STONE IMPLEMENTS

OF THE

POTOMAC-CHESAPEAKE TIDEWATER PROVINCE

BY

WILLIAM HENRY HOLMES

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ILLUSTRATIONS

[NOTE.—In cases of inconsistency in the sizes of the illustrated objects as given in the descriptive titles thereof and in the following list the sizes given in the latter should govern.]

GROUP IN PLASTER ILLUSTRATING THE WORK CARRIED ON IN AN ABORIGINAL QUARRY WORKSHOP

Prepared by the author for the World's Columbian Exposition at Chicago. See Supplementary Note I, page 150

STONE IMPLEMENTS OF THE POTOMAC-CHESAPEAKE TIDEWATER PROVINCE

By William Henry Holmes

PREFATORY NOTES

I

The Indian tribes inhabiting the great province drained by the tidewater tributaries of the Chesapeake were simple fishermen, hunters, and warriors whose art aimed at little beyond the supply of passing needs, and the district now furnishes almost nothing in the way of art remains to attract the popular eye. Little has been preserved beyond the simplest varieties of stone implements; but inconspicuous and elementary as these objects are, they have attracted much attention on the part of archeologists, and are now eagerly studied because of their bearing, not only on the history of the region and its people, but on questions of general import in the history of primitive progress. The explorations and studies recorded in the present paper were undertaken for the purpose of determining, if possible, the precise status of these remains, thus making them safely available to the historian of the race who seeks first of all a safe basis on which to found his structure. But some special questions have arisen that for the time overshadow the more general features of the investigation.

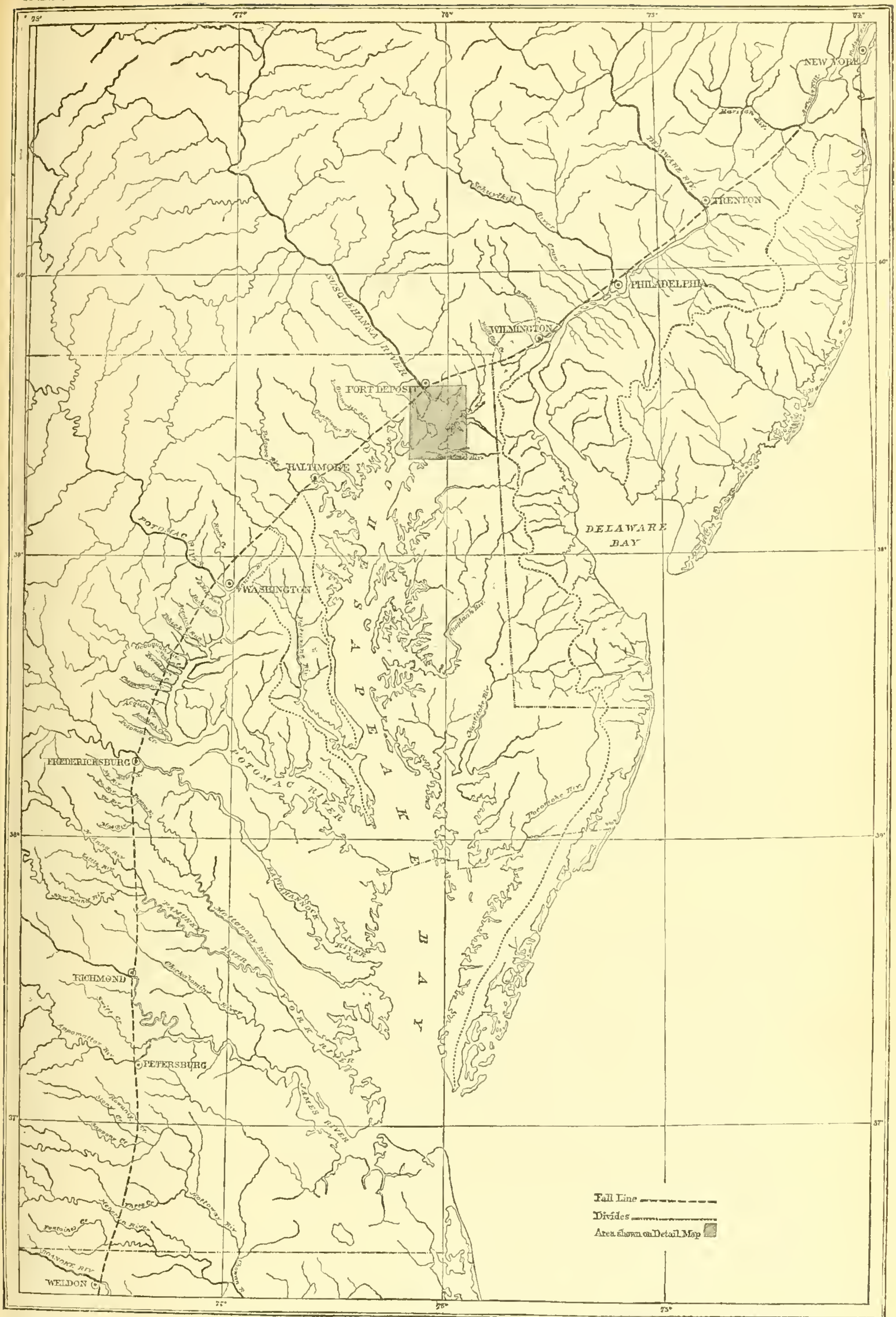
The earlier studies of the stone implements of the province developed decided differences of opinion as to the significance of a peculiar class of rudely flaked stones found in vast numbers about the head of tidewater in James, Potomac, and Susquehanna valleys. The main question at issue may be stated as follows: Do these rude objects form part of the remains left by the peoples of the region known to us historically—the Algonquian tribes and their neighbors—as their associations in a general way indicate; or do they belong to an earlier race of much lower culture as suggested by the fact that somewhat analogous forms, found in other parts of the world, characterize the art of very ancient and primitive peoples?

The most extensive deposits of the rudely flaked stones are found along the bluffs in and about the city of Washington. The careful investigations so fully recorded in these pages have proved beyond the shadow of a doubt that the great deposits are on the sites of workshops connected with extensive quarries where the raw material (Cretaceous bowlders) was obtained. It was further found that the widely scattered specimens of the same class were on sites (village-sites or otherwise) yielding less plentiful supplies of the available raw material where manufacture had been conducted on a smaller scale. That the vast body of the rudely flaked stones of the province are rejects of manufacture was readily shown.

As a second step in the investigation it was deemed necessary to determine the exact relations of these objects with the real implements of the region. This was accomplished by first determining by most careful studies of the rejectage of the great flaking shops just what the product of the flaking operations was. This product, so far as the progress of specialization of form on the shop sites indicates, was found to be a leaf-shape blade. A third step in these explorations was then undertaken for the purpose of determining the destiny of these blades—where they were carried and how and by whom used. Many specimens of identical form were found on Indian village-sites in all parts of the surrounding region, and in several cases on sites of historic Algonquian settlements, where they were intimately intermingled with the midden refuse, pottery, and neolithic implements. It was further discovered that a large percentage of the countless stone implements—knives, spearheads, arrowpoints, etc—found in the broad valley below, were of leaf-blade genesis; that before they received their final shapes by trimming, stemming, and notching, they had been blades, corresponding exactly with those produced in the multitude of shops. The shops are, therefore, a necessary complement of the implements of the region and the implements are a necessary complement of the shops. The shops, great and small, are thus definitely connected with the great body of implements of the region, and these implements are directly connected with the dwelling sites of the historic peoples. The practical unity of the stone art of the region is in this way fully established, no type of implement or shaped stone not being fully accounted for by the well-established facts and necessary conditions of recent Indian occupancy.

That these demonstrations should be complete and satisfactory, studies were made of quarries of other materials in the neighboring highland, where the conditions proved to be the same in every respect. Similar leaf-shape blades were made and carried out to the surrounding valleys where they and the implements specialized from them are found closely associated with the more local art products.

