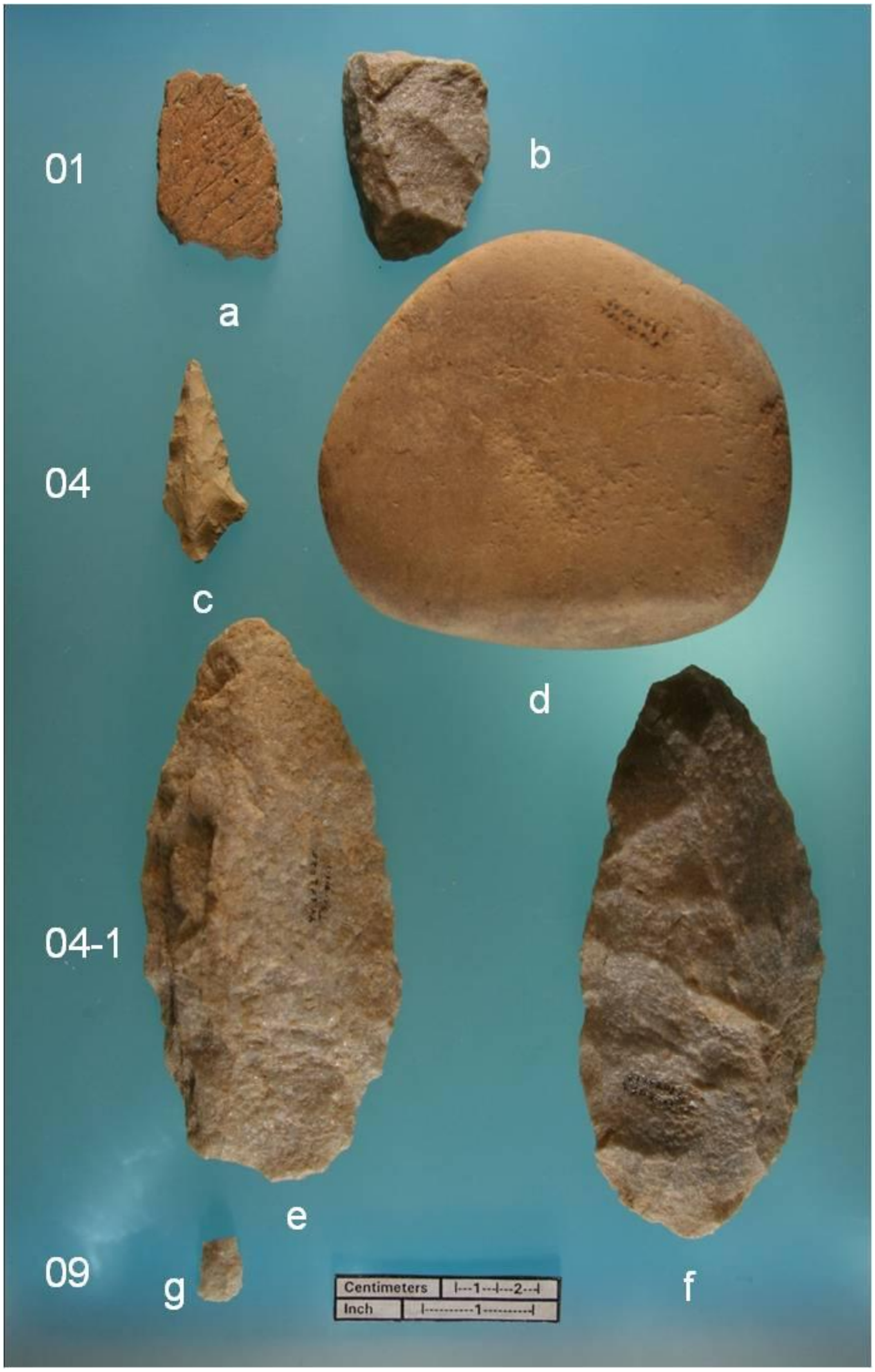


Figure 4.3: Selected artifacts from E1 with levels shown to the left (photo by author).

the surface and 13 inches (33.0 cm.) deep, in the plough zone (Ap soil horizon and the mixing zone in level 2). This indicates that the top 10 inches (25.4 cm.) represents no more than a post-3,000 B.P. depositional episode. The relatively large quartzite endscraper (Figure 4.3b), which should be uncommon in a later Woodland context is an anomaly. However, it is not clear if the Ap soil contained Late Archaic assemblages also.

The Middle Archaic, metavolcanic Morrow Mountain point (Figure 4.3c) in level 4 (16-19") (40.6-48.3 cm.) suggests a post-8,000 years ago age for the deposition above that level. The presence of large tools like the pitted anvil/hammer stone (Figure 4.3d) and a relatively large hearth-like feature (Feature E1) in the same level suggests some degree of integrity of the level. The "twin" quartzite bifaces (Figures 4.3e and 4.3f) found next to each other within the hearth strongly support the integrity of the level. Feature E2, containing FCR, in level 5 is not conclusive with respect to age, since it was only one level deeper.

The small quartzite prismatic blade-like flake (Figure 4.3g) from level 9 (31-34") (78.7-86.4 cm.) brings the earliest age of the cultural material in that area into question. Since blade-like flakes similar to that have been recovered from contexts as late as Early Archaic and as early as the hypothesized pre-Clovis age components on Cactus Hill, it is possible that Area E could contain a deeply buried Clovis or pre-Clovis age occupation. The 31-34-inch (78.7-86.4 cm.) depth is consistent with Paleoamerican levels at the adjacent Cactus Hill site and Rubis-Pearsall farther downstream.

Area E, Test Trench E2 was only excavated into the 2Bt horizon. It produced a light scatter of artifacts including seven sand tempered, cord marked sherds from the Ap soil horizon (see Appendix III: Table 4.2). Based on field results from E1 and the location of E2 at a lower elevation, E2 was not dug below 28 inches (71.1 cm.) deep.

The area between Cactus Hill (Area A) and Blueberry Hill warrants further testing. Although it produced evidence of post-Younger-Dryas scouring and later redeposition, it also produced one blade-like flake (Figure 4.3g) from the well-established Bt soil horizon between 31 and 34 inches (78.7 and 86.4 cm.) deep, which leaves the potential for pre-

Younger-Dryas cultural remains. The profile has not been replicated elsewhere and its depositional history is not clear.

A 4x4-foot (1.22x1.22 meter) test square was also dug in an area of lower elevation near the edge of the access road to the north of Blueberry Hill (see Figure 4.1). This pit was designated F3, which stands for area F test pit 3 in the sequence after E1 and E2. It was designated F rather than E because it was dug on a different landform approximately 1,000 feet (305 meters) east of E1 and not related either culturally or geomorphologically.

The entire soil matrix of the pit consisted of very coarse to coarse, poorly sorted, upward fining sand (see Figure 4.2). Appendix III, Table 4.3 shows the light but noticeable artifact distribution. The presence of an historic, undecorated, glazed, white bodied earthenware sherd in level 6 (26-30") (66.0-76.2 cm.) indicated the archaeological context had been disturbed to an undetermined extent and/or probably was of recent age. Prehistoric artifacts consisted of a relatively light distribution of mostly quartz and quartzite debitage, with the greatest concentration being in level 4 (18-22") (45.7-55.9 cm.) above the historic sherd (see Appendix III: Table 4.3).

Based primarily on the soil in F3 as compared with other soils excavated on Cactus Hill and Blueberry Hill it is likely that this area represents a post-Younger-Dryas deposition. Considering F3 is in the lower part of the Nottoway floodplain between the Blueberry Hill sand ridge and the current river channel, it is likely that Area F was not occupiable before the Younger-Dryas or, if it had been occupied, any evidence of cultural occupation had been subsequently scoured away and the current soil represents post-Younger-Dryas sediments.

With respect to Cactus Hill Area D and F, Wagner and McAvoy (2004) and the author (2004) independently concluded that, during the pre-Younger-Dryas, the Nottoway River likely flowed along the northern edge of Areas A, A/B and B of Cactus Hill. Hypothetically, the buried clay bank, which underlies the Clovis age and pre-Clovis age occupations on Areas A and B at Cactus Hill, formed the pre-Younger-Dryas south bank of the active floodplain that extended along the north edge of the Blueberry Hill sand ridge (Figure 4.4). Alternatively, the Cactus Hill/Blueberry Hill sand ridge could have been an elongated island in a pre-Younger-Dryas, braided floodplain.

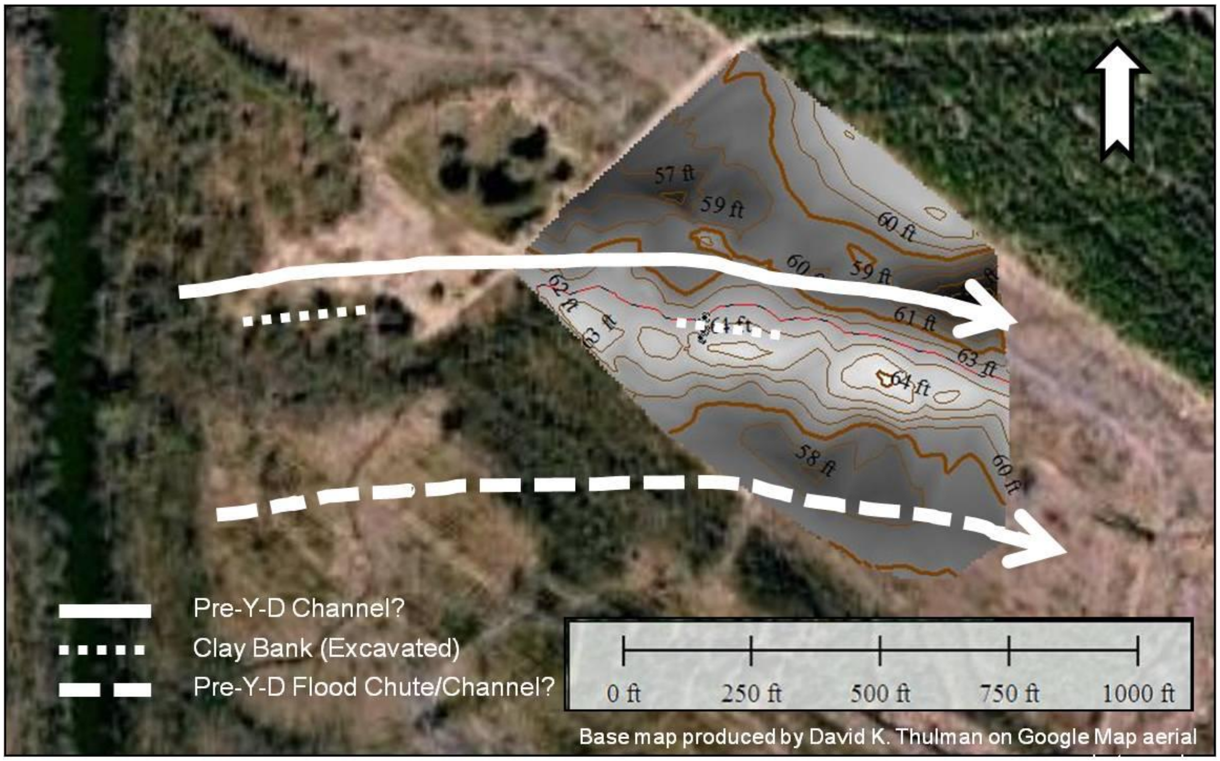


Figure 4.4: Hypothesized pre-Younger Dryas clay banks, channel and possible flood chute (Base map produced by David K. Thulman over Google Map image).

In order to test these hypotheses, in 2001 a roughly north-south auger transect was excavated just north of the elevated sand ridge east of Cactus Hill on what was to become Blueberry Hill. The precise location of this transect has not been determined, but it was possibly slightly east (downstream) of the mid-point of the elevated sand ridge shown as "Blueberry Hill" in Figure 4.1. It was adjacent to Test Trench BBH1, which also has not been relocated.

The area was heavily forested in young pine trees at the time, which severely restricted visibility. Between 2002 and our return to the site in 2010 the trees covering the Blueberry Hill site had been harvested and the area replanted in new pine saplings. The process of replanting disturbed the site surface to the extent that it erased all surface features but stumps from the 2002 landform.

This factor may have played a role in reconciling Wagner and the author's results from auger testing southeast of Cactus Hill. As will be demonstrated below, Wagner must not have been testing the same landform that contains the older soils and artifacts of Blueberry Hill. This is understandable considering the poor visibility at the time and the small horizontal extent of the prime area for a buried pre-Younger-Dryas landform.

As Figure 2.1 shows, the USGS 7.5 minute series topographic map, Sussex Quadrangle depicts the Blueberry Hill sand ridge as being within one, five-foot (1.52 meter) contour interval higher than Cactus Hill. This was the author's reason in 2001 for concluding that the Blueberry Hill sand ridge was a high probability location for a pre-Younger-Dryas, south bank of the ancestral Nottoway River. The purpose of the auger transect was to determine if the northern edge of that sand ridge was underlain by a distinct clay bank, like found at Cactus Hill.

Four cores were excavated at 20-foot (6.1 meter) intervals along a roughly north-south transect, resulting in a 60-foot (18.3 meter) long transect. It produced soil profiles, roughly similar to those at Cactus Hill, Area A and a strong indication of a deeply buried clay bank at the northern end of the transect (Figure 4.5). None of the core samples were sifted for artifacts although one quartzite fire cracked rock was observed in a near-surface core sample.

With respect to Wagner's not detecting lamellae, a comparison of auger tests in 2010 with test excavation profiles indicated that, with the authors' limited soil expertise, the teeth on a three-inch (7.6 cm.) bucket auger can distort the finer textural distinctions in the profile. This is particularly the case with detecting lamellae, a problem also encountered at Chub Sandhill on both Watlington and Rubis-Pearsall, where the lamellae that were there were not detected in the preliminary auger testing. As a result, profiles above the clay in the auger samples have to be considered preliminary.

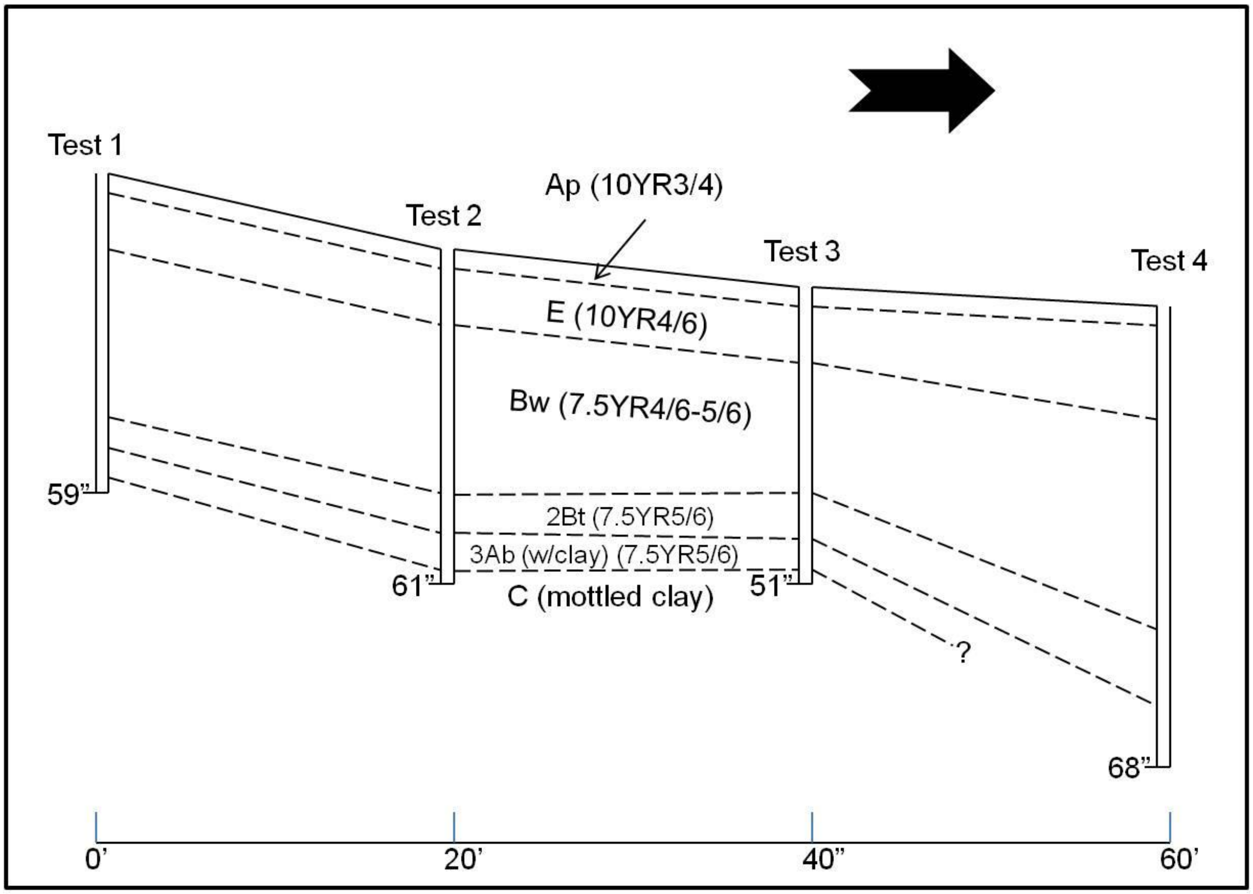


Figure 4.5: Extended profile based on the preliminary auger transect of Blueberry Hill.

It was estimated at the time that the top of the northern-most core (#4) was about 20 inches (50.8 cm.) below the top of the southern-most core (#1) as the auger testing proceeded downslope to the north. However, after the forest had been cleared it became evident that the surface elevation differences were probably in feet rather than inches.

Clay was encountered at approximately 56 inches (142.2 cm.) deep in core #1; 58 inches (147.3 cm.) in core #2; 48 inches (121.9 cm.) in core #3; and not encountered at all in #4, which was stopped at 68 inches (172.7 cm.) deep. This was due to insufficient auger extensions being available at that time.

The slightly uneven depths to the clay in cores 1-3 were possibly the result of one hitting a shallow underlying drainage channel, which was detected during the 2010 excavations. However they do indicate a possible lip on the buried clay bank edge or alternatively a slightly elevated top of core #3, relative to estimated surface contours. The presence of the probable clay bank, indicated by the apparent drop off, was confirmed later, during a systematic auger sample of the site in 2010.

As a result of this and subsequent auger testing it appears that a pre-Younger-Dryas, Nottoway River channel may have run west to east through Cactus Hill and along the northern edge of the Blueberry Hill sand ridge. During Hurricane Floyd, an active flood chute (see Figure 2.1), conforming to the hypothesized pre-Younger-Dryas river channel, ran through the Cactus Hill sand quarry and along the north edge of the Blueberry Hill landform. It was believed likely that this flood chute was following an old channel that bordered the buried clay banks at Cactus Hill and Blueberry Hill.

4.2: 2002 test excavations

4.2.1: Trench BBH1

In 2001, a single 4x5-foot (1.22x1.52 meter) test pit (BBH1) was flat shovel excavated near and between the middle two auger tests (#2 and #3). It was excavated in arbitrary four-inch (10.2 cm.) levels. That location was chosen, because it was immediately behind (south or upslope of) the clay bank identified as being located between auger tests 3 and 4.

Appendix III, Table 4.4 shows the results of that test excavation. The artifacts are noteworthy more for their quality and context than their quantity, even though the very low quantity strongly suggests abandonment of the landform at some point. Only four FCR and four knapped artifacts were recovered (Figure 4.6). Two of the FCR (Figures 4.6b and 4.6c) and all four knapped artifacts (Figures 4.6a, 4.6d, 4.6e and 4.6f) are shown in Figure 4.6. The quartzite FCR scatter and flake (Figure 4.6a) immediately below the plough zone; the isolated quartz FCR in level 3; and the isolated piece of quartz debitage (Figure 4.6d) in level 4 would not have warranted additional interest in the sand ridge. However, the basally thinned, early stage, quartzite biface with cobble cortex (Figure 4.6e) and edge worn flake (Figure 4.6f) in level 6 (26-30") (66.0-76.2 cm.) were touching each other in the east wall of the trench. Had the trench been situated three inches (7.6

cm.) farther west neither would have been recovered and Blueberry Hill may never have been tested beyond test trench, BBH1.

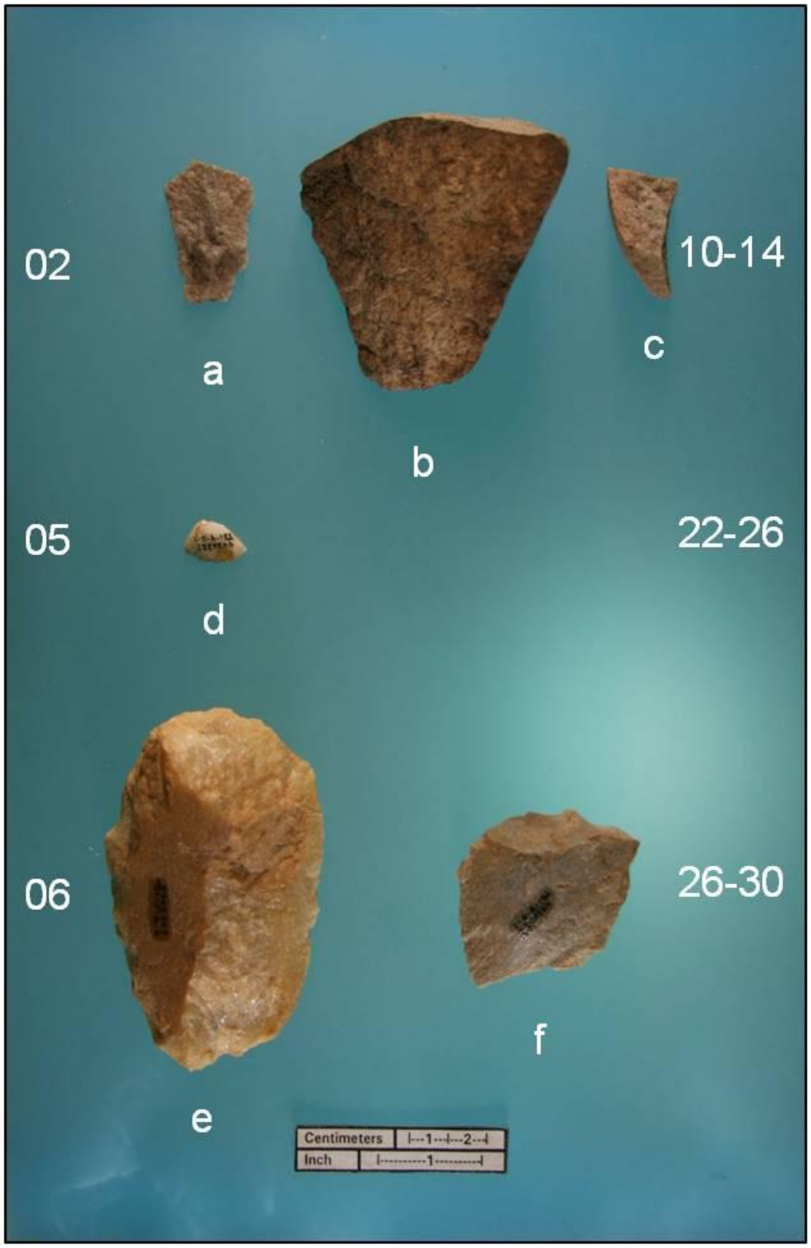


Figure 4.6: Selected artifacts from BBH1 with levels shown to the left and depths to the right (photo by author).

Figure 4.7 shows the preliminary soil profile hastily drawn before back filling the test pit. It indicated a far more stable landform that closely resembled profiles at Cactus Hill in

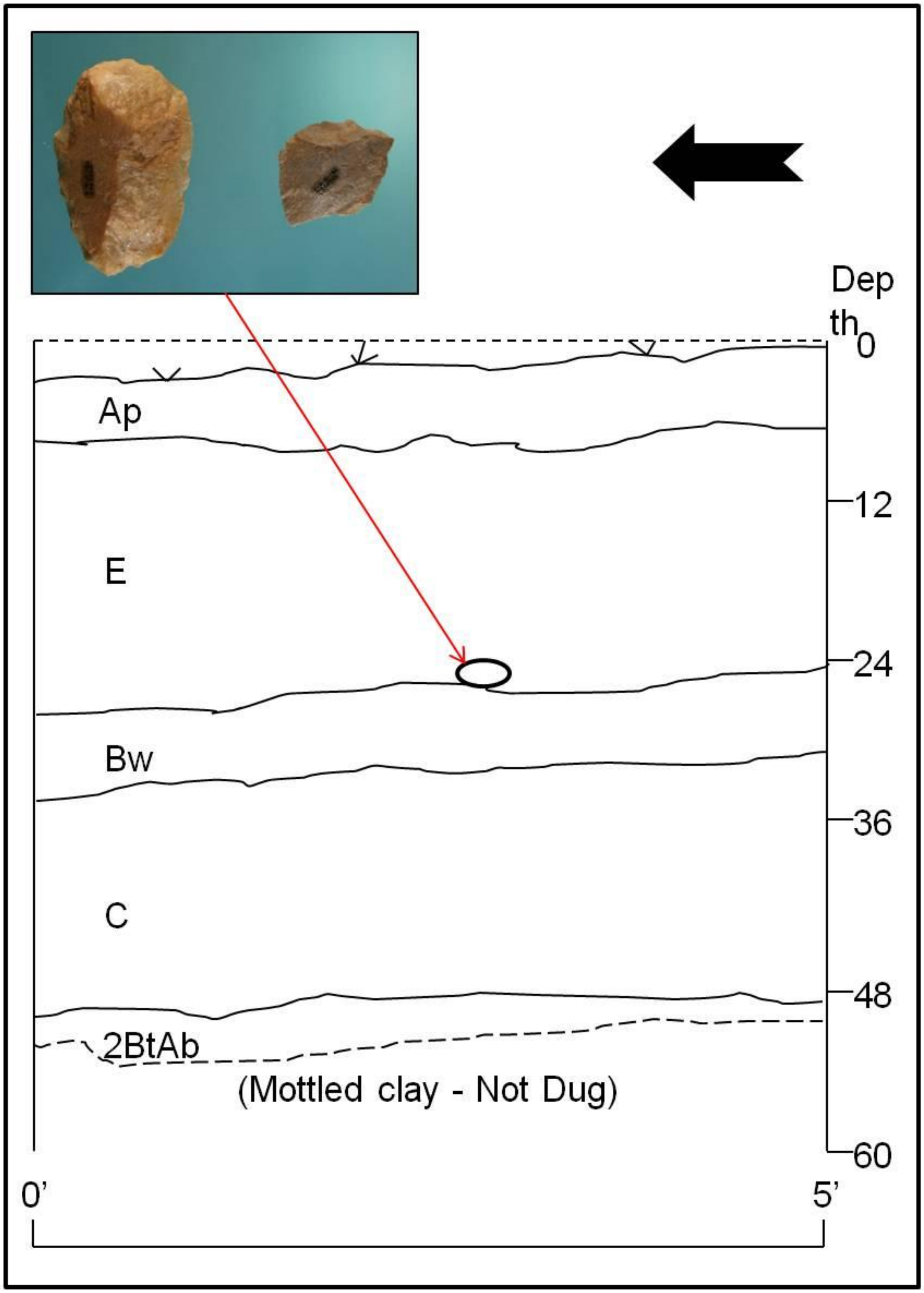


Figure 4.7: East wall field profile of BBH1 (2001) (photo by author).

areas where there were no lamellae. As such, the profile indicated an older and more stable landform than was identified in E1, E2 or especially F3.

As a result, several selected, informal auger tests were examined upslope and along the Blueberry Hill sand ridge to the west. This was done in hopes of locating the upstream end of the clay bank. It was hypothesized that more intense, pre-Younger-Dryas occupations on the sand ridge would be at the upstream end of the landform, closer to Cactus Hill.

This testing located what was thought at the time to be the upstream end of the buried clay bank. No profiles were recorded during these tests, which were mere auger probes to determine the depth of underlying clay. The upstream end of the clay bank was never finally determined. It is possible that other buried occupations could be present to the west of the 2002 and 2010 testing, between Blueberry Hill and Cactus Hill.

Once the possible upstream end of the buried clay bank was located, three, end to end, contiguous 5x10-foot (1.52x3.05 meter) test trenches were excavated to the depth of the underlying clay.

These were configured in a general north-south line, forming a 30-foot (8.14 meter) long by 5-foot (1.52 meter) wide trench above the upslope edge of the clay bank identified in the auger tests. The east-west location and slightly off true north orientation was influenced by the orientation of the tree farm rows, which were approximately six feet (1.83 meters) wide and oriented north-northwest to south-southeast direction.

The actual location was transit mapped with respect to the southeast corner of Block A at nearby Cactus Hill. However, subsequent surface disturbance resulting from tree harvesting and replanting caused initial difficulty in relocating the trench.

The individual sub-trenches were numbered 10, 11 and 12, because at that time it was not clear how they may fit into a subsequent site pattern involving the first three test pits, E1, E2, F3 and what was later to become BBH1. The site had only produced the small artifact scatter recovered in buried context from BBH1 and had shown no surface evidence of a site.

At that time, we did not have the model from subsequent research at Chub Sandhill. Chub Sandhill, Watlington and Rubis-Pearsall demonstrated that a minimal expression of artifacts from the top 15 to 17 inches (38.1-43.2 cm.) could mask deeply buried occupations that were highly significant.

The sub-trenches were excavated in the following order: BBH11, BBH12, followed by BBH10. Recognizing from the auger results that the trenches would be at least four feet (1.22 meters) deep, BBH11 was excavated first to provide easier access to BBH10 and BBH12. Excavating BBH11 first proved to be fortunate in that the site's most significant deeply buried cultural activity surface was detected there. The trenches will be discussed in their order of excavation.

4.2.2: Trench BBH11

Test trench BBH 11 was excavated in 4-inch (10.2 cm.) levels from the bottom of the plough zone, which was the only one of the three plough zones to be sifted (see Appendix III: Table 4.5). One Woodland period, cordmarked pot sherd (Figure 4.8a) was recovered from the plough zone. Three quartzite FCR, one unidentified FCR and 15 quartzite debitage also were recovered.

Level 2 produced one Late Archaic, metavolcanic, Savannah River Point fragment (Figure 4.8b). This point's stratigraphic location in relation to the consistent presence of pottery in the plough zone; diagnostic artifacts subsequently recovered from deeper levels, and other Savannah River points recovered from this area of the site produced a stratigraphic pattern critical to subsequent interpretations of Blueberry Hill's cultural stratigraphy.

Artifact quantities steadily increased from the plough zone down through level 4 (18-22") (45.5-55.9 cm.). Artifacts of note include the large quartzite flake (Figure 4.8c) and jasper flake (Figure 4.8d) in level 4.

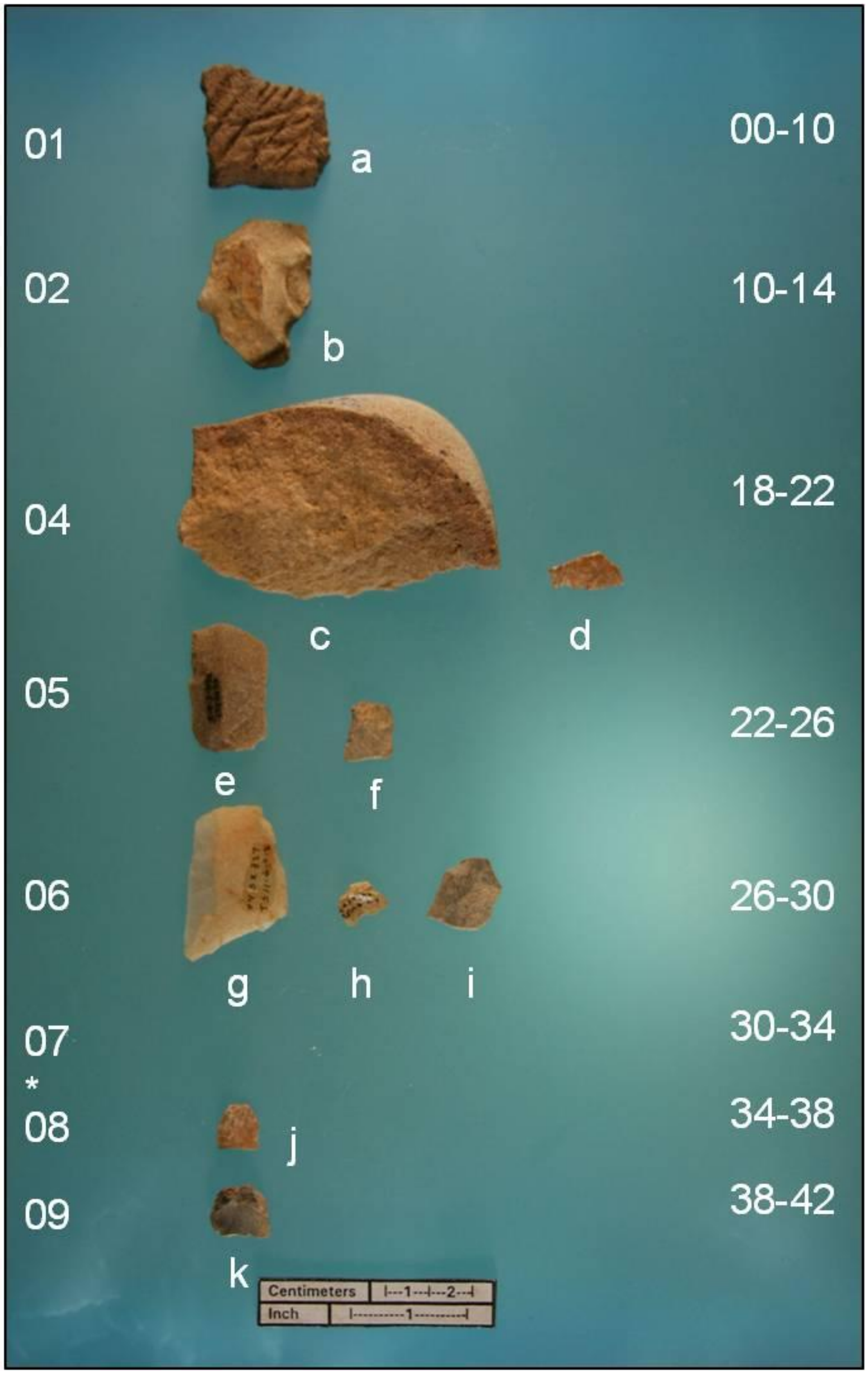


*Figure 4.8: Selected artifacts from BBH11 with levels shown to the left and depths to the right (*see Figure 4.9 for artifacts from level 07) (photo by author).*

Between levels 4 and 7 artifact quantities dropped off even though the quality and diversity of tool-like artifacts and raw materials increased, suggesting a change in patterns. One quartzite blade-like flake (Figure 4.8e) and black metavolcanic flake (Figure 4.8f) were recovered from level 5 (22-26") (55.9-66.0 cm.). One modified/worn quartz artifact (Figure 4.8g), and two metavolcanic flakes (one patinated greenish (Figure

4.8h) and one tan patinated black (Figure 4.8i) were recovered from level 6 (26-30") (66.0-76.2 cm.). Two small jasper flakes (not pictured) also were recovered from level 6. They appear to be of the same material as the jasper flake in level 5.

Level 7 (30-34") (76.2-86.4 cm.) showed a marked increase in the size and quality of artifacts (Figure 4.9). More importantly, the largest artifacts came from the same plane within the level. This immediately suggested they were the manifestation of a buried activity surface. As each artifact was recovered, its depth was marked in the east wall profile (Figure 4.10).

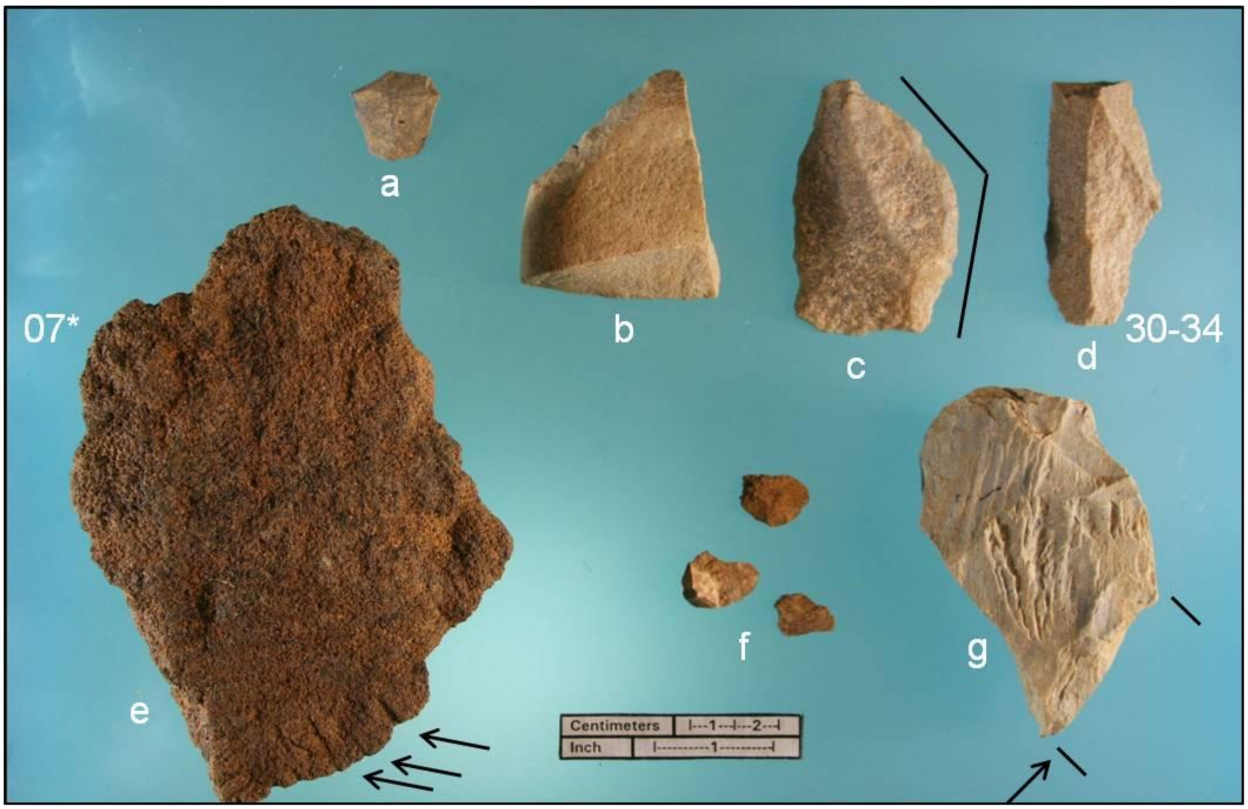


Figure 4.9: Selected artifacts from BBH11, level 7 with the level shown to the left and depth to the right. The black line on the right edge of 53c indicates heavy polish. The black arrows point to bone needle-like sharpening grooves on the sandstone abrader (53e) (Kalin 2012: Personal communication). With the meta-volcanic biface (53g) the arrow indicates direction of the burin blow and the lines indicate the length of the burin scar (photo by author).

Figure 4.9 shows one tan patinated, black metavolcanic flake (Figure 4.9a); one broken quartzite unifacial sidescraper (Figure 4.9b); one heavily edge polished quartzite uniface (Figure 4.9c); one distal end of a moderately large quartzite prismatic blade-like flake

(Figure 4.9d); one large heavily scratched sandstone abrader (Figure 4.9e); three jasper debitage (Figure 4.9f); and one large tan patinated metavolcanic bifacial core-like artifact with a burin on one edge (Figure 4.9g). As shown in the profile in Figure 4.10, they were not clustered but were spaced out across the ten-foot (3.05 meter) length of BBH11.

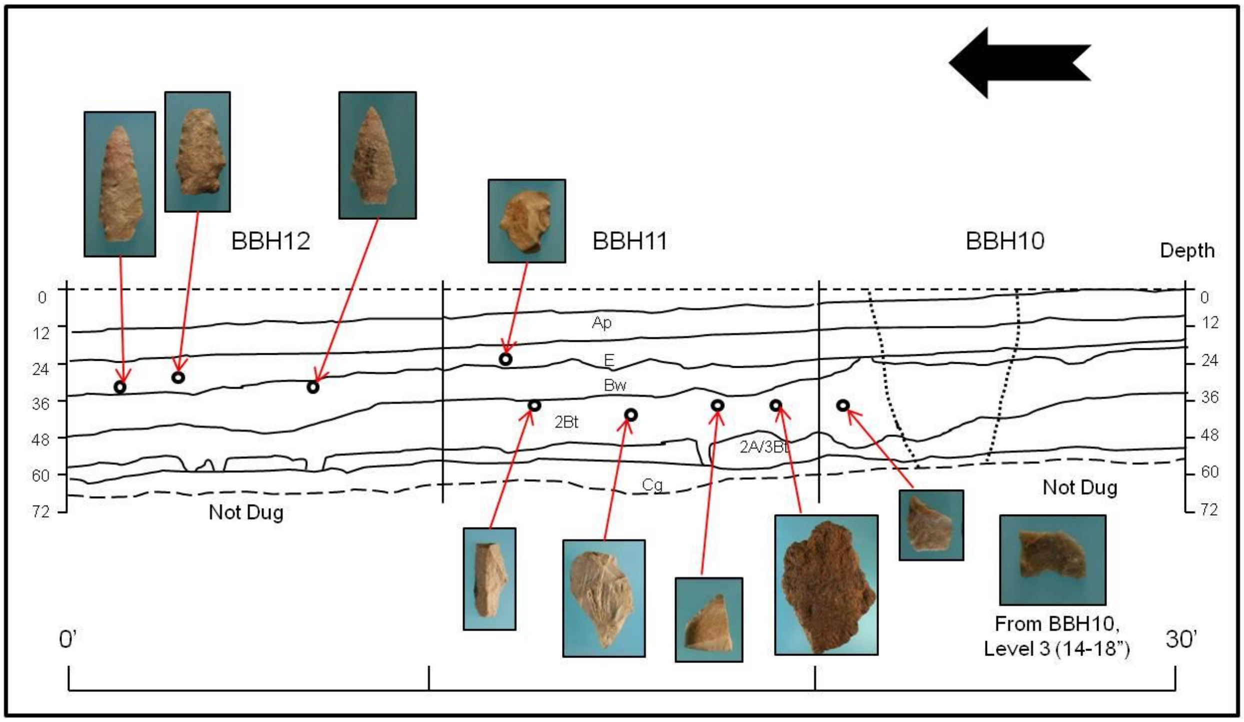


Figure 4.10: East wall profile of 2002, 5x30-foot (1.52x3.05 meter) test trench (photos by author).

Of particular note, the heavily edge polished quartzite flake (Figure 4.9c) has a unifacially worked edge opposite the polished edge, which is on the right side in the photo (Figure 4.9c). It is possible that the heavily polished edge was not the result of use wear but rather intentional grinding to permit safe holding when using the uniface on the opposite edge. In other words, it could be a "backed" scraper. Jeff Kalin (personal communication 2012) observed that the wear pattern on one edge of the large sandstone abrader (Figure 4.9e) is similar to what he produces when sharpening bone needles.