That the subject should be further rounded out and completed, all known classes of implements have been studied and relegated to their proper categories, and the history of their manufacture and the classes of rejectage pertaining to them have been determined. In all this work



Scale 1:2,230,000 = 35m. = 1in.

MAP OF THE POTOMAC-CHESAPEAKE TIDEWATER PROVINCE

Extending from the heavy broken line (the fall line) on the west to the dotted line on the east

there has not been found a single feature of the art remains or industrial phenomena of the region suggesting the presence of other than the known peoples.

The full series of illustrations presented in this paper will enable the student to make comparisons and arrive at his own conclusions. Great care has been taken to arrange these illustrations so that they will tell the story clearly and fully.

It is fortunate for those who may wish to verify or question the results reached in this study that the full range of phenomena is still well within their reach, and need only to be properly consulted to reveal the whole truth.

It is not attempted in the present paper to apply the results reached to the settlement of controversies arising elsewhere. The same is true of the preliminary paper published while the investigations were under way. Contrary to statements repeatedly made by writers on the subject, the question of the existence of a paleolithic period in Europe is not believed by me to be in any way involved. The verity of the determinations of Boucher de Perthes and his followers has never been questioned, and it is held that, where average conditions prevail, the paleolithic step, as usually defined, is the reasonable and natural first step in human progress. The proper settlement of local questions, and especially the question whether local evidence points toward a paleolithic or other early man in Potomac valley, is all that is directly sought.

The student, however, should not lose sight of the fact that the history of flaked stone implements, as developed by these studies, is their history everywhere, and that the lessons to be learned are of primary importance to the science of archeology. The chief lessons are those of the need of a full and proper discrimination of all the varied phenomena connected with the making, the using, and the distribution of the implements, and the impartial application of these phenomena to the elucidation of the history of culture and race.

II

It must be regarded as a striking circumstance that a large part of the varied phenomena considered in this paper are assembled within 2 or 3 miles of the capitol of the nation, much of it being within the capital city or within the area over which the city streets are now laid out. The greatest aboriginal bowlder quarry known, and the most important implement shops yet observed on the Atlantic slope, are located on Fourteenth street 2½ miles from the President's house. One of the most interesting native soapstone quarries in the great series extending along the eastern base of the highland from Massachusetts to Georgia is on Connecticut avenue extended, barely beyond the city limits; and the most important ancient village-site in the whole tidewater province is situated on Anacostia river within the city and little more than a mile from the capitol. Partly within the city limits and extending up the Potomac to Little falls, we have a great native fishing ground surrounded by a multitude of inhabited sites from which our collectors have filled their cabinets with curious objects of art. The spot now the political center of the nation was thus in prehistoric times a chief resort of the native peoples of the region.

It may not then be too much to expect that the glimpses of aboriginal life afforded by this study will prove of interest to the student of history, and the numerous phases of suburban scenery presented in the photographic views will doubtless be appreciated by future generations of Washingtonians.

III

Until recently it was hardly suspected that the Potomac-Chesapeake province was so rich in ancient remains. The arts and industries of the historic aborigines were extremely simple, and no striking monuments or remains of any kind are found to tell of vanished peoples. Careful exploration has, however, developed evidences of an intelligence and enterprise hardly to be expected of tribes of indolent savages. The use of stone by the prehistoric aborigines was limited to the manufacture of implements and utensils, but their knowledge of the mineral resources of the region was so extensive that no deposit of bowlders, no ledge of flakable stone, no deposit of available stone of any kind, seems to have escaped their attention. Quarrying and manufacture were extensive, and the distribution of the product extended in several cases for a hundred miles or more beyond the source of supply.

The historic tribes of the region were mainly of the Algonquian linguistic stock, the stock of Powhatan and King Philip, and this notable people may be connected by means of the art remains of their numerous village-sites with the great body of ancient inhabitants whose domain extended from South Carolina to Nova Scotia. There are some traces of departure from ordinary Algonquian types of art, but these are not decided enough to warrant the assumption that other peoples of independent culture were directly concerned. The culture status indicated by the remains here brought to the attention of students is precisely that of the historic inhabitants encountered by John Smith.

IV

The explorations embodied in this paper began in 1889 and continued with much interruption until 1894. It is evident from this that the field has been but imperfectly covered, for the tidewater Chesapeake country comprises upward of 20,000 square miles of territory, nearly every mile of which abounds in important traces of ancient aboriginal occupancy. To visit all and examine all would require a good part of a lifetime. Realizing this, the method was adopted of passing rapidly over the various sections and selecting a few typical examples of each class of sites or groups of phenomena for minute examination. The detailed studies made of these sites serve in a great

MAP OF THE PINY BRANCH QUARRIES

The shaded areas indicate the quarries approximately and the dotting indicates the distribution of the shops and refuse of manufacture. Scale about 270 feet to the inch; contour internal, 5 feet measure to illustrate the whole subject, and though imperfect in many ways, form nuclei about which additional details can be assembled as they are acquired.

V

There are many students of the aboriginal history of the Potomac-Chesapeake province to whom I am indebted for assistance and who should be mentioned in connection with the archeologic study of the region. Prominent among the collectors who have gathered and preserved the fast disappearing relics are Mr J. D. McGuire, of Ellicott, Maryland. The collection of this gentleman, now installed in his charming home in Ellicott, represents a large part of the province, and includes notable series of objects from the soapstone quarries and from the village-sites and shell banks of the Potomac and Chesapeake. Mr McGuire's writings include an important paper on the quarrying of soapstone as indicated by surface phenomena, and various other articles in which more or less specific references are made to the general archeology of the province.

Among the numerous collections of Potomac river material that of Mr W. Hallett Phillips, of Washington, takes first rank. It affords the student more satisfactory opportunities for study than any other collection, as the various sites were systematically visited and the specimens properly cared for and labeled. Many of the illustrations presented in this paper are from his well-stocked cabinets.

Mr Elmer R. Reynolds has for many years been an enthusiastic collector of local relics, and his various accumulations have largely gone to supply the museums of Europe. He has written valuable papers on the Potomac shell deposits and the soapstone quarries of the District of Columbia.

The historian of the Potomac valley is also deeply indebted to the efforts of Mr S. V. Proudfit, of Falls Church, Virginia, whose extensive collections, consisting of many thousands of specimens, were generously donated to the National Museum. Mr Proudfit's paper on local archeology is among the most important issued up to the beginning of systematic work by the Bureau of Ethnology.

Few students of the region have contributed more largely and successfully to the exposition of our local antiquities than Mr Louis A. Kengla, formerly of West Washington, whose collections are preserved by the Georgetown University and whose valuable pamphlet on the archeology of the District was published as a Toner prize essay by that institution.

Another collector, later in the field than the others yet hardly less persistent and successful, is Mr Thomas Dowling, junior, whose aid I have sought on various occasions. Many specimens from his collections appear in the illustrations of this paper.

Mr William Hunter, of Fairfax county, Virginia, made extensive collections along the banks of the Potomac in the Mount Vernon region, and on the opposite side of the river Mr O. N. Bryan gathered many things of value, both series of objects having found a resting place in the National Museum. Mr John Bury made a valuable collection from the Anacostia village-sites, which was acquired recently by the Bureau of Ethnology.

Baltimore has contributed her share to the work of preserving historic materials through her well-known citizen Colonel W. H. Love, whose large collections of specimens and extensive knowledge of sites have been of much service in the preparation of the present memoir. Among the many others who have taken an active part in the work of collecting are Mr J. C. Lang, of Washington, Mr C. M. Wallace, of Richmond, Mr M. H. Valentine, of Richmond, Mr H. M. Murray, of West River, Maryland, and Prof. Thomas Wilson, of Washington.