Of probably greater importance, Kalin (personal communication 2012) also noted that the metavolcanic bifacial core-like artifact (Figure 4.9g) has a burin on the lower right edge, which is indicated by the arrow marking direction of the blow and the lines marking the ends of the burin flake scar. A similarly burinated biface was recovered from the dated pre-Clovis age Miles Point site in the Eastern side of the Chesapeake Bay. It is Figure 4-4f in Stanford and Bradley (2012: 98). Also, the tip half of the mended pre-Clovis age point from feature A-14 in area A at Cactus Hill also appeared to have been burinated.

A light scatter of smaller artifacts, including jasper (see Figure 4.8j) and tan patinated black metavolcanic (See Figure 4.8k) were recovered from levels 8 and 9. Level 10 was culturally sterile at the 1/4-inch (6.3 mm.) screen filter, which was used throughout the 2001 and 2002 testing.

4.2.3: TrenchBBH12

Test trench BBH12 was excavated next. All four-inch (10.2 cm.) levels below level 6 were excavated in two-inch (5.1 cm.) sub-levels, designated "a" and "b." This was done to refine the vertical provenience of screen residue and better control artifacts possibly associated with the potential activity surface detected in BBH11.

Appendix III, Table 4.6 shows the vertical distribution of artifacts from BBH 12. The plough zone was not screened. The quantities indicate fairly substantial numbers of artifacts in levels three through five. Artifact quantities are light below level five. However, all of the metavolcanic artifacts from this trench occurred in levels 7 through 9. This indicates that the activity producing the metavolcanic debitage originated in levels 7 through 9, possibly associated with the activity surface in level 7 of BBH11.

Figure 4.11 shows selected artifacts from BBH12. The vertical and horizontal distribution of the three Late Archaic Savannah River points (Figures 4.11a, 4.11b, and 4.11e), as shown on the profile in Figure 4.10, are of particular note. When taken in context with the Savannah River point (see Figure 4.8b) from the adjacent trench, they appear to show a descending activity surface from that period. This is also consistent with the peak in artifact quantities in levels 3 and 4. In BBH12 the artifact concentration extends into level 5.

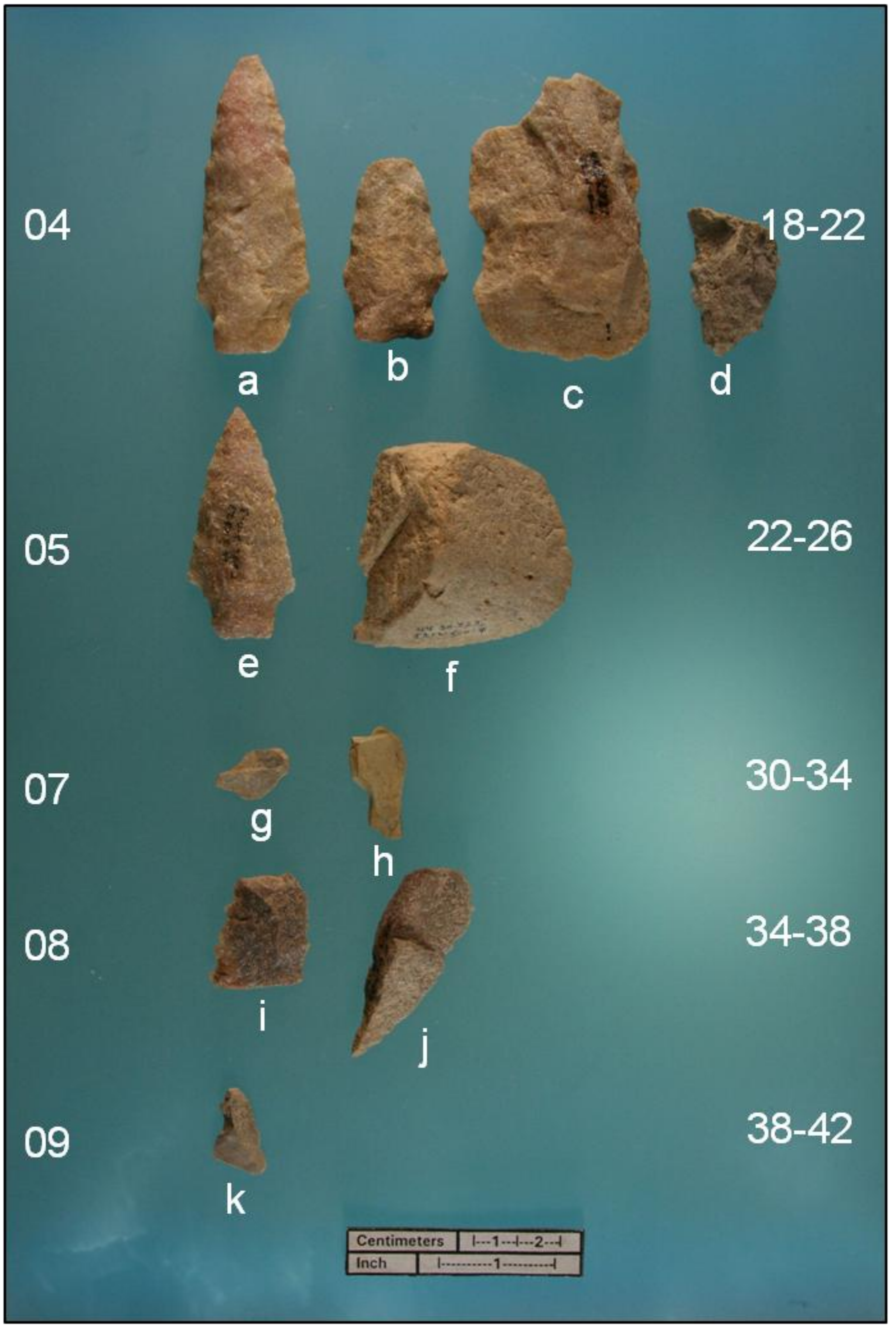


Figure 4.11: Selected artifacts from BBH12 with levels shown to the left and depths to the right (photo by author).

Selected larger, generalized, modified/worn artifacts from levels 4 and 5 include one quartzite biface (Figure 4.11c), one quartzite core fragment (Figure 4.11d), and one pitted cobble/hammerstone-like artifact (Figure 4.11f). Five other modified/worn artifacts (not pictured) were recovered from sub-plough zone levels 3-5, suggesting a concentrated Savannah River occupation. However, the Savannah River phase lasted approximately 700 years, from approximately 3,800 to approximately 4,500 B.P. (Inashima 2008: 249-

251). One cannot determine if the Blueberry Hill Savannah River component reflects an intense occupation or many ephemeral occupations in one spot over hundreds of years.

The deeper artifacts from levels 7-9 show an apparent change in focus. The examples from those levels in Figure 4.11 include one tan patinated black metavolcanic flake (Figure 4.11g) and one green patinated metavolcanic modified/worn artifact (Figure 4.11h) from level 7; two quartzite blade-like flakes (Figures 4.11i and 4.11j) from level 8, and one tan patinated black metavolcanic flake (Figure 4.11k) from level 9. Based on striking platform morphology, the artifact (Figure 4.11i) appears to be the proximal end of a blade. Figure 4.11j appears to be a unifacial core rejuvenation or modification flake. The angle of the platform indicates that the core edge was steep angled. Figure 4.11k is another tan patinated black metavolcanic flake.

Recovery of a distal end of a blade-like flake (see Figure 4.9d) from level 7 in BBH11 indicates a pattern. The fact that Figures 4.11i and 4.11j are from level 8, rather than 7, supports the hypothesis that sub-plough zone occupation levels in BBH11 and 12 tend down to the north – toward a hypothesized ancestral Nottoway River channel.

4.2.4: *Trench BBH10*

Test trench BBH10 was excavated last. It was excavated in the same manner as BBH12: levels 7-9 were troweled rather than flat shoveled. This was due to the growing evidence that the lower levels contained potentially pre-Younger-Dryas aged deposits.

Appendix III, Table 4.7 shows the vertical distribution of artifacts from BBH10. Here again the plough zone was not sifted. Consistent with the immediate sub-plough zone artifact distributions in BBH11 (see Appendix III: Table 4.5) and BBH12 (see Appendix III: Table 4.6), the highest quantities in BBH10 were immediately under the plough zone in levels 2 and 3. In BBH10 the provenience was above that in BBH11 in which the highest artifact intensities were in levels 3 and 4, and BBH12 in which the highest artifact quantities were in levels 3, 4 and 5. Again the metavolcanic artifacts all occurred in and below level 7.

Figure 4.12 shows selected artifacts from BBH10. Figure 4.12a from level 2 (10-14") (25.4-35.6 cm.) is a relatively large quartz modified/worn artifact. Figure 4.12b from

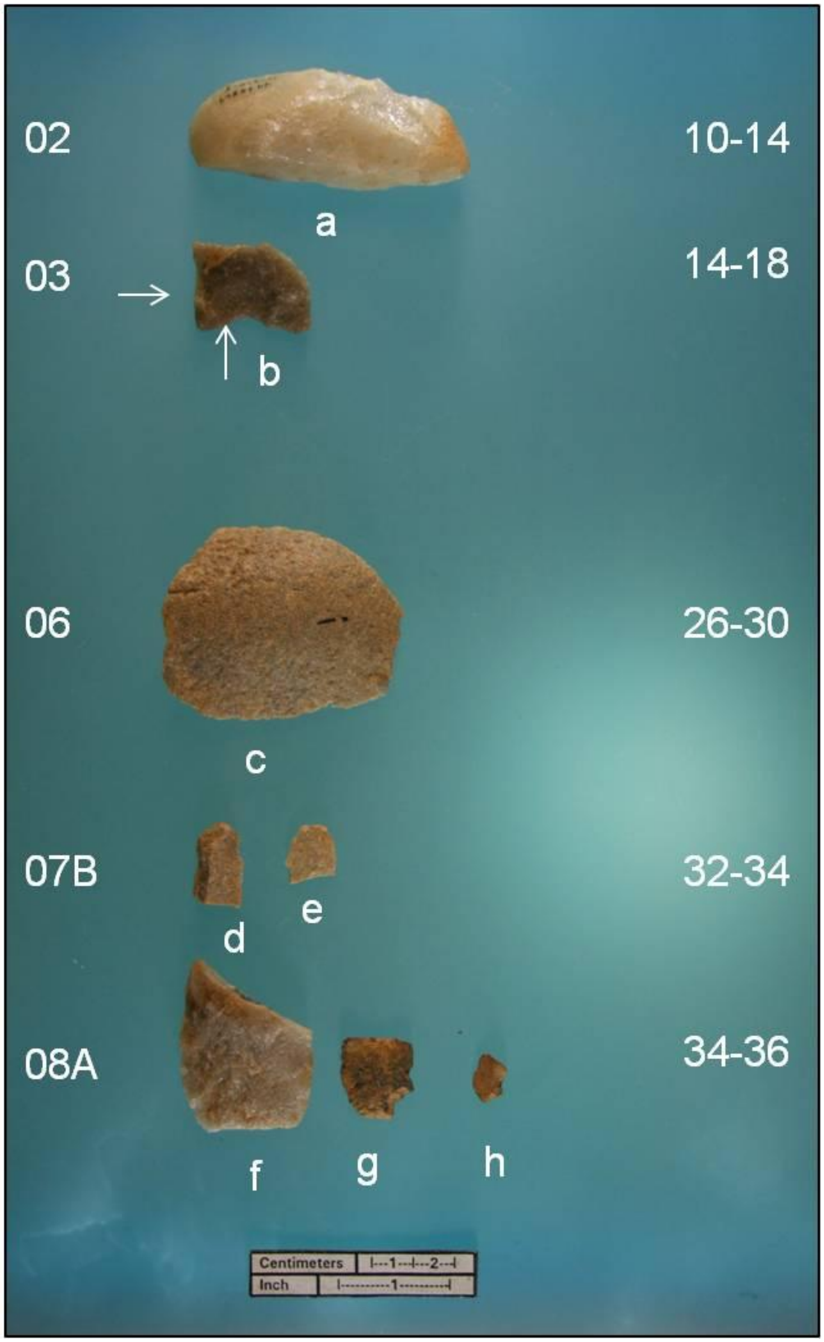


Figure 4.12: Selected artifacts from BBH10 with levels shown to the left and depths to the right (photo by author).

level 3 (14-18") (35.6-45.7 cm.) is the base of a quartzite fluted lanceolate point that will be discussed in more detail below. Figure 4.12c from level 6 (26-30") (66.0-76.2 cm.) is a large quartzite decortization flake fragment. Figures 4.12d and 4.12e from level 7B

(32-34") (81.3-86.4 cm.) are both tan patinated black metavolcanic flakes. Figure 4.12f from level 8A (34-36") (86.4-91.4 cm.) is a quartzite lanceolate point base, which also will be discussed in more detail below. Figures 4.12g and 4.12h, from the same level, are tan patinated black metavolcanic flakes.

Regretfully, the fluted point base (Figure 4.12b) was recovered from the screen and therefore its horizontal location in level 3 is not known. However, the fact that it came from a level consistent with a Savannah River age, it is possible that it is some form of a Savannah River point, such as a large stem fragment (Coe 1964: 42). Factors supporting this interpretation include the fact that the author has observed stem fluting on Savannah River points, albeit never this bold. Additionally, other than the fluted point, no specialized tools common to the Clovis age technology have been recovered from Blueberry Hill.

Attributes suggesting maybe the artifact is a Clovis age fluted point include that the left corner between the arrows as shown in Figure 4.12b is heavily ground, which is not a characteristic of Savannah River points. It is likely that the rest of the base was also heavily ground but the grinding was removed by flaking that appears to have been connected to retooling the base. The reverse side of the point is also fluted. The author has not seen fluting on both faces in Savannah River points. The width of the point is consistent with fluted points in Virginia (Johnson and Pearsall 1991, 1991, 1993, 1995, 1996, 1998, 1999; McCary 1991), rather than any Savannah River points recovered by the author in the Nottoway. The latter are narrower.

Most importantly, a lateral edge initiated "cleaner flake" scar is evident immediately above the arrow on the left side of Figure 4.12b. That is a unique post-fluting attribute that, once recognized, was detected on several fluted points evaluated by the author and Pearsall over the last six years of evaluating fluted point technology in Virginia. The technique involves driving a flake in from an edge to remove the step fracture commonly produced at the distal end of bold flute scar terminations. Specifically, Virginia fluted points 883 (Johnson and Pearsall 1993:46), 903 (Johnson and Pearsall 1993:48), 927 (Johnson and Pearsall 1995:19), 934 and 935 (Johnson and Pearsall 1995:20) were noted as having this attribute. Therefore, it is more likely that the point base (Figure 4.12b) is from a Clovis age fluted point and not a Savannah River stem.

Since the point base was recovered from the screen, it is also possible that it came from the large disturbance in the center of BBH10, shown as dotted lines (see Figure 4.10). That disturbance extended from the base of the plough zone all the way to the top of the clay paleosol, which means that the point could have come from any level.

However, the actual provenience and lack of other Clovis age artifacts are strong enough lines of evidence to infer that the point possibly is not of Clovis age. Further research in 2010 did not shed light on the question.

The Cactus Hill-like lanceolate point (Figure 4.12f) is the most significant diagnostic artifact from the site. Answering the geological questions raised by Wagner and determining the point's age led to the 2010 field season.

The fact that it was located at the same depth and plane as, and adjacent to the artifact cluster in BBH11 indicates that it is associated and therefore from excellent context. The point is not fluted and exceptionally thin, as is the case with most pre-Clovis Cactus Hill points. It is consistent in flaking; lacks lateral edge and basal grinding; and has a generally expanding lanceolate shape, un-like most local fluted points. It has a mix of parallel and selective flake patterns, which also is consistent with pre-Clovis age Cactus Hill points. No finished Cactus Hill-like points have been recovered from Clovis age or above in Cactus Hill, Blueberry Hill, or at Chub Sandhill (Koestline, Watlington, and Rubis-Pearsall), strongly suggesting that the points are of pre-Clovis age.

However, because the point shows no indication of re-working, it is possible that it is a very late stage preform for a late-Paleoamerican Hardaway point or a Hardaway blade (Coe 1964: 64-67). Another contradictory line of evidence is that no distinctively Paleoamerican tool types have been found in association with the fluted point (Figure 4.12b). With such a small sample of sites and diagnostic artifacts from the potential 7,000 year (or greater) span of pre-Clovis age occupations in North America, it is presumptuous yet to use mere non-distinctive tool types as a line of evidence for or against pre-Clovis.

4.3: 2010 Test Excavations

4.3.1: Auger sampling

In 2010, the site was re-tested in depth. An initially unsuccessful attempt was made to relocate the 2002 test pits. However, as was later determined, the transit data linking Blueberry Hill to Area A at Cactus Hill was adequate to get within several feet (meters) of the main 2002 excavation trench (BBH10, BBH11 and BBH12).

Based on the re-established transit datum, the predicted site area was auger tested at a 20-foot (6.1 meter) interval. The sampling method was similar to that used at Chub Sandhill (Chapter 3). However, the interval between samples was 20 feet (6.1 meter) instead of 50 (15.2 meter) and 25 feet (7.62 meter).

The samples were sifted through 1/16-inch (1.6 mm.) mesh (window screen). The resulting sorts produced numerable small shatter fragments that could not be positively identified as being of cultural origin. Therefore, mapping distributions from the auger samples, are confined to positively identified artifacts.

Charcoal was present in many samples. Although it is likely that much of it is cultural, the propensity of small objects to move down in the soil meant that charcoal was not considered a good stratigraphic cultural marker. It is not included in the distribution analysis.

The purpose of deep auger testing was to re-locate the part of the site containing the activity surface identified in BBH10 and BBH11, which was located on, and immediately to the south (upslope) of the buried clay bank. As a result, one of the objectives was to re-map the buried clay bank drop off discovered in 2001. That is shown in Figure 4.13

along with the distribution of artifacts deeper than 30 inches (76.2 cm.) below the surface. At the time we recognized that the modern surface had been altered and that our relative depths were merely gross approximations.

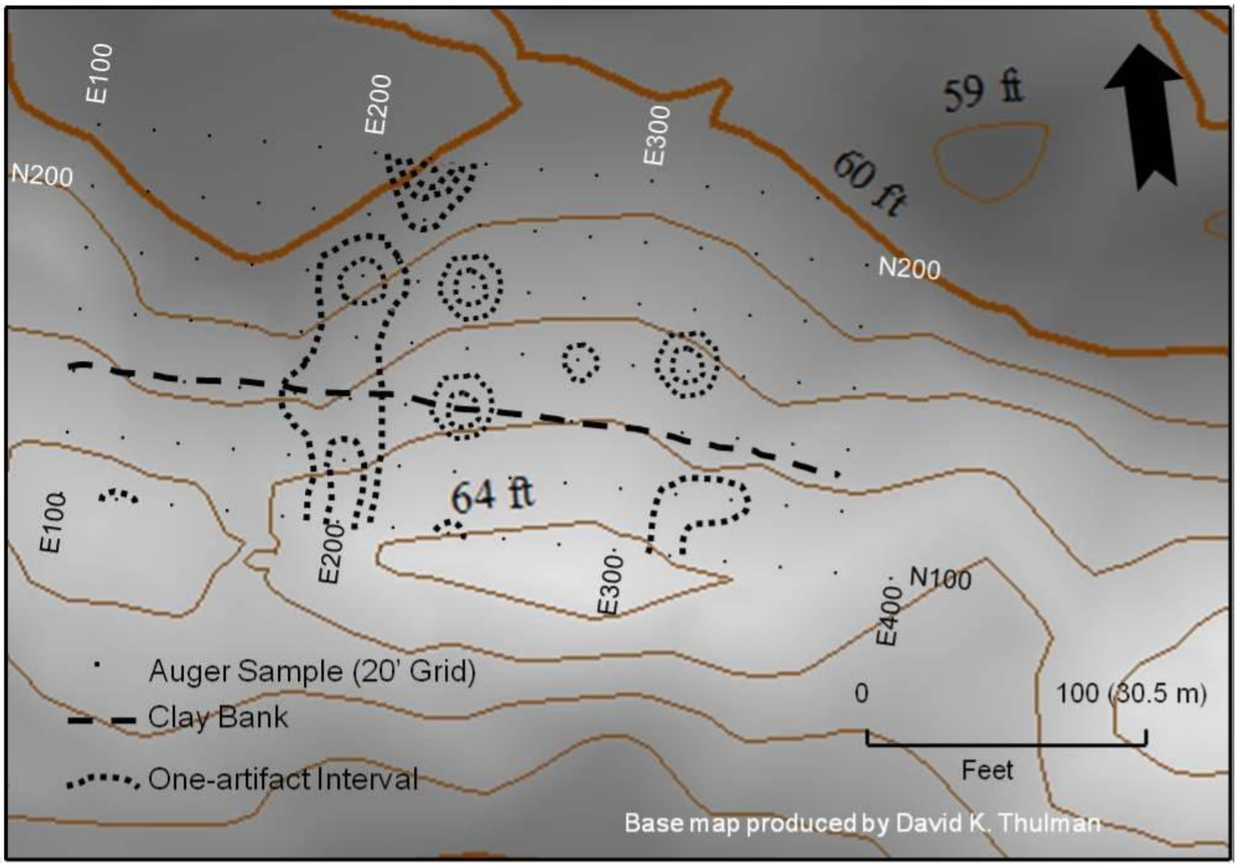


Figure 4.13: Artifacts recovered from auger core samples deeper than 30 inches (76.2 cm.) below the surface (topographic map by and with permission of David K. Thulman).

Since the purpose of the 2010 testing was to relocate and verify the age of the potential pre-Clovis age activity surface, the variables determining the locations of the 2010 test trenches included the closest location to the intersection of the approximate 2002 transit datum, the buried clay bank, and the auger sample results. This is shown in Figure 4.14.

4.3.2: Test Trench Overview

Pit numbering was sequential from number 2 through number 7. As was done on the Rubis-Pearsall site (Chapter 3) the 5x10-foot (1.52x3.05 meter) trenches were sub-divided into 5x5-foot (1.52x1.52 meter) sub-trenches. Also the sub-trenches were dug from the bottom of the plough zone (Ap) in 2-inch (5.1 cm.) levels down to approximately 25 inches (63.5 cm.). From there the levels were divided into 1-inch (2.5 cm.) sub-levels to ensure tighter control on bulk debitage. For this analysis the sub-levels have been merged in the tables for ease of comparison.

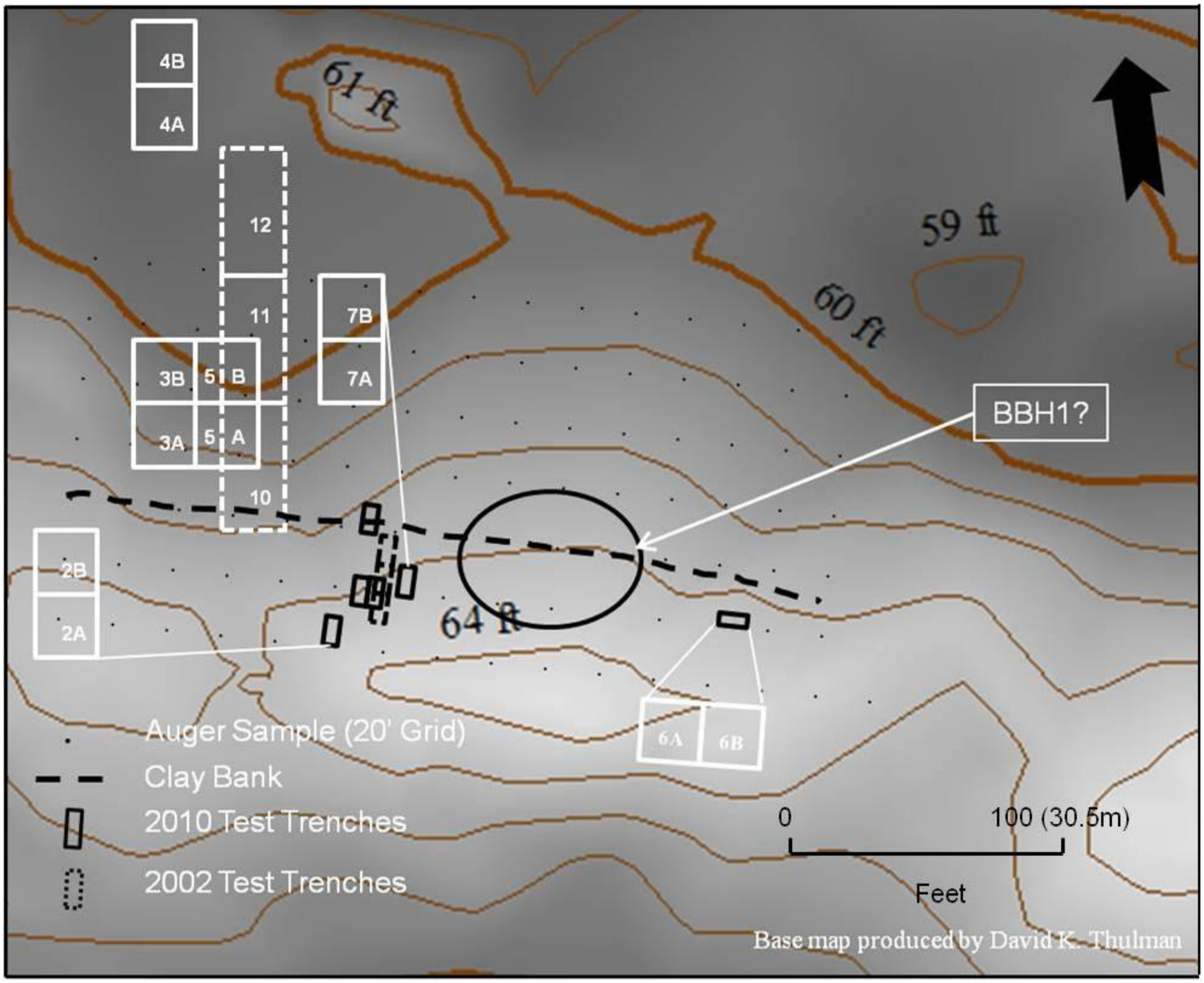


Figure 4.14: Blueberry Hill auger test grid and test trench overview on 2010, 20-foot (6.1 meter) interval, auger test grid (topographic map by and with permission of David K. Thulman).

All levels were flat shovel shaved or scraped, which is considered the equivalent to troweling. All artifacts approximately larger than a United States 25-cent piece (one-inch diameter) (2.5 cm. diameter) were mapped. Soil matrix below level 2 was sifted through 1/8-inch (3.2 mm.) hardware cloth screen with everything remaining in the dry screen being taken back to the lab for sorting.

The Ap (level 1) and level 2 soils were sifted through 1/4-nch mesh. This was done because the Ap had been heavily disturbed and was full of organics, consisting of roots and the spoil from tree clearing. As it eventually turned out, this was a mistake. A small fossilized crinoid bead, discussed below, was recovered from the deepest cultural level in BBH7 located adjacent to the deep activity surface. Because the Ap and level 2 soils were sifted through 1/4-inch (6.3 cm.) mesh, it is impossible to tell if the bead's stratigraphic context was not a result of down drift from the Ap. A comparable sized lead shot was recovered from a deep level in another sub-square. There is little doubt that the shot originated in the surface historic component. Fine screening, if it resulted in the recovery of one or more other beads in the Ap or level 2, would have demonstrated the bead was from a Woodland occupation. As it turned out, the bead could have come from the Ap or level 2 as well as a deeper context.

4.3.2a: Trench BBH2

The first test trench, which includes BBH2A and BBH2B, was excavated near the top of the western edge of the Blueberry Hill sand ridge crest (Figure 4.14). Its southern edge was centered on the N100E200 auger test. Appendix III, Tables 4.8 and 4.9 show stratigraphic distributions of artifacts from BBH2A and BBH2B, respectively.

The general artifact pattern is a diffused "battleship curve," which in both squares peaks for quartzite in level 12 (31-33") (78.7-83.8 cm.) and for quartz in level 11 (29-31") (73.7-78.7 cm.). Artifacts made of metavolcanic and unidentified/exotic materials all occur below 29 inches (73.7 cm.) deep, which indicate that it probably originated no higher in the profile. Clear quartz (crystal?) also seems to peak in levels 12 and 13 (31-35") (78.7-88.9 cm.) in BBH2A, possibly representing an activity locus. The lack of clear quartz from those levels in BBH2B supports a possible horizontally significant context for the clear quartz in BBH2A.

These gross distributions of mostly debitage indicate that an activity surface is present at approximately 28-36 inches (71.1-91.4 cm.) deep. However, the artifact quantities at the peak depths are almost four times as great in BBH2B, which is downslope. Artifact qualities also are significantly greater in BBH2B as demonstrated below.

One Late Archaic, Savannah River point along with a several unidentified modified/worn items and biface fragments were recovered from BBH2A. The Savannah River point's stratigraphic location (close to the bottom of the plough zone) was consistent with other occurrences of Savannah River points on the Blueberry Hill, Koestline and Cactus Hill.

Several noteworthy associations were evident in the high quantity artifact bearing levels of BBH2B. The cross-mended biface (Figures 4.15b and 4.15c) from levels 11B and 12A (30-32 inches deep) (76.2-81.2 cm. deep) were resting on top of each other. Other apparent functionally diagnostic artifacts from the high quantity artifact levels included four modified/worn artifacts (Figures 4.15a, 4.15d, 4.15h, and 4.15j), another biface fragment (Figure 4.15e), and three elongated flakes with high angle platforms (Figures 4.15f, 4.15g, and 4.15i), possibly struck from unifacial cores.

The mended biface and elongated flakes suggest good integrity. However, at least in BBH2B, the recovery of two small pieces of ferrous metal, possibly "tin can" fragments from level 7 (see Appendix III: Table 4.8) and a very small lead shot from the fine screen residue of level 11 do indicate downward migration of small objects. As previously stated, this fact has a profound impact on the stratigraphic interpretation of charcoal and small stone artifacts.

4.3.2.b: Trench BBH3

Test trench BBH3 was located five feet (1.52 meters) north (down slope) of the north end of BBH2 and 2.5 feet (.76 meters) east. The southwest corner was at the N115E205 coordinate of the auger grid (see Figure 4.14). This trench was situated to avoid tree stumps and toward the direction of the approximate 2002 datum.

BBH3A and BBH3B proved to be the only squares that clearly were associated with the

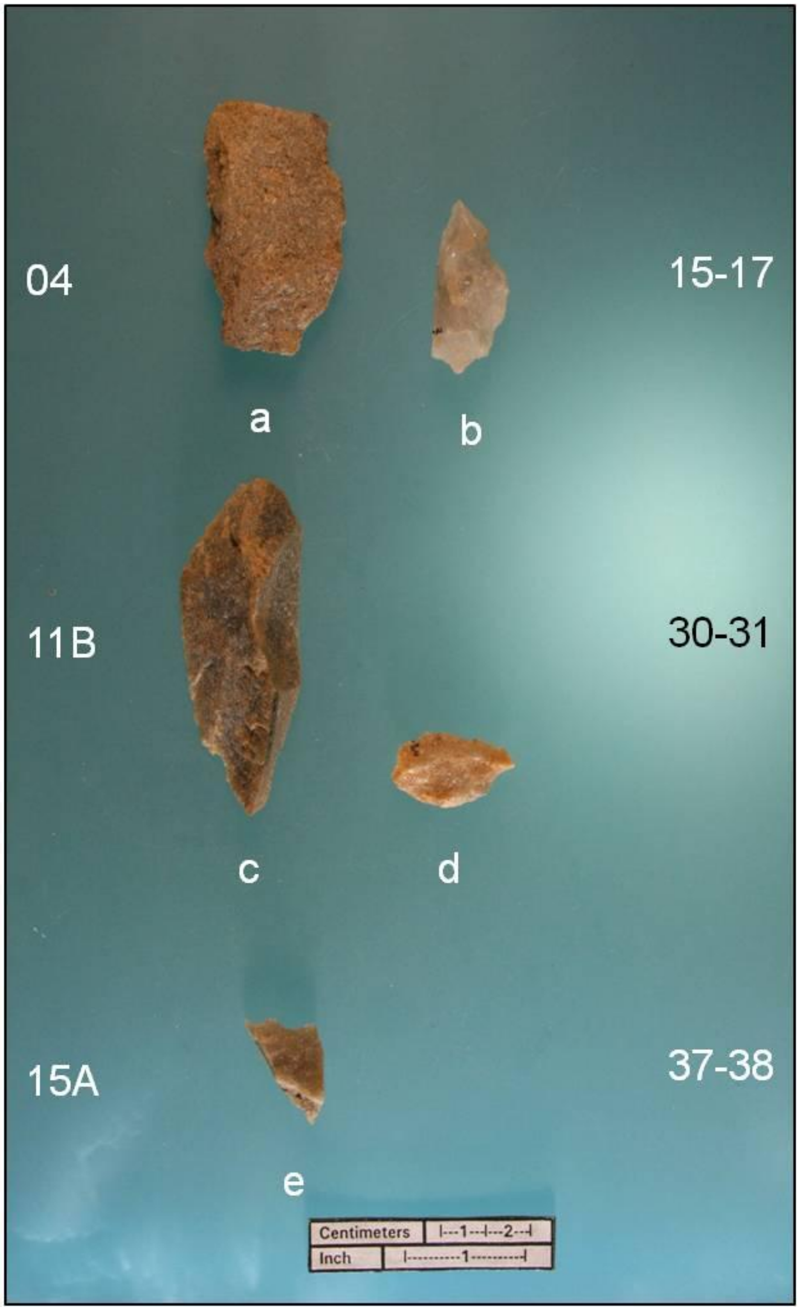


Figure 4.15: Selected artifacts from BBH2B with levels shown to the left and depths to the right (photo by author).

2002 activity surface. Appendix III, Tables 4.10 and 4.11 show stratigraphic distribution of artifacts from BBH3A and BBH3B respectively.

As with BBH2A and BBH2B the artifact concentrations are in the lower halves of the profiles with only a slight increase in and under the plough zone. Quartzite quantities peak between 28 and 30 inches (71.1 and 76.2 cm.) deep (levels 11-14), with level 13 producing the highest quantity. Quartz debitage is scattered in several clusters below 18-20 inches (45.7-50.8 cm.) deep and metavolcanic debitage, again, clusters in the 28-36-inch 71.1-91.4 cm.) depth. Metavolcanic debitage in BBH3A clusters between 28 and 36 inches (71.1 and 91.4 cm.), which is consistent with test trench BBH2.

Quartzite quantities are higher in levels 13 and 14 between 34 and 38 inches (86.4 and 96.5 cm.) deep in BBH3B. A second quantitative peak is in level 11 (28-30") (71.1-76.2 cm.). The quartz quantities are highest in the deepest levels of BBH3B, which is not reflected in the distribution in BBH3A. Again, this suggests some horizontal and vertical integrity to the quartz artifacts. Metavolcanic artifacts were recovered from levels below 28 inches (71.1 cm.). With the chert and jasper debitage consisting of small flakes, they would have been more subject to vertical displacement. The small number (n=3) for chert and jasper in both squares does not warrant any conclusions about their original contexts.

Figure 4.16 shows selected functional and temporal diagnostic artifacts from BBH3A. As would be expected, the plough zone produced two small Woodland potsherds (Figures 4.16a and 4.16b). The large burned cobble fragment (Figure 4.16c) has a unifacially modified edge and apparent charred residue on its surface. Considering its size and stratigraphic context, that thermally altered modified/worn artifact probably dates to the Savannah River period. Four metavolcanic flakes also are shown. These include two (Figures 4.16d and 4.16h) that have a greenish patina and two (Figures 4.16c and 4.16a) with tan patinas over obvious dark gray metavolcanic stone.

The author has examined the sources in the Uwharries Mountains of central North Carolina and found dark gray and greenish gray in various shades of each color. It is likely that both kinds of metavolcanic stone came from there or from stream cobbles.

The large quartzite abrader/pecking stone-like artifact (4.16f) extended through several levels and was removed from level 12B (30-32") (76.2-81.3 cm.). It had moderate impact or grinding- like damage to the cobble cortex on the end to the right in Figure

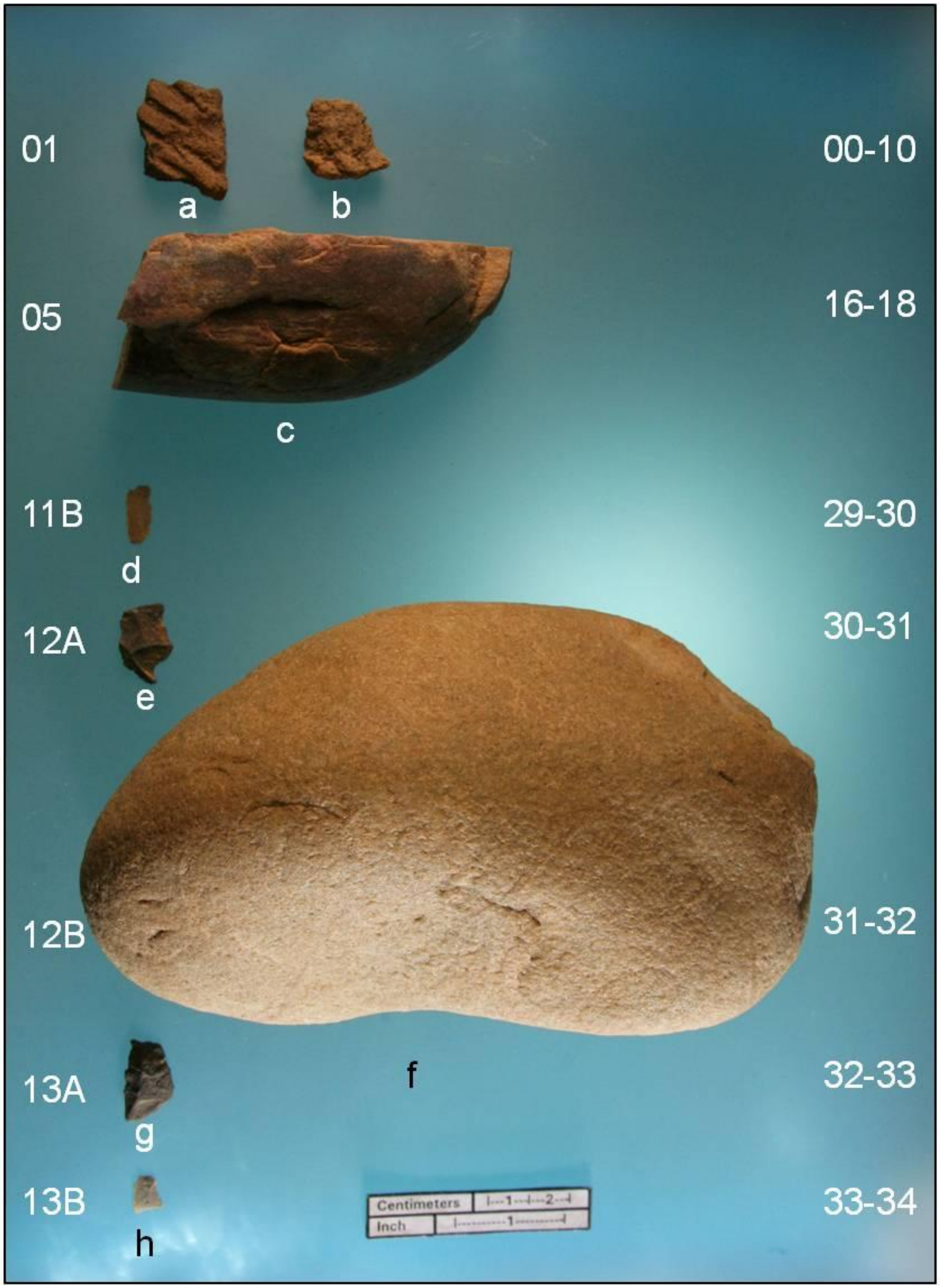


Figure 4.16: Selected artifacts from BBH3A with levels shown to the left and depths to the right (photo by author).

4.16. A close-up of the damage is shown in Figure 4.17. Figure 4.17 also shows a decortization flake scar behind the right edge of the scale, which resulted from a major high angle blow to that end of the cobble. Another small decortization flake scar (not

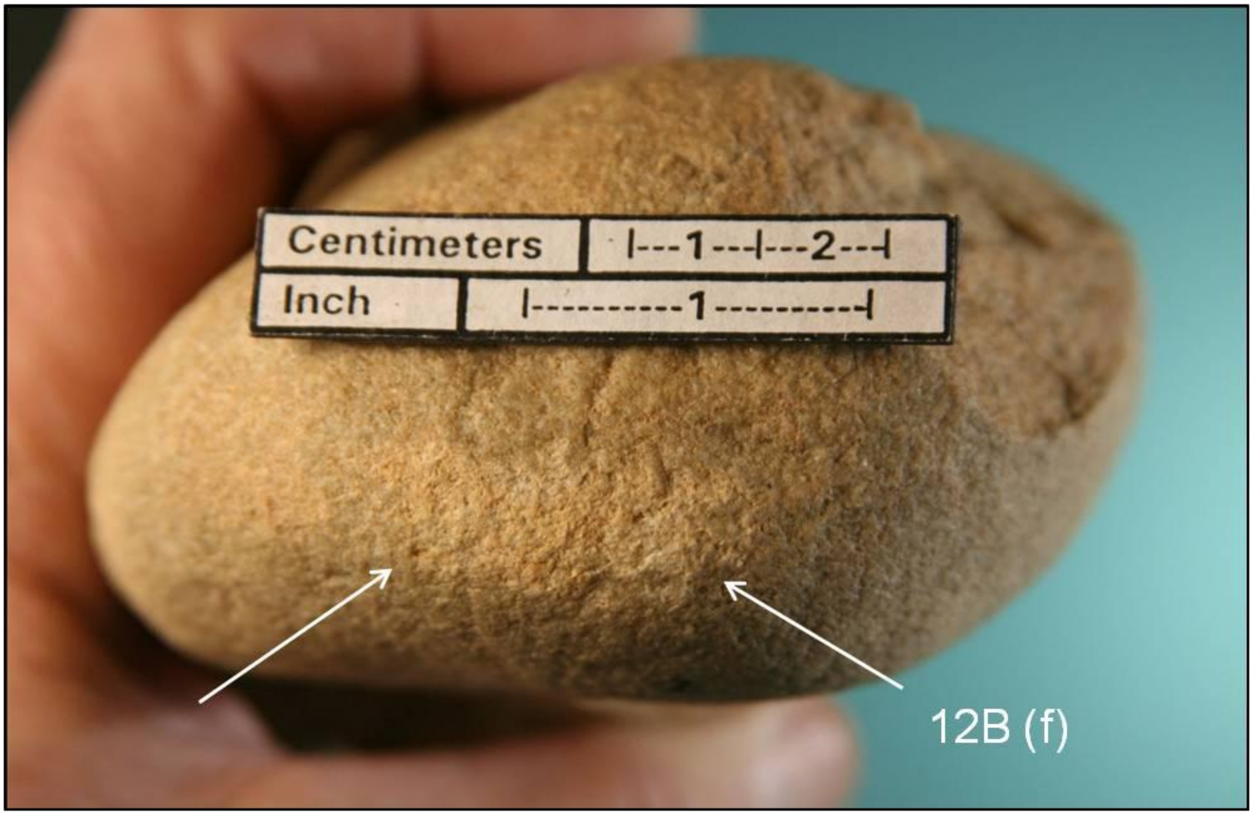


Figure 4.17: Artifact 61f from level 12B (31-33 inches deep) (78.7-83.8 cm.) in BBH3A showing cobble cortex damage (photo by author).

shown) on the side of the cobble near the other end indicated additional heavy pounding use wear. This impact area also had some minor impact damage around the point where the flake was detached, which was similar in intensity to that of the moderate damage shown on the other end of the cobble in Figure 4.17. This suggests that the damage could be from repeated battering. It is possible that the cobble was used to break open or split large cobbles. However, no potential anvil was recovered from the excavated areas, unless one of the large split cobble chopper/abrader-like items from BBH3B (below) were the objects being struck. The cobble's location and large size are consistent with other large artifacts in the 30-36 inch (76.2-91.4 cm.) depth range and peak artifact quantities.