There are still others to whom acknowledgments must be made. To Mr Frank Hamilton Cushing, who a few years ago made a careful study of the Amelia county, Virginia, soapstone quarry; to Mr F. W. Von Dachenhausen, whose collections from the vicinity of Washington have been drawn upon for illustration, and to Mr De Lancey W. Gill, of the Geological Survey, who has been closely associated with me in the work of collecting and elaborating, I am greatly indebted.

I wish especially to acknowledge the assistance given by Mr William Dinwiddie, who has been almost constantly associated with me in field work and in the office, and who was intrusted with much of the laborious task of quarry excavation; by Mr Gerard Fowke, who conducted the exploration of the Piedmont regions of Virginia and Maryland; and by Major J. W. Powell and Mr W J McGee, to whom I am greatly indebted for encouragement, sympathy, and support at all times and in all places.

The artists whose work adds so much to the effectiveness and scientific value of this publication are Miss Mary M. Mitchell, Mr H. C. Hunter, and Miss Frances Weser. The landscape photographs are largely the work of Mr Dinwiddie, and the series of plates of flaked stones are from the studio of Mr T. W. Smillie, of the National Museum.

QUARRY-SHOP REFUSE EXPOSED IN THE BANK OF THE RIVULET

The gneiss appears in the bed of the stream beneath the left foot of the figure

VIEW LOOKING NORTH UP THE RIVULET AT THE FOOT OF THE QUARRY SLOPE

The left hand of the figure is placed to indicate the beginning of the first trench

Chapter I

INTRODUCTORY

THE FIELD OF INVESTIGATION

Previous to the year 1889 little archeologic work was done by the Bureau of Ethnology in the Atlantic coastal region, save, perhaps, in North Carolina, where a number of mounds had been opened under the direction of Dr Cyrus Thomas. A vast, though not an especially attractive field, extending from New Jersey through Delaware, Maryland, Virginia, the Carolinas, Georgia, and Florida, had never received careful or systematic attention. In 1890 the Director of the Bureau decided to begin the survey of this zone, and the first work undertaken was an examination of the tidewater Potomac. Work was begun in the District of Columbia; and with Washington as the initial point, exploration was carried westward into the Piedmont region and eastward and southward to the Atlantic coast.

The great artificial shell fields scattered along the brackish and salt water shore-lines appeared to be the leading feature of interest, and toward these attention was at first directed; but another and somewhat distinct field of investigation soon sprang into prominence. Within the decade ending with 1890 much interest had arisen in regard to the significance of certain rudely flaked stones found in great numbers in the region about Washington. These objects were thought to be of archaic type, and consequently to have an important bearing on two questions of great interest to archeologists, the first relating to the development of art in its early stages, and the second to the nature of the beginnings of man's prewritten history in this country.

A preliminary examination of the subject made it apparent that a solution of the problems thus suggested could be obtained only by a systematic study of the origin, manufacture, distribution, and geologic relations of the articles in question. It was decided to take up this study, and thus the field of investigation was greatly enlarged. The period required for exploration was lengthened indefinitely, and it became necessary to complete certain sections of the work for publication before the whole field could be covered. Division of the subject-matter of investigation into at least two parts was found to be easy and convenient. The main problems of the stone implements separated themselves readily from the history of the peoples and the ordinary traces of their prehistoric and historic presence.

It appeared also that there were convenient geographic subdivisions of the subject, and that in one case at least the geographic unit corresponds very closely with a well-marked ethnologic unit, and strangely enough also with an important unit of colonial history. The great Potomac-Chesapeake province, with its system of tidewater inlets, constitutes a natural subdivision of the coastal zone. Formerly the Susquehanna flowed southward through a restricted valley, entering the sea outside of capes Henry and Charles. By subsequent depression of the land this valley and its tributaries were submerged, and the floods rose until the tide reached Richmond on the James, Washington on the Potomac, and Havre de Grace in the main valley, and one-third of the land became sea, the tortuous shore line following the contours of the hills and valleys in and out in a marvelous maze. Tens of thousands of square miles of upland were transformed more or less completely into a maritime province, and this became the seat of a native confederacy, ruled over by the renowned Powhatan at the period of colonization. This district was thus a native ethnologic unit—a unit in race and culture—and the circumstances of colonization made it a unit in the history of civilization: it is the territory explored, conquered, and mapped by the intrepid John Smith; it is therefore a unit of exploration, conquest, and cartography.

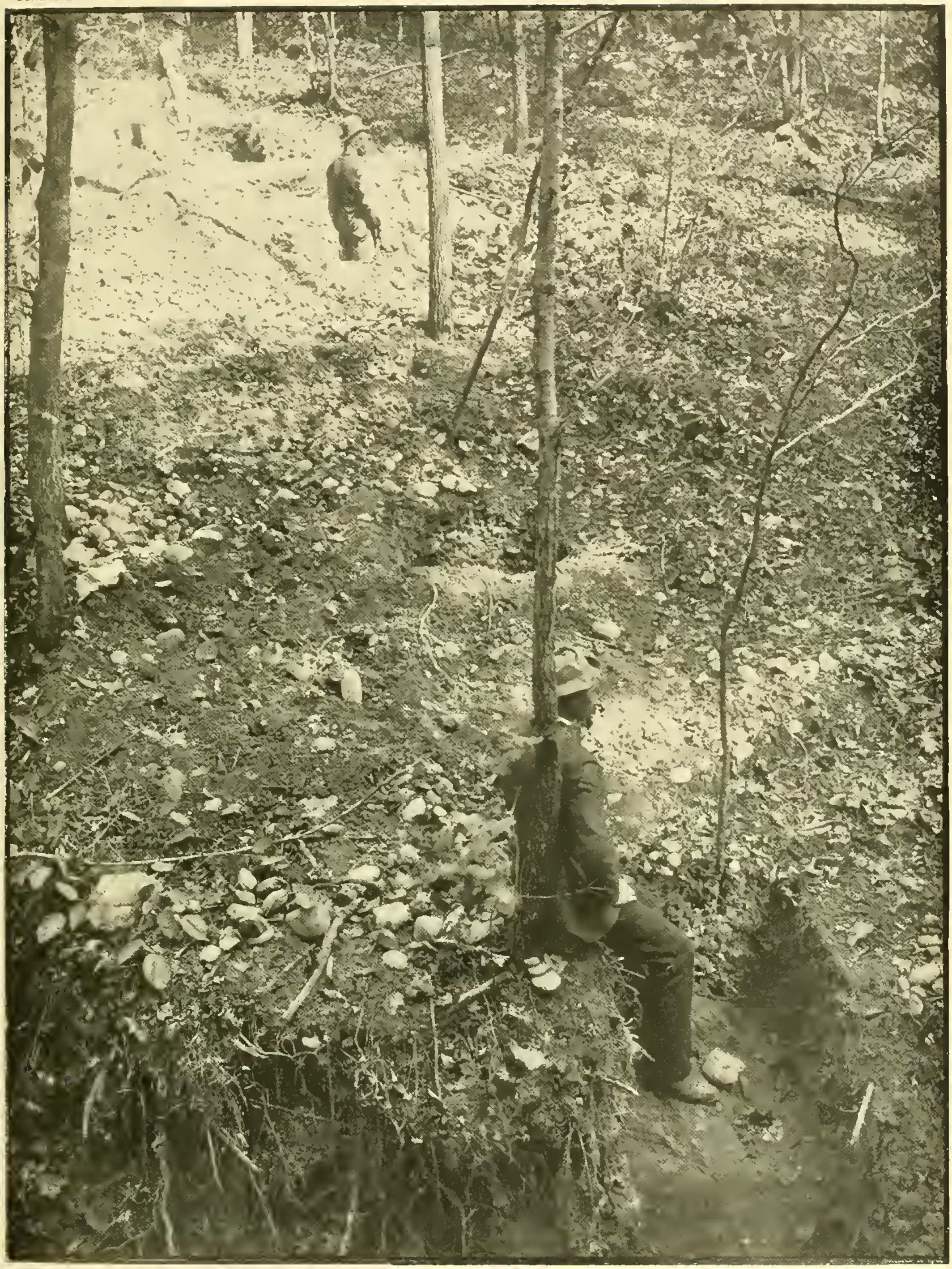
It further appears, from what has been learned of the past of the region, that the historic peoples and conditions pass back without break into the prehistoric era, no traces of distinct occupation or culture phenomena having been found. Archeology but supplements history, and the archeologist works to great advantage in a unique and charming field illumined by the graphic records of the Roanoke, the Jamestown, and the Saint Mary colonies.

In treating the history of this province, it would seem the natural order to present, first, the historical phases of aboriginal occupancy, passing afterward back into the archeologic field; but this order proves inconvenient (as just indicated), and special studies of certain phases of art must receive first attention. The present paper is therefore devoted to examination of the derivation, manufacture, nature, and place in time and culture of the stone implements of the tidewater province—the province of John Smith. This will be followed by other studies, or by a single paper, on the aboriginal history and general archeology of the same area.

The Chesapeake tidewater province lies to the eastward of the heavy dotted line on the map presented in plate I. This is the fall line, where the streams descend from the Piedmont plateau to the tidewater lowland.

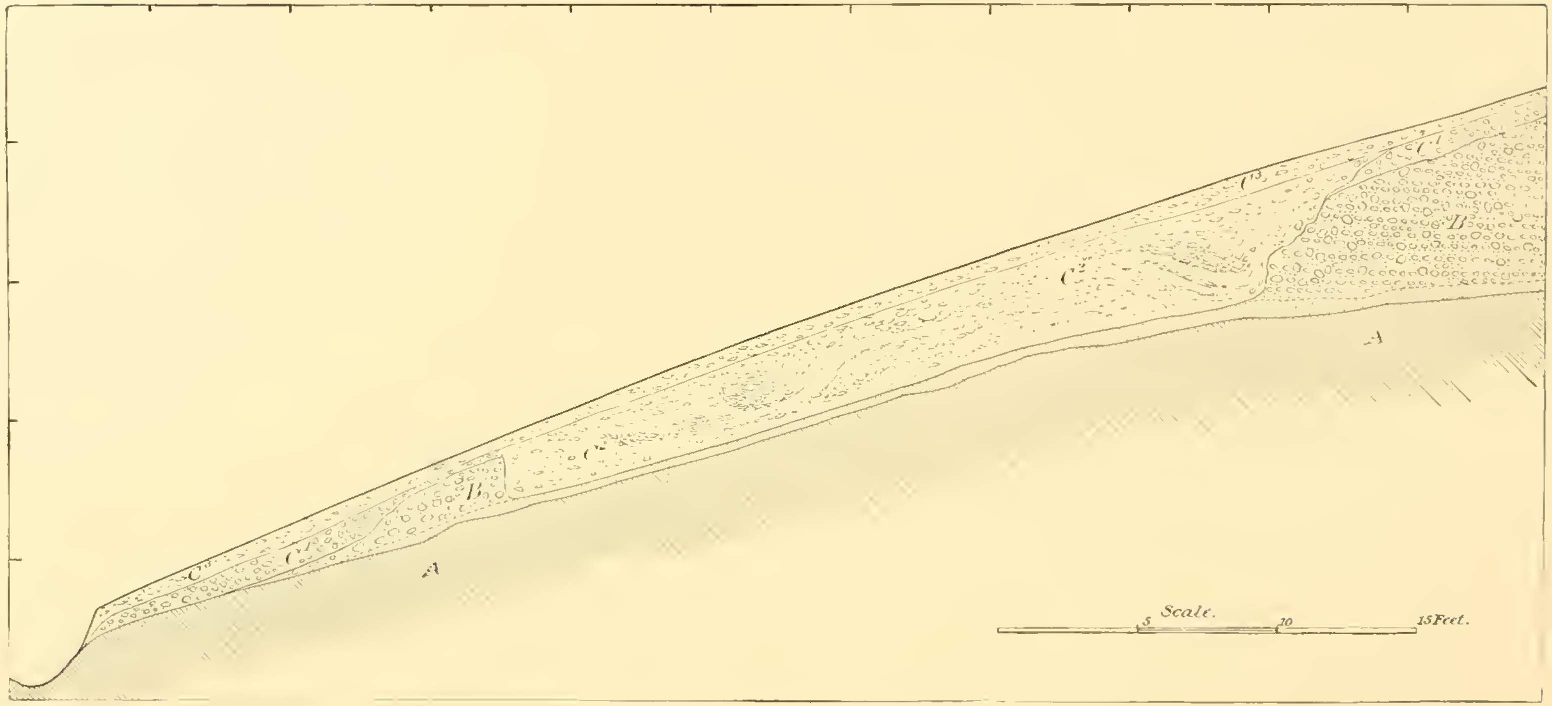
THE ART REMAINS STUDIED

The art remains of a vanished people available for the archeologist comprise all material forms shaped or in any way modified by their hands, whether from design or from the incidents of use. There are



VIEW FROM THE BED OF THE RIVULET, SHOWING EXPLOITATION PITS

The first figure is at the beginning of the trench, and the third figure is at about the fortieth foot



SECTION OF QUARRY EXPOSED BY THE FIRST TRENCH

a, Mica schists; *b*, Potomac (Mesozoic) bowlder beds; c^1, Preartificial slope gravels; c^2, Deposits of shop refuse, showing traces of pits; c^3, Materials rearranged by natural forces since the period of quarrying

(1) fixed works, consisting of structures—mortuary, defensive or otherwise—dwelling sites, stone hearths, pits, cemeteries, quarries, implement shops, and refuse deposits. There are (2) portable works, including implements, utensils, weapons, and articles of dress, ceremony, and diversion. The subject chosen for this paper, the stone implements, includes but a small section of this great field, but nevertheless a most important one. It will be necessary to deal not only with the things themselves which belong to the second group mentioned, but with their origin and manufacture, leading thus to an investigation of the quarries and workshops, which are fixed remains, and to a study of the industries arising from their operation.

The materials used by a great group of tribes like that occupying the tidewater country in colonial and precolonial times were numerous, and the forms given them in art were naturally extremely varied, but the visible remains today are confined to a few materials, and consequently to a limited number of forms. The consideration of these tangible evidences is of the utmost importance to archeology, and their study leads naturally to inquiries into the various arts and industries concerned in their production. Besides this, much may be learned and much more may be surmised with respect to arts and industries of which no material traces remain, and correct inferences may be drawn regarding the customs, habits, and culture of the peoples.

The materials utilized in art were sought and obtained at much expense of time and labor, and the industries to which this search gave rise were no doubt of great moment to the people, although little attention has been paid to the subject by students. Clay was used for pottery, and ocher was obtained for paint. Vegetal and animal substances also were sought and fully utilized. Stone was most extensively used by the primitive inhabitants of the tidewater region, and on account of its durability it is by far the most important material with which we have to deal in the prehistoric study. We can but conjecture as to the beginnings and progress of this search. When men first appeared they found vast supplies of water-worn stones suited to immediate use scattered over the country. These, however, did not serve for all classes of needs, and the energetic savages penetrated the hills, laid bare the rocky deposits, and little by little acquired a mastery of the geologic resources of the province.