Figures 4.18 and 4.19 show selected artifacts from BBH3B. The stratigraphic distribution is consistent with other squares. Another potsherd (Figure 4.18a) was recovered from the plough zone and a Late Archaic Savannah River point (Figure 4.18b)

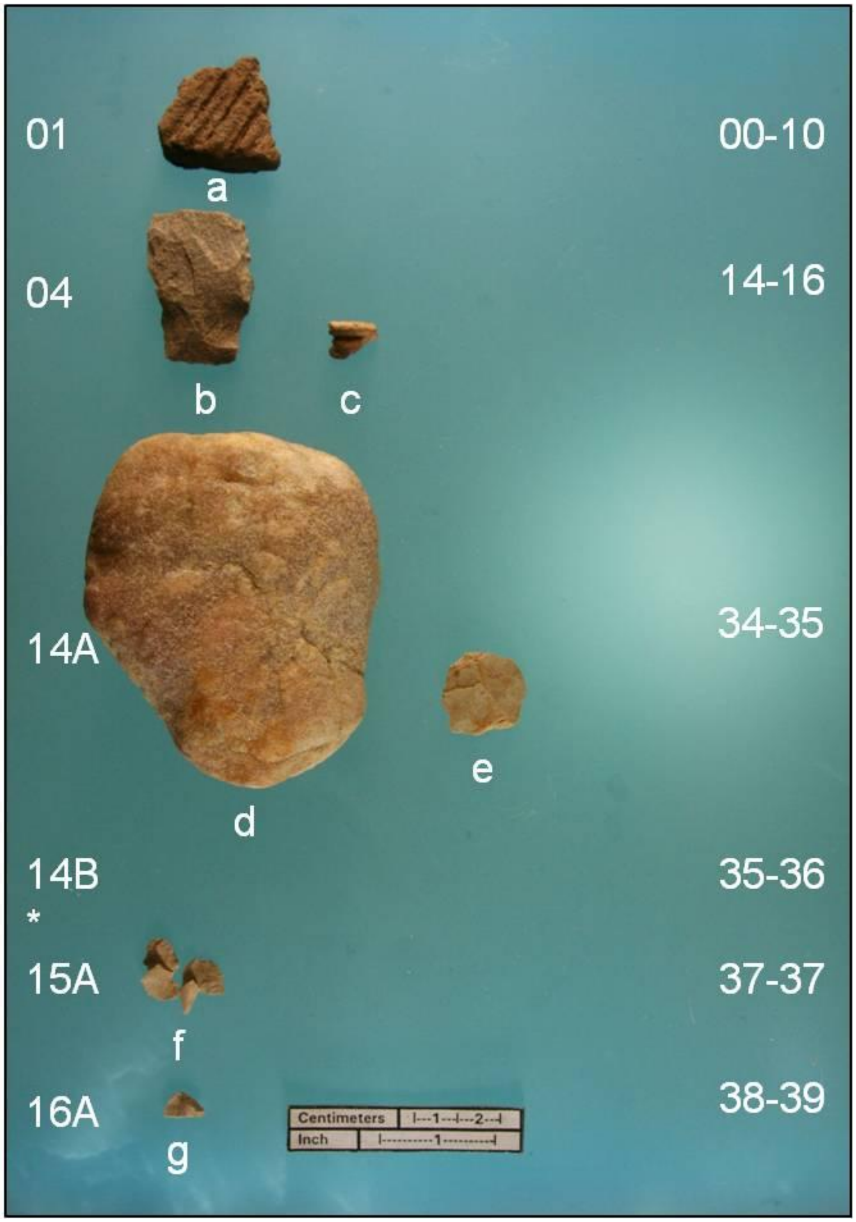


Figure 4.18: Selected artifacts from BBH3B with levels shown to the left and depths to the right. See Figure 4.19 for level 14B artifacts (photo by author).

was recovered from an upper sub-plough zone depth in level 4. A small pottery rim sherd (Figure 4.18c), also from level 4, further attests to the disturbance factors.

Two large, split cobbles with unifacially modified bits at one end of the longitudinal axis (unifacial split cobble chopper-like artifacts) (Figures 4.19a and 4.19b) were recovered from level 14B (35-36") (88.9-91.4 cm.). One (Figure 4.19a) is made of sandstone or decomposing quartzite and the other (Figure 4.19b) is made of quartzite.

Figure 4.19: Sandstone (left) and quartzite (right) large unifacial split cobble chopper/abrader-like lithics from level 14B of BBH3B. Lines delineate extent of chopper-like damage (photo by author).

Besides random unifacial flake scars to the dorsal edge of the upper end of the image shown in Figure 4.19, the sandstone chopper-like artifact (Figure 4.19a) exhibits heavy grinding-like wear over the cobble cortex on the dorsal and ventral surfaces. The edges also are heavily worn indicating that the cobble may have split naturally prior to any cultural use.

Again there is a gap in large artifacts between the area of the profile producing Savannah River points above 18 inches (45.7 cm.) deep and the large activity surface at 28-30 inches (71.1-76.2 cm.) deep. Another relatively large cobble (Figure 4.18d), exhibiting abrasion-like modification, was recovered from level 14A (34-35") (86.4-88.9 cm.).

The broken quartzite unifacial chopper-like artifact (Figure 4.19b) has similar random unifacial flake damage on the dorsal edge of the upper end as shown in Figure 4.19. It also had what appears to be heavy polish covering the highest area on the dorsal surface. No abrasion was observed on the ventral side, which was a fresh break. Of particular note, the break at the end opposite the unifacial damage was caused by a single high angle impact to the dorsal surface. Since there are no non-cultural large artifacts on the site, it is possible that the impact could have been from use as an anvil. However, no other evidence of impact to that surface was present, indicating that the cobble could have been broken elsewhere and been due to accidental dropping on a large object.

Being from the same level (34-36") (86.4-91.4 cm.) as the Cactus Hill-like point from trench BBH10 (see Figure 4.12f and Appendix III: Table 4.7) and one level below the large modified/worn artifacts from BBH11 (see Figure 4.9 and 4.10, and Appendix III: Table 4.5), they clearly were part of an activity surface and further demonstrate the high level of integrity on larger artifacts, especially in this area of the site.

"Gritty cobble choppers" have been inferred from impact marks on the right radio ulna of the purported pre-Clovis aged Ayer Pond bison (*Bison antiques*) butchering site (Lepper 2011: 19). The two cobble choppers here, possibly in association with the large hammer like cobble (see Figure 4.16f), suggests that they are associated with the butchering of a large animal.

However, disturbance factors present in BBH2 were also present in BBH3. They are evidenced by more small "tin can" fragments in level 12 (30-32") (76.2-81.3 cm.) in BBH3A, and levels 5 (16-18") (40.6-45.7 cm.), 10 (26-28") and 16 (38-40") (96.5-101.6 cm.) in BBH3B. It is likely, though, that the two chopper-like tools are in excellent context and are associated with the other modified/worn artifacts on the same plane in BBH10, BBH11 and possibly BBH3A.

4.3.2.c: Trench BBH4

Test trench BBH4 was located 15 feet (4.57 meters) north (downslope) of the end of the north end of square BBH3B (see Figure 4.14). Surface stumps and proximity to the hypothesized clay bank drop off were the main determinants of its location and orientation. It was anticipated that the trench would be off the main activity surface and produce results similar to BBH12.

Appendix III, Tables 4.12 and 4.13 show the quantitative artifact results by level for BBH4A and BBH4B respectively. As expected, the overall artifact distribution tended to peak in the upper half of the profile with the major corresponding quartzite artifact peaks being in levels 6 and 7 (19-23") (48.3-58.4 cm.) in both squares, which is consistent with the Savannah River component. Quartz showed multiple peaks, which was especially noteworthy in BBH4B where there are quartz peaks in levels 2-3 (11-15") (27.9-38.1 cm.), 5-7 (17-23") (43.2-58.4 cm.), 9 (25-27") (63.5-68.6 cm.) and 11-13 (29-35") (73.7-88.9 cm.). In BBH4A, which is upslope, the main peak is in levels 9-11 (25-31") (63.5-78.7 cm.) with the highest quantity in the trench (n=32) being at the top of the concentration (level 9).

As with the other trenches the metavolcanic artifacts are located in the deeper levels. The metavolcanic flakes appeared to be from the same source. Interestingly seven small chert flakes were recovered from level 11 (29-31") (73.7-78.7 cm.). With no other chert artifacts in either square, these probably represent an isolated, *in situ*, activity area. A cross-mend also occurred between two pieces of unidentified FCR recovered from levels 6 and 7.

The trench showed no evidence of down-drifting historic or Woodland artifacts. The distributions of quartz, metavolcanics, and chert suggest multiple occupations over much of the temporal availability of the landform.

4.3.2.d: Trench BBH5

Trench BBH5 was located adjacent to the east side of trench BBH3 (see Figure 4.14). It was located there to expand on the deep activity surface that was identified in BBH3. Immediately upon removal of the plough zone, the edge of the 2002 trench was identified. It essentially split BBH5 along its north-south axis. Fortunately, the northwest corner balk between BBH10 and BBH11 was almost directly in the center of

BBH5. As a result BBH5A encompassed the northwest corner of BBH10 and BBH5B encompassed the southwest corner of BBH11. The fact that the central test trench (BBH3) in 2010 came down 2 1/2 feet (.76 meters) from BBH10 and BBH11, further supports the importance of systematic auger testing with controlled fine screening as a preliminary survey technique on potentially buried, ephemeral prehistoric sites.

Therefore, BBH5A and BBH5B were half squares. The eastern halves consisted of backfill, which was chunked out before excavating the unexcavated parts of the squares. As a result, the artifact quantities for BBH5A and BBH5B have been distorted by the loss of half of their original contexts (see Appendix III: Tables 4.14 and 4.15).

Artifact distributions reflect those of the adjacent trench with two peak quantities. The first is in the levels immediately below the plough zone and the other is between 29 and 35 inches (73.7-88.9 cm.) deep. Also all of the metavolcanic debitage came from the deeper artifact concentration.

Larger artifacts from BBH5 were concentrated in two levels. The upper concentration included two cross-mended FCR recovered from levels 3 (11-13") (27.9-33.0 cm.) and 4 (13-15") (33.0-38.1 cm.). A thermally altered, possible hammerstone was recovered from level 11A (27-28") (68.6-71.1 cm.). Three tan patinated metavolcanic flakes of the same material were recovered from level 13B (32-33") (81.3-83.8 cm.) from BBH5B. Considering their depth and the fact that they were isolated in level 13B, suggests that they were from the deeply buried activity surface identified in adjacent trenches.

Although the plough zone contained large amounts of ferrous metal, brick fragments, asphalt shingle fragments and mortar, none appears to have migrated down below the plough zone. This strongly suggests that historic period disturbances have been minimal if at all in trench BBH5 and possibly at least the areas of BBH10 and 11 covered by BBH5. No historic artifacts were detected below the plough zone in BBH10, 11 and 12. However, the 2002 soil was sifted through 1/4-inch (6.3 mm.) rather than 1/8-inch (3.2 mm.) mesh, which biased the recovery against small metal fragments.

4.3.2.e: *Trench BBH6*

Trench BBH6 was placed near the crest of the Blueberry Hill sand ridge. Its western end was centered on the N120E320 (see Figure 4.14), where a light artifact concentration was detected in the deeper levels during the auger testing. It was placed there to test the artifact concentration and to investigate the possibility that older, less disturbed soils might be discovered.

Appendix III, Table 4.16 shows the distribution of artifacts in BBH6A. They appear to have no appreciable pattern. Most notably, all artifacts except one quartzite debitage came from above 30 inches (76.2 cm.) deep. Considering that trench BBH6 was more than 100 feet (30.5 meters) east of the rest of the trenches, and there were no temporally diagnostic artifacts from the trench, it is not possible at this time to assess the significance of the distribution.

The artifact distribution in BBH6B shows two levels of concentration (see Appendix III: Table 4.17). They are between nine and 17 inches (43.2 cm.) deep and between 21 and 25 inches (53.3-63.5 cm.) deep with a distinct concentration of quartz debitage in level ten (23-25 inches deep) (58.4-63.5 cm. deep).

Apparently, a high energy fluvial event also deposited unusually high quantities of coarse sand and pebbles (n=1807 and 2506 respectively) in levels nine and ten of BBH6B, where the deeper artifact concentration occurred (see Appendix III: Table 4.17). However, that is not reflected in BBH6A which is the upstream square of the trench. There the highest pebble counts were in levels 11 (n=798) and 12 (n=423) (see Appendix III: Table 4.16). Artifacts also penetrated into these deeper levels. No artifacts were recovered below level ten in BBH6B.

No temporally diagnostic artifacts were recovered. Therefore, even with detectable vertically discrete artifact levels it is not clear what the levels represent, culturally. The presence of historic artifacts in levels 3, 6 and 10 in the trench indicates some disturbance.

The artifacts and their distribution provide little information about the occupation of that part of the site. The soil proved to be a different story. Figure 4.20 shows the west wall profile from BBH6A, which exposed well developed lamellae. They were better developed and less disturbed than in other areas of the trench. The lamellae are consistent with those in the older soils at Cactus Hill, resolving one of the potential problems with the site.

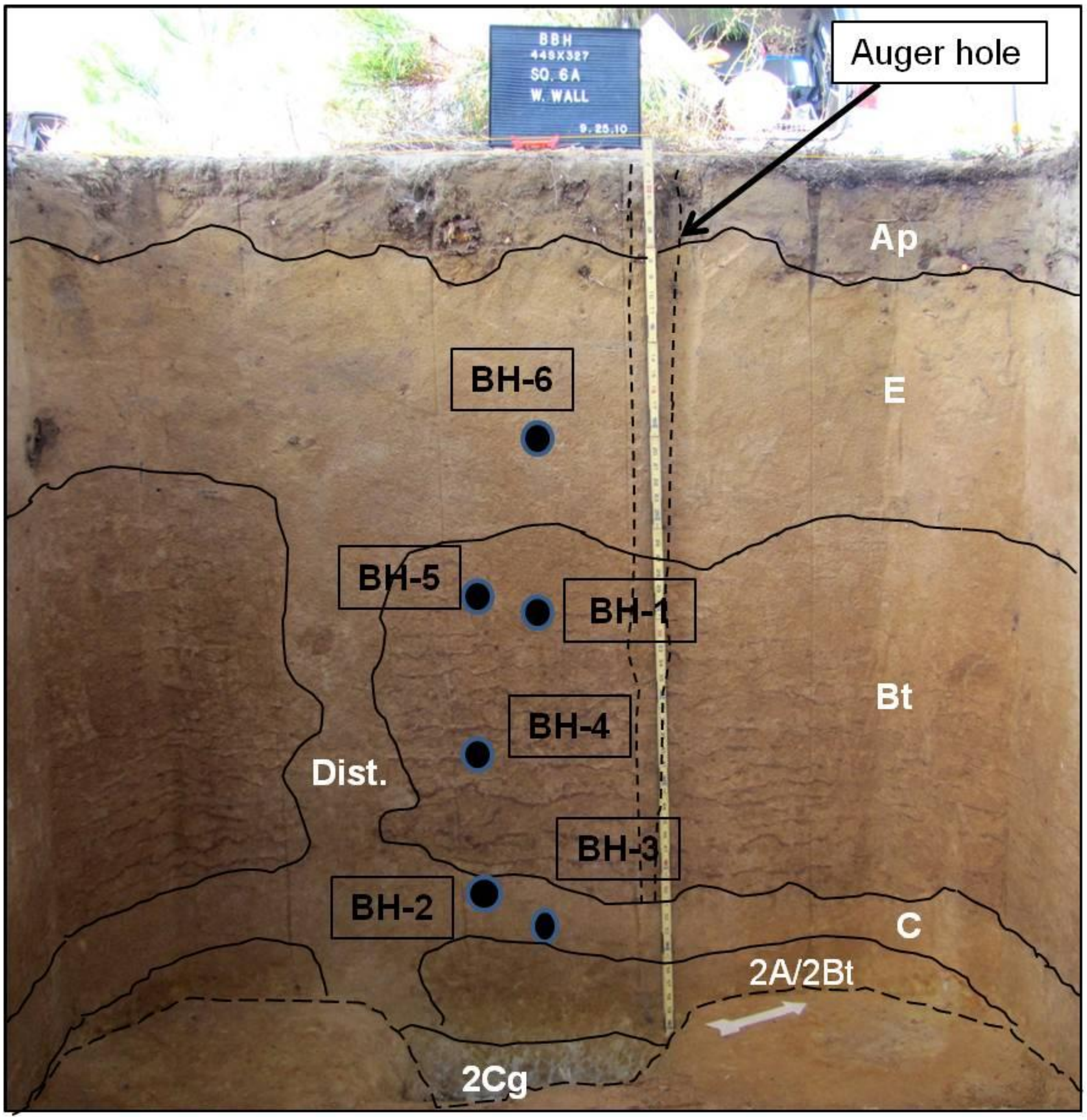


Figure 4.20: West wall profile from BBH6A showing OSL sample locations and well developed lamellae (Bt) (photo by author).

As a result of the potential for older less disturbed soils along the west wall of BBH6A, six OSL samples were recovered from that wall as shown in Figure 4.20. These were taken from approximately 20, 30, 40 and 50 inches (50.8, 76.2, 101.6, and 127.0 cm.) deep. Table 4.18 shows the multiple aliquot results, which were run by Shannon Mahan of the USGS in Denver and initially analyzed by Kevin Burdett, Geologist III at Florida Department of Environmental Protection (Burdette 2011).

With the exception of one minimal age date (8.8±4.5), which has the largest inaccuracy, all strongly support a pre-Younger-Dryas age for the Blueberry Hill landform. They appear to be consistent with the results Feathers et al. (2006: 183,186) got from single grain analysis on Cactus Hill samples (see Table 2.1).

Sample	Depth	Mask size	Central age (ka) Cubic fit	Central age (ka) Linear fit	Minimal Age (ka) Cubic fit	Minimal age (ka) Linear fit
BH-6	50.8 cm (20")	1.0 mm	32.0±4.7	29.3±4.0	**13.0+1.8**	17.5±2.5
BH-5	76.2 cm 30"	1.0 mm	33.1±2.7	32.6±3.5	29.4±2.7	30.2±2.6
BH-1	78.74 cm (31")	1.0 mm	**15.8+1.7**	22.2±2.3	8.8±4.5	**11.9+1.8**
BH-1	78.74 cm (31")	3.0 mm	19.2±2.5	28.2±2.7	15.2±3.2	28.1±2.6
BH-4	101.6 cm (40")	1.0 mm	32.6±2.7	30.0±2.6	23.9±2.3	**25.4+1.9**
BH-2	129.54 cm (51")	1.0 mm	30.0±1.9	**30.6+1.1**	23.8±1.3	30.6±2.7
BH-3	132.8 cm (52")	1.0 mm	32.5±3.4	29.7±2.5	19.0±2.2	29.8±2.5

Table 4.18: OSL results from BBH6A, west wall profile (Burdett 2011). The highlighted bold dates indicate the best quality central and minimum age fits by level.

It is noteworthy that even the dates at the top of the profile suggest that the dune below 20 inches (50.8 cm.) was deposited prior to the end of the Younger-Dryas. Theoretically, ants have redeposited soil at the top, which unless it was redeposited in darkened conditions under deep leaf or pine needle litter, should have had its luminescence clock reset. Experiments using ants have confirmed the bioturbation problem (Rink et al. 2012). The results from Blueberry Hill are consistent with that kind of disturbance. Rink (personal communication 2012) concluded that "perhaps (the) only meaningful OSL age is the one closest to the surface which would set the minimum age on the artifacts below it (assuming it itself is not heavily contaminated by under zeroed upward grains) (at) 13.0±1.8 ka with the cubic fit, and 17.5±2.5 ka with the linear fitting".

Despite the apparent disturbance problems, the author decided to highlight (red) the best quality dates just to see what would happen. Surprisingly, a distinct chronological pattern, consistent with the hypothesized geomorphology of the Cactus Hill part of the sand ridge, emerged. As can be seen in Table 4.18 the sequence of highest quality dates, beginning at the 20-inch depth is approximately ca. 13,000 BP. This is followed at 30 inches by a date of approximately ca. 15,800 BP. The closeness in quality of the ca. 11,900 BP date from that depth cannot be discounted. The 40-inch date of ca. 25,400 BP and 50-inch date of ca. 30,600 BP are also consistent. The oldest dates conform to a post-Heinrich III depositional history for the dune’s formation (Pavich 2012: Personal communication).

The multiple grain OSL data indicate that the artifacts are often in soil that is far older than the artifacts. That would indicate that the site is, at least on the scale of medium to coarse sand grains, somewhat disturbed. However, it has been demonstrated repeatedly that although smaller items migrate downward through the profile, the larger items are in good context relative to each other. The prime example of this is the activity surface generally between 30 and 36 inches (76.2 and 91.4 cm.) deep and numerous cross mends within levels from Cactus Hill, Rubis-Pearsall, and Blueberry Hill.

As mentioned above, while carefully excavating 1/2-inch (12.7 mm.) levels at Cactus Hill it was common, even in deeper levels to find ant colony chambers, often under individual lamella. Although these were small flat voids, when taken in the context of more than 13,000 years as indicated by the OSL results, it is conceivable that larger items could migrate down through the profile, averaging microns per year, as the chambers were abandoned and collapsed. It is also hypothesized that, under these circumstances, the larger items would not be seriously displaced relative to each other. Those items that are small enough to migrate down small burrows would be less contextually reliable. This problem has been noted elsewhere (Johnson and Anthony 1998: 22; Leigh 1998; 2001; Thulman 2012).

Most importantly for the model, the OSL results strongly support a pre-Younger-Dryas age for the Blueberry Hill sand ridge. This is consistent with the results from Rubis-Pearsall. However, it does not date the artifacts or indicate correspondence between the artifacts and the strata in which they were recovered.

4.3.2.f: Trench BBH7

Trench BBH7 was located to the east of and parallel to BBH11, where the activity surface was identified in 2002 (see Figure 4.14). Due to tree stumps it had to be situated 2 1/2 feet (.76 meters) to the east of BBH11. The southwest corner of the trench (BBH7A) was on the N120E220 auger test. Its purpose was to determine the eastward extent of the activity surface in BBH11.

Appendix III, Tables 4.19 and 4.20 show the stratigraphic distribution of artifacts in BBH7A and BBH7B, respectively. Although BBH7B shows a bimodal distribution similar to that in trenches BBH3 and BBH5 the peaks are shifted slightly higher in the profile and the quartzite in BBH7A exhibits a reverse curve with the highest artifact concentrations in the middle between 17 and 29 inches (43.2 and 73.7 cm.) deep. Additionally, the overall quantities are dramatically lower. These factors indicate that BBH7 was probably off the eastern edge of the deeper activity surface.

Square BBH7A produced several small chert and jasper flakes widely scattered through the profile. These are typical of the debitage size in the trench. A small 1/8-inch (3.2 mm.) diameter, fossil, crinoid segment (Figure 4.21 inset) was recovered in the lab sort from the fine screen residue. It is likely a bead but has no evidence of having been culturally modified (Figure 4.21). Its depth in Level 14A (31-32") (78.7-81.3 cm.) places it in the early activity surface of the site.

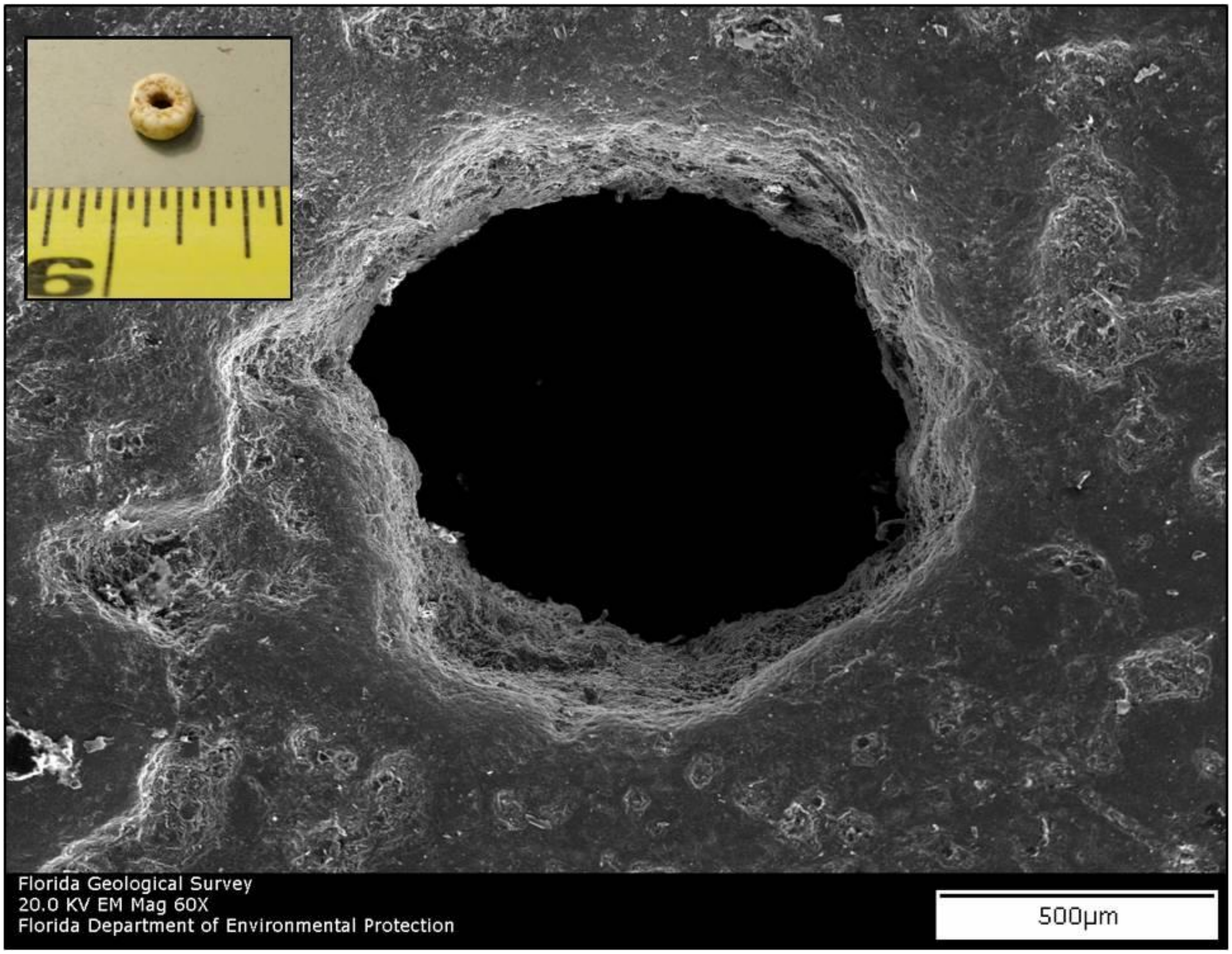


Figure 4.21: High resolution image of the crinoid bead (inset) recovered from level 14A of BBH7A (SEM photo by Cindy Fischler, Florida Geological Survey) (inset photo by and with permission of Becky Garber).

It was probably brought to the site by a human, since it

> …did not originate east of the Blue Ridge. West of the Blue Ridge, however, crinoids occur in a wide range of geologic formations, in strata from Ordovician through Mississippian age (in Virginia). The bead has been abraded, leaving no surface details, so it's impossible to assign this fossil to a particular species or geologic formation. I can safely say that the nearest natural source of a crinoid would be the Ordovician limestones in the Botetourt-Rockbridge-Augusta counties area, about 125 miles northwest of Sussex County. Of course, those are just the nearest localities; it could have come from just about anywhere west of the Blue Ridge. In the Silurian-Devonian-age limestones, which occur strictly west of I-81, there are some beds in which crinoids occur in great abundance and weather out in relief, making them easy to collect. Speaking informally, I'd say this is a more likely source than the Ordovician

> limestones of the Great Valley (David B. Spears, Virginia State Geologist, Personal communication 2011).

Although similar shaped beads in stone and bone are reported from Paleoamerican sites throughout North America (Bradley, et al. 2010: 135; Glowacki 2012; Gramly 1998: 48-49; Hoffman, et al. 2000: 42-43) it is not clear that this one dates from that period or a later period, since items of this size commonly drift downward in Tarboro loamy sand. Crinoid fossil beads have also been recovered from Woodland burials (Lewis and Lewis 1995: 450).

Of particular note is the fact that, regrettably, the plough zone (level 1) and level 2 were sifted through 1/4-inch (6.3 mm.) mesh. With a similar sized lead shot having been recovered from 1/8-inch (3.2 mm.) screening in level 11 in BBH2 it is possible that the bead could have come from a surface or Woodland context. No other lead shots were recovered from below the plough zone. However, it is clear that it originated in the plough zone.

All the larger artifacts from BBH7 were recovered from the upper levels. These include three pieces of the same potsherd (Figure 4.22a) recovered from the plough zone; a large quartzite decortication flake (Figure 4.22b) from level 4 (11-13") (27.9-33.0 cm.); a finely finished distal midsection of a quartzite point (Figure 4.22c) from level 5 (13-15") (33.0-38.1 cm.); and another quartzite decortication flake (Figure 4.22e) from level 11B (26-27") (66.0-68.6 cm.).

The point fragment (Figure 4.22c) was the only potential temporally diagnostic artifact recovered during the 2010 testing. The refined serrated edges indicate probable Early Archaic age as serrations are not common in post Early archaic periods in this region. However, the serrations are not pronounced and could be a residual of pressure flaking. There again, such edge work is not common on later points until the Woodland period.

The small chert flake (Figure 4.22d) from level 7 (17-19") (43.2-48.3 cm.), like two chert

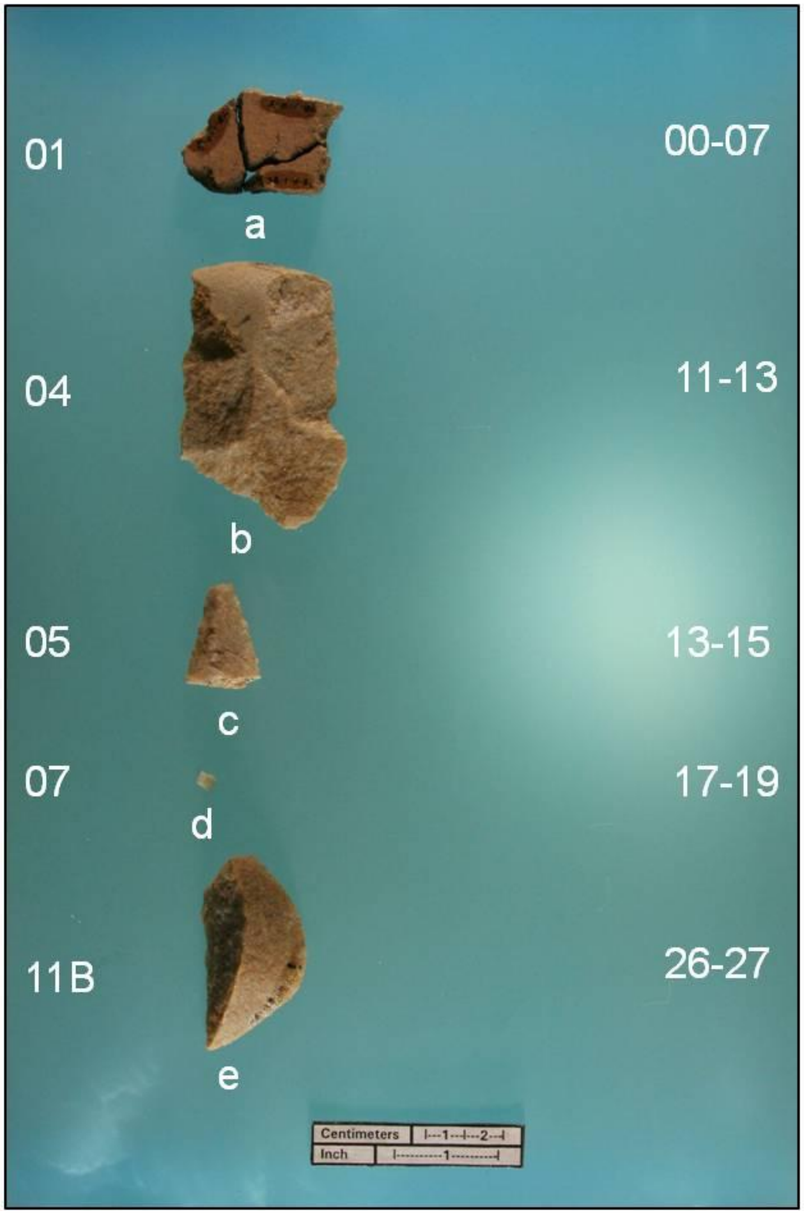


Figure 4.22: Selected artifacts from BBH7B with levels shown to the left and depths to the right (photo by author).

flakes from BBH7A, are Nottoway River chert, similar to chert from the Williamson Paleoamerican site (Benthal and McCary 1973; McCary 1951; McCary and Bittner 1979). Although at the Williamson site, the Williamson chert is almost exclusively associated with the Paleoamerican component, other cultural periods have been found on the Williamson site (McCary and Bittner 1979: 53-54, 59). Therefore, it is not impossible that the Williamson chert is from a later period.

The fact that one of the Williamson-like chert flakes from BBH7A was recovered from level 3 (9-11") (22.9-27.9 cm.) is a problem for assigning an early age to Williamson chert occurrence on the site. That level is consistent with the Late Archaic, Savannah River period occupation. However, the author has observed or found no evidence that Savannah River knappers ever used Williamson chert, which argues against an association.

4.4: Summary and conclusions

4.4.1: Distribution

From a horizontal standpoint, BBH3, BBH5, BBH10 and BBH11 show very similar patterns of vertical separation between the sizes, functional and probably temporal relationships between artifacts. In all four trenches there is a distinct gap between the upper levels and approximately 30 inches (76.2 cm.) below the surface.

In the 2010 excavations all artifacts larger than a quarter (1-inch diameter) (2.5 cm. diameter) were mapped. With respect to large artifacts, which we have demonstrated have relatively higher inter-artifact integrity, the separation between them is consistent in this area of the site. For example in BBH3A the separation is between 18 and 32 inches (45.7 and 81.3 cm.). In BBH3B the gap is between 16 and 35 inches (40.6 and 88.9 cm.). In BBH5A it is between 15 and 27 inches (38.1 and 68.6 cm.). The deeper artifact level in this square started 3 inches (7.6 cm.) higher than in the other squares. It is not clear what this means, such as, overlapping activity surfaces or the activity surface was on some kind of rise. In BBH5B there were no mapped artifacts at any depth below 17 inches (43.2 cm.).

In BBH10 and BBH11 it is more difficult to determine the distributions, because only diagnostic artifacts were being mapped; the counts are based on full 5x10-foot (1.52x3.05 meter) trenches; and the arbitrary levels were four inches (10.2 cm.) thick. The comparative weights by level show the vertical differences more clearly.

In BBH10 the number of quartzite artifacts in level 3 (14-18") (35.6-45.7 cm.) was 34, including the fluted point base found in the lab sorting of screen residue. They weighed 40.5 grams. In level 4 (18-22") (45.7-55.9 cm.) the total number of quartzite artifacts was seven, weighing 3.0 grams. In level 5 (22-26") (55.9-66.0 cm.) the total quartzite was three, weighing 4.7 grams. Level 6 (26-30") (66.0-76.2 cm.) had two, weighing 31.9 grams. One of the two was a large cortical flake weighing 30.0 grams.

From level 7-10 they were divided into 2-inch (5.1 cm.) sub-levels. Level 7A (30-32") (76.2-81.3 cm.) contained 3 quartzite debitage including one blade-like flake, weighing 4.4 grams. Level 7B (32-34") (81.3-86.4 cm.) produced two quartzite debitage weighing 5.2 grams and the first evidence of metavolcanic flakes. Level 8 (34-38") (86.4-96.5 cm.) produced only two quartzite artifacts including the Cactus Hill-like point (and a flake, weighing 9.5 grams, and two metavolcanic flakes. The only mapped artifact in the deeper levels of BBH10 was the Cactus Hill-like point which came from BBH10, within 10 inches (25.4 cm.) of BBH11 (Figure 4.23). No artifacts were recovered below level 8B (see Appendix III: Table 4.7).

However, the differences between levels are more evident in BBH11. In level 4 (18-22") (45.7-55.9 cm.) in BBH11 had 32 quartzite artifacts weighing 98.8 grams. Level 5 (22-26") (55.9-66.0 cm.) produced five artifacts weighing 5.5 grams. Level 6 (26-30") (66.0-76.2 cm.) produced eight artifacts weighing16.3 grams. Level 7 (30-34") (76.2-86.4 cm.) produced 11 quartzite artifacts weighing 101.0 grams. When the large sandstone abrader and metavolcanic core are added in the total weight becomes 562.8 grams. Below that the artifact quantity for level 8 (34-38") (86.4-96.5 cm.) drops to four quartzite debitage weighing 5.8 grams.

Even with the poorer quality data from the 2002 excavation, the mapped modified/worn artifacts and large debitage in BBH10 and BBH11 indicate distinctly separate activity surfaces above 18 inches (45.7 cm.) and below 30 inches (76.2 cm.). The known extent of this activity surface is shown in Figure 4.23.

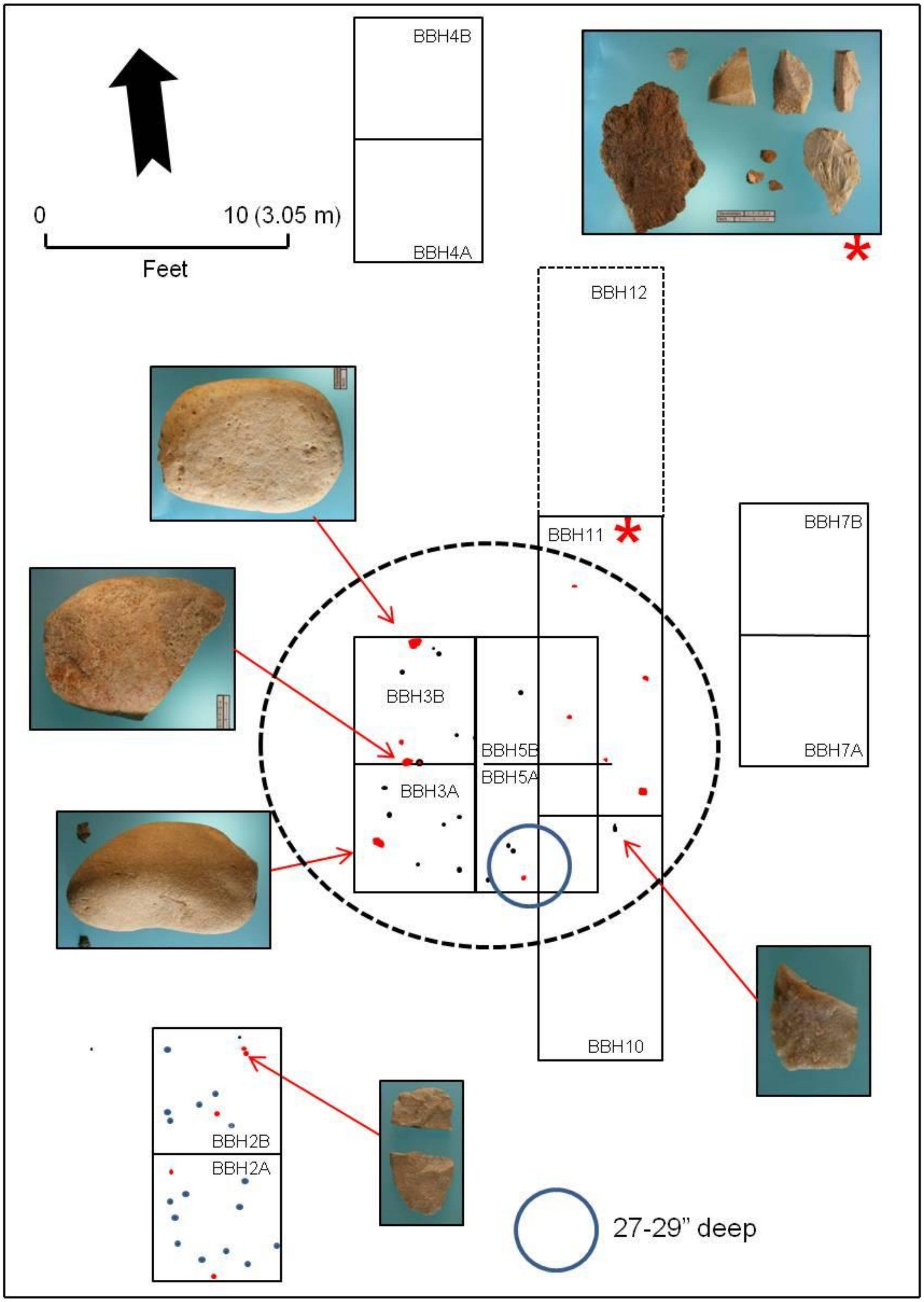


Figure 4.23: Horizontal distribution of potential pre-Clovis age artifacts. Red items are modified or worn artifacts and the black items are debitage (photos by author).

This deeply buried activity area appears to be localized within the grid in BBH3A and 3B, BBH5B, the northern edge of BBH10 and most of BBH11. The cluster of artifacts in the southeast corner of BBH5A is three inches (7.6 cm.) higher than in adjoining squares/trenches and not clearly stratigraphically associated. The lack of deeply buried modified/worn artifacts and large debitage in BBH4, BBH7, BBH12 and the southern 90% of BBH10 seems to define the eastern boundary of the activity surface. The site appears to extend to the west and outside the north edge of BBH3B and south edge of BBH3A and possibly BBH5A (dashed line in Figure 4.23). However, the metavolcanic and chert debitage from the deeper levels of BBH4 have not been fully explained and may indicate an expanded Paleoamerican presence.

BBH2 exhibited evidence of vertical disturbance. The very small lead shot from level 11 is not that great a concern because of its small size. However, there appears to be no vertical separation of large artifact levels through the profile. The cross-mended biface (see Figure 4.15b and 4.15c), lying right on top of each other, suggests that there are pockets of very good integrity in BBH2.

4.4.2: Coarse Sand/Pebble Analysis

As a matter of methodological rigor throughout the model testing and ASV excavations at Cactus Hill, all artifacts and "geo-facts" were recovered after sifting from field screens and taken back to the lab for sorting. Additionally, geo-facts have been sorted and counted. The two main classes of these items have been rounded, coarse sand and pebble sized clasts, and concretions.