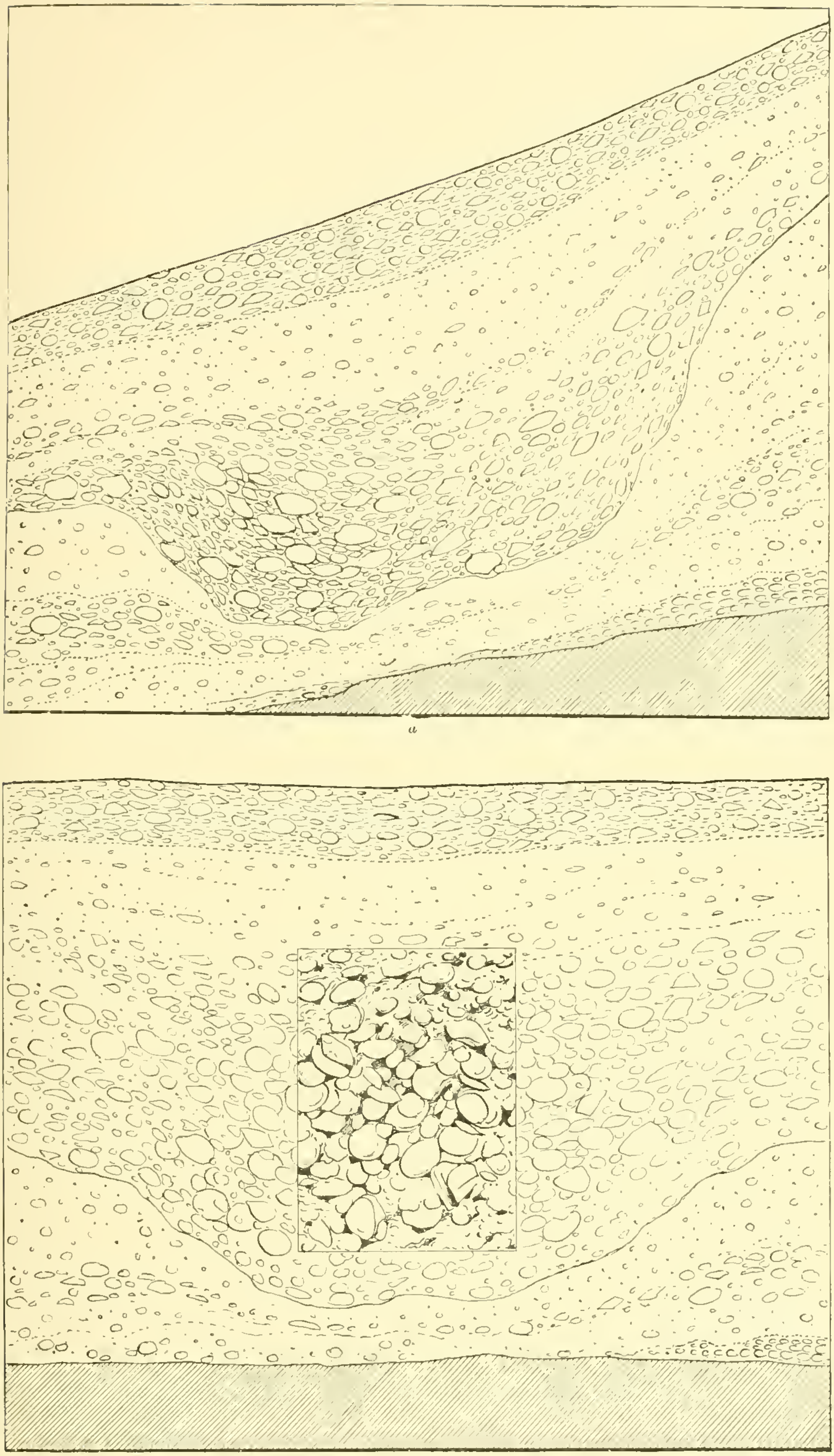
CHARACTER OF THE STONE IMPLEMENTS

MATERIALS AND THEIR DISTRIBUTION

Stone exists in many varieties, forms, and conditions, which differ greatly in the various sections of the country, thus giving much diversity to the manner of its utilization and to the forms employed in art, and many local peculiarities of art phenomena have arisen. Moreover, the tribes of this region were not fully sedentary and the materials acquired in one section were carried into another, giving rise to much variety in the materials employed by a single people or assembled in a given place. This complexity was also increased to some extent by trade, and no doubt by the undertaking of long journeys for the purpose of securing desired materials. Transportation was confined mainly to the smaller and more laboriously finished articles of use. Unshaped raw materials were not extensively transported, and the large body of the heavier tools and utensils made where material was plentiful were deserted when the locality was abandoned.

The peculiarities of the materials procurable in the tidewater region are very marked. The geologic formations found within this area include only limited portions of the crystalline or older sedimentary rocks, but are derived from them by erosive forces and consist of fragmental deposits, such as sands, clays, gravels, and beds of bowlders. The great rivers of Mesozoic and Cenozoic times swept down from the highlands, bearing fragments of all varieties of rocks and depositing them in beds along the margin of the sea. These transported fragments were, when first taken up by the water, sharp and rugged, but by constant rolling they were reduced to rounded forms, and included all sizes from grains of sand and minute pebbles to bowlders and even to great masses. All classes of rocks were thus seized by the floods and carried seaward; but all varieties did not reach the sea, save perhaps as sand or clay. The softer rocks were reduced to powder before the journey was fairly begun; brittle and much-flawed varieties, and all friable shales and slates, separated into minute fragments and formed beds of sand and gravel; the tough, hard, homogeneous pieces were rolled and rounded and carried ever onward, refusing to break or to be reduced to dust, and finally rested along the seashore and more especially about the mouths of the great rivers.

The primitive inhabitants of the crystalline highland had to make use of massive forms of rock or of rude angular or slightly water-worn fragments, and the reduction of these to available sizes and forms was a difficult work. But the inhabitants of the lowlands were born to more fortunate conditions. The agents of nature—the floods—had with more than human intelligence and power selected the choice bits of rock, the tough quartzite, the flinty quartz, the tough and brittle lavas, the indurated slates, the polished jasper, and the beautiful flints, from all the cliffs and gorges of the mountains, and had reduced them to convenient sizes and shapes, and had laid them down in the beds of the shallow estuaries, where through the subsequent rising of the land and the cutting of valleys they were found at the door of the tidewater lodge, ready or almost ready for immediate use in the arts. Each river coming from a different section of the highland secured and transported the varieties of rock most prevalent in its drainage basin, so that the great tidewater region is divided into mineralogic areas corresponding somewhat to those of the mountain valleys supplying the material.



SECTION OF ANCIENT PIT FILLED WITH QUARRY-SHOP REFUSE FROM ABOVE

The rectangle elaborated in the lower figure indicates approximately the area included in the photograph reproduced in plate VIII

It will readily be seen that these conditions of mineral resources must have had a marked effect on the art of the region, and thus on the culture of the natives inhabiting it. One drainage area supplies quartz mainly, and the art is quartz art; another supplies quartzite, and the art is quartzite art, and so on. All of these and other conditions will be considered in the discussion of the distribution of the remains of the region, to which subject a subsequent chapter is devoted.

All kinds and conditions of rock in both lowland and highland were exposed to some extent on the surface of the ground and were thus readily obtained, but the more desirable varieties occur in the main beneath the surface, and when the demand for them was great they had to be sought and quarried, thus giving rise to one of the most important of primitive industries.

QUARRYING

Quarrying begins with the removal of a fragment or mass of material partially buried in the ground. It is but a step further to the uncovering and removal of portions wholly buried, and only another step to quarrying on a large scale. The methods and extent of the quarrying necessarily differed with the peoples and their circumstances, with the nature of the material, and with the conditions under which it existed.

Of the details of quarrying operations our knowledge is yet imperfect, though much has been learned in certain directions; and of the tools used in quarrying, aside from those made of stone and left on the sites, no definite information has as yet been obtained. It is quite likely that implements of wood, buckhorn, and bone were used as in foreign stone-age quarries, but traces of these have wholly disappeared from the sites thus far examined. Fire may have been used in some localities as an agent in fracturing masses of stone, but the tidewater region furnished little material, save perhaps quartz, suitable for manipulation by this means. Massive forms of rock are found west of the fall-line or western border of the tidewater country. Flint, jasper, and rhyolite were quarried far back in the highland, and vein quartz was found, and, no doubt, to some extent quarried, in a multitude of places over the whole Piedmont region, and down to and even below the margin of the tidewater area. Steatite or soapstone is a tough, massive rock interbedded with gneissic formations, and rarely occurs in detached masses. In the beginning of its use it was secured where exposed on the surface by prying off small masses. When its compactness made this impracticable it was removed by cutting out roundish masses with stone picks. The lumps thus secured were ready for the sculptor's chisel. In time quarrying developed and was extensively carried on in many parts of Virginia and Maryland beyond the tidewater border.

In the tidewater province proper, quartzite occurs in the shape of bowlders or cobbles only, which, mainly during the Potomac and

Lafayette periods, were derived by erosive forces as fragments from heavy strata in the mountainous region to the northwest. Heavy deposits of these stones accumulated about the mouths of the rivers; by subsequent erosion they were exposed to view in many places and most advantageously for human use in the steeper bluffs that border the streams. Countless numbers, loosened from the well-compacted beds by erosion, descended to the lower slopes and into the streams to be again deposited at lower levels. The surface or float cobbles were extensively used, but the aborigines came to need more than could thus be obtained, and resorted to digging them from their places in the bluffs. The implement makers seem to have found that the freshly removed stones were more easily worked than surface finds, and quarrying, thus encouraged, was carried, in at least two places, over acres of ground. The bowlders were not always easily loosened and removed, as the rounded stones were held together by a matrix of sand and clay which had assumed almost the consistency of a sandstone; but the miners did not always penetrate the formation from above or even directly from the face of the outcrop. It happened that in many cases the bowlder beds rested on a surface of disintegrated gneiss exposed in bluff slopes, and by removing the upper surface of this with such pikes as were at hand the bowlders were undermined and easily knocked down. So far as observed, the bowlder deposits containing workable stone in any considerable quantity rest on the gneissic surfaces where they were laid down by the waters of the ancient sea.

Quartz, which was more generally if not more extensively used than any other material, is found in two forms. It occurs in countless veins which penetrate the gneissic rocks over a large district west of the fall-line. Being much less destructible than the gneisses, it weathers out in dike-like ridges and breaks up into blocks and angular pieces which spread over the ground in vast numbers. Choice varieties of this vein rock were, without doubt, quarried to some extent, but it was so plentiful on the surface that quarrying was not generally necessary. Carried down by the streams of all periods, it occurs plentifully as pebbles and bowlders in all formations in the tidewater region, and was selected or quarried along with the quartzite.

Jasper, flint, rhyolite, and other varieties of stone were rather rare within the tidewater districts, occurring sparingly as pebbles, small bowlders, and worn fragments in gravel deposits and in the beds of rivers. They were procured, however, by the tidewater tribes from masses in place in the uplands and mountains, the quarries being quite extensive, as will be shown subsequently.

MANUFACTURE

Initial Stages

Having secured the raw materials from the surface or by quarrying, the next step was either to utilize them unchanged or to shape them for use. Sharp-edged and pointed stones were used for cutting,

CHARACTER OF QUARRY-SHOP REFUSE AT THE FORTYFOURTH FOOT

The bowlders have nearly all been broken and many pieces are partly shaped

digging, etc, and rounded cobbles from the river or from gravel beds were well suited for striking, pounding, grinding, etc, but with these unmodified forms we have little to do, as it is not easy to say that any given specimen was used at all unless it bears decided marks of use; and decided marks of use may be regarded as giving the object an artificial form, as in the case of the improvised mortars, mullers, and hammerstones so common in the Chesapeake-Potomac region.

Shaping Processes

The shaping processes by means of which stone was made to assume artificial forms adapted to human needs are varied and ingenious and their mastery is of the greatest importance to all primitive peoples. These processes are distinguished by such terms as breaking, flaking, cutting, drilling, scraping, pecking, grinding, and polishing. All are purely mechanical; none are chemical, save a possible use of fire to induce changes in the rock in some parts of the quarry work. A wide range of manual operations is represented, and these may be conveniently arranged in four groups: 1, *fracturing*, represented by the terms breaking, flaking, and chipping; 2, *incising*, including cutting, picking, and scraping; 3, *battering*, including such acts as bruising, pecking, and hammering; 4, *abrading*, as in rubbing, drilling, boring, sawing, and polishing. These acts are employed according to the nature of the stone or the results desired; as, for example, fracture is employed where the stone to be shaped is brittle, like flint, jasper, or quartz; incision is employed where the stone is relatively soft, such as soapstone, serpentine, and the like; battering is applied to tough materials, capable of resisting the shocks of percussion, like granitic rocks and many of the eruptives. Nearly all varieties are capable of being shaped by grinding and rubbing.

The processes employed in a given case were determined by the nature of the material, by the intelligence and skill of the workman, by the character of the object designed, and by a number of minor considerations. Ninety percent of the stone implements produced in the tidewater country were shaped by the fracturing processes. For convenience of treatment, I shall present the implements in groups determined by the processes mainly employed in their production as follows: 1, fractured or flaked implements; 2, battered or pecked implements, and, 3, incised or cut implements. Abrading processes were mainly auxiliary to the others and will not be presented at length.