The latter consists of several varieties of soil and sand concretions. They include gritty concretions consisting of coarse sand that is easily broken down; large black concretions, which at Cactus Hill were often in association with FCR features; clayey medium to fine sand concretions of various strong brown to yellowish brown colors; and obvious or possible insect nests similar to those of mud wasps. Due to the difficulty of visually sorting them into types, they will only be reported as being retained. Some may actually be small pottery fragments.

The coarse sand and pebble sized clasts, hereinafter referred to as pebbles were not sorted by raw material. However, they were counted and weighed. Following the 2002 excavation and lab work, the counts by level were compared (Figure 4.24). The relative similarities of the resulting bar charts were evident with what appears to be a significant correlation between pebble counts and diagnostic artifacts.

All three bar charts generally have the same shapes with an apparent small increase in pebble numbers at the top of the profile. Although it cannot be confirmed, in BBH10, which was the highest and furthest back from the clay bank drop off, its plough zone was not sifted so if there were a peak at the top, the evidence is lacking. The BBH11 plough zone was the only one sifted. It produced a significant number of pebbles. There is a distinct peak at the top of BBH11 and a slight indication of one in level 2 of BBH12. Its plough zone also was not sifted. Assuming that BBH10 had pebbles in its plough zone, all three show distinct lower quantities in the upper centers of the profiles. All three also show large pebble increases in the lower portions with drop offs at the bottom.

Also the BBH11 bar chart shifts to the right when compared with both BBH10 and BBH12. With BBH10 being upslope, this can be explained by either erosion or the fact that being upslope it would have received less flood energy and therefore fewer pebbles would have been deposited. This does not explain the similar quantitative drop off in BBH12, which was down slope. As can be seen from the profile for all three pits (see Figure 4.10), the plotted Savannah River points were recovered progressively deeper to the north (down slope), which indicated that, during the Savannah River phase (approximately 4,000 years ago), the surface slope of the sand bank over the clay bank was progressively increasing through BBH12, which could have distorted the pebble distribution pattern.

That would have been expected along the hypothesized old channel. The question arises as to when did the old channel fill to its current sand depth? This would indicate that, barring some other explanation for the artifact patterns, the filling to current levels was not complete until sometime between Savannah River and the present. Alternatively, a

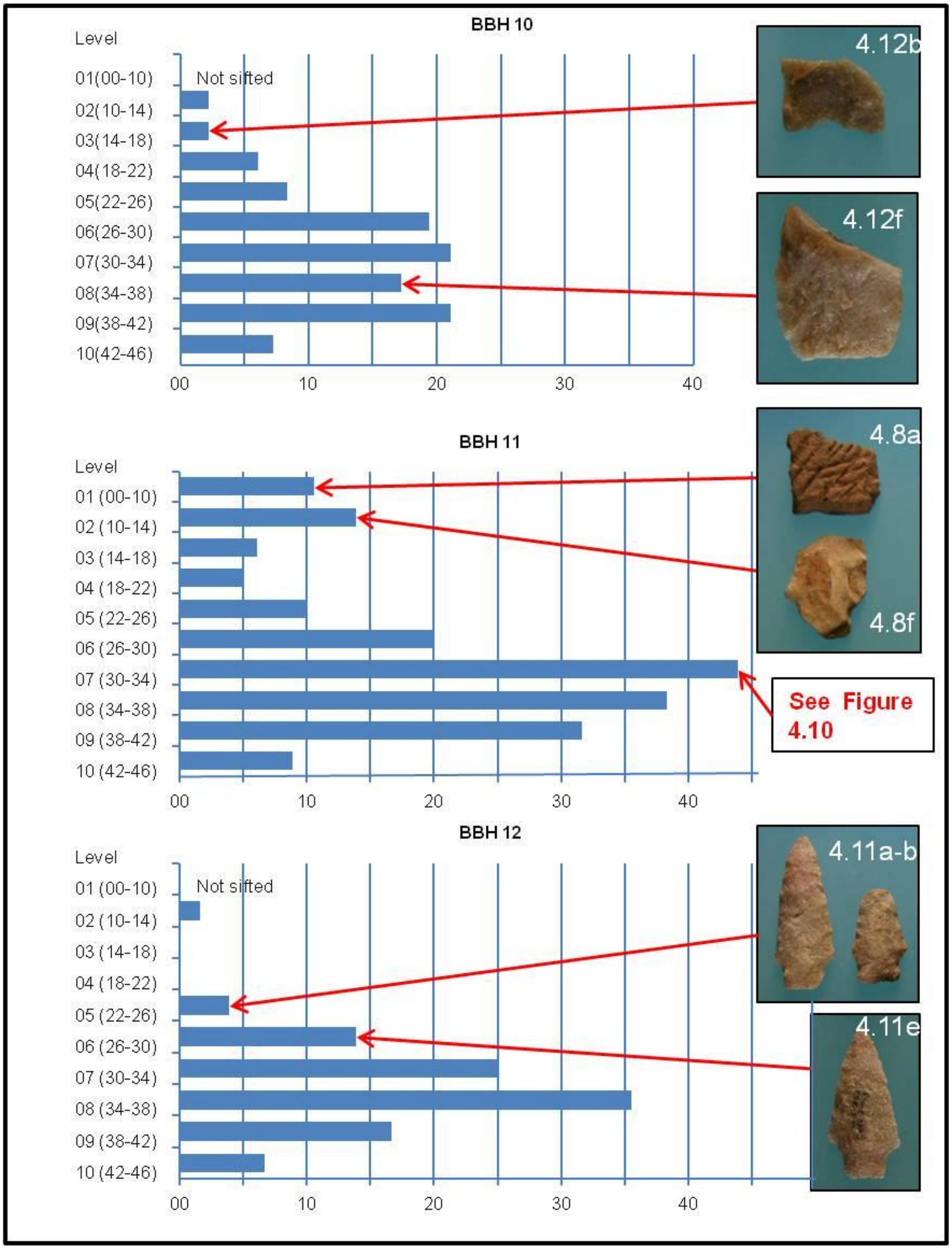


Figure 4.24: Pebble quantities > 1/4-inch (6.3 mm.) mesh for Trenches BBH10-11 (2002) relative to slope. Temporally diagnostic artifacts are shown to the right (photos by author).

bioturbation induced, uniform percolation rate for the Savannah River points, combined with later colluvial soil creep, could have produced the difference between current surface topography and the apparent buried surface topographic pattern associated with the points. However, it was clear at the time that the bi-polar pebble patterns were similar to the bi-polar artifact patterns (Johnson 2004: 19).

One of the goals of the 2010 excavations was to check the accuracy of these bar charts. Greater rigor was used in data recovery with the use of 1/8-inch (3.2 cm.) mesh screen, rather than the 1/4-inch (6.3 cm.) screen used in the 2002 test. The tighter mesh produced high quantities of coarse sand (see Appendix III: Tables 4.8-4.16 and 4.19-4.20). However, it became evident quickly that the extremely high quantities of coarse sand between the two screen meshes were quantitatively overwhelming the >1/4-inch (>6.3 cm.) data.

The bar charts in Appendix IV show the results from re-sifting the pebbles from trenches BBH2, BBH3 and BBH4 through 1/4-inch (6.3 cm.) mesh. It is split out by sub-square to see if there were anomalies to the pattern. However, the 2010 data strongly support the 2002 data and the conclusion that a distinct pattern of particle size distribution in the >1/4-inch (>6.3 cm.) size category exists, at least on that part of Blueberry Hill. The data indicate that the major differences in alluvial patterns on that part of the site are better indicated by larger grain sizes, in excess of 1/4-inch (6.3 cm.).

However, that pattern is not obvious on all parts of the site. The >1/4-inch (>6.3 cm.) pebbles from square BBH6A, which shows an apparent inverted pattern relative to those for the western end of the landform. It is possible, however, that the pebble peak in the center of the bar chart merely represents a shift in the overall curve up the profile with the peak in the upper levels, noted 100 feet (30.5 meters) away, and not being present, because it was farther away from the pebble source, the Nottoway River channel. BBH6A is within the same contour interval of 63-64 feet (19.2-19.5 meters) as BBH2 and in an area that appears to be flatter than the area containing BBH2-4. This was a field observation that is supported by the transit map (see Figure 4.14). Hypothetically, being at the downstream end of the landform, the area was more stable during flood episodes.

With respect to climate patterns, the pebble curves from the western end of the site are similar to pollen curves for pine (*Pinus*) (Figure 4.25) from the region (Figure 4.26). Markewich and Markewich (1994:24-25) suggest that the most recent dune forming episode occurred between 15,000 and 3,000 years ago. It is not clear if their date range was in calibrated years B.P. Jones and Johnson (1997:C8) and Pavich (personal communication 2012) agree that dune formation in the Cactus Hill area probably began as early as 30-33,000 B.P., possibly coinciding with Heinrich 3.

The Hack Pond pine pollen diagram is shown in Figure 4.25a. As would be expected, elevated cold related pollen counts would have persisted further north and west in the Appalachian Mountains at Hack Pond (Figure 4.26a). There the decline appears to have begun at approximately 10, 800 years ago, which is much later than in the area of Dismal Swamp near Blueberry Hill. There the decline appears to have begun between 13,000 and 14,000 years ago (Figure 4.25). However, the pollen graph shapes do remain consistent with the pebble bar chart shapes from both.

The geographically nearest pollen sequence is from Dismal Swamp (4.23b), located approximately 50 miles southeast of Blueberry Hill (Figure 4.26b). It is one of the better dated sequences discussed here. Whitehead (1972: 306) notes the potential contamination of the deeper dates by organic compounds percolating down through the peat profiles. This impact may be similar to that detected on Rubis-Pearsall between the OSL dates and Palmer and Clovis aged points (see Figure 3.27). According to Whitehead's caveat, the 13,000 years ago age line on the graph could be a young estimate.

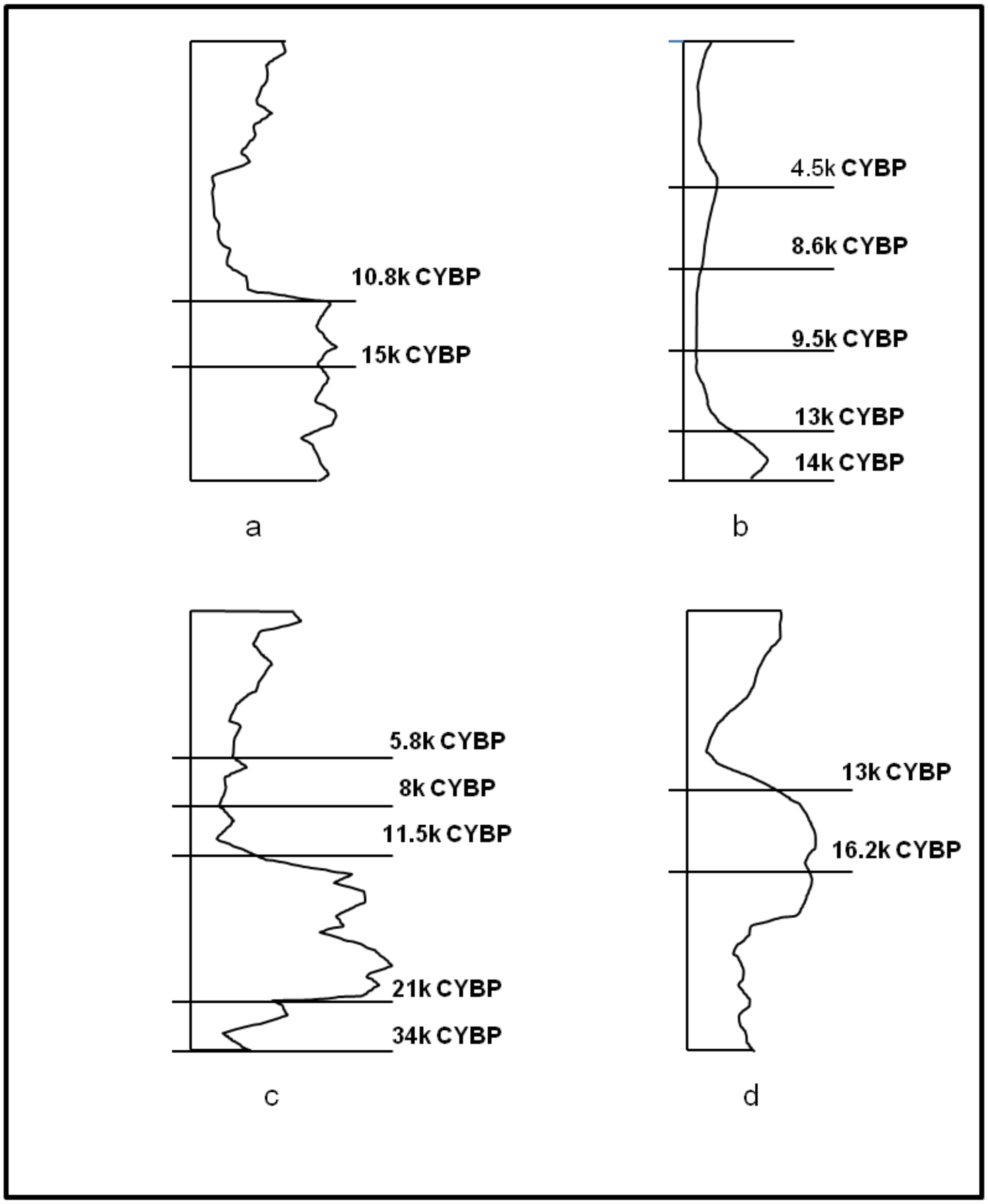


Figure 4.25: Selected regional pollen graphs for pine (pinus) with date estimates on proposed vegetational shifts by referenced authors. (a - Hack Pond, VA (Craig 1969: Plate 1); b - Dismal Swamp, VA (Whitehead 1972: 305); c - Rockyhock Bay, NC (Whitehead 1981: 457); d - Bladen County, NC (generalized diagram from Frey 1953; date estimates from Whitehead 1967)

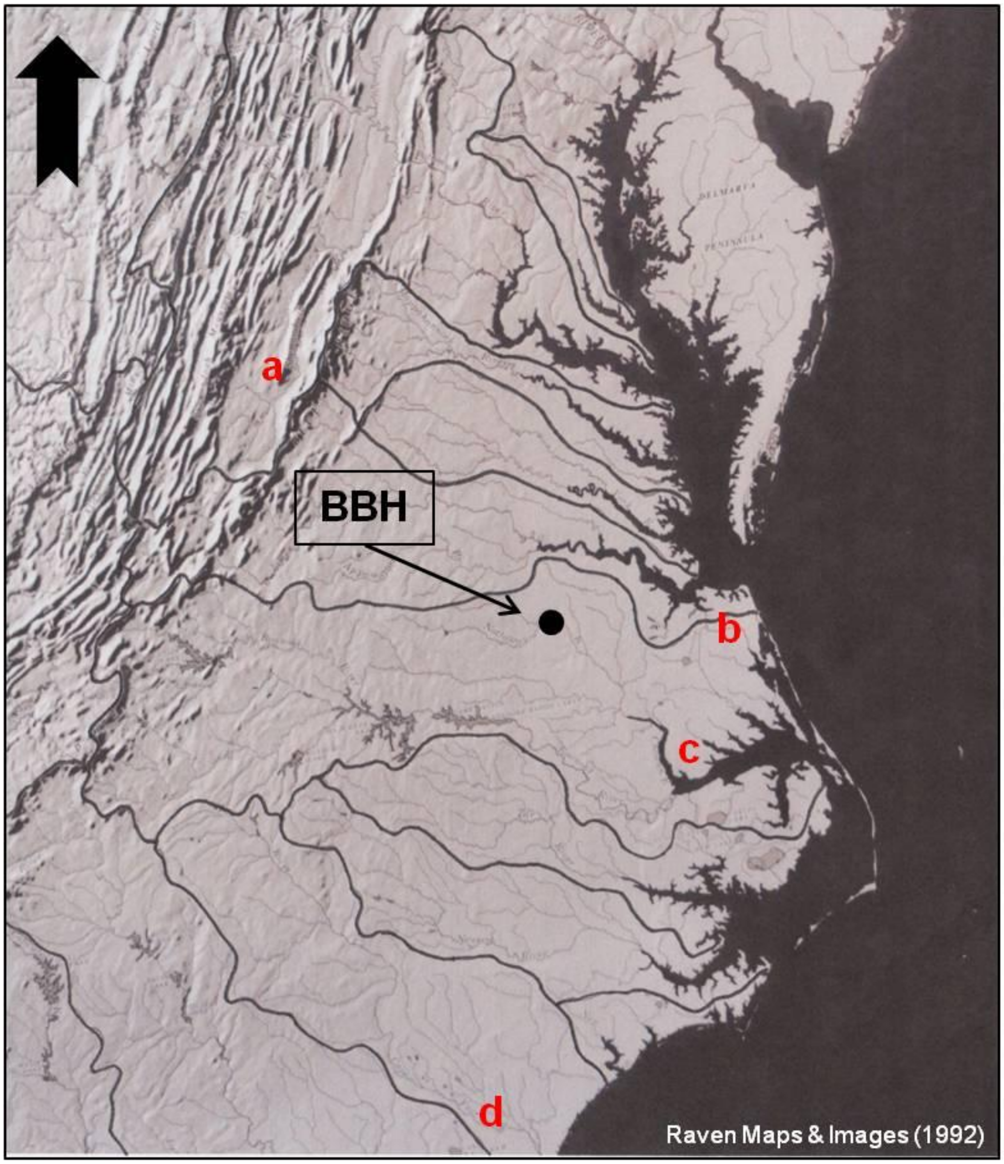


Figure 4.26: Selected regional pollen sample locations: (a - Hack Pond, VA (Craig 1969: Plate 1); b - Dismal Swamp, VA (Whitehead 1972: 305); c - Rockyhock Bay, NC (Whitehead 1981: 457); d - Bladen County, NC) (Base map reproduced with permission of Raven Maps and Images).

Gardner's (1974) work at the Thunderbird site in the Shenandoah Valley of northwestern Virginia set the tone for an interdisciplinary team approach to Paleoamerican studies in the Middle Atlantic Region. Carbone (1976), one of Gardner's students, was a leader in addressing the specific relationship between vegetational reconstruction and the archaeological record. He used Craig's (1969) study of Hack and Quarles Ponds as the foci for reconstruction of the Thunderbird site's paleoenvironmental context.

Note on the Dismal Swamp diagram (Figure 4.25b) that at approximately 4,500 years ago the pine pollen trend shifts from an upward trajectory to a downward trajectory. This appears to be a result of a sharp corresponding increase in cypress (*Taxodium distichum*), which would be expected with increased precipitation in a feature like Dismal Swamp. That may explain why that part of the graph's pattern does not compare well with the pebble bar chart patterns.

The next nearest sequence is from just south of Dismal Swamp, in northeastern North Carolina at Rockyhock Bay (Figure 4.25c). It is another well dated sequence (Whitehead 1981: 44.9). The pollen site is two miles east of the Chowan River, of which the Nottoway is a tributary, and 65 miles southeast of Blueberry Hill (Figure 4.26c). The main decline of pine pollen appears to have begun prior to the end of the Younger-Dryas, sometime before 11,500 years ago (Whitehead 1981: 457). The reason for the 1,500 year discrepancy between that part of the Rockyhock Bay and nearby Dismal Swamp (Figure 4.25b), and Bladen County (Figure 4.25d) farther south is not clear.

Leigh (2008: 96) notes the general climate for the 30,000-16,000 years ago time frame involved "very cold winters; cool summers; dry; windy conditions sufficient to move much eolian sand on floodplains, uplands, and Carolina bay rims." That was followed by the terminal Pleistocene (16-11,000 years ago), which was characterized by cold winters and mild summers with a possible pronounced flood season. The early Holocene (11-5,500 years ago) would have had cooler winters, relative to modern conditions, gradual warming and, again, a possible pronounced flood season. The late Holocene (5,500-0 years ago) was characterized by modern climatic conditions.

All one can conclude is that across much of the site the Savannah River component (approx. 4,000-3,700 years ago) dates to the early part of the Late Holocene climate. However, based on correlating the pollen and pebble curves for BBH12 (see Figure 4.24), the two Savannah River points appear to correspond with the early Holocene (11-5,500 years ago).

The activity surface with its Cactus Hill-like point (see Figures 4.12f) appears to date at or before the onset of the rapid drop-off in pine pollen, which is evidenced by comparing the pebble curve in BBH10 and BBH11 (see Figure 4.24) with the pollen curves in Figure 4.25. The fact that the pebble counts seem to rise in the profile as the elevation drops may account for the discrepancy of the two Savannah River points, which were recovered from the farthest downslope part of the 2002 trench. The variable of bioturbation influenced down-drift of large artifacts complicates the equation and may contribute to any discrepancies.

Essentially, the pine pollen and >1/4-inch (>6.3 cm.) pebble graphs from the west side of Blueberry Hill have similar patterns. However, as a precise dating tool for the strata, much more work needs to be done. The pebble curves were likely produced by variations in the frequencies of flood events over time, which appear to have a general correlation with the presence of arboreal pine pollen but the precise relationship is unclear. It is intriguing and possibly significant that the activity surface and Cactus Hill-like point neatly fit the pre-Younger-Dryas pollen curve.

However, the precipitation and potential flood pattern does conform roughly to the character of the pebble quantities. One of the problems is dating the particular levels. Another is that there might be no direct correlation between the pollen and pebble data. That the curve shapes are clearly similar and their dates are roughly similar is all that can be stated at this time.

Chapter 5 - Summary, Conclusions and Implications

5.1: Summary

The model (Chapter 2) is a working hypothesis and this thesis is the first step in testing it. The Chub Sandhill (Chapter 3) and Blueberry Hill (Chapter 4) tests are evaluated, using multiple lines of evidence. Both the simplest explanations for each line and alternative explanations as appropriate are presented and discussed. Hopefully, through this method a relatively unbiased evaluation can be produced.

The fact that the Cactus Hill site contains evidence of probably stratified pre-Clovis age occupations (Johnson 1997; McAvoy and McAvoy 1997) gives it its special importance. That is also the reason why the ability to replicate the Cactus Hill context on other landforms is particularly significant.

5.1.1: Cactus Hill

Chapter 2 laid out ten lines of evidence supporting the Paleoamerican and Pre-Clovis ages of Cactus Hill, which forms the basis for the proposed predictive power of this research. Those lines of evidence, when assuming the simplest explanations, supported a Paleoamerican occupation. They include:

5.1.1.a: Geomorphology

All of the studies of the site concluded that its soil matrix was eolian and therefore accretional, rather than alluvial and episodic. Wagner and McAvoy (2004: 314) further concluded that the site had not been disturbed by post-depositional pedoturbational processes.

However, based on rough particle size analysis of the Blueberry Hill site (see Figures 4.24 and Appendix IV), which is on the same sand ridge 1,000 feet (30.5 meters) to the east, the site appears to have been subject to a pattern of flooding that is consistent with post-33,000 years ago climate models (Markewich et al. 2011; Pavich, personal communication 2012). It is not fully clear how severe the flood events were that deposited the numerous very coarse sand clasts (>1/4-inch) (>6.3 cm.), but it is likely that they were deposited by water transport. For example, if the deposition were due to ice rafting (Michael B. Collins 2011: personal communication) there is little likelihood that major scouring accompanied the flooding. The relatively low number and consistent nature of the depositional patterns suggest that the process was not severe or episodic. Leigh's suggestion that he Late Glacial and Early Holocene may have had pronounced flood seasons is supported by the Blueberry Hill pebble data.

5.1.1.b: Bioturbation

Bioturbation appears to be a far more critical and influential variable. MacPhail and McAvoy (2008: 692), although acknowledging the presence of "small-scale biological working," concluded that "the site appears intact with minor disturbances affecting the long-term integrity of the stratigraphy."

The author both agrees and disagrees with that assessment. The amount of impact on the archaeological integrity appears to vary between severe and relatively minor. The author has observed in detail the processes by which insects have moved soil from within the site to the surface. This is not a problem confined to sites in sandy soils but is present on most sites in Eastern North America. If this impact were fatal to Cactus Hill then it would be fatal to all others. However, its impact still must be accounted for.

It appears that this constant reworking of the soil provides a process by which artifacts percolate through the profile. With Tarboro soil the amount of disturbance appears to depend in part on the clay content of the soil. The soil on Rubis-Pearsall was low in clay and also appears to have been heavily impacted by hickory tap roots. Figure 3.16 shows an extreme example of artifact percolation in RP2. However, the Clovis age component in RP7 contained a distinct cross-mend between a jasper flake and core (see Figure 3.23) in a level containing a fluted point and adz in isolated context. This indicates that even in the poorest soil conditions sites in Tarboro soil can have pockets of relatively undisturbed soil.

Cactus Hill, which was far more stable, seemed to have far less disturbance, as can be seen in the consistent temporally diagnostic point relationships throughout the profile. Intact stone features and cross-mends between artifacts within levels are also prevalent. Fiedel's (2012) critique would apply to any site if anomalous diagnostics were taken out of context. Watlington and Koestline also had relatively consistent stratigraphic relationships between points except in Block B of Watlington (see Figure 3.11). The problem appears to be most prevalent with items <1/4-inch (>6.3 cm.) in size.

There is also some evidence of slow relative down drift of larger items as ants and other insects move the finer sand grains from under them and redeposit the grains on the surface. No study was done on the depth of the various burrows on Cactus Hill or the other sites investigated, which clearly varied by species (ants, wasps, worms, and toads) and soil resistance. To do so would have required the measurements to be taken from the original surface, which was constantly being removed by the excavation. It is therefore possible that the impact would have been confined to specific depth ranges that may have impacted the upper few feet (meter or less) of the profile with the cumulative impact being more toward the top. In other words, the deeper levels may have been less disturbed by bioturbation, depending on the chronology of the deposition above.

The fact that the Clovis age (see Figure 3.22) and Early Archaic Palmer-like (see Figure 3.24a) points from Rubis-Pearsall, which date to 13,000 and 11,000 years ago respectively, were in soil that dated to 18,900±2.4 ka and 20,500±2.6 ka respectively, strongly suggests that even the larger artifacts can drift down through the profile and end up in older soil. However, it appears from these and many other examples (documented throughout this thesis) that the larger items, including larger charcoal, migrate together, while maintaining their relative *in situ* relationships.

The problem seems to have had an influence on OSL samples as would be expected, especially if samples included small, single grains that have been moved.

5.1.1.c: Stratigraphic consistency of diagnostic artifacts

This consistency was present on every part of the Cactus Hill excavation (McAvoy and McAvoy 1997: Figure 6.1; Johnson 1997: Figures 7, 10 and 12). With the exception of Rubis-Pearsall, similar stratigraphic integrity was present on every other site tested in the Nottoway.

When evaluating the pre-Clovis age integrity of Cactus Hill, this is the most compelling argument against criticism of its pre-Clovis age component on the grounds of disturbance. If the three curated points, (see Figures 2.4 and 2.6c), which are not preforms as proposed by Fiedel (2012), which were recovered from below definite Clovis age levels were the result of disturbance then where is the donor level for those points? It is inconceivable that either point style would not have been recovered from among the more than 200 points recovered in context from above Clovis aged points, if that is where they originated.

It is clear that small artifact mixing due to bioturbation is a major problem and that the largest items have down drifted to some extent relative to natural stratigraphy. However, the impact on larger items is only relative to their external context, not their horizontal and vertical positions relative to each other. The amount of displacement relative to the entire stratigraphic column is not known but is a study worthy of future research in Tarboro loamy sand and other soils.

5.1.1.d: Cultural integrity

This line of evidence refers to the presence of numerous fire cracked rock, artifact features, cross-mends and stratigraphically isolated activity surfaces mapped and photographed in various levels in Cactus Hill. This high level cultural/feature integrity was also present on all other sites tested for this model.

The same stratigraphic analysis applies to features as to chronologically diagnostic points. The cultural integrity at Cactus Hill is consistent with other stratified sites that are routinely accepted by the archaeological community. Contrary to Fiedel (2012) a higher standard should not apply merely because the implications are greater. The data stand or fall on their merits no matter what the implications might be.

5.1.1.e: Raw material differences

McAvoy et al. (2000:3-4) noted a distinct pattern difference in raw stone between the Clovis age and pre-Clovis age artifacts from Areas A/B and B. The preponderance of chert in the Clovis age levels and the presence of gray and greenish metavolcanic stone in the pre-Clovis age levels and their absence in the Clovis age occupation levels, were noted. This is also the case with Blueberry Hill, where most of the meta-volcanic debitage was first encountered at the level of the large activity surface, 30-36 inches (76.2-91.4 cm.) deep. Due to the low number of diagnostic artifacts from both the Clovis age (n=1) and pre-Clovis age levels (n=7) in Area A, no assumptions about raw material were made by the author.

The main problem here is the generally small samples of pre-Early Archaic artifacts from all areas of the site. The material differences do indicate good integrity in those levels. The main difference in the points is that no Clovis aged points are made of gray or green patinated metavolcanic stone. The one high quality black metavolcanic fluted point (in three pieces) indicates that both groups probably exploited stone, either directly (outcrops) or indirectly (cobbles), from the Uwharries metavolcanic sources in North Carolina.

The gray and green patinated metavolcanic stone is common in later Early and Middle Archaic points. The preponderance of Cactus Hill points, observed by the author from the Middle Atlantic Region, were made of green patinated metavolcanic stone. Observed fluted points, made of that material, are rare.

5.1.1.f: Stone tool differences

Tool differences in the early levels were striking. According to McAvoy et al. (2000:5) the Clovis age levels contained the normal array of formal tools associated with that period, including "endscrapers, a graver spur, a limace, a spokeshave, a chisel-graver, and several small fragments of unifacial tools." The pre-Clovis age tools were edge worn flakes and cores.

In Area A the pre-Clovis age material included four similar sized quartzite blade-like flakes, one small quartz core, and two pieces of the same parallel sided point mid-section made of an unidentified metamorphosed quartz-like material (see Figure 2.6c). The cluster of blade-like flakes was unique on Cactus Hill, indicating a feature.

It is possible that these differences reflect functional areas separated by a shorter amount of time than is indicated by other lines of evidence, namely OSL and C-14 dating. However, since the points are not of obvious Clovis age, it is likely that the tools represent a different technology altogether. There is no evidence that Clovis and pre-Clovis age technologies at Cactus Hill are related in either form or manufacture.

5.1.1.g: Radiocarbon dates

The carbon dates from Areas A/B and B are in sequence with the stratigraphy and the artifact changes. It is unlikely that the dated carbon moved up in the profile even if the larger artifacts may have migrated down the profile.

However, the discontinuity between the Clovis age and the Early Archaic Palmer point, and the far older OSL dates from RP7 and RP8, indicate that the larger artifacts may have maintained their relative positions, while moving down due to bioturbation. It is not clear yet how bioturbation impacts larger pieces of charcoal or masses of it left by a hearth. The 8,077±53 cal BP (7,250±40 C-14 BP) date from Feature 2 in trench W3 at Watlington was actually slightly younger than the earliest dates associated with bifurcate points, which were recovered from above and below the feature (see Figure 3.11).

5.1.1.h: Luminescence dates

Feathers (2006:184) concluded that the OSL data from Cactus Hill was "in agreement with the radiocarbon chronology..." That appears to have been supported at nearby Blueberry Hill, although the results from Blueberry Hill may be less reliable, due to multiple grain dating (Rink et al. 2012).

However, the central points of the Rubis-Pearsall OSL dates on the earliest cultural levels were 5-7,000 years earlier than known ages of the diagnostic points. Although it supported the hypothesized pre-Younger-Dryas age of the landform, it did indicate an incongruity between the artifacts and the soil in which they were recovered at that site.

This does raise the question, if the C-14 and OSL dates are in agreement could the corresponding artifact levels be younger than the associated C-14 dates? The Clovis age and other dates that corresponded with the Clovis age and other appropriate aged artifacts from Cactus Hill indicates that the problem encountered with the Rubis-Pearsall OSL dates are probably due to the low clay content of the Rubis-Pearsall soil.

5.1.1.i: Phosphate analysis

Hodges and Baker concluded that the areas of Cactus Hill they tested "did appear to demonstrate discernible anthropogenic modifications of the soil in the form of increased phosphate in the occupation levels (McAvoy et al. 2000: 11)." Other than indicating that the cultural levels were stable and chemically recognizable, the results indicate that bioturbation at Cactus Hill probably is far less than at some other sites.

They did point out that the variation between occupation and sterile levels were not as pronounced as expected. That would support the hypothesis that bioturbation has had an impact, but not so great as to totally disturb the soil matrix.

5.1.1.j: Phytolith analysis

McWeeney's analysis of phytoliths was based on weight, with the higher weights expected to be in the occupation levels, where they were. In that respect her analysis mirrored and, therefore, reinforced the phosphate analysis.

Since the stable clays were the source for both sets of data, both would be subject to similar bioturbation problems, since the clays would be found adhering to sand grains. However, here again the bioturbation problem does not appear to have severely compromised the correspondence between phytolith weights and cultural levels.

In the final analysis, ten lines of evidence, in their simplest explanations, support the integrity of the Clovis and pre-Clovis age occupations at Cactus Hill. More importantly they also support the occupations levels above the Clovis age occupation.

Clearly, there are alternative explanations for many of the simplest explanations. However, the chance that all of the simplest explanations are wrong is far less probable than any one simple explanation being wrong.

5.1.2: Rubis-Pearsall

It is clear from the frequent wall collapses during the process of wall profiling as shown in Figure 3.10 that the Rubis-Pearsall dune had less clay than Cactus Hill (Areas A and B), where there were no similar wall collapses during the nine years of the excavation. The only wall damage at Cactus Hill was due to extreme weather, artifact hunters digging in the walls, and insect burrowing.

Since testing at Chub Sandhill was merely to identify pre-Younger-Dryas age landforms and occupations, it largely relied on artifact recovery. Data associated with the more sophisticated lines of evidence applied to the results from Cactus Hill were not gathered. Therefore, those are not applicable to Rubis-Pearsall.

5.1.2.a: Geomorphology

No micromorphological studies comparable to those done at Cactus Hill were done at the Chub Sandhill Natural Resource Conservation Area. However, a broad geomorphological study was done on the larger landform context.

First of all, the project area soil was classified as Tarboro, which is identical to that at Cactus Hill. Second, the landform consisted of a large point bar as at Cactus Hill. Third, the upstream aspect of the point bar was open to the northwest, like Cactus Hill. This latter line of evidence was critical to replicating the seasonality part of the Cactus Hill model.

The field study involved a 2,800-foot (853 meter) long transect interval sample (TIS) with the transect being placed parallel to the point bar migration axis and auger core samples being dug at 100-foot (30.5 meter) intervals (see Figure 3.3). The TIS identified a clay bank and old channel buried under the third terrace (see Figure 3.4). Subsequent auger transects at the north ends of the three terraces confirmed the presence of buried cultural material in all three terraces.

No similar large transect was sampled at Cactus Hill. There McAvoy and Wagner (2004) spot tested the area around Cactus Hill. By also sampling Area D, they effectively tested a comparable area to the second and third terraces of Chub Sandhill.

The lack of auger sampling across the whole Cactus Hill point bar leaves the possibility, however remote, that pre-Younger-Dryas landforms may be present in the floodplain to the north of Cactus Hill. This was not a problem at Chub Sandhill.

5.1.2.b: Bioturbation

Area A at Cactus Hill was excavated, using excessive rigor. At After 1995, most squares were hand trowel dug in 1/2-inch (12.7 cm.) sub-levels, with all artifacts and “geofacts” being mapped or systematically recovered. Every fourth 5x5-foot (1.52x1.52 meter) square was sifted by sub-level through 1/16-inch (1.6 cm.) window screen with total recovery for lab sorting.

Rubis-Pearsall was excavated in 2-inch (5.1 cm.) levels by flat shovel, and then by trowel in the deeper levels. As a result, insect burrows were not noted. However, the incongruity of the stratigraphic position of the fluted point and associated modified/worn artifacts from RP7, level 14 and Palmer point from RP8, level 10 with the much older OSL dates from those levels indicate faunal bioturbation. In fact that incongruity is a second line of evidence indicating the potential magnitude of that kind of bioturbation. The first line was visual observation of the insect burrows and nests at Cactus Hill.

As can be seen in the inset photo in Figure 3.17 hickory tap roots and tap root molds were a major problem during the excavation at Rubis-Pearsall. This problem was noted at Cactus Hill but was in no way nearly as great compared to what was encountered at Rubis-Pearsall.

If modeled over thousands of years, the tap root problem should have had a significant adverse impact on the pedological and archaeological integrity of Rubis-Pearsall. That problem was largely confirmed by the archaeology. However, the archaeology also demonstrated that with the Clovis age component there were pockets of relatively undisturbed cultural material, especially at the deepest cultural levels.

5.1.2.c: Stratigraphic consistency of diagnostic artifacts

Rubis-Pearsall diagnostic artifacts were consistent within the horizontal plain. The pre-Younger-Dryas artifacts on Rubis-Pearsall were located on top of the buried clay bank only, where they would be expected if the model were supported.

However, in the vertical plane, the artifact mixing was verifiable on the clay bank (see Figure 3.27). Only two mid-Early Archaic, Fort Nottoway point fragments were recovered from west of the clay bank. Although no earlier or later diagnostics were recovered from off the edge of the clay bank that does not mean there are none still there.

Here again, however, Clovis age artifacts in RP7 appear to have survived the vertical artifact mixing, apparently largely intact. The jasper fluted point was associated with a quartzite adz and unifacial jasper core (see Figure 3.21). Most significantly, the last flake struck from the core, both of which cross-mended, was recovered from the next level (see Figure 3.23). This is the strongest indicator that the site does have pockets of relatively undisturbed cultural context.

The light scatter of pottery in near surface contexts; several Fort Nottoway point fragments and probable quartzite reduction areas; and the Morrow Mountain III point and probable hearth indicate that the landform was visited by people after the river appears to have shifted west.

5.1.2.d: Cultural integrity

No relatively undisturbed cultural features were detected in any of the eleven 5x10-foot (1.52x3.05 meter) trenches excavated on Rubis-Pearsall. Some FCR was recovered, especially in RP11 (see Figure 3.28), where there were several cross-mends within and between levels. This further supports the horizontal integrity of the site, while also supporting the presence of vertical mixing present on the site. Cactus Hill had numerous, intact FCR features with cross mends, all above the Early Archaic.

The low quantity of FCR recovered from the site is consistent with the model suggesting that the third terrace was largely abandoned after the hypothesized Younger-Dryas migration of the main channel to the west of the second terrace (see Figures 3.27 and 3.28). The presence of FCR in RP11 is consistent with the recovery of a Middle Archaic, Morrow Mountain I point (see Figure 3.28g) from the same trench.

FCR are rare in Early Archaic or earlier contexts. The presence of pottery near the surface does not appear to have been associated with any FCR.

A single, moderate sized quartzite flake from sample 15 (74-79") (188.0-200.7 cm.) in auger test S150E200 (see Appendix I: Table 3.11a) was not pursued because of its depth and the dangers of wall collapses at those depths. A very small quartz debitage was recovered from sample 27 (133-137") (337.8-348.0 cm.) in auger test S300W250. Although there are several ways these artifacts could have gotten that deep, such as bioturbation and dropping in from the auger core wall, they cannot be written off without verification. This is probably more the case with the larger quartzite flake.

It is important to note that the preliminary auger test on Rubis-Pearsall produced one small quartzite flake from approximately 40 inches (101.6 cm.) below the surface and no other artifacts. That flake from that depth indicated that the site had deeply buried cultural occupations, which were verified by the test excavations. As stated above, with little surface or shallow subsurface indications of a site on Rubis-Pearsall, this auger test graphically demonstrates the economy and efficiency of this method in locating deeply buried archaeological levels.

The Fort Nottoway use appears to have been fairly intensive and involved at least mid- to late stage biface reduction, i.e. a quartzite lithic workshop. Although not specifically relevant to the model testing, several probable Fort Nottoway overshot flake terminations were recovered. They indicate that within the Fort Nottoway biface reduction technology either the knappers were intentionally using the technique in their thinning process or it was an accidental bi-product of thinning extra large quartzite bifaces. Further research into this would have particular relevance to Stanford and Bradley's (2012) hypothesized connection of Solutrean to Clovis age intentional use of overshot thinning.

5.1.2.e: Raw material differences

Only minor raw material differences were detected in the vertical and horizontal plains. The distinct tan chert concentration identified in RP2 was an anomaly. The fact that it extended from level 12 through level 24 (29-55") (73.7-139.7 cm.) is the most striking evidence of vertical disturbance on the site.

5.1.2.f: Stone tool differences

Within the Clovis age cluster of artifacts in RP7, three of the recognized artifacts were made of jasper. The fluted point was made of high quality light brown jasper. The core and mended flake were made of a coarser, mottled light brown to tan jasper. Similar looking mottled jasper artifacts, including a blade-like flake, were recovered by the author from below well-established Middle Archaic levels at Cactus Hill. The adz was made of quartzite similar to that from the Nottoway River cobbles.

5.1.2.g: Radiocarbon dates

Although scattered charcoal was recovered and mapped in the deeper levels, the high degree of disturbance in the site made its context questionable. No radiocarbon analysis was done. However, all the mapped and sifted charcoal from the site was retained.

Theoretically, many of the screened and piece-plotted pieces of charcoal, particularly from the more rigorously excavated contexts at Cactus Hill and Blueberry Hill, can be species identified. If sufficient numbers can be so identified and show stratigraphically correlated associations by species, the resulting analysis could produce a horizontally checkable vertical record of change in tree species throughout the profiles, and therefore a paleo-arboreal succession for the site vicinity. One could use an environmentally focused analysis to cull out disturbed charcoal, focusing on dating only the positively identified arboreal changes. If those changes could be identified and dated then the archaeological sequence could be compared to that sequence. In other words, let the paleo-environmental reconstruction serve the primary technique to drive carbon dating, thereby serving as an as a separate, independent line of evidence for the archaeology. This analysis is still planned for the Cactus Hill data.

5.1.2.h: Luminescence dates

Pavich ran two multiple grain OSL dates on the levels from which the fluted point and Palmer point were recovered. Since the walls had collapsed in RP7, the samples were recovered from a remnant intact wall in RP8, where the Palmer point was recovered. The dates were recovered in support of the USGS research project on Pleistocene climate in the Middle Atlantic.

The dates, 20,500±2,600 (Palmer level) and 18,900±2,400 (Clovis age level) overlap within the first sigma but are inconsistent with the recognized ages of the associated diagnostic artifacts. The age difference for early Palmer points and the mean age OSL date is 9,000 years. The difference for the fluted point, using 13,000 years ago for the point, is almost 5,900 years. This is consistent with what would be expected from multiple grain OSL dating in sandy soils (Rink et al. 2012).

However, the soil dates were not a problem for testing the model. Actually, they support the model, which hypothesizes that the clay bank protected older soils from being scoured by post-Younger-Dryas onset flooding. The OSL dates indicate that the soil is old enough not only for Clovis age occupations, which was verified archaeologically, but also for pre-Clovis aged occupations, which are still possible on Rubis-Pearsall.

A critique is in order. It would have been desirable to have conducted a comparable OSL analysis on the Watlington and Koestline sites as well. The OSL dates on Rubis-Pearsall do not demonstrate that the soils on Watlington and Koestline are not Post-Younger-Dryas in age. That is only inferred from the geological and archaeological data.

5.1.2.i: Phosphate analysis

No soil samples were retained and no phosphate analysis was attempted. The site is not threatened and is accessible in the future. Such analysis would be appropriate if the site were subjected to further systematic excavation rather than testing as was done here.