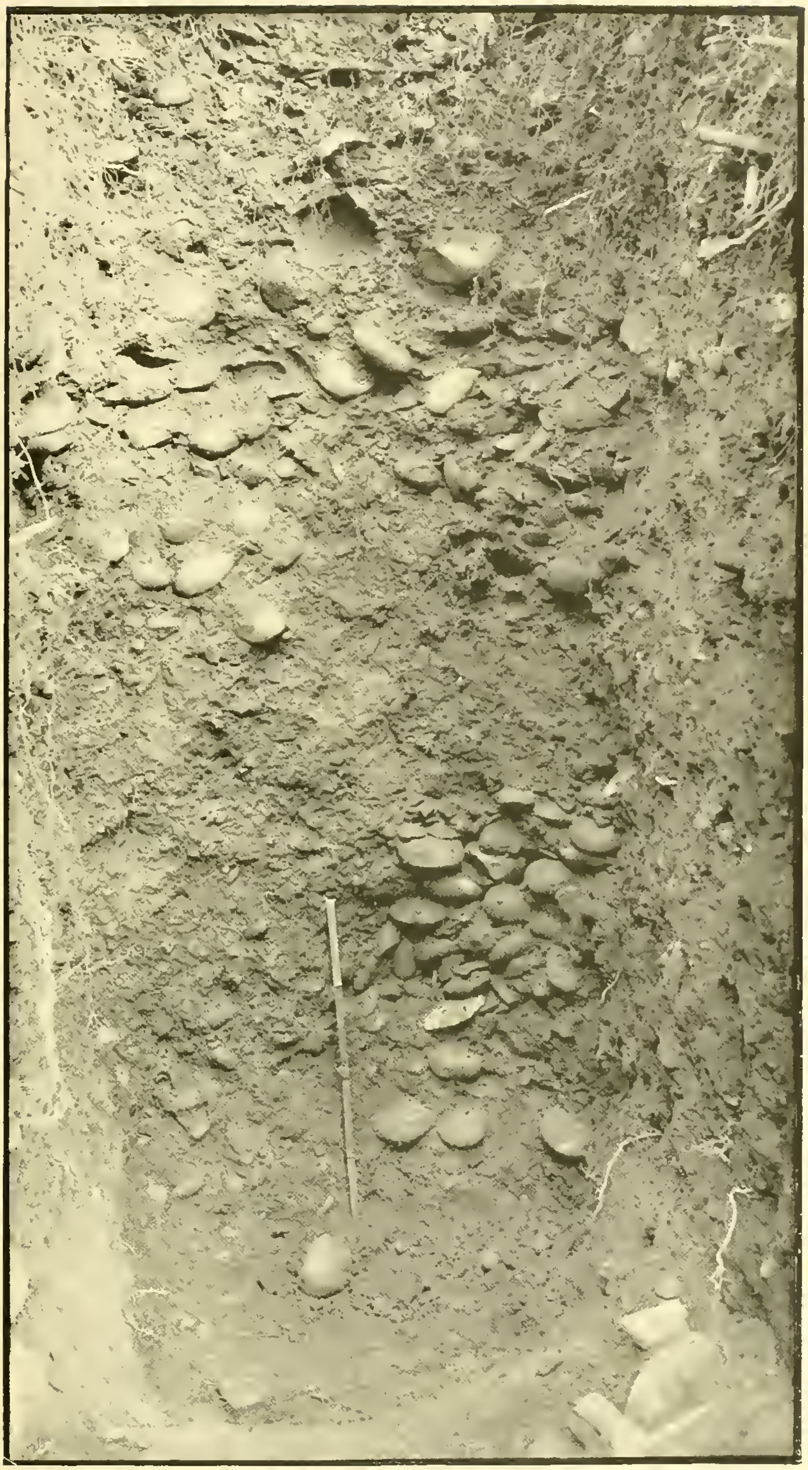
Fracturing or flaking—The art of flaking stone was very extensively practiced in the tidewater region, and ample opportunity is furnished for observing the work in all its phases. The first step in the process, where masses were dealt with, consisted in breaking the material by heavy blows into somewhat approximate shapes and sizes; the second step was roughing out by free hand percussion the blank forms of the various classes of tool desired; the third step was the specialization of forms by direct or indirect percussion, or by pressure. As to the order and the manner of conducting these steps, many observations have been made. The finished objects were often produced at once by carrying the work without interruption through all the stages of progress. This was true of sporadic work, where materials were scattered or where the implement was needed at once; but where materials were plentiful and demands not pressing, the workshops became factories and there was an opportunity for, and no doubt a tendency toward, specialization of labor. It was more convenient and profitable for certain individuals to give exclusive attention to the separate steps—first, to quarrying, breaking up the material and selecting pieces in large numbers; second, to roughing-out the blank forms in numbers; and, third, to the work of trimming, specializing, and finishing. These three well-defined steps gave rise to separate industries, carried on by the same individuals at different times or places or by distinct groups of experts at convenient times and places. It would seem that the first and second steps, whether performed by one or by two groups of workmen, were generally accomplished on the spot yielding the raw material; it would be unprofitable to transport masses of material of which nine-tenths would finally have to be consigned to the refuse heap. The blank forms of the articles to be shaped, worked out so far as thoroughly to test the material and its capacity for specialization, were removed from the source of supply to be finished when convenient or when need demanded.

Where disseminated materials were utilized, and especially in cases of immediate need, all the steps were frequently taken and the perfect implement produced at once; but it is observed that in many cases where the material was sparsely scattered as bowlders or nodules over the face of the country, the work of collection and blocking out was first attended to and the hoards of blanks thus produced were transported and stored, subject to final distribution for specialization or use.

Details of these steps in the art of flaking and the variations in process, resulting from differences in material and in articles designed, will, so far as possible, be given in connection with the investigation of the sites affording the observations.

As has been indicated, flaking was employed almost exclusively in the production of projectile points, knives, scrapers, perforators (or drills), hand axes or choppers, notched axes, hoes, and picks; it served to aid in roughing out the forms of various articles finished by pecking and grinding; these are mortars, pestles or mullers, axes, celts, chisels, pipes, ornaments, and diversional and ceremonial objects.

Battering or pecking processes—The acts employed in this class of operations were generally percussive, the impact resulting in a bruising and crumbling of minute portions of the surface of the stone. The hammer used was hard and tough, and the stone shaped was sufficiently tough practically to preclude fracture by the ordinary blow. No specialized tool was necessary, though such came to be made, the



FACE OF THE TRENCH AT THE SEVENTYSEVENTH FOOT, SHOWING POCKETS OF ARTIFICIAL REFUSE

CHARACTER OF REFUSE DEPOSITS AT THE SEVENTYSEVENTH FOOT AND FROM TWO TO FOUR FEET BENEATH THE SURFACE result being reached by striking one stone against another of proper relative durability. The several acts are known as battering, bruising, and pecking, the latter term being in common use for the act by which shaping was mostly accomplished. Materials suitable for shaping by this process are plentiful and widely distributed. They occur in the tidewater country wherever flakable stones abound, but the most favorable localities, so far as observed, are along the river banks about the head of tidewater. Village-sites located on the lower terraces about Washington and Georgetown furnish many specimens illustrating failures in all stages of the shaping of celts, grooved axes, pestles, and ceremonial articles from bowlders of diorite and various of the denser varieties of crystalline metamorphic rocks. An examination of certain inhabited sites farther up the river, and in various parts of the highland, develops the fact that extensive work of this class was carried on, and it is probable that a large part of the lowland supply of pecked tools was derived from these distant sources. Such a site and its products are described in detail further on. There is no evidence that the stone used was obtained by quarrying. The ordinary practice seems to have been to select water-worn stones of suitable texture that already approximated the form desired. Battering processes, and the tools produced by them, are presented systematically in a subsequent section.

Abrading processes—Shaping by abrasion in its most elemental form consists in rubbing one object against another with such force as to remove minute particles from one or both. The operations are generally expressed by such terms as grinding, sawing, boring, rubbing, and polishing. All stones are abradable, and all hard stones can be made to serve in the active operations of abrading. These processes were usually supplementary to those of flaking or battering, and were suited especially to sharpening edges and points already approximate in shape, and to giving smooth finish to surfaces. Their employment was very general but not confined to particular localities to such an extent as to leave extensive evidences of the work done. Stones modified in shape and surface characters from use in grinding and polishing are found on many sites in the tidewater country. The products of this group of processes are properly treated for the most part in connection with those of pecking.

Incising processes—This important class of operations shape materials by cutting, piercing, scraping, etc. They imply the use of a hard edged or pointed tool, and a substance to be shaped of somewhat less hardness. The presence of steatite in large bodies and often in exposed situations along the western border of the tidewater country from the Susquehanna to the Savannah led to the extensive utilization of cutting processes by the later aboriginal inhabitants of the region. Our extensive exploration of the quarry sites has given us a clear comprehension of methods of procuring and shaping, and of the results achieved. Rudely shaped stone picks were employed in cutting out the masses, and neatly flaked, pecked, and ground chisels of hard stone served to rough out and trim the bowls and other articles. A subsequent section of the present memoir is devoted to this division of the subject.

POCKET OF REFUSE DEPOSITS AT THE SEVENTYSEVENTH FOOT AND FROM FIVE TO NINE FEET BENEATH THE SURFACE

Chapter II

MANUFACTURE OF FLAKED STONE IMPLEMENTS

INTRODUCTORY STATEMENT

The discussion of flaked implements comprehends a study of all that pertains to the procuring of flakable stone by means of search, collection, and quarrying, and of everything pertaining to the manufacture of implements by fracture, as in breaking and in flaking or chipping by percussion or pressure; it includes also a classification and descriptive presentation of the finished products and a reference to their respective uses. In the final section the distribution of the raw materials is treated in connection with the study of the distribution of implements.

It is most convenient in treating this complex subject to begin at once with the study of the great industries of quarrying and manufacture, taking up the regions studied or the sites examined in approximately the order of their exploration.