5.1.2.j: Phytolith analysis

Again, no soil samples were recovered but the site is available for further excavation and analysis.

5.1.3: Blueberry Hill

Blueberry Hill is located approximately 1,000 feet (305 meters) east and downstream from Cactus Hill on the same elongated sand ridge (see Figure 4.1). It was first tested in 2002 and thought then to contain one and possibly two buried Paleoamerican components. Several large and medium sized artifacts were found at a deep level separated from the other large artifacts by approximately 10 inches (25.4 cm.). As a result, it was thought to also be relatively undisturbed.

Subsequently, in 2009, Wagner (personal communication) expressed concerns about the age of the landform and, therefore, the possibility that it could date to Paleoamerican times. In order to resolve his concerns, the site was systematically retested in 2010.

The testing first involved auger sampling on a 20-foot (6.1 meter) grid over the approximate area of the 2002 test. This was done to relocate the potential activity surface found in 2002. Once that was done, the site was subjected to six additional 5x10-foot (1.52x3.05 meter) trenches sub-divided into 5x5-foot (1.52x1.52 meter) squares. To increase the quality of data recovery, all soil was sifted through 1/8-inch (3.2 mm.) mesh and levels were refined to arbitrary two and one-inch (2.5 cm.) levels rather than the four and two-inch (10.2 and 2.5 cm.) levels dug in 2002.

5.1.3.a: Geomorphology

Both of Wagner's problems with the site related to its landform and geology. First, he contended that, according to McAvoy, the site elevation was not as high as that of Cactus Hill and therefore not as old (Wagner, personal communication 2009). Second, he also stated that his auger testing in the area produced no lamellae, which were significant on Cactus Hill and supported the older age of the landform.

With respect to the first potential problem, we selected the Blueberry Hill landform in 2002, because the USGS 7.5 minute series, Sussex, Va. topographic map of the Cactus Hill area showed the Blueberry Hill landform being five feet (1.52 meters) higher than

Cactus Hill (see Figure 2.1). It was one of the main variables we discovered from our testing at the Barr site and applied to Chub Sandhill and Blueberry Hill.

In 2002, Waters and the author conducted an auger transect across the north side of the landform and detected a buried clay bank, similar to that at Cactus Hill (see Figures 4.4 and 4.5). The buried clay bank was re-located and better defined in 2010 (see Figure 4.13). As a result, the site possesses the main buried paleosol feature present on Cactus Hill and which formed the main geological feature of the model.

Wagner's second potential problem was the apparent lack of lamellae. It is fully understandable how he would have had trouble finding lamellae on the Blueberry Hill landform. In our auger sampling and test excavations we located no lamellae either. It was only in BBH6 that we encountered strong lamellae (see Figure 4.20). We did observe ephemeral lamellae in several of the other test trench wall profiles but those were undetectable in adjacent bucket auger cores.

However, the presence of lamellae would not in and of itself mean that the landform is old enough. In a saturated environment lamellae have been produced in controlled conditions over 16 days (Bond 1986). The author hypothesized that the lamellae on Cactus Hill were the result of a periodic, elevated (perched) water table. Hypothetically, during major floods, like observed following Hurricane Floyd, the lower levels containing lamellae would remain saturated for more than two weeks. Over thousands of years and many Floyd-like flood events, strong lamellae could have easily formed in the permeable sand and ideal iron rich clays of Cactus Hill. This is one of several ways lamellae seem to form (Rawling 2000).

The perched water table model for producing lamellae is based on saturation as the mechanism for producing the lamellae. Bond's (1986) experiment demonstrates the viability of this model. It would seem logical that at higher elevations above a riverine water source, lamellae would take longer to form and that strong lamellae would have formed over very long periods of time, depending on climatic precipitation rates and the availability of iron rich clay particles. The strong lamellae on Blueberry Hill (see Figure 4.20), like those at Cactus Hill, suggest the Blueberry Hill sand ridge is as old.

The hurricane Floyd flood water flowing through the flood chute adjacent to the Cactus Hill and the Blueberry Hill landforms, indicated that possibly the chute was an old channel. It probably existed before the Younger-Dryas. During the Younger-Dryas onset, the river probably scoured the entire floodplain up to the buried clay bank. A buried channel similar to the one in front of both Cactus Hill and RP also was detected off the clay bank on Blueberry Hill.

An additional line of evidence not evaluated at Cactus Hill but used to help explain the river channel shifts at Chub Sandhill relates to the stratigraphic patterns of pebbles (sand clasts >1/4-inch) (>1/4 cm.). These are graphically shown for Blueberry Hill in Figures 4.22 and Appendix IV). They show a distinct pattern that is almost identical to the patterns on regional pine pollen graphs (see Figure 4.25). Based on the chronologies associated with many of the pollen graphs, it is likely that the deeper peaks in pebbles date to mostly before the Younger-Dryas onset, but may include it.

If the larger clasts were being lifted by flood waters then a possible problem arises. The main fluvial periods were before the Bolling Alerod, i.e. Clovis age climate and after the Younger-Dryas onset. The major low point for both the pine pollen and pebble graphs appear to coincide with the warm, dry period following the end of the Younger-Dryas and "8,200 cal BP cold event."

However, it is not clear what the seasons or mechanisms may have been that lifted the pebbles high enough to be deposited on the adjacent dunes. Collins (personal communication 2009) suggested that ice rafting would have been a way to lift the larger clasts onto vegetated banks without scouring away the smaller clasts. If this were the mechanism, then the pebble bar chart patterns may have been as much a result of seasonal temperature as precipitation.

If so then the pebble patterns could support the hypothesized pre-Clovis age activity surface in the dune. However, the gradual sinking of larger artifacts also may have transported those on the deep activity surface into older strata. As a result, the pebble patterns appear to help with the pre-Younger-Dryas age of the landform but are not definitive with respect to the artifact pattern.

This is a whole different area of potential research. It is beyond the scope of this thesis.

5.1.3.b: Bioturbation

As with Chub Sandhill, Blueberry Hill was excavated with flat shovels used as large bladed trowels. Therefore, other than toads and the tops of ant nests, the actual level of bioturbation on the site was not estimated. The hickory tap root problem was not as severe as it was at Rubis-Pearsall but worse than at Cactus Hill.

That is probably why the buried activity surface was relatively intact. However, small pieces of tin can and one small lead shot did migrate, apparently from the plough zone, into sub-plough zone levels: as deep as 28 inches (71.1 cm.) with the metal and 32 inches 81.3 cm.) for the lead shot.

The larger artifacts, especially in the deepest cultural levels appear to not have been seriously impacted.

5.1.3.c: Stratigraphic consistency of diagnostic artifacts

Pottery was relatively common in the plough zone, along with historic artifacts of various ages. Savannah River points were relatively common immediately below the plough zone. Interestingly the only area in which they appeared in deeper levels was to the north on the edge of the clay bank (see Figure 4.9). Hypothetically, they were deposited on the bank and were covered by later sedimentary/eolian deposition.

The fluted point (see Figure 4.12b) from BBH10 possesses numerous attributes of Clovis age points and few of any other type. However, it was recovered in the lab from a screen sort of BBH10 material. Although it is probably of Clovis age, it is also less likely that it was some form of late stage failure from another time period, such as Savannah River. Its stratigraphic context in level 3 (14-18") (35.6-45.7 cm.) is consistent with the Savanna River occupation but a large disturbance in the center of BBH10 coupled with the lack of horizontal context means the original vertical and horizontal contexts are questionable. Additionally, the upslope-most of the four Savannah River points is almost 10 feet (3.05 meters) downslope from BBH10 (see Figure 4.10), which indicates that the fluted point base (see Figure 4.12b) may not be horizontally associated.

It was recovered from the 14-18-inch (35.6-45.7 cm.) deep level. The OSL sample from 20 inches (50.8 cm.) deep but 100 feet (30.5 meters) to the west at the same elevation produced a 13.0±1.8 ka BP date, which was the highest quality date from among the cubic and linear fit dates (see Table 4.20).

The other point base (see Figure 4.12f), recovered from Blueberry Hill was mapped *in situ* at the north end of BBH10. It was from outside the disturbed area and in the same basic level as the activity surface discussed below (see Figure 4.10). It is a lanceolate that resembles the Cactus Hill point technology present on Cactus Hill (see Figure 2.4) and from probable Paleoamerican contexts at 44PY152 below Smith Mountain Watergap in southwest central Virginia (see section 5.3).

Due to the slight crushing of the center of the base and its width, it was initially thought to possibly be a late stage fluted point preform. However, it is quite thin; it has a finished edge; it has expanding sides, it is relatively short, and there is no evidence of striking nipple preparation/isolation for a flute. It is likely that the base damage may have been the result of bipolar impact damage, jamming the point into the haft.

However, it is still possible that it could be a preform for a later Hardaway side notched point. One was recovered in good context in Area A at Cactus Hill, although that point and other Hardaway points have concave bases and are smaller (Johnson 1997: Figure 8).

Unlike the Cactus Hill points from Cactus Hill, this point shows no evidence of reworking. Whereas Fiedel's (2012) contention that the pre-Clovis age points from Cactus Hill could be preforms like Hardaway Blades is not valid, based on the two dimensional photographs in Coe (1964:65) it could be valid with the Cactus Hill-like point from Blueberry Hill. However, it is equally likely that Hardaway blades are pre- rather than post-Clovis in age.

The highest quality OSL dates from the two cores recovered from 30-inches (76.2 cm.) deep in BBH6A were 15.8$\pm$1.7 ka BP and 11.9$\pm$1.8 ka BP (see Table 4.20). These dates, which again were from the same surface elevation and landform but 100 feet (30.5 meters) to the east, were from above the level of the lanceolate point (see Figure 4.12f). The dates are from approximately the same level as the large artifacts on the activity surface in BBH2 and BBH3A, which are higher than the point, mapped at between 30 and 32 inches (76.2 and 81.3 cm.) deep.

However, the OSL dates (see Table 4.20) below 20 inches (50.8 cm.) deep appear to have all been subjected to bioturbation, most likely by ants, and are therefore suspect. Their stratigraphic context merely supports the older age for the point but does not resolve the point typology question.

One quartzite point midsection was recovered from level 5 (13-15") (33.0-38.1 cm.) in BBH7. It could be a Savannah River point fragment but its straight sides and finely trimmed edges could be from an earlier Middle or Early Archaic time period.

The low number of diagnostic points is likely a function of post-Younger-Dryas abandonment of the site as a major encampment. This probably was due to the river shifting course to its current north-south channel adjacent to the west side of Cactus Hill (see Figure 4.1). This would make the site similar to Rubis-Pearsall in that respect.

5.1.3.d: Cultural integrity

The consistent recovery of Savannah River points and FCR from under the plough zone indicates the site was used during the Late Archaic. The mapping of larger artifacts drops off dramatically below 15-18 inches (38.1-45.7 cm.) above the area of the deep activity surface. The top of that surface begins at approximately 30 inches (76.2 cm.) deep. This is highly significant in that it shows a 12-15 inch (30.5-38.1 cm.) gap between the Savannah River occupation and the deepest activity surface.

Site integrity is Blueberry Hill's strongest suit. The site was first identified in 2002 as having a potential early component in part by the presence of a distinct activity surface in BBH11, extending into BBH10, where the lanceolate point (see Figure 4.12f) was mapped. That floor was confirmed in 2010 in the adjacent test trenches (see Figure 4.23).

Horizontally, the deep activity surface appears to be isolated. Figure 4.23 indicates that it may be centered on BBH3A and extends approximately 10 feet (3.05 meters) to the east and northeast. This means that significant parts of this activity surface are still available for detailed research.

5.1.3.e: Raw material differences

This is one of the major problems with assigning a possible Clovis age occupation to this site merely based on the fluted point base. The site is noticeably low in chert artifact quantities, which are common in the Clovis aged levels at Cactus Hill.

Most of the artifacts are made of quartzite, secondarily of quartz and next of metavolcanic stone. The metavolcanic stone debitage in the area of the deep activity surface and to its north in BBH4 seems to begin and cluster in the deepest cultural levels. That would indicate a possible association, which would fit with the elevated presence of metavolcanic debitage in the pre-Clovis age component at Cactus Hill.

5.1.3.f: Stone tool differences

This site offers an unusual array of modified/worn stone artifacts, particularly on the deep activity surface (see Figure 4.23). In BBH1, which was an unknown distance east of the activity surface, the modified/worn artifacts include a high percentage of formal tools. These include a boldly end thinned quartzite early stage biface (see Figure 4.6e) and an edge worn quartzite flake (see Figure 4.6f) from level 6 (26-30") (66.0-76.2 cm.). These were the only tools from that test trench, which was some distance east of BBH11, and may actually represent a totally different occupation area. The bold end thinning is fully consistent with Clovis age technology, which could account for its location away from the probably earlier activity surface. Its correlation with the poorly provenienced fluted point base in BBH10 is not known. Both are vertically above the deep activity surface, which could be significant.

BBH11 produced a broken quartzite unifacial side scraper (see Figure 4.9b); heavily edge polished possibly backed sidescraper-like artifact of quartzite (Figure 4.9c); distal end of a large quartzite prismatic blade-like flake (Figure 4.9d); a large heavily striated sandstone abrader (4.7e), and a large metavolcanic broken bifacial core-like artifact with a burin spall struck along one edge (Figure 4.9g).

BBH2 produced thirteen mapped artifacts from below 30 inches (76.2 cm.). These included several larger flakes and debitage, two blade-like flakes; one fragment of a unifacial quartzite denticulate from the 37-38 inch (94.0-96.5 cm.) depth, and two pieces of the same quartzite biface (see Figure 4.15b and 4.15c), which were resting almost directly on top of each other. However, with the presence of a very small lead shot from level 11 (29-3) it is not clear how good the contextual integrity of the smaller artifacts might be.

Next to BBH11, BBH3 was the most productive trench in the excavation. BBH3A produced a very large pitted and impact flaked quartzite cobble (see Figure 4.16f and Figure 4.17) which bottomed out at the 32 inch (81.3 cm.) depth. BBH3B produced a quartzite hammerstone/abrader-like artifact (see Figure 4.18d) and two very large unifacially worked, split cobble chopper/abrader-like artifacts (see Figure 4.19), one of quartzite and the other of a decomposed quartzite or sandstone. The probable hammerstone was from level14A (34-35") (86.4-88.9 cm.) and the two split cobble choppers were resting on the bottom of level 14B (35-36") (88.9-91.4 cm.).

BBH5, which was between BBH3 and BBH10/11, produced a thermally altered quartzite hammerstone from level 11A (27-28") (68.6-71.1 cm.) along with several mapped flakes from the same level. These artifacts were on a level approximately six inches (15.2 cm.) above the deep activity surface and therefore may represent a separate, later occupation.

BBH4 and BBH7 are noteworthy because they produced no mapped artifacts from the comparably deeper levels. This suggests that they were located outside the activity surface area, which helps to define its eastern boundary.

Other than the fluted point base, no formal Clovis age artifacts, such as endscrapers, spurs, limaces, wedges, chisel gravers, or spokeshaves (concave scrapers) were recovered. The fluted biface from BBH10, and distal end of a blade-like flake and broken sidescraper from BBH11 are the only artifacts similar to the Clovis age formal technology.

No other area on Cactus Hill, Barr, Chub Sandhill or Blueberry Hill produced such a large tool concentration. The large sandstone abrader and two split cobble choppers are unique in any of the excavations covered by this thesis and recovered from Area A at Cactus Hill.

Based on unique modified/worn artifacts and the Cactus Hill-like point, it is very possible that the artifact concentration located between 30 and 36 inches (76.2 and 91.4 cm.) deep is of pre-Clovis age. It is also possible that the area excavated did not have a Clovis Age occupation, despite the fluted point.

The fact that the stone tool technology is not sophisticated or complicated like Clovis age technologies should not be a delimiting factor at this stage of our understanding of pre-

Clovis age artifact. They do not have to look like "what we think they should look like," basically because we have nothing contemporary with which to compare them. The author and others made that probable mistake by assigning surface recovered Cactus Hill-like ("Appomattox") points to a "Mid-Paleo" time period, because they were obviously (sic) a technological degeneration (sic) from Clovis age points.

Finally, a small, white, imported, crinoid bead (see Figure 4.21) was recovered from BBH7A, level 14A (31-32") (78.7-81.3 cm.). Because the bead is so small, it falls within the range of other artifacts, demonstrated to have migrated down through the profile elsewhere on the site and in the same square (see Appendix III: Table 4.19). Its recovery from lab sorting of screen residue from 1/8-inch (3.2 mm.) mesh screen indicates that future excavations on this and other potentially early sites in the Nottoway be comparably sifted.

5.1.3.g: Radiocarbon dates

Although charcoal samples were recovered and retained, the potential for down drift due to bioturbation and the discovery of no clearly cultural features made context for any of it problematic. No charcoal samples were dated.

5.1.3.h: Luminescence dates

Analysis of the six OSL samples from BBH6A (see Table 4.18) clearly show that the initial Blueberry Hill dune dates to between 13,000 and 25,000 years ago and possibly as early as Heinrich Event 3, which dates to approximately 30-33,000 years ago (Markewich et al. 2011: 5-6; Pavich, personal communication 2012). The multiply consistent dates demonstrate that the Blueberry Hill sand ridge, like Cactus Hill, was available to pre-Younger-Dryas human populations.

Since the analyses were run on multiple grain samples, they are likely stratigraphically older than any associated archaeology (Rink et al. 2012). The fact that broad inconsistencies occur between dates within the same depths strongly suggests mixing.

The stratigraphic sequence of the highest quality dates is merely a tantalizing coincidence without data from additional lines of evidence.

Furthermore, since the dates were recovered from more than 100 feet (30.5 meters) east of the deep activity surface in BBH3, 5, 10 and 11, caution should be used in directly applying them to the cultural stratigraphy. Any future excavations in that area should include additional OSL samples and analysis, including from areas hypothesized as being post-Younger-Dryas in age.

5.1/3.i: Phosphate analysis

No samples were recovered.

5.1.3.j: Phytolith analysis

No samples were recovered.

5.2: Conclusions

5.2.1: Methodological

Cactus Hill taught the author a fundamental fact. As a professional government archeologist for 15 years, before beginning work at Cactus Hill, the author was made well aware of the damage government mandated archaeology has done to the nation's archaeological record.

Traditional government archaeological discovery (survey) methods, as practiced in the United States, involving widely spaced, shallow shovel test pit samples and 1/4-inch (6.3 mm.) screens, are totally inadequate to detect ephemeral, deeply buried Paleoamerican sites. All too often, critical decisions about site significance, if sites are even discovered, are based on minimal survey data. As a result, government archaeology methods produce massive numbers of false negatives that distort the archaeological record, especially with respect to ephemeral sites. For example, two of the most significant site types, prehistoric Paleoamerican sites and historic slave sites, are so ephemeral that they are almost never discovered.

These methods are usually determined by guideline, containing minimum sampling thresholds of what is considered adequate to "get the boxes checked." One might call it "cook book archaeology." Although higher quality methods are authorized if situations warrant, the contract bidding process invariably drives the methods to the minimum methodological denominator.

The methods called for at Cactus Hill and the other sites involved in this research were in stark contrast to those generally employed in government archaeology. When dealing with ephemeral sites of both national and international significance, it is imperative that the methods fit the site, not the other way around.

In 1996, when the author decided to return to Block A, at Cactus Hill, to explore below the probable Clovis age level that he had excavated in 1993, he called Dennis Stanford at the Smithsonian. The author pointed out that what he might find could be highly controversial, so he asked if Stanford had any suggestions. Stanford (Personal communication 1996) said only, "map everything."

Fortunately, in the late 1970s the author had volunteered at the Thunderbird Paleoamerican site in Virginia (Gardner 1994), and did his masters field school at the Shawnee Minisink site in eastern Pennsylvania (McNett 1985). At both sites, Stanford's mantra was used to the fullest. Doing so was neither new nor foreign.

Several major methodological lessons stand out from this research. They include:

1. It this imperative to thoroughly recovery geological as well as archaeological field data. The recovery of the pebbles led to the pebble bar charts shown in Figure 4.24.

2. No potential data were left in the field. All dry, field screen residues were returned to the lab for washing and sorting under lab conditions, not thrown away. This was designed to not merely improve artifact quantities but, more importantly, to improve the quality/comparability of the data from test/excavation unit to test/excavation unit. The potential biases introduced under varying field conditions and through crew member differences, was dramatically reduced. The discovery of the crinoid bead from BBH7 (see Figure 4.21) in the lab is the most striking example.

3. It would have been almost impossible to discover the buried Paleoamerican components at either Rubis-Pearsall or Blueberry Hill without the use of systematic, tight interval auger testing, involving fine screening of core samples. The auger testing also made it possible to detect the buried clay banks and direct the test excavations to the targeted buried cultural areas. The Clovis age artifacts from RP7 were discovered with the first test trench on the clay bank after six relatively unproductive trenches off the clay bank. The buried activity surface on Blueberry Hill was immediately relocated after eight years, involving extensive ground surface alteration. In fact, the second trench in 2010 hit the buried activity surface discovered in 2002 and the fourth test trench (BBH5) came down on the lost 2002 test trench.

4. The model's testing strategy was built on reconstructing the geomorphology of the floodplains before any archaeology was done. This was an improvement over the method used with the Barr site. Of course, geomorphological reconstruction helped direct the archaeological testing toward the prime locations for early sites. An added benefit was that it helped form the context for (explain) how changes in the river channels influence abandonment of older landforms with both Rubis-Pearsall and Blueberry Hill. Without this knowledge it is likely that the older landforms would never have been tested. Unlike Cactus Hill, the upper levels of Rubis-Pearsall and Blueberry Hill are largely devoid of significant archeological material and features, probably due to the sites having been largely abandoned by people after the "8,200 BP cold event." Knowing that the landforms might have been prime habitation sites, when the river was adjacent to them, was critical.

There were methods that could have been useful but were not employed. Much of this research was done with no budget. As a result, most of the scientific work was haphazard. Fortunately, other professionals saw the potential benefit of this research design and contributed critical assistance. Of particular note are Dave Thulman, who was instrumental in topographically mapping Blueberry Hill and arranging the evaluation of the crinoid bead and the OSL dates on Blueberry Hill. Milan Pavich and his United States Geological Survey team provided the two OSL dates and soil analysis for the Paleoamerican component at Rubis-Pearsall. Marshall Payn of the Epigraphic society donated $2,500.00 for scientific research, which helped pay for the six OSL dates from Blueberry Hill. The author regrets the fact that even more could probably have been done to add to the data recovered.

5.2.2: Research

Multiple lines of evidence strongly support a Clovis and pre-Clovis age presence in good stratigraphic context on Cactus Hill. For argument sake, since Cactus Hill is only one site it must be replicated if it is to stand up over time. Failing to stand up would mean it is possibly "an accident." In other words, the weaker alternative hypotheses, offered as contradictory evidence (Fiedel 2012), would gain strength.

Using a geological and archaeological model derived from Cactus Hill, this research design was able to predict and verify a Clovis age occupation on Rubis-Pearsall. Also, optically stimulated luminescence (OSL) dates on the soil from Rubis-Pearsall demonstrate that the Rubis-Pearsall landform is probably more than 20,000 years old and therefore old enough to have been available to pre-Clovis age people.

Using the same model, the results of the analysis on six OSL samples demonstrated that the Blueberry Hill landform is also old enough to have been occupied during both Clovis and pre-Clovis times. The intriguing, well documented, deep artifact area in Blueberry Hill, which is more than 10 inches (25.4 cm.) below a fluted point base, is a strong candidate for a pre-Clovis age occupation. The questionable context for the fluted point base and the debatable typology of the un-fluted lanceolate point leave the deep activity surface context in question. More work on the site is necessary to firmly support or reject the hypothesized pre-Clovis age.

The landform aspects of these sites also support a hypothesized settlement pattern related to the sites. With each site having a north aspect, it is clear that they were primarily occupied during warmer months (late Spring, Summer and/or early Fall). This is by far not the whole picture but it is at least a very good start in understanding detailed pre-Younger-Dryas cultural settlement patterns in the Nottoway and possibly other surviving Coastal Plain watersheds in the Middle Atlantic and Southeastern United States. In that respect it is an appropriate addition to McAvoy's (1992) preliminary analysis of Clovis age settlement patterns in the Inner Coastal Plain of the Nottoway River Valley.

Additionally, it is critical to understand that current river courses do not reflect previous river courses, even as recently as 8,000 years ago, which was corroborated at both Chub Sandhill and Blueberry Hill. Non-quarry related Paleoamerican sites are generally ephemeral enough without allowing current site distributions to delete temporally significant landforms. This becomes an even greater problem when the ephemeral Paleoamerican sites are deeply buried in those deleted (and subsequently abandoned) landforms.

An apparent stratigraphic pattern was detected in the three sites. In each site the hypothesized Paleoamerican occupation levels were between 30 and 36 inches (76.2 and 91.4 cm.) deep. In Rubis-Pearsall even deeper cultural levels are possible. The Paleoamerican strata may be tied to a broader climatic pattern manifested in the geomorphology of the dunes. A probable climatic pattern shown in regional pollen graphs was mirrored in the quantitative analysis of larger (>1/4-inch) (>6.3 mm.) sand grains from the trenches on Blueberry Hill.

This research design has produced a working model for predicting stratified, deeply buried, pre-Younger-Dryas (Clovis and pre-Clovis aged occupations) in the Nottoway River Valley of Virginia and possibly elsewhere.

5.3: Implications

With that conclusion the question remains: what next? How can the results of this thesis be expanded? Current plans are to attempt not only replication of the Cactus Hill pre-Clovis age occupation outside the Nottoway Watershed but also to address the broader issue of interaction and possibly inter-regional communication during the Early Archaic through pre-Clovis age periods.

Cactus Hill-like points (Figure 5.1a-5.1d) from another Virginia site, 44PY152 below Smith Mountain Gap, were recovered from association with a stratified Clovis age assemblage (William A. Childress, personal communication 2011). They are almost identical in morphology to those from pre-Clovis age levels at Cactus Hill. Two of the points (Figure 5.1c and 5.1d) were made of greenish patinated metavolcanic stone, similar to the material most commonly used for Cactus Hill-like points, recovered from the Nottoway Watershed (see Figures 2.4 and 2.7). Site 44PY 152 is located on the south bank of the Roanoke River watershed approximately 150 miles west of Blueberry Hill. The north aspect is consistent with the Nottoway model.

Figure 5.2 shows that the Nottoway/Chowan and Roanoke Watersheds both drain into Albemarle Sound in eastern North Carolina. Prior to the current inundation of the Albemarle Sound, the Nottoway was a tributary of the Roanoke. That means that the pre-Clovis age occupations at Cactus Hill and possibly Blueberry Hill would have been in the same watershed as that at PY152. They may represent two parts of the same macro-band settlement pattern. If that is the case, then the Early Archaic macro-band model for the Southeastern United States, proposed by Anderson (1996: 29-45) and Anderson and Hanson (1988: 267-272) may have had a far deeper heritage in the Middle Atlantic than originally proposed by the author 16 and 23 years ago (Johnson 1979; 1996: 211).

This is further supported by significant differences between the points, tool-like artifact types and apparent raw material preferences, and those recovered from Meadowcroft (Boldurian 1985; Carlisle and Adovasio 1982; Stanford and Bradley 2012:93) and Miles Point (Lowery et al. 2010; Stanford and Bradley 2012:98), which may have had an

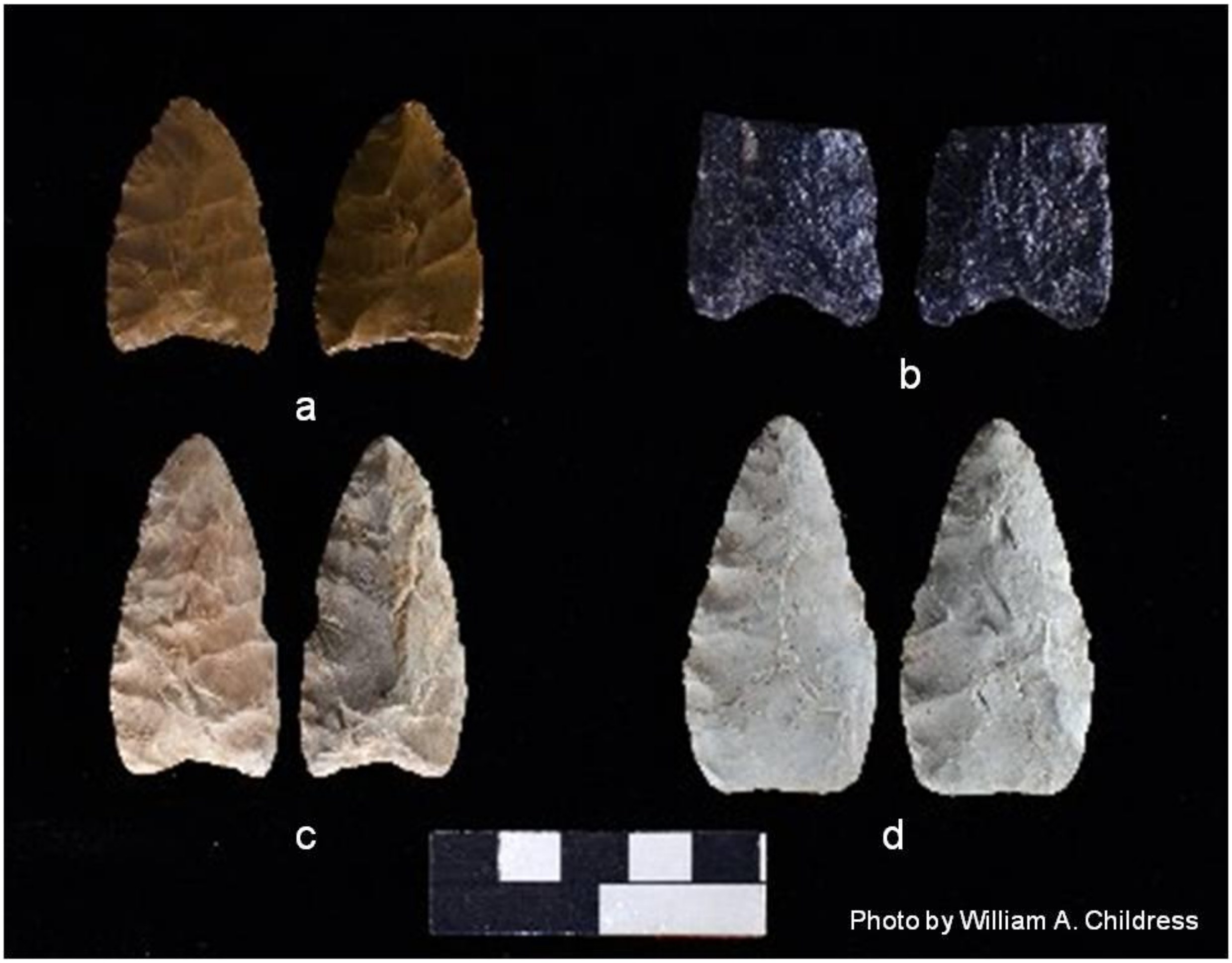


Figure 5.1: Cactus Hill-like points from 44PY152 (photo by and with permission of William A. Childress).

ancestral Susquehanna Watershed focus. Essentially, we may already be recognizing macro-band divisions in the pre-Clovis age occupations in the Middle Atlantic Region. Alternatively, the differences could have been due to temporal rather than spatial factors.

Site 44PY152 and several other sites are located at the east end of a notch in Smith Mountain through which the Roanoke River flows (Blanton et al. 1996; Childress 1993). This river is on a natural riverine corridor between the interior Tennessee and New River Drainages (Ohio River Watershed) and the Middle Atlantic Piedmont and Coastal Plain (Figure 5.2).

A potential Pre-Clovis age association with extinct fauna at the SV-2 site in the Saltville Valley, along with the notable presence of fluted points from nearby contexts (McDonald

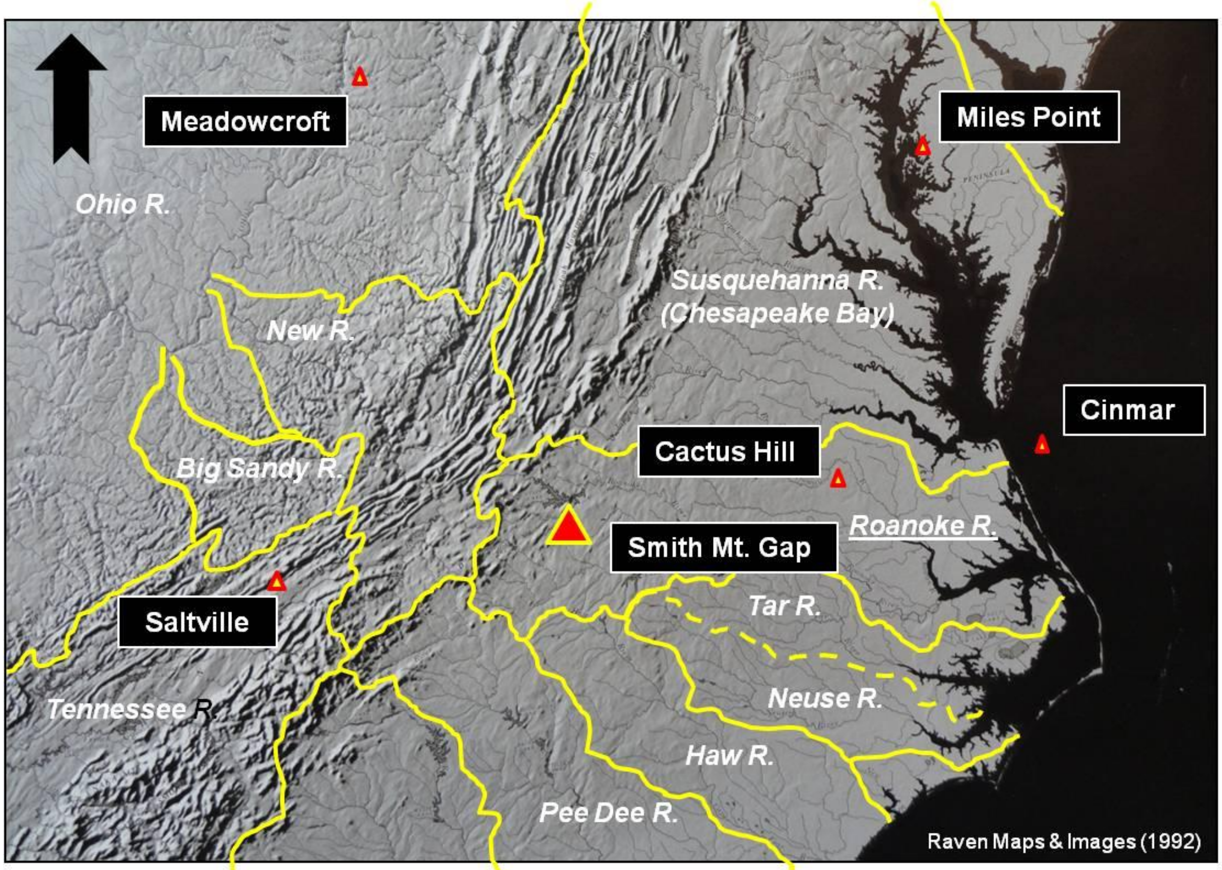


Figure 5.2: Possible watershed core areas for pre-Clovis age macro-bands at the time of the hypothesized pre-Clovis age occupation of Cactus Hill, Blueberry Hill and 44PY152 at Smith Mountain Watergap (base map reproduced with permission of Raven Maps and Images).

2000: 5), fits within this hypothesized pattern. Site SV-2 is located in the headwaters of the Tennessee River Valley in southwestern Virginia (Figure 5.2). The faunal concentration in the Saltville Valley could have attracted early groups from east of Smith Mountain Gap or been part of the western range of pre-Clovis and Clovis age bands occupying territories in the Tennessee Valley.

However, a contribution to the Solutrean hypothesis might prove problematic. If the deep activity surface in Blueberry Hill is of pre-Clovis age and related to the other Cactus Hill pre-Clovis age expressions, then there appears to be a problem with the tool-like artifacts. They are not similar to those from Miles Point or the Solutrean. They have some similarities, such as burins, bifaces, points, macro-blades and cores but the rest of the Cactus Hill tool kit is generally expedient. It is unlike the Clovis age tool kit, which is one of the lines of evidence that separates the Clovis Age artifacts, recovered from Cactus Hill, from the site's pre-Clovis age artifacts.

The problem this raises is, how do we get from a sophisticated technology as is evident at the older Miles Point through a less formal technology like found at Cactus Hill and Blueberry Hill back to the highly formal Clovis age technology?

Although with such a paucity of sites and artifacts to work from, one can speculate that the vast time period between Miles Point and Cinmar at one end, and Clovis at the other end was very complex with macro-bands naturally forming and becoming isolated. The apparent divergence is tantalizingly evident between the Chesapeake Bay (ancestral Susquehanna Watershed) and the ancestral Roanoke Watersheds. The isolation may have led to divergent technologies.

For example, the preliminary examples of 23,000 year old technology in the ancestral Susquehanna looks different than the 20,000 year old technology emerging from ancestral Roanoke, which looks different than the 15,000 year old technology emerging from Buttermilk Creek (Gault and Friedkin sites) in Texas. If this is the case then it would support diffusion of a powerful Clovis culture, based on a sophisticate technology, over pre-existing but culturally distinct groups across North America.

This would bring us back to the ultimate question about Clovis: Where did it come from? The results from Cactus Hill would argue that it did not go from Solutrean through Cactus Hill to Clovis. If this were not the path then where should archaeologists look?

If Stanford and Bradley (2012) are correct that Solutrean was a maritime, coastally adapted culture and technology, is it possible that a residual Solutrean culture remained along the exposed Continental Shelf and eventually spawned Clovis, which spread from east to west? The coastal ecotone would have remained a viable core area throughout the Late Pleistocene climatic fluctuations. Why would a culture successfully adapted to such a relatively stable environment have to make dramatic changes in its technology?

Technologies possibly would have diverged as spin-off bands moved into new interior environments.

Clovis, to have spread as rapidly as it did across such diverse environments and cultures, could have had more than mere technology as a driving force. The obvious analogue would be emergence of the horse culture on the Great Plains of central North America. It dramatically changed many linguistic and culturally different groups and even drew groups from outside the Great Plains to it. Archaeologically, the resulting differences are imperceptible to an untrained eye.

However, there are subtle but recognizable differences in Clovis age technologies from region to region. They may reflect the regional differences that existed before Clovis.

A research design has been submitted and plans are in place to test a complex of Early Archaic, Clovis and possibly pre-Clovis age sites in the upper Leesville Lake Reservoir, immediately below Smith Mountain Gap in southwest-central Virginia. A similar testing program has also begun downstream from Thoroughfare Gap in north-central Virginia. The purpose of these lines of research is to expand research on the hypothesized early Paleoamerican patterns raised by this thesis.

Appendix I

Chapter 3: portrait data tables

Core	Depth	Quartzite		Quartz		MV	CH	Other		FR	CP	FA	FL/ CH
		DE	M	DE	M	DE	DE	DE	M				
S000	07-12”	1	-	-	-	-	-	-	-	-	1	-	-
	12-17”	4	1	2	-	-	1	-	-	2	-	-	-
	17-23”	2	-	-	-	-	-	-	-	-	-	-	-
S200	04-09”	1	-	1	-	-	-	-	-	-	15	-	-
	09-14”	1	-	-	-	-	-	-	-	-	-	-	+
	14-20”	-	-	1	-	-	-	-	-	-	-	1	+
S400	08-11”	-	-	1	-	-	-	-	-	-	-	1	-
	11-15”	-	-	-	-	-	-	-	-	-	-	1	-
	15-22”	-	-	1	-	-	-	-	-	-	-	-	+

+ Charcoal sample (not itemized)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.1: Artifact data from 1/16-inch (1.6 mm.) mesh sifting of T-3 transect auger cores (Koestline site). Depths are in inches below the surface.

Core	Depth	Quartzite		Quartz		MV	CH	Other		FR	CP	FA	FL/ CH
		DE	M	DE	M	DE	DE	DE	M				
Quarry	00”	39	3	13	1	1	2	3	1	7	-	-	-
T-4/S000	08-15”	2	-	1	-	-	-	-	-	-	-	-	-
	15-21”	4	-	-	-	-	-	-	-	-	-	-	-
	21-26”	3	-	1	-	-	1	-	-	-	-	-	-
T-4/S100	08-14”	1	-	-	-	-	-	-	-	-	-	-	-
	19-24”	2	-	-	-	-	-	-	-	-	-	-	-
	24-30”	-	-	1	-	-	-	-	-	-	-	-	-
	30-35”	1	-	-	-	-	-	-	-	-	-	-	-
T-4/S200	08-15”	2	-	3	-	-	-	-	-	-	-	-	-
	15-22”	5	-	-	-	-	-	-	-	-	-	-	-
	22-28”	6	-	2	-	-	-	-	-	-	-	-	+
	28-35”	4	-	2	-	-	-	-	-	-	-	-	-
	35-41”	2	-	-	-	-	-	-	-	-	-	-	-
T-5/S000	12-19”	-	-	-	-	-	-	-	-	-	-	-	+
	19-23”	1	-	2	-	-	-	-	-	-	-	-	-
	23-29”	6	-	-	-	1	-	-	-	2	-	-	+
	29-35”	1	-	1	-	-	-	-	-	1	-	-	+
	42-46”	2	-	-	-	-	-	-	-	-	-	-	+
T-5/S100	00-08”	1	-	-	-	-	-	-	-	-	-	-	-
	08-14”	-	-	-	-	-	-	-	-	-	-	-	+
	14-20”	2	-	1	-	-	-	-	-	-	-	-	+
	20-26”	2	-	-	-	-	-	-	-	-	-	-	+
	26-33”	-	-	-	-	-	-	-	-	-	-	-	+
	33-39”	3	-	-	-	-	-	-	-	-	-	-	+
	51-57”	-	-	-	-	-	-	-	-	-	-	-	+
T-5/S200	14-20”	2	-	-	-	-	-	-	-	-	-	-	+
	20-26”	1	-	-	-	-	-	-	-	-	-	-	+
	26-33”	-	-	-	-	-	-	-	-	-	-	-	+

+ Charcoal sample (not itemized)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.4: Artifact data from quarry edge, and 1/16-inch (1.6 mm.) mesh sifting of T-4/T-5 transect auger cores (Watlington site). Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FA	FL/ CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
01 (00-09)	-	29	-	-	1	-	1	-	-	-	-	-	3	-	+
02 (09-13)	3	72	-	-	3	-	3	-	-	-	4	-	8	-	+
03 (13-17)	-	153	8	4	9	-	2	-	-	-	2	-	10	-	+
04 (17-21)	12	299	4*	-	8	-	5	-	3	-	3	-	18	2	+
05 (21-25)	10	345	10*	3	17	1	4	-	4	-	3	1	28	1	+
06 (25-29)	8	301	7	-	10	1	5	-	19	-	2	-	36	11	+
07 (29-33)	-	101	1*	-	4	-	-	-	5	-	3	-	20	1	+
08 (33-37)	-	5	-	-	-	-	-	-	-	-	1	-	2	-	-
09 (37-41)	-	2	-	-	-	-	-	-	-	-	-	-	2	-	-

+ Charcoal sample (not itemized)
* Includes unidentified point tips (Figure 3.9 b, g and p respectively)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.5: Watlington Block A test trench W1 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FA	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
01 (00-09)	4	11	-	-	1	-	-	-	-	-	-	-	4	-	+
02 (09-13)	5	15	-	-	11	-	1	-	1	-	-	-	5	-	+
03 (13-17)	4	31	1	-	10	-	2	-	2	-	1	-	6	1	+
04 (17-21)	14	75	7a	3	20	1	7	-	2	-	6	2	7	2	+
05 (21-25)	18	76	6	1	40	-	4	-	1	-	3	1	22	2	+
06 (25-29)	6	64	5b	-	12	1	2	-	-	-	4	2	12	5	+
07 (29-33)	-	11	-	-	-	-	-	-	-	-	-	-	11	-	+
08 (33-37)	-	3	-	-	-	-	-	-	-	-	-	-	2	-	+
05 – Fea. 1 (Figure 14)	*2c*	*1*	-	*3c*	-	-	-	-	-	-	-	-	-	-	+

\+ Charcoal sample (not itemized)
* Includes two Middle Archaic Morrow Mountain II points (Figure 3.9 c and d)
** Includes Early Archaic Ft. Nottoway or Palmer point base (Figure 3.9 m)
*** Includes 5 quartzite items (four mend) and three quartz items (two mend)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.6: Watlington Block A test trench W2 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FA	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
N. Wall*	1	45	1*	-	5	-	-	-	1	-	-	-	6	2	+
W. Wall*	-	15	2	-	5	-	-	-	-	-	-	-	4	-	+
1 (00-10)	-	12	-	-	-	-	1	-	-	-	-	-	2	-	+
2a (10-12)	1	7	-	-	-	-	-	-	2	-	-	-	1	-	+
2b (12-14)	2	11	-	1	1	-	-	-	-	-	1	-	1	2	+
3a (14-16)	2	29	-	-	-	-	-	-	-	-	-	-	1	1	+
3b (16-18)	3	32	1	-	3	-	1	-	1	-	2	-	3	1	+
4a (18-20)	-	60	7a	-	-	-	-	1	-	-	1	-	6	1	+
4b (20-22)	2	94	4a	-	6	-	-	2a	1	-	1	1	6	1	+
5a (22-24)	5	133	9		6	1	2	1a	-	-	1	-	7	1	+
5b (24-26)	8	118	1*	1	9	-	-	-	-	-	4	1	10	1	+
6a (26-28)	3	96	1	-	8	-	2	-	-	-	2	-	14	5	+
6b (28-30)	-	101	3	-	11	1	1	1a	3	-	1	-	16	1	+
7a (30-32)	-	56	1	-	5	-	-	1	1	-	1	-	8	-	+
7b (32-34)	-	20	-	-	1	-	-	-	-	-	-	-	10	1	+
8a (34-36)	-	8	-	-	1	-	-	-	-	-	-	-	5	-	-
8b (36-38)	-	2	-		1	-	-	-	-	-	-	-	3	-	-
9a (38-40)	-	-	-	-	-	-	-	-	-	-	-	-	5	-	+
9b (40-42)	-	1	-	-	-	-	-	-	-	-	-	-	4	-	+
10a (42-44)	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
10b (44-46)	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-
11a (46-48)	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
11b (48-50)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12a (50-52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12b (52-54)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13a (54-56)	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-
13b (56-58)	-	2	-	-	-	-	-	-	-	-	-	-	6	-	-
14a (58-60)	-	-	-	-	-	-	-	-	-	-	-	-	39	-	-
14b (60-62)	-	-	-	-	-	-	-	-	-	-	-	-	160	-	-

+ Charcoal sample (not itemized)

a Points shown in Figure 3.9 include north (N) wall slump Palmer point (x); level 4a Guilford point (s); level 4b quartzite lanceolate Guilford point or Morrow Mountain II point preform (t) and meta-volcanic Morrow Mountain II point (u); level 5a meta-volcanic Morrow Mountain II point (v); level 5b quartzite Palmer point (w); level 6b black meta-volcanic Palmer/Kirk corner notched point fragment.

* North (N) wall slump (10-foot wall) and west (W) wall slump (5-foot wall).

MV – Meta-volcanic
CH/JA – Chert/Jasper
PB – Coarse sand/pebbles
FA – Faunal
FL/CH – Floral/Charcoal
FR – Fire cracked rocks
DE – Debitage
M – Modified or worn

Table 3.7: Watlington Block A test trench W4 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FA	FL/ CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
E. Wall	1	18	2	-	1	-	-	-	1	-	-	-	1	2	+
NE Wall	-	61	3*	-	9	-	-	-	4	-	-	-	5	2	-
NW Wall	2	76	7	-	1	1*	-	-	-	-	-	-	2	1	+
												-			
01 (00-09)	-	12	1	-	-	-	-	-	1	-	-	-	5	1	-
02 (09-13)	2	30	1	-	4	1	-	-	-	-	-	-	6	1	+
03 (13-17)	2	83	-	-	13	-	3	-	2	-	1	-	10	1	+
04 (17-21)	-	169	4*	-	49	1	6	1*	2	-	2	-	19	5	+
05 (21-25)	15	217	3*	1	26	-	3	-	4	-	-	-	32	7	+
06 (25-29)	2	456	4*	2	28	1	2	-	6	-	5	-	38	1	+
07 (29-33)	-	141	4	-	8	-	1	-	3	-	-	-	14	-	+
08 (33-37)	-	16	-	-	2	-	-	-	1	-	-	-	5	-	+
09 (37-41)	-	1	-	-	-	-	-	-	-	-	-	-	8	-	-
10 (41-45)	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
11 (45-49)	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
12 (49-53)	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
13 (53-57)	-	3	-	-	-	-	-	-	-	-	-	-	5	-	+
14 (57-61)	-	-	-	-	1	-	-	-	-	-	-	-	27	-	+
04 Fea. 3	*3*	*77*	*9*	-	*4*	*1*	*2*	-	*2*	-	-	-	*2*	*3*	+

+ Charcoal sample (not itemized)
* Artifacts shown in Figure 3.9 include northeast (NE) wall slump quartzite endscraper (q) in inset; northwest (NW) wall slump quartz Palmer point (r) in inset; level 4 quartzite possible Palmer point (e) and meta-volcanic Palmer-like point (f); level 5 quartzite Palmer/Decatur point (j); level 6 quartzite endscraper (n).

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.8: Watlington Block A test trench W5 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH /JA	Other			PB	FA	FL/ CH
	FR	DE	M	FR	DE	M	DE	M	DE	FR	DE	M			
01 (00-09)	-	12	1	-	2	1	-	-	-	-	-	-	124	-	+
02 (09-13)	10	38	-	-	8	1	-	-	-	3	-	-	11	-	+
03 (13-17)	10	92	4	2	33	-	1	-	-	7	1	-	11	1	+
04 (17-21)	37	166	6	6	34	7*	9	-	-	11	2	-	16	1	+
05 (21-25)	20	373	6*	-	73	-	13	-	1	1	1	2	28	1	+
06 (25-29)	9	437	6	-	79	2	18	3*	5	-	3	-	46	-	+
07 (29-33)	2	185	-	1	34	-	2	1	5	4	3	-	36	3	+
08 (33-37)	-	26	-	-	1	-	1	-	-	-	-	-	15	1	+
09 (37-41)	-	8	-	-	-	-	1	-	-	-	-	-	17	1	+
10 (41-45)	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-
11 (45-49)	-	1	-	-	-	-	-	-	-	-	-	-	15	-	-
12 (49-53)	-	-	-	-	-	-	-	-	-	-	-	-	41	-	-
05 Fea. 2	*1*	*10*	*2*	-	*5*	-	*1*	-	*1*	*2*	-	-	*1*	+	+

+ Charcoal or faunal sample (not itemized)
* Artifacts shown in Figure 3.11 include level 4 quartz Lecroy point (a); level 5 quartzite Palmer or reworked Morrow Mountain-like point tips (c and d); level 6 meta-volcanic Lecroy point (g)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.9: Watlington Block B test trench W3 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FA	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
NE Wall	-	23	-	-	5	-	1	-	1	-	5	-	286	4	+
NW Wall	3	62	3*	3	5	-	-	-	1	-	2	-	12	3	+
01 (00-09)	1	13	3	1	6	-	1	-	-	-	1	-	33	2	-
02 (09-13)	2	22	-	2	2	-	-	-	-	1	13	4	-	-	+
03 (13-17)	7	64	-	7	12	1	4	1	-	-	6	-	12	23	+
04 (17-21)	9	106	11	9	34	2	2	-	6	-	29	-	21	10	+
05 (21-25)	21	250	6*	21	67	4	7	-	15	-	61	6	32	1	+
06 (25-29)	5	297	14*	5	51	1	6	-	25	-	50	-	80	8	+
07 (29-33)	1	105	6	1	3	1	4	-	8	-	-	-	33	2	+
05 Fea. 2	*1*	-	*2*	*1*	-	-	-	-	-	-	-	-	-	-	+

+ Charcoal sample (not itemized)
* Artifacts shown in Figure 3.11 include northwest (NW) wall slump quartzite Fort Nottoway-like point tip (q); level 5 quartzite Morrow Mountain-like point (e); level 6 quartzite sidescraper and endscraper (j and k)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.10: Watlington Block B test trench W6 artifacts. Depths are in inches below the surface.

Core	Level/ Depth	Quartzite		Quartz		MV	CH	Other		FA	FL/ CH
		DE	M	DE	M	DE	DE	DE	M		
S100W250	02/07-14"	1	-	-	-	-	-	-	-	-	+
	03/14-19"	-	-	-	-	-	-	-	-	-	+
	04/19-24"	-	-	-	-	-	-	-	-	-	+
	18/74-78"	Bt (not sifted below 09/41-44")									
S150W200	02/07-14"	-	-	-	-	-	-	-	-	-	+
	03/14-19"	-	-	-	-	-	-	-	-	-	+
	04/19-24"	-	-	-	-	-	-	-	-	-	+
	05/24-29"	-	-	-	-	-	-	-	-	-	+
	06/29-34"	-	-	-	-	-	-	-	-	-	+
	07/34-39"	-	-	1	-	-	-	-	-	-	+
	08/39-44"	-	-	-	-	-	-	-	-	-	+
	09/44-49"	-	-	-	-	-	-	-	-	-	+
	11/54-59"	-	-	-	-	-	-	-	-	-	+
	14/69-74"	-	-	-	-	-	-	-	-	-	+
	15/74-79"	1	-	-	-	-	-	-	-	-	+
	21/102-106"	Very coarse sand (not sifted below 18/89-94")									
S200W200	01/00-08"	-	-	3	-	-	-	-	-	-	+
	02/08-14"	-	-	-	-	-	-	-	-	-	+
	03/14-21"	-	-	1	-	-	-	-	-	-	+
	04/21-28"	-	-	-	-	-	-	-	-	-	+
	05/28-35"	-	-	-	-	-	-	-	-	-	+
	06/35-40"	-	-	-	-	-	-	-	-	-	+
	17/91-96"	Gray mottled clay (sifted to bottom)									
S200W250	06/25-30"	-	-	-	-	-	-	-	-	-	+
	07/30-37"	-	-	-	-	-	-	-	-	-	+
	08/37-43"	1	-	-	-	-	-	-	-	-	-
	29/153-158"	Very coarse sand (not sifted below 19/98-104")									
S200W300	01/00-08"	1	-	-	-	-	-	-	-	-	+
	02/08-13"	-	-	-	-	-	-	-	-	-	+
	03/13-19"	-	-	1	-	-	-	-	-	-	+
	04/19-25"	-	-	-	-	-	-	-	-	-	+
	05/25-31"	-	-	-	-	-	-	-	-	-	+
	06/31-37"	-	-	-	-	-	-	-	-	-	+
	09/51-53"	Bt (not sifted below 08/48-51")									

+ Charcoal sample (not itemized or retained)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.11a: Artifact data from 1/16-inch (1.6 mm.) mesh sifting of R-P transect interval sample, auger cores. Depths are in inches below the surface.

Core	Level/ Depth	Quartzite		Quartz		MV	CH	Other		FA	FL/ CH
		DE	M	DE	M	DE	DE	DE	M		
S250W200	02/08-14”	-	-	-	-	-	-	-	-	-	+
	03/14-20”	-	-	-	-	-	-	-	-	-	+
	04/20-26”	1	-	-	-	-	-	-	-	-	+
	05/26-32”	-	-	-	-	-	-	-	-	-	+
	06/32-39”	-	-	-	-	-	-	-	-	-	+
	07/39-45”	-	-	1	-	1	-	-	-	-	+
	08/45-51”	-	-	-	-	-	-	-	-	-	+
	18/104-109”	Mottled gray/strong brown clay (not sifted below 10/63-69”)									
S250W225	02/10-16”	-	-	-	-	-	-	-	-	-	+
	03/16-22”	-	-	-	-	-	-	-	-	-	+
	04/22-29”	-	-	-	-	-	-	-	-	-	+
	05/29-35”	1	-	-	-	-	-	-	-	-	+
	06/35-41”	-	-	-	-	-	-	-	-	-	+
	15/85-90”	Strong brown clay (not sifted below 10/56-62”)									
S250W250	01/00-07”	-	-	-	-	-	-	-	-	-	+
	02/07-12”	-	-	-	-	-	-	-	-	-	+
	03/12-17”	-	-	-	-	-	-	-	-	-	+
	04/17-23”	-	-	-	-	-	-	-	-	-	+
	05/23-28”	-	-	-	-	-	1	-	-	-	+
	06/28-34”	2	-	-	-	-	-	-	-	-	-
	07/34-39”	-	-	-	-	-	-	-	-	-	+
	11/53-59”	-	-	-	-	-	-	-	-	-	+
	12/59-63”	-	-	-	-	-	-	-	-	-	+
	18/87-92”	-	-	-	-	-	-	-	-	-	+
	19/92-95”	-	-	-	-	-	-	-	-	-	+
	26/120-125”	Coarse sand (not sifted below 22/104-108”)									
S250W300	01/00-08”	-	-	-	-	-	-	-	-	-	+
	02/08-16”	-	-	-	-	-	-	-	-	-	+
	04/23-29”	-	-	-	-	-	-	-	-	-	+
	05/29-34”	1	-	-	-	-	1	-	-	-	-
	18/97-102”	Very coarse sand (not sifted below 06/34-40”)									

+ Charcoal sample (not itemized or retained)

MV – Meta-volcanic
FA – Faunal
M – Modified or worn
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
PB – Coarse sand/pebbles
DE – Debitage

Table 3.11b

Core	Level/ Depth	Quartzite		Quartz		MV	CH	Other		FA	FL/ CH
		DE	M	DE	M	DE	DE	DE	M		
S275W250	01/00-08”	-	-	-	-	-	-	-	-	-	+
	02/08-14”	-	-	1	-	-	-	-	-	-	+
	03/14-22”	-	-	-	-	-	-	-	-	-	+
	04/22-30”	-	-	-	-	-	-	-	-	-	+
	05/30-37”	1	-	-	-	-	-	-	-	-	+
	06/37-44”	-	-	-	-	-	-	-	-	-	+
	07/44-50”	-	-	-	-	-	-	-	-	-	+
	08/50-55”	-	-	-	-	-	-	-	-	-	+
	10/60-64”	Bt (not sifted below 08/50-55”)									
S300W200	03/15-20”	-	-	-	-	-	-	-	-	-	+
	04/20-27”	-	-	-	-	-	-	-	-	-	+
	06/33-39”	-	-	-	-	-	-	-	-	-	+
	07/39-45”	-	-	-	-	-	-	-	-	-	+
	08/45-50”	-	-	1	-	-	-	-	-	-	+
	22/121-126”	Gray clay (not sifted below 10/55-61”)									
S300W250	01/00-09”	-	-	-	-	-	-	-	-	-	+
	02/09-15”	-	-	-	-	-	-	-	-	-	+
	03/15-21”	-	-	-	-	-	-	-	-	-	+
	04/21-28”	1	-	-	-	-	-	-	-	-	+
	05/28-34”	4	-	1	-	-	-	-	-	-	+
	06/34-41”	-	-	1	-	-	-	-	-	-	+
	07/41-46”	1	-	-	-	-	-	-	-	-	-
	08/46-51”	-	-	-	-	-	-	-	-	-	+
	11/62-67”	-	-	-	-	-	-	-	-	-	+
	16/86-91”	-	-	-	-	-	-	-	-	-	+
	18/95-98”	-	-	-	-	-	-	-	-	-	+
	19/98-103”	-	-	-	-	-	-	-	-	-	+
	23/115-119”	-	-	-	-	-	-	-	-	-	+
	24/119-124”	-	-	-	-	-	-	-	-	-	+
	26/128-133”	-	-	-	-	-	-	-	-	-	+
	27/133-137”	-	-	1	-	-	-	-	-	-	-
	28/137-140”	-	-	-	-	-	-	-	-	-	+
	30/144-148”	Very coarse sand (sifted to bottom)									

+ Charcoal sample (not itemized or retained)

MV – Meta-volcanic
FA – Faunal
DE – Debitage

CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn

PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.11c

Core	Level/ Depth	Quartzite		Quartz		MV	CH	Other		FA	FL/ CH
		DE	M	DE	M	DE	DE	DE	M		
S300W300	01/00-08”	-	-	-	-	-	-	-	-	-	+
	02/08-14”	-	-	-	-	-	-	-	-	-	+
	03/14-20”	-	-	1	-	-	-	-	-	-	+
	04/20-26”	-	-	1	-	-	-	-	-	-	+
	05/26-32”	-	-	1	-	-	-	-	-	-	+
	06/32-39”	1	-	-	-	-	-	-	-	-	-
	09/49-55"	Wet, gray/strong br., mottled clay (not sifted below 07/39-45”)									
S325W350	02/08-15”	-	-	-	-	-	-	-	-	-	+
	03/15-22”	-	-	-	-	-	-	-	-	-	+
	04/22-28”	-	-	1	-	-	1	-	-	-	+
	05/28-35”	-	-	1	-	-	-	-	-	-	+
	10/60-65”	Bt (sifted to bottom)									
S325W275	02/09-14”	-	-	-	-	-	-	-	-	-	+
	03/14-20”	1	-	-	-	-	-	-	-	-	+
	04/20-25”	-	-	1	-	-	-	-	-	-	+
	05/25-31”	-	-	1	-	-	-	-	-	-	+
	06/31-36”	-	-	-	-	-	-	-	-	-	+
	07/36-43”	-	-	-	-	-	-	-	-	-	+
	08/43-50”	-	-	-	-	-	-	-	-	-	+
	09/50-55”	-	-	-	-	-	-	-	-	-	+
	10/55-61”	-	-	-	-	-	-	-	-	-	+
	12/66-71”	Mottled strong brown/gray clay (not recorded below 10/55-61”)									
S350W150	01/00-09”	-	-	-	-	-	-	-	-	-	+
	02/09-15”	-	-	-	-	-	-	-	-	-	+
	03/15-21”	-	-	-	-	-	-	-	-	-	+
	04/21-26”	-	-	-	-	-	-	-	-	-	+
	05/26-32”	-	-	-	-	-	-	-	-	-	+
	06/32-37”	-	-	-	-	-	-	-	-	-	+
	07/37-42”	-	-	-	-	-	-	-	-	-	+
	08/42-47”	-	-	-	-	-	-	-	-	-	+
	09/47-52”	-	-	-	-	-	-	-	-	-	+
	13/66-72”	-	-	-	-	-	-	-	-	-	+
	14/72-77”	-	-	-	-	-	-	-	-	-	+
	18/93-97”	-	-	-	-	-	-	-	-	-	+
	24/120-125”	-	-	-	-	-	-	-	-	-	+
	25/125-130”	-	-	-	-	-	-	-	-	-	+
	27/135-140”	-	-	-	-	-	-	-	-	-	+
	28/140-144”	-	-	-	-	-	-	-	-	-	+
	30/149-153”	Gray clay (not sifted below 28/140-144”)									

+ Charcoal sample (not itemized or retained)

MV – Meta-volcanic
CH/JA – Chert/Jasper
PB – Coarse sand/pebbles
FA – Faunal
FL/CH – Floral/Charcoal
FR – Fire cracked rocks
DE – Debitage
M – Modified or worn

Table 3.11d

Core	Level/ Depth	Quartzite		Quartz		MV	CH	Other		FA	FL/ CH
		DE	M	DE	M	DE	DE	DE	M		
S350W200	01/00-07”	-	-	-	-	-	-	-	-	-	+
	02/07-14”	-	-	-	-	-	-	-	-	-	+
	03/14-19”	1	-	-	-	-	-	-	-	-	+
	04/19-24”	-	-	-	-	-	-	-	-	-	+
	05/24-29”	3	-	-	-	-	-	-	-	-	+
	07/34-39”	1	-	-	-	-	-	-	-	-	+
	09/43-48”	-	-	-	-	-	-	-	-	-	+
	14/66-71”	-	-	-	-	-	-	-	-	-	+
	15/71-76”	-	-	-	-	-	-	-	-	-	+
	27/126-134”	Gray clay (not sifted below 17/81-86”)									
S350W225	01/00-08”	1	-	-	-	-	-	-	-	-	-
	03/14-20”	-	-	-	-	-	-	-	-	-	+
	04/20-27”	-	-	-	-	-	-	-	-	-	+
	05/27-32”	-	-	2	-	-	-	-	-	-	+
	06/32-39”	1	-	-	-	-	-	-	-	-	+
	07/39-45”	1	-	-	-	-	-	-	-	-	+
	09/51-57”	-	-	-	-	-	-	-	-	-	+
	14/80-85”	1	-	-	-	-	-	-	-	-	-
	16/90-95"	Gray clay (not sifted below 15/85-90)									
S350W250	01/00-07”	-	-	-	-	-	-	-	-	-	+
	02/07-12”	-	-	-	-	-	-	-	-	-	+
	03/12-16”	-	-	1	-	-	-	-	-	-	+
	04/16-21”	1	-	-	-	-	1	-	-	-	+
	05/21-27”	5	-	-	-	-	-	-	-	-	+
	06/27-32”	-	-	-	-	-	-	-	-	-	+
	07/32-37”	3	-	-	-	-	-	-	-	-	-
	08/37-43”	-	-	-	-	-	-	-	-	-	+
	09/43-48”	-	-	-	-	-	-	-	-	-	+
	13/61-65”	Mottled gray/strong brown clay (not sifted below 10/48-53”)									
S350W275	01/00-09”	2	-	-	-	-	-	-	-	-	-
	02/09-15”	-	-	-	-	-	-	-	-	-	+
	03/15-22”	-	-	-	-	-	-	-	-	-	+
	04/22-28”	1	-	-	-	-	-	-	-	-	+
	05/28-33”	-	-	-	-	-	-	-	-	-	+
	06/33-39”	5	-	-	-	-	-	-	-	-	+
	07/39-45”	-	-	-	-	-	-	-	-	-	+
	08/45-50”	-	-	-	-	-	-	-	-	-	+
	09/50-56”	-	-	-	-	-	-	-	-	-	+
	10/56-61”	-	-	-	-	-	-	-	-	-	+
	11/61-66”	-	-	-	-	-	-	-	-	-	+
	13/71-78	Mottled strong brown/gray clay (not recorded below 11/61-66”)									

+ Charcoal sample (not itemized or retained)

MV – Meta-volcanic
Faunal
DE – Debitage

CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn

PB – Coarse sand/pebblesFA –
FR – Fire cracked rocks

Table 3.11e

Core	Level/ Depth	Quartzite		Quartz		MV	CH	Other		FA	FL/ CH
		DE	M	DE	M	DE	DE	DE	M		
S350W300	01/00-09”	-	-	-	-	-	-	-	-	-	+
	02/09-14”	-	-	-	-	-	-	-	-	-	+
	03/14-19”	1	-	-	-	-	-	-	-	-	+
	04/19-24”	-	-	-	-	-	-	-	-	-	+
	05/24-29”	1	-	-	-	-	-	-	-	-	+
	06/29-34”	1	-	-	-	-	-	-	-	-	+
	07/34-39”	2	-	-	-	-	-	-	-	-	+
	08/39-44”	1	-	-	-	-	-	-	-	-	+
	10/49-54”	-	-	-	-	-	-	-	-	-	+
	13/60-63”	Mottled gray/str. br. clay w/water (not sifted below 10-49-54”)									
S400W200	02/08-16”	-	-	-	-	-	-	-	-	-	+
	03/16-21”	-	-	-	-	-	-	-	-	-	+
	05/28-34”	1	-	-	-	-	-	-	-	-	+
	20/113-116”	Mottled strong brown/gray clay (not sifted below 08/46-52”)									
S400W250	01/00-09”	-	-	-	-	-	-	-	-	-	+
	02/09-15”	-	-	-	-	-	-	-	-	-	+
	03/15-21”	-	-	-	-	-	-	-	-	-	+
	04/21-26”	-	-	-	-	-	-	-	-	-	+
	05/26-33”	-	-	-	-	-	-	-	-	-	+
	06/33-40”	1	-	1	-	-	-	-	-	-	+
	07/40-46”	-	-	-	-	-	-	-	-	-	+
	08/46-51”	-	-	-	-	-	-	-	-	-	+
	09/51-57”	-	-	-	-	-	-	-	-	-	+
	13/71-76”	Strong brown clay (not sifted below 10/51-57”)									
S400W300	01/00-09”	-	-	-	-	-	-	-	-	-	+
	02/09-15”	-	-	-	-	-	-	-	-	-	+
	03/15-20”	-	-	-	-	-	-	-	-	-	+
	04/20-27”	-	-	-	-	-	-	-	-	-	+
	08/46-51”	Mottled str. & yellow br. Clay (not recorded below 04/20-27”)									
S450W200	01/00-09”	-	-	-	-	-	-	-	-	-	+
	02/09-14”	-	-	-	-	-	-	-	-	-	+
	03/14-19”	-	-	-	-	-	-	-	-	-	+
	04/19-26”	-	-	-	-	-	-	-	-	-	+
	05/26-32”	-	-	-	-	-	-	-	-	-	+
	08/44-50”	-	-	-	-	-	-	-	-	-	+
	10/56-61”	-	-	-	-	-	-	-	-	-	+
	16/90-93”	Mottled gray clay (not sifted below 14/78-84”)									

+ Charcoal sample (not itemized or retained)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.11f

Core	Level/ Depth	Quartzite		Quartz		MV	CH	Other		FA	FL/ CH
		DE	M	DE	M	DE	DE	DE	M		
S450W250	01/00-11”	-	-	-	-	-	-	-	-	-	+
	02/11-16”	-	-	-	-	-	-	-	-	-	+
	03/16-22”	-	-	-	-	-	-	-	-	-	+
	04/22-28”	-	-	-	-	-	-	-	-	-	+
	05/28-33”	-	-	-	-	1	-	-	-	-	+
	06/33-39”	-	-	-	-	-	-	-	-	-	+
	13/66-72”	Mottled strong brown/gray clay (not recorded below 06/33-39”)									
S450W300	01/00-09”	-	-	-	-	-	-	-	-	-	+
	02/09-16”	-	-	-	-	-	-	-	-	-	+
	03/16-22”	-	-	-	-	-	-	-	-	-	+
	04/22-29”	-	-	-	-	-	-	-	-	-	+
	05/29-36”	-	-	-	-	-	-	-	-	-	+
	06/36-42”	-	-	-	-	-	-	-	-	-	+
	07/42-28”	-	-	-	-	-	-	-	-	-	+
	19/108-111”	Coarse sand (not sifted below 07/42-48”)									
S500W250	01/00-08”	-	-	-	-	-	-	-	-	-	+
	02/08-13”	-	-	-	-	-	-	-	-	-	+
	03/13-20”	-	-	-	-	-	-	-	-	-	+
	04/20-26”	-	-	-	-	-	-	-	-	-	+
	05/26-33”	-	-	-	-	-	-	-	-	-	+
	06/33-39”	-	-	-	-	-	-	-	-	-	+
	12/69-75”	Gray sandy clay (not sifted below 11/63-69”)									

+ Charcoal sample (not itemized or retained)

MV – Meta-volcanic
CH/JA – Chert/Jasper
PB – Coarse sand/pebblesFA – Faunal
FL/CH – Floral/Charcoal
FR – Fire cracked rocks
DE – Debitage
M – Modified or worn

Table 3.11g

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FL/ CH	FA
	FR	DE	M	FR	DE	M	DE	M	DE	M	DE	M			
	Approx. 9 inches of Ap soil removed by fire road														
01 (09-13)	-	-	-	-	-	-	-	-	-	-	-	-	3	+	-
02 (13-17)	-	4	-	-	-	-	-	-	-	-	-	-	-	+	-
03 (17-21)	-	31	-	-	1	-	-	-	-	-	-	-	3	+	-
04 (21-25)	-	120	-	-	-	-	2	-	-	-	-	-	4	+	1
05 (25-29)	-	260	2	-	-	-	5	-	-	-	-	-	8	+	-
06 (29-33)	-	369	6	-	1	-	15	-	2	-	-	-	3	+	-
07 (33-37)	-	269	2	-	3	-	10	-	-	-	-	-	12	+	-
08 (37-41)	-	93	-	-	1	-	4	-	-	-	-	-	15	+	-
09 (41-45)	-	25	-	-	-	-	1	-	-	-	-	-	4	+	-
10 (45-49)	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-

+ Charcoal sample (not itemized)

MV – Meta-volcanic
CH/JA – Chert/Jasper
PB – Coarse sand/pebbles
FA – Faunal
FL/CH – Floral/Charcoal
FR – Fire cracked rocks
DE – Debitage
M – Modified or worn

Table 3.12: Test trench RP1 artifacts (note four-inch levels). Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FL/ CH	FA
	FR	DE	M	FR	DE	M	DE	M	DE	M	DE	M			
01 (00-09)	-	-	-	-	-	-	-	-	-	-	-	-	2	+	-
02 (09-11)	-	-	-	-	-	-	1	-	-	-	-	-	1	+	-
03 (11-13)	-	-	-	-	-	-	-	-	-	-	-	-	2	+	-
04 (13-15)	-	-	-	-	-	-	-	-	-	-	-	-	2	+	-
05 (15-17)	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
06 (17-19)	-	-	-	-	-	-	-	-	-	-	-	-	2	+	-
07 (19-21)	-	1	-	-	-	-	-	-	-	-	-	-	-	+	-
08 (21-23)	-	1	-	-	1	-	-	-	-	-	-	-	-	+	-
09 (23-25)	-	2	-	-	-	-	-	-	-	-	-	-	3	+	-
01 (00-09)	-	-	-	-	-	-	-	-	-	-	-	-	2	+	-
10 (25-27)	-	2	-	-	-	-	-	-	-	-	-	-	1	+	-
11 (27-29)	-	4	-	-	-	-	-	-	-	-	-	-	-	+	-
12 (29-31)	-	6	-	-	1	-	-	-	11	1	-	-	3	+	-
13 (31-33)	-	8	2	-	-	-	-	-	12	-	-	-	8	+	-
14 (33-35)	-	7	-	-	-	-	-	-	6	-	-	-	12	+	-
15 (35-37)	-	6	1	-	-	-	-	-	7	-	-	-	14	+	-
16 (37-39)	-	5	-	-	-	-	-	-	6	-	-	-	22	+	-
17 (39-41)	-	8	-	-	-	-	-	-	12	-	-	-	27	+	-
18 (41-43)	-	1	-	-	-	-	-	-	3	-	-	-	12	+	-
19 (43-45)	-	-	-	-	-	-	-	-	1	-	-	-	1	+	-
20 (45-47)	-	-	-	-	-	-	-	-	-	-	-	-	2	+	-
21 (47-49)	-	-	-	-	-	-	-	-	-	-	-	-	2	+	-
22 (49-51)	-	-	-	-	-	-	-	-	2	-	-	-	-	+	-
23 (51-53)	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
24 (53-55)	-	-	-	-	-	-	-	-	1	-	-	-	-	+	-

+ Charcoal sample (not itemized)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.13: Test trench RP2 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV			CH/JA		Other		PB	FL/ CH	FA
	FR	DE	M	FR	DE	M	FR	DE	M	DE	M	DE	M			
00 Slump	-	59	-	-	-	-	-	-	-	-	-	1	-	7	+	-
															-	
01 (00-09)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
02 (09-11)	-	3	-	-	-	-	-	-	-	-	-	-	-	1	+	-
03 (11-13)	-	1	-	-	-	-	-	-	-	-	-	-	-	2	+	-
04 (13-15)	-	4	-	-	-	-	-	-	-	-	-	-	-	2	+	-
05 (15-17)	-	3	-	-	-	-	-	-	-	-	-	-	-	1	+	-
06 (17-19)	-	8	-	-	-	-	-	-	-	-	-	-	-	1	+	-
07 (19-21)	-	8	1	-	1	-	-	-	-	-	-	-	-	5	+	-
08 (21-23)	-	14	-	-	-	-	-	-	-	1	-	-	-	2	+	-
09 (23-25)	-	33	1	-	1	-	-	2	-	-	-	-	-	4	+	-
10 (25-27)	-	47	1	-	1	-	-	-	-	-	-	-	-	5	+	-
11 (27-29)	-	55	1	-	1	-	-	1	-	-	-	1	-	4	-	-
12 (29-31)	1	106	1	-	1	-	-	1	-	1	1	1	-	6	+	-
13 (31-33)	-	143	2	-	2	-	-	-	-	3	-	2	-	7	+	-
14 (33-35)	-	96	1	2	2	-	-	3	-	1		-	-	10	+	-
15 (35-37)	-	80	2	-	1	-	-	-	-	1	-	-	-	12	+	-
16 (37-39)	-	47	1	-	-	-	-	-	-	-	-	-	-	10	+	-
17 (39-41)	-	12	-	-	-	-	-	-	-	-	-	-	-	8	+	-
18 (41-43)	-	2	-	-	-	-	-	-	-	-	-	-	-	5	+	-
19 (43-45)	-	-	-	-	-	-	-	-	-	-	-	-	-	2	+	-
20 (45-47)	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
21 (47-49)	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
22 (49-51)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-

+ Charcoal sample (not itemized)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.14: Test trench RP3 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FL/ CH	FA
	FR	DE	M	FR	DE	M	DE	M	DE	M	DE	M			
01 (00-08)	1	19	-	-	-	-	-	-	-	-	-	-	3	-	-
02 (08-10)	-	30	-	-	1	-	-	-	1	-	-	-	1	+	-
03 (10-12)	-	61	-	-	4	-	-	-	-	-	-	-	5	-	-
04 (12-14)	-	95	-	-	7	-	-	-	3	-	-	-	6	-	-
05 (14-16)	-	105	-	1	14	-	-	-	1	-	-	-	8	-	-
06 (16-18)	1	145	-	-	23	-	-	-	-	-	-	-	14	-	-
07 (18-20)	1	287	1	-	34	-	-	-	1	-	-	-	23	-	-
08 (20-22)	-	245	-	-	34	-	-	-	1	-	-	-	23	+	-
09 (22-24)	4	235	2	-	27	-	-	-	5	-	-	-	29	+	-
10 (24-26)	-	171	-	-	9	-	-	-	5	-	-	-	26	+	-
11 (26-28)	1	107	-	-	11	-	-	-	2	-	-	-	23	+	-
12 (28-30)	1	32	-	-	3	-	-	-	-	-	-	-	13	-	-
13 (30-32)	-	24	-	-	-	-	-	-	-	-	-	-	14	-	-
14 (32-34)	-	9	-	-	-	-	-	-			-	-	3	-	-
15 (34-36)	-	3	-	-	-	-	-	-	-	-	-	-	7	-	-
16 (36-38)	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-
17 (38-40)	-	1	-	-	-	-	-	-	-	-	-	-	2	-	-
18 (40-42)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19 (42-44)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20 (44-46)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

+ Charcoal sample (not itemized)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.15: Test trench RP4 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FL/ CH	FA
	FR	DE	M	FR	DE	M	DE	M	DE	M	DE	M			
	Approx. 6 inches of Ap soil removed by fire road														
01 (06-08)	-	4	-	-	-	-	-	-	1	-	-	-	1	-	-
02 (08-10)	-	1	-	-	-	-	-	-	-	-	-	-	2	-	-
03 (10-12)	-	-	-	-	-	-	1	-	-	-	-	-	1	+	-
04 (12-14)	-	-	-	-	-	-	-	-	1	-	-	-	2	+	-
05 (14-16)	-	1	-	-	-	-	1	-	3	-	1	-	1	+	-
06 (16-18)	-	2	-	-	2	1	-	-	-	1	-	-	1	+	-
07 (18-20)	-	8	-	-	3	-	-	-	6	-	-	-	11	+	-
08 (20-22)	-	6	-	-	2	-	-	-	5	-	-	-	8	+	-
09 (22-24)	2	10	-	-	2	-	-	-	10	-	-	-	11	-	-
10 (24-26)	-	10	1	1	2	-	-	-	5	-	-	-	21	+	-
11 (26-28)	-	6	-	-	1	-	-	-	6	-	-	-	15	+	-
12 (28-30)	-	8	-	-	-	-	-	-	8	-	-	-	27	+	-
13 (30-32)	-	2	-	-	-	-	-	-	3	-	-	-	12	+	-
14 (32-34)	-	1	-	-	-	-	-	-			-	-	6	+	-
15 (34-36)	-	-	-	-	-	-	-	-	-	-	-	-	7	+	-
16 (36-38)	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-
17 (38-40)	-	1	-	-	-	-	-	-	-	-	-	-	2	+	-
18 (40-42)	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
19 (42-44)	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
20 (44-46)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

+ Charcoal sample (not itemized)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.16: Test trench RP5 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FL/CH	FA
	FR	DE	M	FR	DE	M	DE	M	DE	M	DE	M			
00 Slump	-	24	1	-	-	-	-	-	1	-	-	-	1	+	-
	Approx. 9 inches of Ap soil removed by fire road														
01 (09-11)	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
02 (11-13)	-	1	-	-	-	-	-	-	-	-	-	-	1	+	-
03 (13-15)	-	-	-	-	-	-	-	-	-	-	-	-	1	+	-
04 (15-17)	-	1	-	-	-	-	-	-	-	-	-	-	2	+	-
05 (17-19)	-	1	-	-	-	-	-	-	1	-	-	-	1	+	-
06 (19-21)	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-
07 (21-23)	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-
08 (23-25)	-	9	-	-	-	-	-	-	1	-	-	-	-	-	-
09 (25-27)	-	27	-	-	1	-	-	-	-	-	-	-	2	-	-
10 (27-29)	-	21	-	-	-	-	-	-	-	-	-	-	1	+	-
11 (29-31)	-	33	-	-	-	-	-	-	-	-	-	-	6	+	-
12 (31-33)	-	78	-	-	1	-	1	-	-	-	-	-	5	+	-
13 (33-35)	-	96	-	-	-	-	-	-	1	-	-	-	3	+	-
14 (35-37)	-	152	-	-	-	-	2	-	-	-	-	-	10	+	-
15 (37-39)	-	157	-	-	-	-	1	-	2	-	-	-	13	+	-
16 (39-41)	-	62	-	-	-	-	-	-	1	-	-	-	11	+	-
17 (41-43)	-	41	-	-	1	-	-	-	1	-	-	-	4	+	-
18 (43-45)	-	12	-	-	-	-	-	-	1	-	-	-	8	+	-
19 (45-47)	-	5	-	-	-	-	-	-	-	-	-	-	7	+	-
20 (47-51)	-	2	-	-	-	-	-	-	-	-	-	-	2	+	-

+ Charcoal sample (not itemized)

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.17: Test trench RP6 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FL/ CH	FA
	FR	DE	M	FR	DE	M	DE	M	DE	M	DE	M			
00 Slump	-	1	1	-	2	-	-	-	-	-	-	-	12	+	-
01 (00-09)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
02 (09-11)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03 (11-13)	-	1	-	-		-	-	-	-	-	-	-	1	-	-
04 (13-15)	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
05 (15-17)	-	-	-	-	-	-	-	-	-	-	-	-	2	+	-
06 (17-19)	-	-	-	-		-	-	-	-	-	-	-	-	+	-
07 (19-21)	-	1	-	-	-	-	-	-	-	-	-	-	2	+	-
08 (21-23)	-	1	1	-	1	-	-	-	-	-	-	-	-	+	-
09 (23-25)	-	2	-	-	-	-	-	-	-	-	-	-	2	-	-
10 (25-27)	-	5	-	-	-	-	-	-	-	-	-	-	-	+	1
11 (27-29)	-	2	1	-	1	-	-	1	-	-	-	-	5	+	-
12 (29-31)	-	4	-	-	-	-	-	-	-	-	-	-	8	+	-
13 (31-33)	-	9	1	-	1	1	-	-	-	-	-	-	12	+	1
14 (33-35)	-	2	2	-	-	-	-	-	-	2*	-	-	13	+	-
15 (35-37)	-	4	-	-	-	-	-	-	1	-	-	-	20	+	1
16 (37-39)	-	2	-	-	-	-	1	-	-	-	-	-	24	+/9	3
17 (39-41)	-	1	-	-	-	-	-	-	-	-	-	-	18	+/6	-
18 (41-43)	-	-	-	-	-	-	-	-	-	-	-	-	26	+/4	-
19 (43-45)	-	-	-	-	-	-	-	-	-	-	-	-	22	+	-
20/21(45-49)	-	2	-	-	-	-	-	-	-	-	-	-	2	+	-
22 (49-51)	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-
23 (51-53)	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
24 (53-55)	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
25 (55-57)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26 (57-59)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

+ Charcoal sample (not itemized). Numbers after "/" under FL/CH indicate number of mapped pieces of charcoal larger than a pencil eraser (approx. 1/4-inch or 6.3 mm.).

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.18: Test trench RP7 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FL/ CH	FA
	FR	DE	M	FR	DE	M	DE	M	DE	M	DE	M			
01 (00-09)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
02 (09-11)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03 (11-13)	-	3	-	-	1	-	1	-	-	-	-	-	-	+	-
04 (13-15)	-	1	-	-	1	-	1	-	-	-	-	-	-	+	-
05 (15-17)	-	5	-	-	1	-	-	-	-	-	-	-	-	-	-
06 (17-19)	-	1	-	-	1	-	2	-	-	-	-	-	-	-	-
07 (19-21)	-	4	-	-	-	-	3	-	-	-	-	-	6	+	-
08 (21-23)	-	2		-	1	-	9	-	-	-	-	-	7	+	-
09 (23-25)	-	13	-	-	5	-	15	-	-	-	-	-	3	+	-
10 (25-27)	-	17	1	-	5	1	18	-	-	-	-	-	4	+	-
11 (27-29)	-	18	2	-	9	-	25	2	1	-	-	-	3	+/3	-
12 (29-31)	-	27	-	-	7	-	10	-	-	-	-	-	13	+/7	-
13 (31-33)	-	23	-	-	7	-	15	-	-	-	-	-	47	+/3	-
14 (33-35)	-	20	1	-	8	-	14	-	-	-	-	-	17	+/1	-
15 (35-37)	-	9	-	-	2	-	2	-	-	-	-	-	27	+/5	-
16 (37-39)	-	2	-	-	2	-	3	-	-	-	-	-	47	+/9	-
17 (39-41)	-	1	-	-	-	-	-	-	-	-	-	-	20	+/6	-
18 (41-43)	-	-	-	-	-	-	-	-	-	-	-	-	12	+	-
19 (43-45)	-	-	-	-	-	-	-	-	-	-	-	-	16	+	-

+ Charcoal sample (not itemized). Numbers after "/" under FL/CH indicate number of mapped pieces of charcoal larger than a pencil eraser (approx. 1/4-inch or 6.3 mm.).

MV – Meta-volcanic
FA – Faunal
DE – Debitage

CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn

PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.19: Test trench RP8 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FL/ CH	FA
	FR	DE	M	FR	DE	M	DE	M	DE	M	DE	M			
00 Slump	-	36	-	-	1	-	-	-	-	-	-	-	3	+	-
01 (00-09)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
02 (09-11)	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-
03 (11-13)	-	3	-	-	1	-	-	-	-	-	-	-	1	+	-
04 (13-15)	-	6	-	-	-	-	-	-	-	-	-	-	2	+	-
05 (15-17)	-	13	-	-	-	-	-	-	1	-	-	-	2	+	-
06 (17-19)	-	11	-	-	1	-	1	-	-	-	-	-	1	+	-
07 (19-21)	-	14	1	-	-	-	-	-	-	-	-	-	2	+	1
08 (21-23)	2	24	1	-	-	-	1	-	1	-	-	-	1	+	-
09 (23-25)	-	34	1	-	-	-	-	-	-	-	-	-	1	+	-
10 (25-27)	-	44	1	-	2	-	1	-	-	-	-	1	5	+	-
11 (27-29)	1	75	3	-	5	-	1	-	-	-	-	-	8	+/1	-
12 (29-31)	-	58	-	-	3	-	-	-	-	-	-	-	5	+	-
13 (31-33)	-	77	1	-	-	1	1	-	-	-	-	-	22	+/1	-
14 (33-35)	-	39	-	-	-	-	4	-	-	-	-	-	13	+/1	-
15 (35-37)	-	20	-	-	-	-	1	-	-	-	-	-	6	+	-
16 (37-39)	-	12	-	-	-	-	-	-	-	-	-	-	19	+/3	-
17 (39-41)	-	4	-	-	-	-	-	-	-	-	-	-	6	+	-
18 (41-43)	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-
19 (43-45)	-	1	-	-	-	-	-	-	-	-	-	-	4	+	-

+ Charcoal sample (not itemized). Numbers after "/" under FL/CH indicate number of mapped pieces of charcoal larger than a pencil eraser (approx. 1/4-inch or 6.3 mm.).

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.20: Test trench RP9 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Pottery	PB	FL/ CH	FA
	FR	DE	M	FR	DE	M	DE	M	DE	M				
01 (00-09)	-	1	-	-	-	-	-	-	-	-	-	2	-	-
02 (09-11)	-	2	-	-	-	-	-	-	-	-	-	1	+	-
03 (11-13)	-	1	-	-	-	-	-	-	-	-	-	1	+	-
04 (13-15)	-	7	-	-	-	-	-	-	-	-	1	1	+	-
05 (15-17)	-	4	-	-	-	-	-	-	-	-	-	-	+	-
06 (17-19)	-	21	-	-	-	-	-	-	-	-	-	1	+	-
07 (19-21)	-	15	-	-	-	-	-	-	-	-	-	-	+	-
08 (21-23)	-	51	-	-	-	-	-	-	-	-	-	-	+	-
09 (23-25)	-	29	-	-	-	-	3	-	-	-	-	1	+	1
10 (25-27)	-	90	-	-	-	-	1	-	-	-	-	2	+	-
11 (27-29)	-	131	-	-	1	-	2	-	-	-	-	7	+/5	1
12 (29-31)	-	133	1	-	1	-	1	-	1	-	-	18	+/8	-
13 (31-33)	1	363	1	-	-	-	2	-	-	-	-	12	+/7	1
14 (33-35)	-	333	2	-	-	-	3	-	-	-	-	17	+	-
15 (35-37)	-	148	-	-	-	-	1	-	-	-	-	16	+	-
16 (37-39)	1	132	1	-	-	-	2	-	-	-	-	10	+	-
17 (39-41)	-	27	-	-	-	-	-	-	-	-	-	7	+	-
18 (41-43)	-	14	-	-	-	-	-	-	-	-	-	8	+	-
19 (43-45)	-	5	-	-	1	-	-	-	-	-	-	3	+	-
20 (45-47)	-	5	-	-	-	-	-	-	-	-	-	2	+	-
21 (47-49)	-	-	-	-	-	-	-	-	-	-	-	-	+	-
22 (49-51)	-	-	-	-	-	-	-	-	-	-	-	-	-	-

+ Charcoal sample (not itemized). Numbers after "/" under FL/CH indicate number of mapped pieces of charcoal larger than a pencil eraser (approx. 1/4-inch or 6.3 mm.).

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.21: Test trench RP10 artifacts. Depths are in inches below the surface.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FL/ CH	FA
	FR	DE	M	FR	DE	M	DE	M	DE	M	DE	M			
01 (00-09)	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
02 (09-11)	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
03 (11-13)	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
04 (13-15)	-	-	1	-	-	-	-	-	-	-	-	-	-	+	-
05 (15-17)	-	1	-	-	-	-	-	-	-	-	-	-	1	+	-
06 (17-19)	2	2	-	-	-	-	-	-	-	-	-	-	1	+	-
07 (19-21)	-	1	-	-	-	-	-	-	-	-	-	-	1	+/1	-
08 (21-23)	-	2	-	-	-	-	-	-	-	-	-	-	1	+/3	1
09 (23-25)	-	6	-	-	-	-	-	-	-	-	-	-	2	+	1
10 (25-27)	-	5	-	2*	-	-	-	1	-	-	-	-	1	+/3	-
11 (27-29)	3*	2	1	2*	-	-	1	-	-	-	-	-	3	+/1	-
12 (29-31)	-	4	1	2*	-	-	-	-	-	-	-	-	4	+/1	1
13 (31-33)	-	3	-	-	-	-	-	-	-	-	-	-	9	+/3	-
14 (33-35)	-	2	-	-	-	-	-	-	-	-	-	-	8	+	-
15 (35-37)	-	-	-	-	1	-	-	-	-	-	-	-	10	+/3	-
16 (37-39)	-	-	-	-	-	-	-	-	-	-	-	-	11	+/4	-
17 (39-41)	-	-	-	-	-	-	-	-	-	-	-	-	10	+	-
18 (41-43)	-	-	-	-	-	-	-	-	-	-	-	-	7	+	-
19 (43-45)	-	-	-	-	-	-	-	-	-	-	-	-	8	+	-
20 (45-70)	-	-	-	-	-	-	-	-	-	-	-	-	3	+	-

+ Charcoal sample (not itemized). Numbers after "/" under FL/CH indicate number of mapped pieces of charcoal larger than a pencil eraser (approx. 1/4-inch or 6.3 mm.).
* Cross mends within and between levels

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 3.22: Test trench RP11 artifacts sifted through ¼-inch (6.3 mm.) mesh. Depths are in inches below the surface.

Level	East Half				West Half				Total			
	QZ	QU	OT	Tot	QZ	QU	OT	Tot	QZ	QU	OT	Tot
03 (11-13)	2	1	-	3	-	-	-	-	2	1	-	3
04 (13-15)	-	-	-	-	3	1	-	4	3	1	-	4
05 (15-17)	1	-	-	1	6	-	-	7	7	-	-	7
06 (17-19)	1	-	-	1	-	-	-	-	1	-	-	1
07 (19-21)	1	-	-	1	-	-	-	-	1	-	-	1
08 (21-23)	1	1	-	2	7	3	-	10	8	4	-	12
09 (23-25)	2	1	-	3	10	2	-	12	12	3	-	15
10 (25-27)	7	2	1	10	4	-	-	4	11	2	1	14
11 (27-29)	5	11	2	18	12	4	-	16	17	15	2	34
12 (29-31)	1	1	1	3	4	1	-	5	5	2	1	8
13 (31-33)	4	3	-	7	3	5	-	8	7	8	-	15
14 (33-35)	4	1	1	6	1	-	-	1	5	1	1	7
15 (35-37)	2	2	-	4	-	-	-	-	2	2	-	4
16 (37-39)	1	1	-	2	1	1	-	2	2	2	-	4
17 (39-41)	2	2	-	4	-	-	-	-	2	2	-	4
18 (41-43)	-	-	-	-	-	1	-	1	-	1	-	1
19 (43-45)	-	-	-	-	-	1	-	1	-	1	-	1
20 (45-70)	-	-	-	-	-	1	-	1	-	1	-	1

Note: Level 20 consisted of small 2x2-foot (.61x.61 meter) sub-squares in the floor at the ends of the trench.

QZ – Quartzite QU – Quartz OT – Other material Tot – Total artifacts

Table 3.23: Artifact data from the 1/8-inch (3.2 mm.) sample from RP11. The table does not include data from the ¼-inch (6.3 mm.) sample. Depths are in inches below the surface.

Appendix II

Chapter 3: landscape data tables

Level	Quartzite			Quartz			MV		CH/JA		Other			PB	Pottery			FA	FL/ CH	Hist.
	FR	DE	LI	FR	DE	LI	DE	LI	DE	LI	FR	DE	LI		SA	SE	UN			
01 (00-10)	74	469	7a	41	214	10b	5	-	2	-	105	7	-	50	68	21	-	10	+	13
02 (10-14)	102	385	13c	27	83	2	1	-	9	-	34	1	1	55	1	-	9	7	+	-
03 (14-18)	39	342	14d	21	78	1	2	1	18	1e	36	4	-	70	1	-	-	1	+	1
04 (18-22)	12	195	1	11	52	-	1	-	15	1e	18	6	-	222	2	-	2	-	+	-
05 (22-26)	5	44	1	3	7	2	-	1	4	-	-	-	-	162	-	-	-	-	+	-
06 (26-30)	3	-	10	-	6	1	-	-	-	-	-	-	-	649	-	-	-	-	+	-
07 (30-34)	-	2	-	-	1	-	-	-	-	-	-	-	-	2274	-	-	-	-	+	-
08 (34-38) ++	-	3	-	-	-	-	-	-	-	-	-	-	-	543	-	-	-	-	-	-
09 (38-42) +++	-	-	-	-	-	-	-	-	-	-	-	-	-	1916	-	-	-	-	-	-

a Includes Savannah River point (Figure 3.6c)
b Includes triangular point (Figure 3.6b)
c Includes Halifax point (Figure 3.6e)
d Includes lanceolate (Figure 3.6h) & Morrow Mountain points (Figure 3g & i))
e Includes small Morrow Mountain point (Figure 3.6k)
+ Charcoal sample (not itemized)
++ East ½ of level
+++ East ¼ of level

MV – Meta-volcanic CH/JA – Chert/Jasper PB – Pebbles FA – Faunal FL/CH – (Floral)/Charcoal FR – fire cr. rocks
DE – debitage LI – Modified or worn SA – Sand temper SE – Shell temper UN – Unidentified temper

Table 3.2: Test trench K1 artifacts.

Level	Quartzite			Quartz			MV		CH/JA		Other			PB	Pottery			FA	FL/ CH	Hist.
	FR	DE	LI	FR	DE	LI	DE	LI	DE	LI	FR	DE	LI		SA	SE	UN			
01 (00-09)	19	48	4	4	23	2	1	-	-	-	11	8a	-	46	9	0	18	1	+	-
02 (09-13)	17	44	5b	-	26	2	4	-	1	-	20	7a	2a	96	5	-	-	1	+	-
03 (13-17)	4	40	2c	5	44	2	2	-	-	-	24	5a	-	187	-	-	-	1	+	-
04 (17-21)	3	32	2	4	36	1	3	-	2		7	19a	-	508	1	-	-	5	+	-
05 (21-25)	-	6	-	-	18	1	1	-	1	-	-	7a	-	1107	-	-	-	-	+	-
06 (25-29)	(No data recovered - poorly sorted, culturally sterile, coarse fluvial sand)																			

a Mostly greenstone
b Includes Possible Morrow Mountain points (Figure 3.6 p and q)
c Includes unidentified lanceolate biface (Figure 3.6r)
+ Charcoal sample (not itemized)
MV – Meta-volcanic CH/JA – Chert/Jasper PB – Pebbles FA – Faunal FL/CH – (Floral)/Charcoal FR – fire cr. rocks
DE – debitage LI – Modified or worn SA – Sand temper SE – Shell temper UN – Unidentified temper

Table 3.3: Test trench K2 artifacts.

Appendix III

Chapter 4: portrait data tables

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-10)	44	118	12	37	7	-	-	-	-	-	-	-	30	42	-
2 (10-13)	38	104	-	23	12	-	1	-	-	-	1	-	10	2	+
3 (13-16)	51	105	-	45	23	1	4	-	1	-	3	1	7	-	-
4 (16-19)	67	161	5	51	43	6	6	1a	-	-	-	-	23	-	-
4 (Fea. 1)	5	6	5b	3	-	-	1	-	-	-	-	-	-	-	-
5 (19-22)	35	162	7	14	23	3	8	1	2	-	-	1	46	-	-
5 (Fea. 2)	7c	2	2e	4d	-	-	-	-	-	-	-	-	1	-	-
6 (22-25)	13	80f	2	6	21	-	10	1	1	-	-	-	43	-	-
7 (25-28)	6	47	-	3	4	1	6	-	1	-	-	-	72	-	-
8 (28-31)	1	22	-	-	2	-	-	-	3	-	-	-	52	-	-
9 (31-34)	-	15g	-	-	2	-	-	-	-	-	-	-	44	-	-
10 (34-37)	-	1	-	-	-	-	1	-	-	-	-	-	68	-	-
11 (37-40)	-	2	-	-	-	-	-	-	-	-	-	-	124	-	-
12 (40-43)	-	-	-	-	1	-	-	-	-	-	-	-	115	-	-

+ Charcoal sample (not itemized)
a Morrow Mountain II point.
b Includes two matching bifaces from hearth-like feature.
c Includes one cross-mend of two fragments.
d Includes one cross-mend of three fragments.
e Includes mended pecked/pitted and burned cobble.
f Includes one cross-mend of four fragments.
g Includes one blade-like flake.

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.1: Cactus Hill/BBH, Area E, 4x5-foot (1.22x1.52 meter), test trench E1 artifacts, sifted through ¼-inch mesh (6.3 mm.), using three-inch (7.6 cm.) levels except for plowzone/level 1. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-12)	4	8	-	3	3	1	-	-	-	-	-	-	3	7	-
2 (12-16)	5	6	-	4	5	-	1	-	-	-	-	-	12	-	-
3 (16-20)	2	5	-	-	-	-	-	-	-	-	1	-	17	-	-
4 (20-24)	3	-		10	3	-	-	-	-	-	-	-	56	-	-
5 (24-28)	-	-	-	-	-	-	-	-	-	-	-	1-	20	-	-

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.2: Cactus Hill/BBH, Area E, 4x5-foot (1.22x1.52 meter), test trench E2 artifacts, sifted through ¼-inch (6.3 mm.) mesh, using four-inch (10.2 cm.) levels except for plowzone/level 1. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 (10-14)	-	-	-	-	3	1	-	-	-	-	1	-	-	-	-
3 (14-18)	-	1	-	-	1	1	-	-	-	-	-	-	3	-	-
4 (18-22)	1	23	-	-	3	-	-	-	-	-	-	-	6	-	-
5 (22-26)	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-
6 (26-30)	-	5	-	-	-	-	-	-	1	-	-	a	21	-	-
7 (30-34)	-	1	-	-	-	-	-	-	-	-	-	-	3	-	-
8 (34-38)	-	2	-	-	-	-	-	-	-	-	-	-	11	-	-
9 (38-42)	-	-	-	-	-	-	-	-	-	-	-	-	25	-	-
10 (42-46)	-	1b	-	19b	-	-	-	-	-	-	-	-	77	-	-

a Historic, undecorated, white bodied earthenware.
b questionable!

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.3: Cactus Hill/BBH, Area F, 4x4-foot (1.22x1.22 meter), test square F3 artifacts, sifted through ¼-inch (6.3 mm.) mesh, using four-inch (10.2 cm.) levels except for plowzone/level 1, which was not sifted. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 (10-14)	3	1	-	-	-	-	-	-	-	-	-	-	7	-	+
3 (14-18)	-	-	-	1	-	-	-	-	-	-	-	-	5	-	+
4 (18-22)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
5 (22-26)	-	-	-	-	1	-	-	-	-	-	-	-	5	-	+
6 (26-30)	-	-	2	-	-	-	-	-	-	-	-	-	8	-	+
7 (30-34)	-	-	-	-	-	-	-	-	-	-	-	-	14	-	+
8 (34-38)	-	-	-	-	-	-	-	-	-	-	-	-	1	-	+
9 (38-42)	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
10 (42-46)	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
11 (46-50)	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
12 (50-54)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

+ Charcoal sample (not itemized)

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.4: Test trench BBH1 artifacts, from 4x5-foot (1.22x1.52 meter) trench, excavated in four-inch (10.2 cm.) levels sifted through ¼-inch (6.3 mm.) mesh except for plowzone/level 1, which was not sifted. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/ CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-10)	3	15	-	-	-	-	-	-	-	-	1	a	11	1	-
2 (10-14)	-	13	-	2	1	-	-	1b	-	-	1	-	14	-	+
3 (14-18)	7	20	-	1	2	-	-	-	-	-	-	-	6	-	+
4 (18-22)	18	31	1	2	-	-	-	-	1	-	7	-	5	-	+
5 (22-26)	6	4	1	1	-	-	1	-	-	-	4	-	10	-	+
6 (26-30)	-	7	1	-	3	-	2	-	2	-	1	-	20	-	+
7 (30-34)	-	9c	2d	-	-	-	-	1	3	-	-	2e	39	-	-
8 (34-38)	-	4	-	-	1	-	1	-	1	-	-	-	34	-	+
9 (38-42)	-	-	-	-	-	1	1	-	1	-	-	-	27	-	-
10 (42-46)	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-

+ Charcoal sample (not itemized)
a One historic metal fragment.
b Meta-volcanic Savannah River point
c Including one prismatic blade-like flake fragment.
d Including one uniface.
e Including one sandstone abrader.

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.5: Test trench BBH11 artifacts from 5x10-foot (1.52x3.05 meter) trench, sifted through ¼-inch (6.3 mm) mesh, using four-inch (10.2 cm.) levels except for plowzone/level 1. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	FA	FL/ CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 (10-14)	3	12	-	-	1	-	-	-	-	-	-	-	2	-	+
3 (14-18)	20	43	1	1	1	-	-	-	-	-	1	-	-	-	+
4 (18-22)	23	47	5a	1	1	-	-	-	-	-	4	-	-	-	+
5 (22-26)	4	21	2b	-	1	-	-	-	-	-	1	-	4	-	+
6 (26-30)	1	8	-	-	-	-	-	-	-	-	-	-	14	-	+
7a (30-32)	-	2	-	-	1	-	1	-	-	-	-	-	8	-	-
7b (32-34)	-	-	1	-	-	-	-	1	-	-	-	-	17	-	-
8a (34-36)	-	2c	1	-	-	-	-	-	-	-	-	-	17	-	-
8b (36-38)	-	-	-	-	-	-	1	-	-	-	-	-	19	-	+
9a (38-40)	-	-	-	-	-	-	1	-	-	-	-	-	11	-	-
9b (40-42)	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-
10a (42-44)	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-
10b (44-46)	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-

+ Charcoal sample (not itemized)
a Including two Savannah River point bases.
b Including one Savannah River point base.
c Including one blade-like flake.

MV – Meta-volcanic
FA – Faunal
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.6: Test trench BBH12 artifacts from 5x10-foot (1.52x3.05 meter) trench, sifted through ¼-inch (6.3 mm) mesh, using four-inch (10.2 cm.) levels except for plowzone/level 1. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 (10-14)	1	65	3	-	9	1	-	-	-	-	-	-	2	-	-
3 (14-18)	1	32	2a	-	1	-	-	-	-	-	-	-	2	-	+
4 (18-22)	-	7	-	-	1	-	-	-	-	-	-	-	6	-	-
5 (22-26)	1	3	-	-	2	-	-	-	-	-	-	-	8	-	-
6a (26-30)	-	4	-	-	1	-	-	-	-	-	-	-	19	-	+
7a (30-32)	-	3b	-	-	-	-	-	-	-	-	-	-	5	-	-
7b (32-34)	1	2	-	-	-	-	2	-	-	-	-	-	16	-	+
8a (34-36)	-	1	1c	-	-	-	1	-	-	-	-	-	6	-	+
8b (36-38)	-	-	-	-	-	-	1	-	-	-	-	-	11	-	+
9a (38-40)	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-
9b (40-42)	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-
10a (42-46)	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-

+ Charcoal sample (not itemized)
a Fluted point fragment (Clovis age?).
b Including one prismatic blade-like flake fragment.
c Cactus Hill-like point base.

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.7: Test trench BBH10 artifacts from 5x10-foot (1.52x3.05 meter) trench, sifted through ¼-inch (6.3 mm) mesh, using four-inch (10.2 cm.) levels except for plowzone/level 1. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-11)	-	1	-	-	1	-	-	-	-	-	-	2a	3	-	+
2 (11-13)	3	4	-	-	2	-	-	-	-	-	-	-	111	-	+
3 (13-15)	-	5	-	1	5	-	-	-	-	-	-	-	157	-	+
4 (15-17)	-	1	1b	-	6	1	-	-	-	-	-	-	121	-	+
5 (17-19)	-	8	-	-	6	-	-	-	-	-	-	-	164	-	+
6 (19-21)	-	11	1	-	9	-	-	-	-	-	-	-	204	-	+
7 (21-23)	1	12	-	-	8	-	-	-	-	-	-	2c	213	-	+
8 (23-25)	-	14	-	-	6	-	-	-	-	-	-	-	105	-	+
9 (25-27)	-	27	1	-	8	-	-	-	-	-	-	-	128	-	+
10 (27-29)	-	27	-	-	8	-	-	-	-	-	-	-	205	-	+
11 (29-31)	-	25	2	-	14	-	-	-	-	-	-	-	352	-	+
12 (31-33)	-	29d	1	-	13	-	-	-	-	-	-	-	267	-	+
13 (33-35)	-	13	-	-	8	-	-	-	-	-	-	-	199	-	+
14 (35-37)	-	6	-	-	3	-	-	-	-	-	-	-	129	-	+
15 (37-39)	-	6	1	-	1	-	-	-	-	-	-	-	120	-	+
16 (39-41)	-	-	-	-	-	-	-	-	-	-	-	-	100	-	+
17 (41-43)	-	-	-	-	-	-	-	-	-	-	-	-	152	-	+
18 (43-45)	-	-	-	-	-	-	-	-	-	-	-	-	40	-	+
19 (45-47)	-	-	-	-	-	-	-	-	-	-	-	-	38	-	-
20 (47-49)	-	-	-	-	-	-	-	-	-	-	-	-	39	-	-

+ Charcoal sample (not itemized)
a Ferrous metal.
b Savannah River point.
c Clear quartz.
d Includes one blade-like flake.

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.8: Test trench BBH2A artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone was sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 10-18 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-11)	-	2	-	-	-	-	-	-	-	-	3	2a	5b	-	+
2 (11-13)	1	1	-	-	1	-	-	-	-	-	-	-	77	-	+
3 (13-15)	-	2	-	-	1	-	-	-	-	-	-	-	59	-	+
4 (15-17)	1	8	-	2	2	-	-	-	-	-	-	-	48	-	+
5 (17-19)	1	3	-	-	2	-	-	-	-	-	-	-	41	-	+
6 (19-21)	-	13	-	-	7	-	-	-	-	-	-	-	104	-	+
7 (21-23)	-	21	-	-	7c	-	-	-	-	-	-	-	86	-	+
8 (23-25)	-	31	-	-	6	-	-	-	1	-	-	-	275	-	+
9 (25-27)	-	39	-	-	10	-	-	-	-	-	-	-	361	-	+
10 (27-29)	-	46	1	-	9	-	-	-	-	-	-	-	230	-	+
11 (29-31)	-	51	1d	-	33c	-	1	-	-	-	-	2	444	-	+
12 (31-33)	-	111e	3d	-	16f	1	-	-	-	-	-	2	1452	-	+
13 (33-35)	-	45	-	-	10g	1	-	-	-	-	-	-	886	-	+
14 (35-37)	-	29	-	-	10	-	-	-	-	-	-	-	796	-	+
15 (37-39)	-	15	-	-	4	-	1	-	-	-	1	1	524	-	+
16 (39-41)	-	11	-	-	1	-	-	-	-	-	-	-	461	-	+
17 (41-43)	-	1	-	-	-	-	-	-	-	-	-	-	172	-	+
18 (43-45)	-	-	-	-	-	-	-	-	-	-	-	-	268	-	+
19 (45-47)	-	-	-	-	4	-	-	-	-	-	-	-	182	-	+
20 (47-49)	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-

+ Charcoal sample (not itemized)
a Ferrous metal.
b From ¼-inch screen..
c Includes one clear quartz.
d Includes one ross mend between one-inch levels.
e Includes three blade-like flakes.
f Includes five clear quartz.
g Includes four clear quartz.

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.9: Test trench BBH2B artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone was sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 10-18 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-10)	-	3	-	a	-	-	-	-	-	-	-	10b	3	2	+
2 (10-12)	-	2	-	-	-	-	-	-	-	-	-	-	49	-	+
3 (12-14)	1	4	-	a	-	-	-	-	-	-	-	-	90	-	+
4 (14-16)	2	1	-	-	-	-	-	-	-	-	1	-	73	-	+
5 (16-18)	-	2	1	-	-	-	-	-	-	-	-	-	111	-	+
6 (18-20)	-	1	-	-	1	-	-	-	-	-	-	-	125	-	+
7 (20-22)	-	6	-	-	-	-	-	-	-	-	-	-	95	-	+
8 (22-24)	-	9	-	-	1	-	-	-	-	-	-	-	164	-	+
9 (24-26)	-	7	-	-	8	-	1	-	-	-	-	-	218	-	+
10 (26-28)	-	12	-	-	8	-	-	-	-	-	-	-	158	-	+
11 (28-30)	-	18	-	a	-	-	1c	-	-	-	-	-	220	-	+
12 (30-32)	-	18	1d	a	-	-	1	-	1	-	-	2b	276	-	+
13 (32-34)	-	29	-	-	2	-	2	-	-	-	-	-	400	-	+
14 (34-36)	1	24	1	-	5	-	3	-	-	-	-	-	924	-	+
15 (36-38)	-	7	-	-	3	-	-	-	-	-	-	-	600	-	+
16 (38-40)	-	10	-	-	-	-	-	-	-	-	-	-	1090	-	+
17 (40-42)	-	5	-	-	2	-	-	-	-	-	-	-	435	-	+

+ Charcoal sample (not itemized)
a Cobble.
b Ferrous metal
c Blade-like flake.
d Large pitted/flaked cobble.

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.10: Test trench BBH3A artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone was sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 10-16 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-10)a	-	2	-	-	-	-	-	-	-	-	-	11b	8	1	c
2 (10-12)	-	3	-	-	1	-	-	-	-	-	-	1b	76	-	+
3 (12-14)	-	2	1d	-	-	-	-	-	-	-	-	-	48	-	+
4 (14-16)	-	1	1b	-	-	-	-	-	-	-	-	-	59	1	+
5 (16-18)	-	1	-	1	-	-	-	-	-	-	-	1b	53	-	+
6 (18-20)	-	2	-	-	-	-	1	-	-	-	-	-	45	-	+
7 (20-22)	2	4	-	-	-	-	-	-	-	-	-	-	34	-	+
8 (22-24)	-	6	-	-	-	-	-	-	-	-	-	-	61	-	+
9 (24-26)	-	5	-	-	-	-	1	-	-	-	-	-	63	-	+
10 (26-28)	-	9	-	-	2	-	2	-	-	-	-	1b	127	-	+
11 (28-30)	-	20	-	-	2	-	-	-	-	-	-	-	205	-	+
12 (30-32)	-	11	-	-	2	-	-	-	-	-	-	-	250	-	+
13 (32-34)	-	8	1	-	-	-	-	-	-	-	-	-	207	-	+
14 (34-36)	-	28	3e	-	1	-	2	-	-	-	-	-	593	-	+
15 (36-38)	-	31	1	-	6	-	7	-	1	-	-	-	1185	-	+
16 (38-40)	-	12	-	-	5	-	2	-	1	-	-	2f	1468	-	+
17 (40-42)	-	4	-	-	6	-	2	-	-	-	-	-	897	-	+

+ Charcoal sample (not itemized)
a Includes levels 1A1 (spoil) and 1A2 (Ap).
b Ferrous metal, brick and asphalt shingle.
c Not recovered.
d Possible Savannah River Stemmed point.
e Includes one large quartzite and one large sandstone unifacial chopper/abrader-like tools.
f Includes one ferrous metal and one unidentified stone debitage.

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.11: Test trench BBH3B artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone was sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 10-16 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-11)a	-	-	-	-	-	-	-	-	-	-	-	5b	-	-	c
2 (11-13)	1	23	-	-	2	-	-	-	-	-	-	-	212	-	+
3 (13-15)	-	36	-	-	3	-	-	-	-	-	-	-	176	-	+
4 (15-17)	1	39	-	-	2	-	-	-	-	-	-	-	147	-	+
5 (17-19)	1	48	-	-	6	-	-	-	-	-	1	-	271	-	+
6 (19-21)	-	81	1	-	9	-	-	-	-	-	1d	-	263	-	+
7 (21-23)	1	62	-	-	7	-	-	-	-	-	1d	3	324	-	+
8 (23-25)	1	35	-	-	2	-	-	-	-	-	-	-	244	-	+
9 (25-27)	2	44	-	-	32	-	-	-	-	-	-	4	850	-	+
10 (27-29)	-	46	-	-	18	-	-	-	-	-	-	-	1556	-	+
11 (29-31)	-	36	-	-	11	-	-	-	7	-	-	-	1541	-	+
12 (31-33)	-	3	-	-	1	-	-	-	-	-	-	-	362	-	+
13 (33-35)	-	2	-	-	2	-	2	-	-	-	-	-	350	-	+
14 (35-37)	-	2	-	-	4	-	-	-	-	-	-	-	405	-	+
15 (37-39)	-	1	-	-	2	-	3	-	-	-	-	-	406	-	+
16 (39-41)	-	2	-	-	3	-	3	-	-	-	-	-	420	-	+

+ Charcoal sample (not itemized)
a Includes 1A1 (spoil) and 1A2 (Ap).
b Includes ferrous metal and brick.
c Not recovered.
d Mend.

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.12: Test trench BBH4A artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone was sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 8-15 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-11)a	-	3	-	-	-	-	-	-	-	-	-	1b	-	-	c
2 (11-13)	1	19	-	-	19	-	-	-	-	-	-	-	238	-	+
3 (13-15)	-	60	-	-	12	-	-	-	-	-	-	-	505	-	+
4 (15-17)	-	35	-	-	9	-	-	-	-	-	-	3	340	-	+
5 (17-19)	5	56	-	4	13	-	-	-	-	-	1	-	359	-	+
6 (19-21)	6	61	-	1	19	-	-	-	-	-	-	-	368	-	+
7 (21-23)	7	90	-	-	28	-	-	-	1	-	-	-	402	-	+
8 (23-25)	2	41	-	-	3	-	-	-	-	-	-	-	225	-	+
9 (25-27)	9	34	-	-	19	-	-	-	1	-	-	-	607	-	+
10 (27-29)	-	24	-	-	8	-	-	-	-	-	-	-	680	-	+
11 (29-31)	-	11	-	-	14	-	-	-	-	-	-	-	956	-	+
12 (31-33)	-	15	-	-	24	-	-	-	-	-	-	-	2324	-	+
13 (33-35)	-	12	-	-	14	-	2	-	1	-	-	-	2732	-	+
14 (35-37)	-	6	-	-	5	-	-	-	-	-	-	-	507	-	+
15 (37-39)	-	2	-	-	2	-	-	-	1	-	-	-	559	-	+
16 (39-41)	-	-	-	-	-	-	-	-	-	-	-	-	625	-	+

+ Charcoal sample (not itemized)
a Includes 1A1 (spoil) and 1A2 (Ap).
b Brick fragment.
c Not recovered.

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.13: Test trench BBH4B artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone was sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 8-15 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/ CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-09)	-	4	-	2	2	-	-	-	-	-	-	#a	7	-	+
2 (09-11)	-	1	-	-	-	-	-	-	-	-	-	-	-	-	+
3 (11-13)	3b	9	-	-	-	-	-	-	-	-	-	-	69	-	+
4 (13-15)	3b	9	-	-	1	-	-	-	-	-	-	-	44	-	+
5 (15-17)	2	4	-	-	-	-	-	-	-	-	-	-	44	-	+
6 (17-19)	-	2	-	-	-	-	-	-	-	-	-	-	47	-	+
7 (19-21)	-	-	-	-	-	-	-	-	-	-	-	-	50	-	+
8 (21-23)	-	1	-	-	-	-	-	-	-	-	-	-	23	-	+
9 (23-25)	-	2	-	-	1	-	-	-	-	-	-	-	86	-	+
10 (25-27)	-	4	-	-	-	-	-	-	-	-	-	-	133	-	+
11 (27-29)	-	5	1c	-	1	-	1	-	-	-	-	-	121	-	+
12 (29-31)	-	4	-	-	2	-	-	-	-	-	-	-	125	-	+
13 (31-33)	-	6	-	-	1	-	-	-	-	-	-	-	310	-	+
14 (33-35)	-	4	-	-	1	-	-	-	-	-	-	-	323	-	+
15 (35-37)	-	-	-	-	2	-	-	-	-	-	-	-	288	-	+
16 (37-39)	-	-	-	-	1	-	-	-	-	-	-	-	267	-	+
17 (39-41)	-	-	-	-	-	-	-	-	-	-	-	-	94	-	+

+ Charcoal sample (not itemized)
a Includes a large uncounted sample of ferrous, plus asphalt shingle, mortar and undecorated white
bodied earthenware.
b Includes one mend between levels.
c Hammerstone?.

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.14: Test trench BBH5A artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone was sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 10-15 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. <u>Note that for comparative purposes the actual size of the square is 5x2.5 feet (1.52x.76 meters), because the eastern approximately 1/2 of the square consisted of backfill soil from the 2002 test trench.</u> Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/ CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-09)	-	1	-	-	-	-	-	-	-	-	-	1a	-	-	+
2 (09-11)	-	1	-	-	-	-	-	-	-	-	-	-	-	-	+
3 (11-13)	-	5	-	-	-	-	-	-	-	-	-	1a	3	-	+
4 (13-15)	-	1	-	-	-	-	-	-	-	-	-	-	15	-	+
5 (15-17)	-	1	-	1	-	-	-	-	-	-	-	-	16	-	+
6 (17-19)	1	4	-	-	-	-	-	-	-	-	-	-	21	-	+
7/8 (19-23)	2	2	-	-	-	-	-	-	-	-	-	-	29	-	+
9 (23-25)	-	-	-	-	-	-	-	-	-	-	-	-	26	-	+
10 (25-27)	6	1	-	-	-	-	-	-	-	-	-	-	35	-	+
11 (27-29)	-	3	-	-	-	-	-	-	-	-	-	1b	33	-	+
12 (29-31)	-	3	-	-	1	-	-	-	-	-	-	2b	53	-	+
13 (31-33)	-	5	-	-	2	-	3	-	-	-	-	-	66	-	+
14 (33-35)	-	3	-	-	-	-	-	-	-	-	-	-	91	-	+
15 (35-37)	-	-	-	-	4	-	-	-	-	-	-	-	116	-	+
16 (37-39)	-	-	-	-	-	-	-	-	-	-	-	-	135	-	+
17 (39-41)	-	-	-	-	-	-	-	-	-	-	-	-	131	-	+

+ Charcoal sample (not itemized)
a Ferrous metal.
b Hornfels.
c Hammerstone(?).

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.15: Test trench BBH5B artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone was sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 10-15 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. <u>Note that for comparative purposes the actual size of the square is 5x2.5 feet (1.52x.76 meters), because the eastern approximately 1/2 of the square consisted of backfill soil from the 2002 test trench.</u> Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-07)	1	11	1	-	3	-	-	-	-	-	2a	2b	8	-	-
2 (07-09)	-	2	-	-	1	-	-	-	-	-	-	-	2	-	-
3 (09-11)	2	8	-	-	2	-	4	-	-	-	-	1c	104	-	+
4 (11-13)	-	3	1	-	4	-	1	-	-	-	-	-	114	-	+
5 (13-15)	-	5	-	-	2	-	1	-	1	-	-	-	157	-	+
6 (15-17)	-	1	-	-	-	-	1	-	-	-	-	1d	161	-	+
7 (17-19)	-	5	-	-	1	-	4	-	-	-	-	-	200	-	+
8 (19-21)	1	1	-	-	3	-	-	-	-	-	-	-	238	-	+
9 (21-23)	-	2	-	-	-	-	4	-	-	-	-	-	233	-	+
10 (23-25)	-	1	-	-	2	-	-	-	-	-	-	-	231	-	+
11 (25-27)	-	8	-	-	-	-	1	-	-	-	-	-	798	-	+
12 (27-29)	-	1	-	-	-	-	-	-	-	-	-	-	423	-	+
13 (29-31)	-	1	-	-	-	-	-	-	-	-	-	-	135	-	+
14 (31-33)	-	-	-	-	-	-	-	-	-	-	-	-	19	-	-
15 (33-35)	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-
16 (35-37)	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-
17 (37-39)	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-
18 (39-41)	-	-	-	-	-	-	-	-	-	-	-	-	14	-	+

+ Charcoal sample (not itemized)
a Mend.
b Includes ferrous metal and lavender glass.
c Lavender glass.
d Clear glass.

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.16: Test trench BBH6A artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone and level 2 were sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 11-15 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/ CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-07)	4	2	-	-	5	-	-	-	-	-	-	2a	-	-	+
2 (07-09)	1	1	-	-	2	1	-	-	-	-	-	-	-	-	-
3 (09-11)	1	7	1	-	17	-	2	-	1	-	-	-	217	-	+
4 (11-13)	-	11	-	-	19	2	3	-	-	-	-		233	-	+
5 (13-15)	-	10	-	-	16	-	3	-	-	-	-	-	356	-	+
6 (15-17)	-	16	1	-	10	-	-	-	-	-	-	-	399	-	+
7 (17-19)	-	7	1	-	3	-	3	-	1	-	-	-	676	1	+
8 (19-21)	-	9	-	-	2	-	1	-	-	-	-	-	1124	-	+
9 (21-23)	-	15	-	-	2	-	-	-	-	-	-	-	1807	-	+
10 (23-25)	-	12	-	-	14	-	1	-	-	-	-	1a	2506	-	+
11 (25-27)	-	-	-	-	-	-	-	-	-	-	-	-	337	-	+
12 (27-29)	-	-	-	-	-	-	-	-	-	-	-	-	224	-	-
13 (29-31)	-	-	-	-	-	-	-	-	-	-	-	-	215	-	+
14 (31-33)	-	-	-	-	-	-	-	-	-	-	-	-	234	-	-
15 (33-35)	-	-	-	-	-	-	-	-	-	-	-	-	47	-	-
16 (35-37)	-	-	-	-	-	-	-	-	-	-	-	-	19	-	-
17 (37-39)	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-
18 (39-41)	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-

+ Charcoal sample (not itemized)
a Ferrous metal

MV – Meta-volcanic
CP - Pottery
DE – Debitage
CH/JA – Chert/Jasper
FL/CH – Floral/Charcoal
M – Modified or worn
PB – Coarse sand/pebbles
FR – Fire cracked rocks

Table 4.17: Test trench BBH6B artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone and level 2 were sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 11-15 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. Depths are in inches.

Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-07)	-	2	-	1	-	-	-	-	-	-	-	10a	1	-	+
2 (07-09)	-	-	-	-	-	-	-	-	-	-	-	-	1	-	+
3 (09-11)	-	-	-	-	1	-	-	-	-	-	-	-	92	-	+
4 (11-13)	-	1	-	-	2	-	-	-	-	-	-	-	82	-	+
5 (13-15)	-	-	-	-	-	-	-	-	-	-	-	-	87	-	+
6 (15-17)	-	3	-	-	1	-	-	-	1	-	-	-	80	-	+
7 (17-19)	-	1	-	-	1	-	-	-	-	-	-	1b	67	-	+
8 (19-21)	-	1	-	-	-	-	-	-	-	-	-	5b	92	-	+
9 (21-23)	-	2	-	-	-	-	-	-	-	-	-	1b	181	-	+
10 (23-25)	-	1	-	-	1	-	-	-	1	-	-	-	200	-	+
11 (25-27)	-	3	-	-	-	-	-	-	-	-	-	-	217	-	+
12 (27-29)	-	3	-	-	2	-	-	-	-	-	-	1	355	-	+
13 (29-31)	-	-	-	-	-	-	-	-	1	-	-	-	362	-	+
14 (31-33)	-	-	-	-	-	-	-	-	-	1c	-	-	226	-	+
15 (33-35)	-	-	-	-	-	-	-	-	-	-	-	-	126	-	+
16 (35-37)	-	-	-	-	-	-	-	-	-	-	-	-	104	-	-

+ Charcoal sample (not itemized)
a Includes ferrous metal and brick.
b Ferrous metal.
c Possible crinoid bead.

MV – Meta-volcanic
CH/JA – Chert/Jasper
PB – Coarse sand/pebbles
CP - Pottery
FL/CH – Floral/Charcoal
FR – Fire cracked rocks
DE – Debitage
M – Modified or worn

Table 4.18: Test trench BBH7A artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone and level 2 were sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 11-15 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. Depths are in inches.

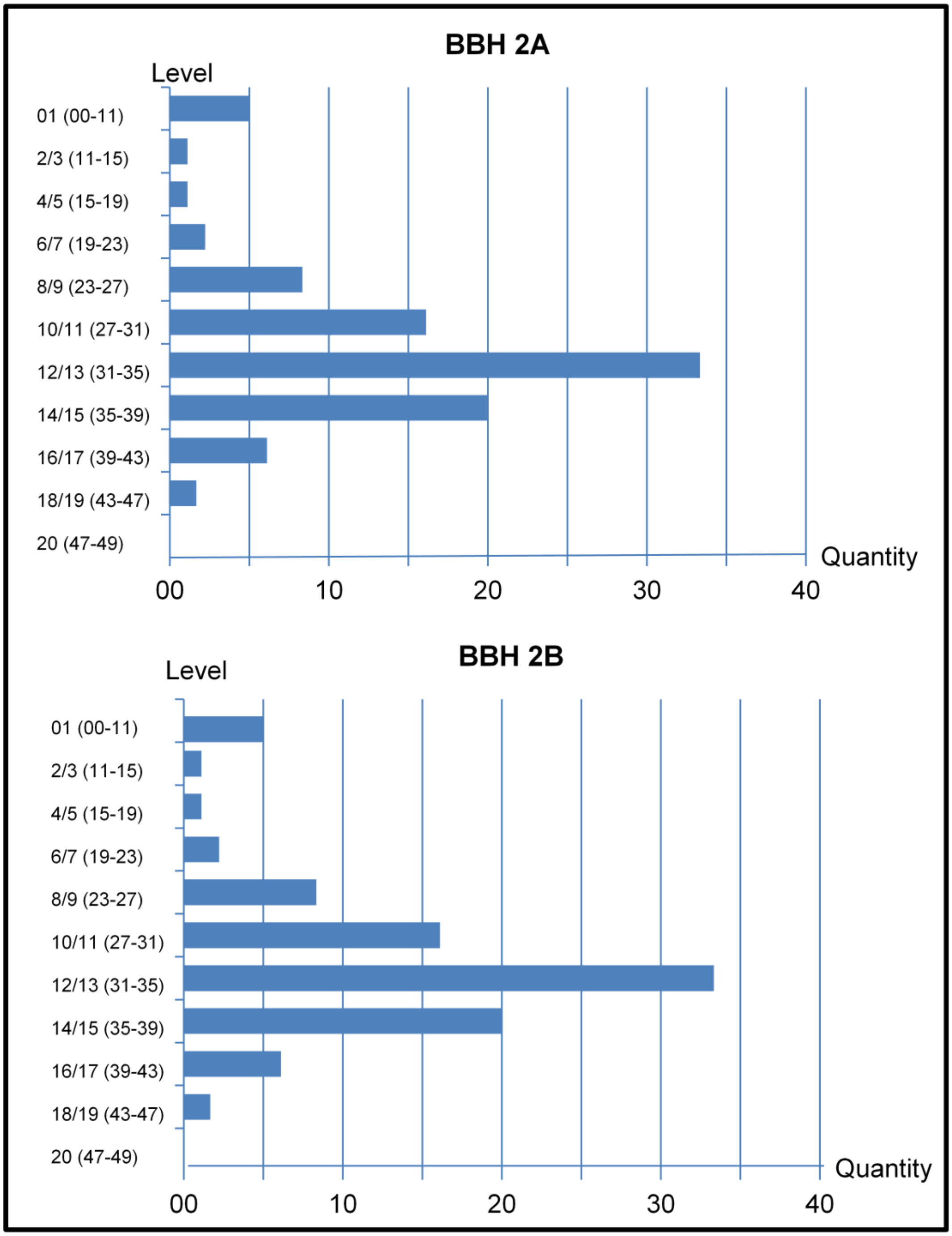
Level	Quartzite			Quartz			MV		CH/JA		Other		PB	CP	FL/CH
	FR	DE	M	FR	DE	M	DE	M	DE	M	FR	DE			
1 (00-07)	2	2	-	-	-	-	-	-	-	-	-	11a	5	3	+
2 (07-09)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
3 (09-11)	-	2	-	-	-	-	-	-	-	-	-	-	141	-	+
4 (11-13)	-	1	-	-	-	-	-	-	-	-	-	-	80	-	+
5 (13-15)	-	2	1b	-	1	-	-	-	-	-	-	-	70	-	+
6 (15-17)	-	-	-	-	1	-	-	-	-	-	-	-	78	-	+
7 (17-19)	-	2	-	-	-	-	-	-	1	-	-	-	50	-	+
8 (19-21)	-	-	-	-	-	-	-	-	-	-	-	-	112	-	+
9 (21-23)	-	2	-	-	-	-	-	-	-	-	-	-	163	-	+
10 (23-25)	-	3	-	-	3	-	-	-	-	-	-	-	202	-	+
11 (25-27)	-	5	-	-	2	-	-	-	-	-	-	-	257	-	+
12 (27-29)	-	7	-	-	-	-	-	-	-	-	-	-	454	-	+
13 (29-31)	-	8	-	-	1c	-	-	-	1	-	-	-	392	-	+
14 (31-33)	-	2	-	-	-	-	-	-	-	-	-	-	358	-	+
15 (33-35)	-	4	-	-	-	-	-	-	-	-	-	-	412	-	+
16 (35-37)	-	-	-	-	-	-	-	-	-	-	-	-	315	-	+

+ Charcoal sample (not itemized)
a Includes ferrous metal, slag, mortar and brick.
b Point mid-section, possibly serrated..
c Clear quartz..

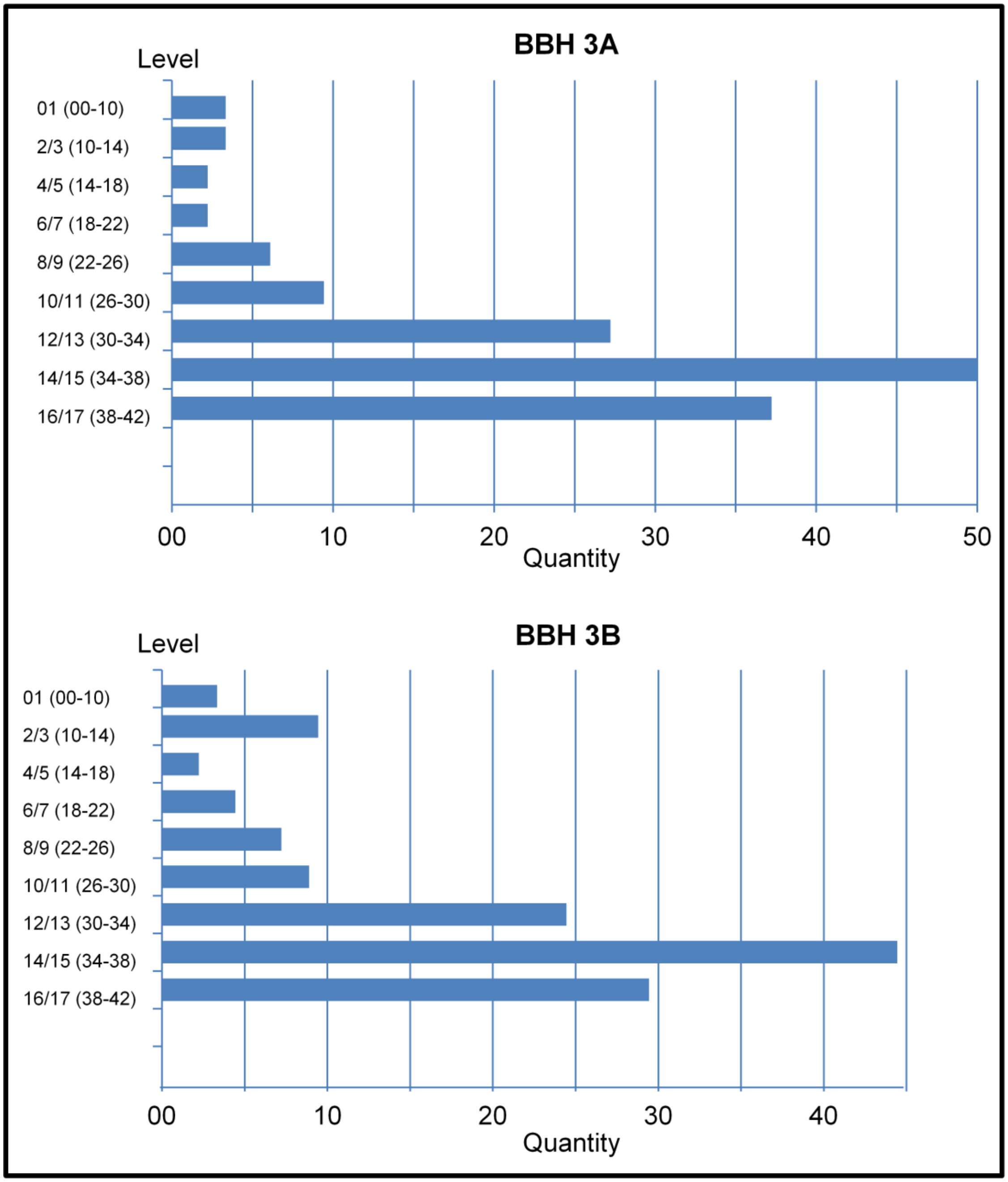
MV – Meta-volcanic
CH/JA – Chert/Jasper
PB – Coarse sand/pebbles
CP - Pottery
FL/CH – Floral/Charcoal
FR – Fire cracked rocks
DE – Debitage
M – Modified or worn

Test trench BBH7B artifacts from 5x10-foot (1.52x3.05 meter) trench, using two-inch (5.1 cm.) levels except for plowzone/level 1. The Plowzone and level 2 were sifted through 1/4-inch (6.3 mm.) mesh. All other levels were sifted through 1/8-inch (3.2 mm) mesh. Levels 11-15 were excavated in one-inch (2.5 cm.) sub-levels, which are merged here for comparative purposes. Depths are in inches.

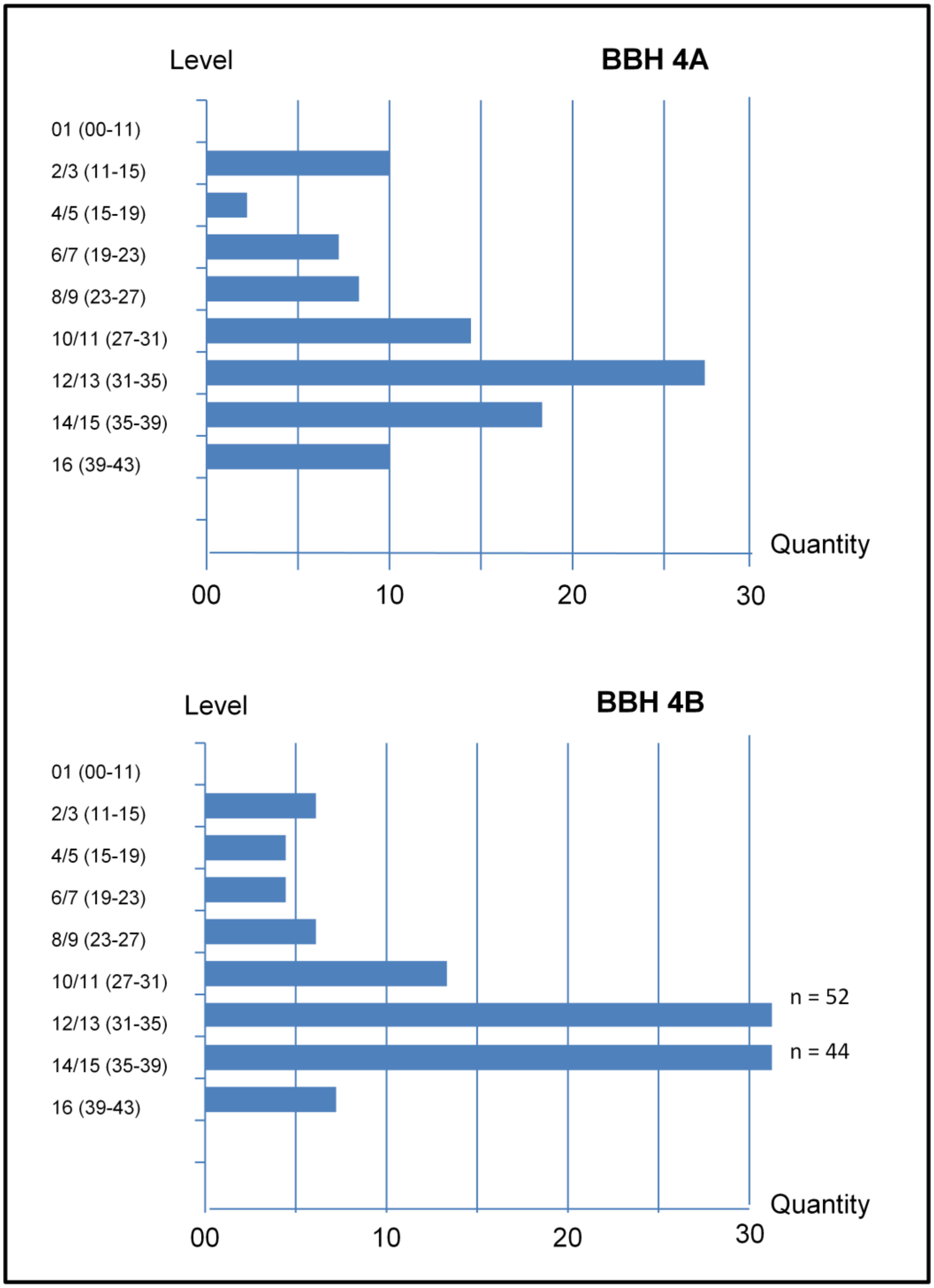
Appendix IV
BBH coarse sand/pebble histograms



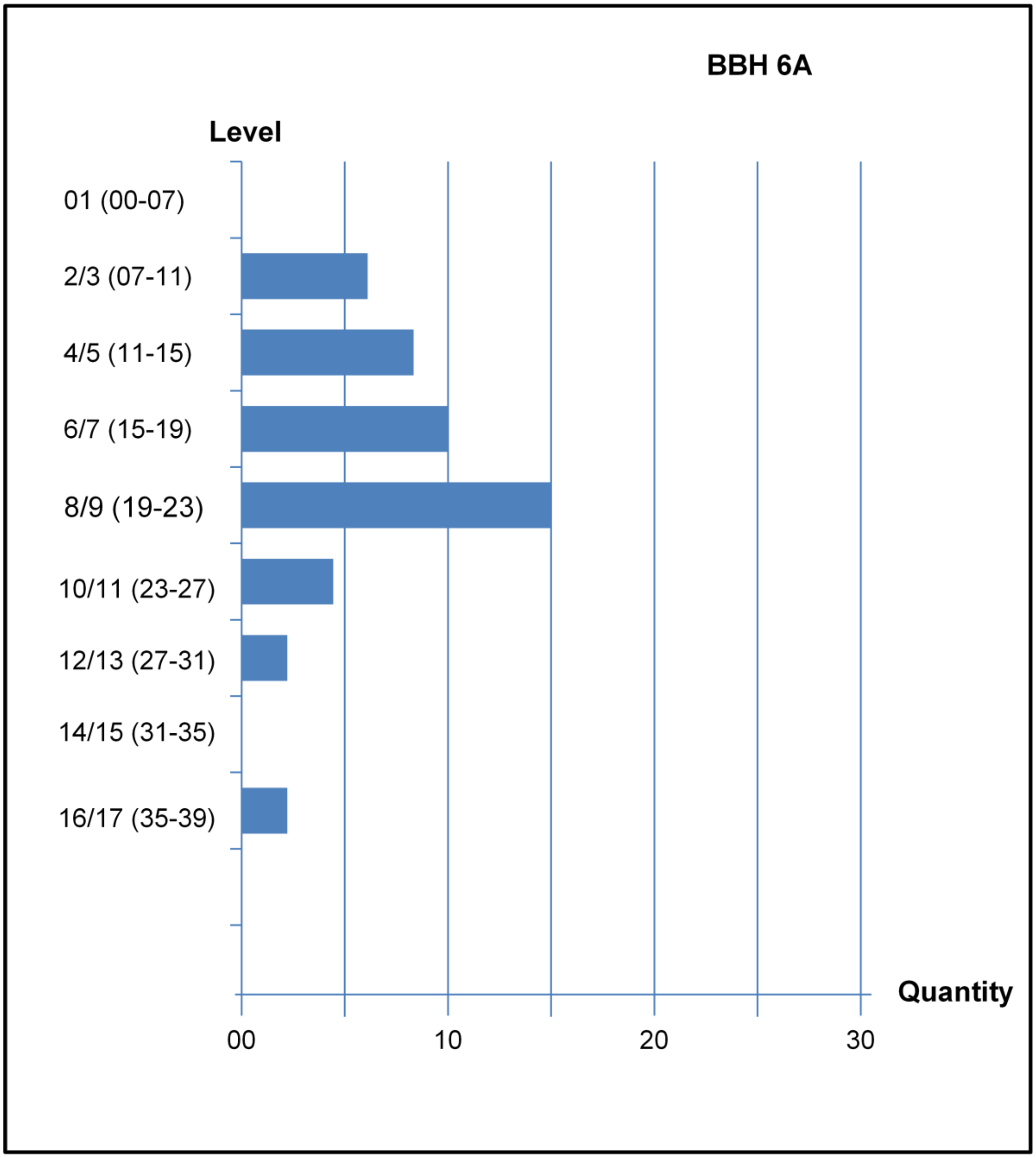
Pebble quantities > ¼-inch (6.3 mm.) mesh for Trench BBH2 (2010) relative to slope with BBH2A being up-slope. Depths are in inches.



Pebble quantities > ¼-inch (6.3 mm.) mesh for Trench BBH3 (2010) relative to slope with BBH3A being up-slope. Depths are in inches.



Pebble quantities > ¼-inch (6.3 mm.) mesh for Trench BBH4 (2010) relative to slope with BBH4A being up-slope. Depths are in inches.



Pebble quantities > ¼-inch (6.3 mm.) mesh for Square BBH6A (2010). Depths are in inches.

References cited

ANDERSON, D.G. 1996: Models of Paleoindian and Early Archaic settlement in the Southeast: a historical perspective, in D.G. Anderson and K. Sassaman (ed.), *The Paleoindian and Early Archaic Southeast*: 29-57. Tuscaloosa (AL): University of Alabama Press.

ANDERSON, D.G. and HANSON, B.T. 1988: Early Archaic settlement in the southeastern United States: a case study from the Savannah River Valley, *American Antiquity* 53: 262-286.

ANDERSON, D. G., YERKA, S.J. and GILLAM, C. 2010: Employing high-resolution bathymetric data to infer possible migration routes of Pleistocene populations, *Current Research in the Pleistocene* 27: 55-59.

BATEMAN, M. D., FREDERICK, C.D., JAISWAL, M.K. and SINGH, A.K., VI. 2003: Investigations into the potential effects of pedoturbation on luminescence dating, *Quaternary Science Reviews* 22: 1169-1176.

BENTHAL, J.L. and McCARY, B.C. 1973: The Williamson Site: a new approach, *Archaeology of Eastern North America* 1: 127-132.

BERKELEY, G. 1710: A treatise concerning the principles of human understanding, in E.A. Burtt (ed.), *The English Philosophers from Bacon to Mill*, 509-584. New York (NY): The Modern Library.

BLANTON, D.B., CHILDRESS, W.A., DANZ, J., MITCHELL, L., J. SCHULDENREIN, J. and ZINN, J. 1996: Archaeological assessment of sites 44PY7, 44PY43, and 44PY152 at Leesville Lake, Pittsylvania County, Virginia, *Virginia Department of Historic Resources Research Report Series No. 7*. Williamsburg (VA): William and Mary Center for Archaeological Research.

BOLDURIAN, A.T. 1985: Variability in flintworking technology at the Krajacic Site: possible relationships to the Pre-Clovis occupation of the Cross Creek Drainage in southwestern Pennsylvania. Unpublished Ph.D. dissertation, Department of Anthropology, University of Pittsburgh (PA).

BOND, W.J. 1986: Illuvial band formation in a laboratory column of sand. *Soil Science Society of America Journal* 50: 265-267.

BOSS, S.K., HOFFMAN, C.H. and COOPER, B. 2002: Influence of fluvial processes on the Quaternary geologic framework of the Continental Shelf, North Carolina, USA, *Marine Geology* 183:45-65.

BRADLEY, B.A., COLLINS, M.B. and HEMMINGS, A. 2010: Clovis technology, International *Monographs in Prehistory - Archaeological Series* 17. Ann Arbor (MI).

BURCH, E.S., JR. 1972: The caribou/wild reindeer as a human resource, *American Antiquity* 37: 339-368.

BURDETT, K. 2011: Blueberry Hill OSL analysis (letter report). Florida Department of Environmental Protection, Tallahassee (FL).

CALLAHAN, E. 1979: The basics of biface knapping in the eastern fluted point tradition: a manual for flintknappers and lithic technologists, *Archaeology of Eastern North America* 7: 1-180.

CARBONE, V.A. 1976: Environment and prehistory in the Shenandoah Valley. Unpublished Ph.D. dissertation, Department of Anthropology, The Catholic University of America, Washington (D.C.).

CARLISLE, R. C. and ADOVASIO, J.M. (ed.) 1982: *Meadowcroft: Collected Papers on the Archaeology of Meadowcroft Rockshelter and the Cross Creek Drainage*, edited volume prepared for the symposium: *The Meadowcroft Rockshelter Rolling Thunder Review: the*

Last Act. Forty-Seventh Annual Meeting of the Society for American Archaeology, Minneapolis (MN).

CHILDRESS, W.A. 1993: The Smith Mountain Site: a buried Paleoindian occupation in the southwestern Piedmont of Virginia, *Current Research in the Pleistocene* 10: 7-9.

COE, J. L. 1964: Formative Cultures of the Carolina Piedmont, *Transactions of the American Philosophical Society* 54 (5): 1-130.

CRAIG, A.J. 1969: Vegetational history of the Shenandoah Valley, Virginia, *Geological Society of America, Inc. Special Paper* 123: 283-296.

COLLINS, M.B. and BRADLEY, B.A. 2008: Evidence for Pre-Clovis occupation at the Gault Site (41BL323), Central Texas, *Current Research in the Pleistocene* 25: 70-72.

COURTY, M.A. 2001: Microfacies analysis assisting archaeological stratigraphy, in P. Goldberg, V.T. Holliday and C.R. Ferring(ed.), *Earth Sciences and Archaeology*, 173-204. New York (NY): Kluwer/Plenum Press.

DENT, R.J. 1985: Amerinds and the environment: myth, reality, and the Upper Delaware Valley, in C.W. McNett, *Shawnee Minisink: a Stratified Paleoindian-Archaic Site in the Upper Delaware Valley of Pennsylvania*, 123-163. Orlando (FL): Academic Press.

DILLEHEY, T.D. (ed.). 1989: *Monte Verde, a Late Pleistocene Settlement in Chile: Paleoenvironment and Site Context*, volume I. Washington (DC): Smithsonian Institution Press.

1997: *Monte Verde, a Late Pleistocene Settlement in Chile: The Archaeological Context and Interpretation*, volume II. Washington (DC): Smithsonian Institution Press.

EGLOFF, K.T. 1989: Native American sites in a Fall Line transition study area, *Research Report Series No. 5*. Richmond (VA): Virginia Department of Historic Resources.

FEATHERS, J.K., RHODES, E.J., HUOT, S. and McAVOY, J.M. 2006: Luminescence dating of sand deposits related to Late Pleistocene human occupation of the Cactus Hill Site, Virginia, USA, *Quaternary Geoarchaeology* 1: 167-187.

FEDJE, D.W., MACKIE, Q., DIXON. E.J. and HEATON, T.H. 2004: Late Wisconsin environments and archaeological visibility on the northern Northwest Coast, in D.B. Madsen (ed.), *Entering America: Northeast Asia and Beringia before the Last Glacial Maximum*, pp. 97-138. Salt Lake City (UT): University of Utah Press.

FIEDEL, S.J. 1999a: Artifact provenience at Monte Verde: confusion and contradictions, *Scientific American Discovering Archaeology:* 1-23.

1999b: Older than we thought: implications of correlated dates for Paleoindians, *American Antiquity* 64: 95-115.

2006: *Climate Change and Point Style Shifts: A Tentative Correlation*. Unpublished paper presented at the Middle Atlantic Archaeological Conference, Virginia Beach (VA)

2012: Is that all there is? The weak case for Pre-Clovis occupation of Eastern North America, in A.M. Gingerich, *The Eastern Fluted Point Tradition*. Salt Lake City (UT): University of Utah Press (in press).

FOSS, J.E. 1974: Soils of the Thunderbird Site and their relationship to cultural occupation and chronology, in W.M. Gardner (ed.), *The Flint Run Paleo-Indian Complex: A Preliminary Report 1971-73 Seasons*; *Occasional Publication No. 1*, pp. 66-83. Washington (DC): Department of Anthropology, Catholic University of America.

FREY, D.G. 1953: Regional Aspects of the late glacial and post-glacial pollen succession of southeastern North Carolina, *Ecological Monographs* 23: 289-313.

FRINK, D.S. 1994: The Oxidizable Carbon Ratio (OCR): a proposed solution to some of the problems encountered with radiocarbon data, *North American Archaeologist* 15: 17-30.

2000: *OCR Analysis of Cactus Hill Site Sediments*. Essex (VT), Archaeology Consulting Team, Inc. (letter report)

FRISON, G.C. 1999: *The Goshen Cultural complex: a Paleoindian Cultural Group Overlapping Clovis*. Unpublished paper presented at the First Clovis and Beyond Conference, Santa Fe (NM).

FRISON, G. and BRADLEY, B. 1999: *The Fenn Cache Clovis Weapons & Tools*. Santa Fe (NM): One Horse Land & Cattle Company.

GARDNER, W.M. 1974: The Flint Run Complex: pattern and process during the Paleo-Indian to Early Archaic, in W.M. Gardner (ed.), *The Flint Run Paleo-Indian Complex: A Preliminary Report 1971-73 Seasons*; *Occasional Publication No. 1*, pp. 5-47. Washington (DC): Department of Anthropology, Catholic University of America.

1989: An examination of cultural change in the Late Pleistocene and Early Holocene (circa 9200 to 6800 B.C.), in J.M. Wittkofski and T.R. Reinhart (eds.), *Paleoindian Research in Virginia: A Synthesis*; *Special Publication No. 19*, pages 5-51. Courtland (VA): Archaeological Society of Virginia.

GILBERT, M.T.P., JENKINS, D.L., GOTHERSTROM, A., NAVARAN, N., SANCHEZ, J.J., HOFREITER, M., THOMSEN P.F., BINLADEN, J., HIGHAM, T.F.G., YOHE, R.M., II, PARR, R., CUMMINGS, L.S. and WILLERSLEV, E. 2008: DNA from pre-Clovis human coprolites in Oregon, North America, *Science* 320: 786-789.

GINGERICH, J.A.M. (ed.). 2012: *The Eastern Fluted Point Tradition*. Salt Lake City (UT): University of Utah Press. (in press)

GLOWACKI, M. 2012: The first Florida "bling": Paleoindian beads, *The Florida Anthropologist* 65: 49-52.

GOODYEAR, A.C., III. 2006: Recognizing the Redstone fluted point in the South Carolina Paleoindian Point Database, *Current Research in the Pleistocene* 23: 100-102.

GRAMLY, R.M. 1998: The *Sugarloaf site: Palaeo-Americans on the Connecticut River*. Buffalo (NY): Persimmon Press.

2008: *Return to Olive Branch: Excavations 2002-2005*. North Andover (MA): American Society for Amateur Archaeology.

HEMMINGS, C.A. and ADOVASIO, J.M. 2012: *Inundated Landscapes and the Colonization of the Northeastern Gulf of Mexico.* Unpublished paper presented at the Smithsonian Institution Pre-Clovis in the America Conference, Washington, D.C.

HOFFMAN, J.L., ROSE, R.O., MARTIN, L.D. and AMICK, D.S. 2000: Folsom adornment and bone technology, *Current Research in the Pleistocene* 17: 42-45.

HOLEN, S.R. 2007: The age and taphonomy of mammoths at Lovewell Reservoir, Jewell County, Kansas, USA, *Quaternary International*, 169-170: 51-63.

INASHIMA, P.Y. 2008: Establishing a radiocarbon date based framework for northeastern Virginia Archaeology, *Quarterly Bulletin of the Archaeological Society of Virginia* 63: 187-290.

JOHNSON, L.L. and STRAIGHT, M. (eds.). 1992: *Paleoshorelines and Prehistory: An Investigation of Method*. Boca Raton (FL): CRC Press.

JOHNSON, M.F. 1979: *Prehistoric survey of the Herndon Municipal Golf Course. Occasional Paper 79-1.* Falls Church (VA), Northern Virginia Chapter, Archaeological Society of Virginia.

1989: The lithic technology and material culture of the first Virginians: an Eastern Clovis perspective, in J.M. Wittkofski and T.R. Reinhart (eds.), *Paleoindian Research in Virginia: A Synthesis*; *Special Publication No. 19*, pp. 95-138. Cortland (VA): Archaeological Society of Virginia.

1996: Paleoindians near the edge: a Virginia perspective, in D.G. Anderson and K.E. Sassaman (eds.), *The Paleoindian and Early Archaic Southeast*, pp. 187-212. Tuscaloosa (AL): University of Alabama Press.

1997: Additional research at Cactus Hill: preliminary description of Northern Virginia Chapter-ASV's 1993 and 1995 excavations, in J.M. McAvoy and L.D. McAvoy (eds.), *Archaeological Investigations of Site 44SX202, Cactus Hill, Sussex County, Virginia*, Appendix G. Richmond (VA), Virginia Department of Historic Resources.

2004: *Chub Sandhill Paleoamerican Survey: Part I – Geoarchaeology*. Richmond (VA): Virginia Department of Conservation and Natural Resources (unpublished technical report).

2006: *Chub Sandhill Paleoamerican Survey: Part II – Archaeological Research during the 2005-2006 Seasons*. Richmond (VA): Virginia Department of Conservation and Natural Resources (unpublished technical report).

JOHNSON, M.F. and ANTHONY, N.H. 2002: *Archaeological Investigations: Lorton town Center 2 (LTC-2) (44FX2077.* Falls Church (VA): Fairfax County Archaeological Services (unpublished technical report).

JOHNSON, M.F. and PEARSALL, J.E. 1991a: The Dr. Ben C. McCary Virginia fluted point survey, nos. 846-867, *Quarterly Bulletin of the Archaeological Society of Virginia* 46:55-69.

1991b: The Dr. Ben C. McCary Virginia fluted point survey, nos. 868-890, *Quarterly Bulletin of the Archaeological Society of Virginia* 46:145-162.

1993: The Dr. Ben C. McCary Virginia fluted point survey, nos. 880-885 and 891-920, *Quarterly Bulletin of the Archaeological Society of Virginia* 48:45-63.

1995: McCary fluted point survey, nos. 921-941, *Quarterly Bulletin of the Archaeological Society of Virginia* 50:17-31.

1996: The Dr. Ben C. McCary Virginia fluted point survey, nos. 942-951, *Quarterly Bulletin of the Archaeological Society of Virginia* 51:178-185.

1998: The Ben C. McCary Virginia fluted point survey, numbers 952-974, *Quarterly Bulletin of the Archaeological Society of Virginia* 53: 2-17.

1999: The Dr. Ben C. McCary Virginia fluted point survey: numbers 975-999, *Quarterly Bulletin of the Archaeological Society of Virginia* 54: 36-53.

JONES, K.B. and JOHNSON, G.H. 1997: Geology of the Cactus Hill archaeological site (44SX202) Sussex County, Virginia, in J.M. McAvoy and L.D. McAvoy (eds.), *Archaeological Investigations of Site 44SX202, Cactus Hill, Sussex County, Virginia*, Appendix C, Richmond (VA): Virginia Department of Historic Resources.

JUDGE, W.J. 1973: *Paleoindian Occupation of the Central Rio Grande Valley of New Mexico*. Albuquerque (NM): University of New Mexico Press.

JUDGE, W.J. and SEBASTIAN, L. (eds.). 1988: *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*. Denver (CO): U.S. Department of the Interior, Bureau of Land Management.

KILLICK, D.J., JULL, A.J.T. and BURR, G.S. 1999: A failure to discriminate: querying oxidizable carbon ratio (OCR) dating, *SAA Bulletin* 17 (Online version)

LEIGH, D.S. 1998: Evaluating artifact burial by eolian verses bioturbation processes, South Carolina Sandhills, USA, *Geoarchaeology* 3:309-330.

2001: Buried artifacts in sandy soils: techniques for evaluating bioturbation verses sedimentation, in P. Goldberg, V.T. Holliday and C.R. Ferring (eds.), *Earth Sciences and Archaeology*, pp. 269-293. New York (NY): Kluwer Academic Press.

2008: Late Quaternary climates and river channels of the Atlantic Coastal Plain, Southeastern USA, G*eomorphology* 101: 90-108.

LEPPER, B. 2011: Pre-Clovis butchers of *Bison Antiquus*, *Mammoth Trumpet* 26: 16-20.

LEWIS, T.M.N. and LEWIS, M.D.K. 1995: *Prehistory of the Chickamauga Basin in Tennessee*, Volume II, (compiled and edited by L.P. Sullivan). Knoxville (TN): University of Tennessee.

LOWERY, D.L., O'NEAL, M.A., WAH, J.S., WAGNER, D.P. and STANFORD, D.J. 2010: Late Pleistocene upland stratigraphy of the western Delmarva Peninsula, USA, *Quaternary Science Reviews* xxx: 1-9.

LUND, C.C. 1997: *Late Pleistocene and Holocene Dunes along the Nottoway River, Sussex County, Virginia*. Williamsburg (VA): Department of Geology, College of William and Mary.

MacPHAIL, R.I. and McAVOY, J.M. 2008: A micromorphological analysis of stratigraphic integrity and site formation at Cactus Hill, an early Paleoindian and hypothesized Pre-Clovis occupation in south-central Virginia, USA, *Geoarchaeology: An International Journal* 23: 675-694.

McAVOY, J.M. 1992: Nottoway River survey – part I - Clovis settlement patterns, *Archaeological Society of Virginia Special Publication Number 28*.

McAVOY, J.M. and McAVOY, L.D. 1997: *Archaeological Investigations of Site 44SX202, Cactus Hill, Sussex County, Virginia*. Richmond (VA): Virginia Department of Historic Resources.

McAVOY, J.M., BAKER, J.C., FEATHERS. J.K., HODGES, R.L., McWEENEY, L. and WHYTE, T.R. 2000 *Summary of Research at the Cactus Hill Archaeological Site, 44SX202, Sussex County, Virginia*. Washington (DC): National Geographic Society (grant report #6345-98)

McCARY, B.C. 1951: A workshop of early man in Dinwiddie County, Virginia. *American Antiquity* 17: 9-17.

1978: Excavations at the Williamson site, Dinwiddie County, Virginia, *Quarterly Bulleting of the Archaeological Society of Virginia* 33: 45-60.

1991: Survey of Virginia fluted points. *Special Publication Number 12*. Richmond (VA): Archaeological Society of Virginia.

McDONALD, J.N. 2000: An outline of the Pre-Clovis archaeology of SV-2, Saltville, Virginia, with special attention to a bone tool dated 14,510yr BP., Jeffersoniana 9: 1-59.

McNETT, C.W., Jr. 1985: *Shawnee Minisink: a stratified Paleoindian-Archaic site in the Upper Delaware Valley of Pennsylvania*. Orlando (FL), Academic Press.

MALHI, R.S., KEMP, B.M., ESHLEMAN, J.A., CYBULSKI, J., SMITH, D.G., COUSINS, S. and HARRY, H. 2007: Mitochondrial haplogroup M discovered in prehistoric North Americans, *Journal of Archaeological Science* 34: 642-648.

MANDEL, R.D. and BETTIS, E.A., III. 2001: Use and analysis of soils by archaeologists and geoscientists, in P. Goldberg, V.T. Holliday and C. R. Ferring (eds.), *Earth Sciences and Archaeology*, pp.173-204. New York (NY): Kluwer/Plenum Press.

MARKEWICH, H.W., LITWIN, R.J., PAVICH, M.J. and BROOK, G. 2009: Late Pleistocene eolian features in southeastern Maryland and Chesapeake Bay Region indicate strong WNW-NW winds accompanied growth of the Laurentide Ice Sheet, *Quaternary Research* 71: 409-425.

MARKEWICH, H.W. and MARKEWICH, W. 1994: *An overview of Pleistocene and Holocene inland dunes in Georgia and the Carolinas – morphology, distribution, age and* *paleoclimate*, U.S. Geological Survey Bulletin 2069. Washington (DC): United States Government Printing Office.

MARKEWICH, H.W., PAVICH, M.J., LITWIN, R.J. and SMOOT, J.P. 2011: *Evidence for Late MIS3 Abrupt Climate Change Preserved in the Delmarva Peninsula Stratigraphic Record*. Unpublished paper presented at the Geological Society of America Annual Meeting, Minneapolis (MN).

MARTIN, P.S. 1973: The discovery of America, *Science* 179: 969-974.

MELTZER, D. J. and MEAD, J.I. 1985: Dating Late Pleistocene extinctions: theoretical issues, analytical bias, and substantive results, in J.I. Mead and D.J. Meltzer (eds.), *Environments and Extinctions: Man and Late Glacial North America*, pp.145-174. Orono (ME): Center for the Study of Early Man.

MOORE, C.R, and DANIEL, I.R., JR. 2011: Geoarchaeological investigations of stratified sand ridges along the Tar River, North Carolina, in C.R. Ewen, T.R. Whyte and R.P.S. Davis, Jr. (eds.), *The Archaeology of North Carolina: Three Archaeological Symposia*, pp. 1-1 through 1-42. Raleigh (NC): North Carolina Archaeological Council Publication 30.

MORSE, D.F. and GOODYEAR, A.C., III. 1973: The significance of the Dalton adz in Northeast Arkansas, *Plains Anthropologist* 18: 100-102.

MULLIGAN, C.J., HUNLEY, K., COLE, S. and LONG, J.C. 2004: Population genetics, history, and health patterns in Native Americans, *Annual Review of Genomics and Human Genetics* 2004/5: 295-315.

MURRAY, A.S. and WINTLE, A.G. 2000: Luminescence dating of quartz using an improved single-aliquot regenerative-dose protocol, *Radiation Measurements* 32: 57-73.

OVERSTREET, D.F. 1993: *Chesrow A Paleoindian Complex in the Southern Lake Michigan Basin*. Milwaukee (WI): Great Lakes Archaeological Press.

2004: Pre-Clovis occupation in southeastern Wisconsin, in B. Lepper and R. Bonnichsen (eds.), *New Perspectives on the First Americans*, pp. 41-48. College Station (TX), Center for the Study of the First Americans and Texas A&M University.

OVERSTREET, D.F., JOYCE, D.J. and WASION, D. 1995: More on cultural contexts of mammoth and mastodon in the southwestern Lake Michigan Basin, *Current Research in the Pleistocene* 12: 40-42.

OVERSTREET, D.F. and STAFFORD, T.W., JR. 1997: Additions to a revised chronology for cultural and non-cultural mammoth and mastodon fossils in the southwestern Lake Michigan Basin, *Current Research in the Pleistocene* 14: 70-71.

PAVICH, M.J., MARKEWICH, H.W., LITWIN, R.L. and BROOK, G.A. 2008: *Measurement of Galaceoisostatic Adjustments in the Mid-Atlantic Region for the Last Two Glacial Cycles*. Unpublished paper presented at the Quaternary Ice Sheet-Ocean Interactions and Landscape Responses session, 20th AMQUA Biennial Meeting at Pennsylvania State University, State College (PA).

PEREZ, S.I., GONZALEZ, B., SARDI, M. and POLITIS, G.G. 2000: Discrepancy between cranial and DNA data of early Americans: implications for American peopling, *PLoS ONE* 4(5): e5746. doi: 10.1371/journal.pone.0005746.

PERON, J.T. (1999) *Micromorphology of the Cactus Hill Site (44SX202), Sussex County, Virginia*. Unpublished BA (Honors) thesis, Department of Anthropology and Earth Sciences, Harvard University, Cambridge (MA).

POWERS-JONES, A.H., PADMORE, J. and GILBERTSON, D.D. 1989: Studies of late prehistoric and modern opal phytoliths from coastal dunes and machair in northwest Britain. *Journal of Archaeological Science* 16: 27-45.

RAVEN MAPS AND IMAGES. 1992: *Landforms and Drainage of the 48 States*. Colorado Springs (CO): Pikes Peak Lithography.

RAWLING, J.E., III. 2000: A review of lamellae, *Geomorphology* 35: 1-9.

RAY, N., WEGMANN, D., FAGUNDES, N.J.R., WANG, S., RUIZ-LINARES, A. and EXCOFFIER, L. 2009: *A Statistical Evaluation of Models for the Initial Settlement of the American Continent Emphasizes the Importance of Gene Flow with Asia*. Society for Molecular Biology and Evolution, Oxford University Press (Online publication).

REDMOND, B.G., McDONALD, H.G., GREENFIELD, H.J. and BURR, M.L. 2012: New evidence for Late Pleistocene human exploitation of Jefferson's ground sloth (*Megalonyx Jeffersonii*) from northern Ohio, USA, *World Archaeology* 44: 75-101.

RINK, W.J., DUNBAR, J.S., TSCHINKEL, W.K., KWAPICH, C., REPP, A., STANTON, W. and THULMAN, D.K. 2012: Subterranean Transport and Deposition of Quartz by Ants in sandy sites Relevant to Age Overestimation in Optical Luminescence Dating, *Journal of Archaeological Science* (doi: 10.1016/j.jas.2012.11.006) (Advanced copy printed from Science Direct web site)

SAGAN, C. 1996: *The Demon-Haunted World: Science as a Candle in the Dark*. New York (NY): Ballantine Press.

SCHURR, T.G. 2004: Molecular genetic diversity in Siberians and Native Americans suggests and early colonization of the New World, in D.B. Madsen (ed.), *Entering America Northeast Asia and Beringia before the Last Glacial Maximum*, pp.187-238. Salt Lake City (UT): University of Utah Press.

SCUDDER, S. J. 1996: Human influence on pedogenisis: midden soils on a Southwest Florida Pleistocene island, in E.J. Reitz, L.A. Newsom and S.J. Scudder (eds.), *Case Studies in Environmental Archaeology*, pp. 55-69. New York (NY): Plenum Press.

SONNENBURG, E.P., BOYCE, J.I. and REINHARDT, E.G. 2011: Quartz flakes in lakes: microdebitage evidence for submerged Great Lakes prehistoric (Late Paleoindian-Early Archaic) tool making sites, *Geology* 39: 631-634.

STANFORD, D.J. and BRADLEY, B.A. 2012: *Across Atlantic Ice: the Origin of America's Clovis Culture*. Berkley (CA): University of California Press.

THOMAS, D.H. 1973: An empirical test for Steward’s model of Great Basin settlement patterns, *American Antiquity* 38: 155-176

THULMAN, D.K. 2012: Bioturbation and the Wakula Springs Lodge Site artifact distributions, *The Florida* Anthropologist 65: 25-34.

UNITED STATES OF AMERICA. 1990: 104 Public Law 101-601; United States Code 3001-3013 (Native American Graves Protection and Repatriation Act).

WAGNER, D.P. and McAVOY, J.M. 2004: Pedoarchaeology of Cactus Hill, a sandy Paleoindian site in southeastern Virginia, *U.S.A. Geoarchaeology: An International Journal* 19: 297-322.

WATERS, M.R., FORMAN, S.L., JENNINGS, T.A., NORDT, L.C., DRIESE, S.G., FEINBERG, J.M., KEENE, J.L., HALLIGAN, J., LINDQUIST, A., PIERSON, A.J., HALLMARK, C.T., COLLINS, M.B. and WIEDERHOLD, J.E. 2011: The Buttermilk Creek complex and the origins of Clovis at the Debra L. Friedkin Site, Texas, *Science* 331: 1599-1603.

WATERS, M.R. and STAFFORD, T.W., JR. 2007: Redefining the age of Clovis: implications for the peopling of the Americas, *Science* 315:1122-1126.

WHITEHEAD, D.R. 1967: Studies of full glacial vegetation and climate in Southeastern United States, in E.J. Cushing and H.F. Wright (eds.), *Quaternary Paleoecology*, pp. 237-248.

1972: Developmental and environmental history of the Dismal Swamp, *Ecological Monographs* 42:301-315.

1981: Late Pleistocene vegetational change in northeastern North Carolina, *Ecological Monographs* 51: 451-471.

WYCKOFF, D.G., THELER, J.L. and CARTER, B.J. (eds.) 2003: *The Burnham Site in Northwestern Oklahoma: Glimpses beyond Clovis*? Sam Noble Oklahoma Museum of Natural History and Oklahoma Anthropological Society Memoir 9.

YOUNG, D.E. and BONNICHSEN, R. 1984: Understanding stone tools: a cognitive approach, in *Peopling of the Americas Process Series, Volume 1*. Orono (ME): Center for the Study of Early Man.