Five materials were extensively used for flaking by the tidewater peoples: quartzite, quartz, rhyolite, jasper, and flint. Several other materials occur less abundantly, among which may be mentioned sandstone, limestone, slate, argillite, basic eruptive rocks, iron quartzite, chalcedony, and quartz crystal. Quartzite and quartz were obtained largely in the form of water-worn pebbles and cobbles from the fragmental deposits of the tidewater region. These materials in this form are closely associated in distribution, and their examination will, in the main, be taken up conjointly. The most extensive deposits of fragmental quartz and quartzite occur about the head of the tidewater Potomac, and their most extensive utilization was confined to the vicinity of Washington. Surface deposits were worked wherever found on the Potomac, James, and other rivers. Rhyolite, argillite, jasper, and flint were obtained from quarries in the mountains, and to some extent along the rivers in fragments, bowlders, and pebbles.

The great quarries about Washington will be described and discussed in detail. Most of them were opened in the littoral deposits abounding in pebbles of quartz and quartzite; many others in veins of steatite or soapstone. They may be taken as types of this class of phenomena observed in and about the tidewater province as well as over the whole Atlantic slope.

Of the exotic materials—rhyolite, jasper, argillite, flint, etc—rhyolite is by far the most important, and the South mountain quarries of this stone may be taken as a type of the great class of quarries furnishing rock from the mass.

QUARRY-WORKSHOPS OF THE DISTRICT OF COLUMBIA

HISTORY OF THE RESEARCH

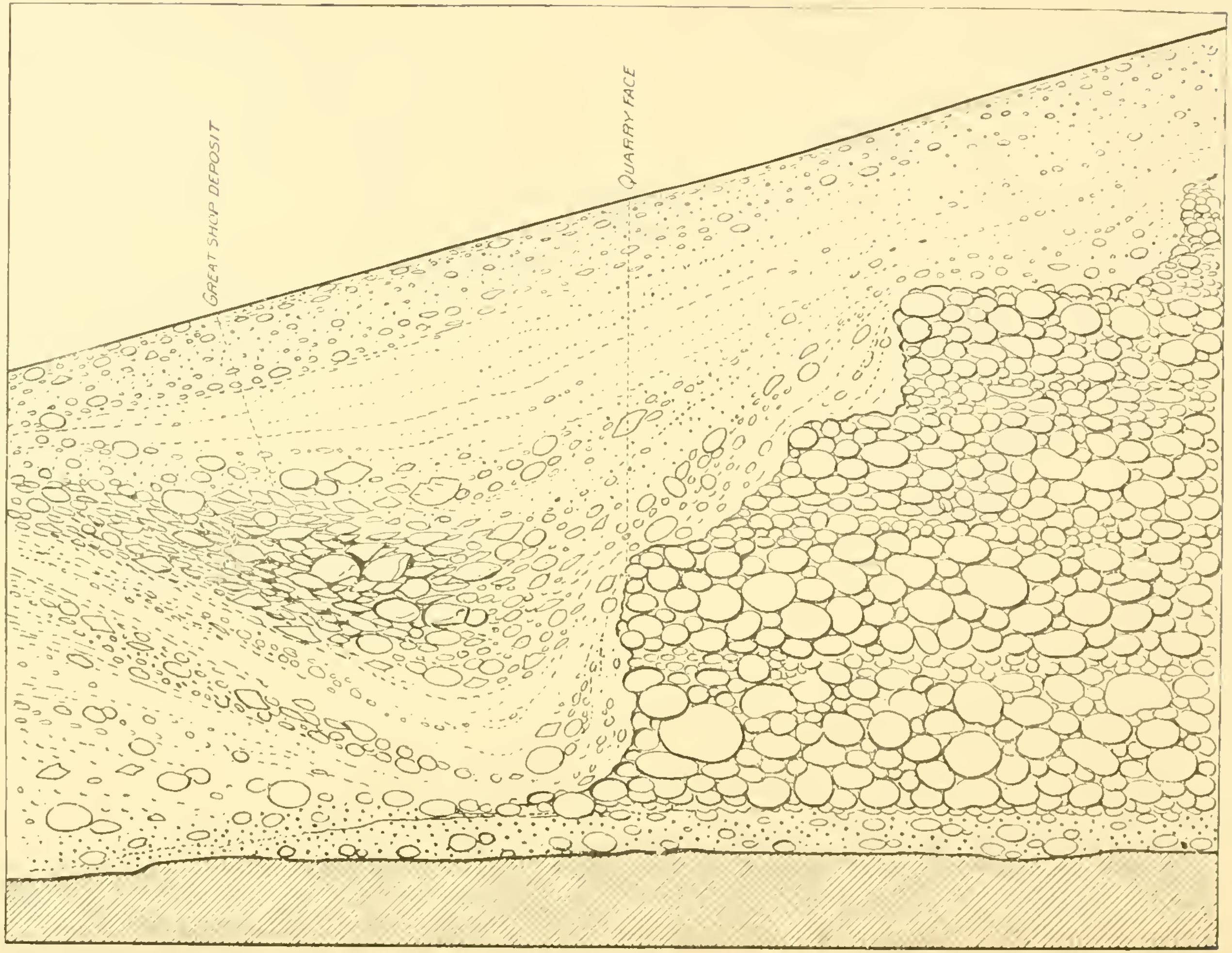
From time to time during the decade ending with 1890, the attention of archeologists was called to a class of rudely worked stones found in great numbers in the vicinity of the city of Washington; all are shaped exclusively by flaking, and are of forms so simple and rude that the idea prevailed that they were very ancient, this idea being strengthened by the assumption that they are somewhat closely related in form to typical European paleolithic implements. The best-known variety is the so-called "turtleback," a bowlder slightly flaked on one side, giving somewhat regularly arranged conchoid facets suggesting the plates of a turtle's back; but more highly developed forms of varying stages of elaboration are almost equally numerous. The materials are mainly quartzite and quartz, the former very largely predominating.

These objects are pretty generally scattered over the surface of the country, and are found to some extent throughout the tidewater region, being less numerous toward the sea. They occur in greatest abundance, however, as shown by recent discoveries, along the steep faces of the terraces bordering Washington city on the north and west. So plentiful are these rude objects in certain of the suburbs that they are brought in with every load of gravel from the creek beds, and the laborer who sits by the wayside breaking stones for the streets passes them by thousands beneath his hammer each year; the capital city is paved with the art remains of a race who occupied its site in the shadowy past, and whose identity has been a matter of much conjecture.

The first discussion of these objects within my memory occurred at a meeting of the Anthropological Society of Washington in the winter of 1878. A paper on the turtlebacks was read by Dr W. J. Hoffman, in which their character and manner of occurrence, their age and probable relations to the Abbott finds of New Jersey, were discussed, the conclusion reached being that they were probably paleolithic, and that they had, therefore, a purely adventitious association with the relics of Indian art with which they were intermingled on various sites. Later Mr S. V. Proudfit engaged in the collection and study of these forms, and in 1888 published a short paper relating thereto in the journal issued by the Anthropological Society, the *American Anthropologist*. His views of their nature, so far as elaborated, were opposed to those of Dr Hoffman, and have stood the test of later research.

Mr Thomas Wilson, on his return from a long sojourn in Europe in 1887, having been appointed curator of the department of prehistoric archeology in the National Museum, took up the subject afresh, and published a series of papers on the general subject of paleolithic man,

PORTION OF AN EXTENSIVE DEPOSIT OF SHOP REFUSE NEAR THE QUARRY FACE



SECTION SHOWING THE IRREGULAR QUARRY FACE, THE BOWLDER BEDS AT THE RIGHT AND A DEPOSIT OF SHOP REFUSE AT THE LEFT making reference to and giving numerous illustrations of these finds. The view taken by Mr Wilson was that they are paleolithic; and as such they were labeled, distributed, and published. His assignment of these objects to this period of human progress was, I understand, based entirely on their supposed analogies of form with the paleolithic implements of Europe.

A somewhat elaborate discussion of the subject took place at a meeting of the Anthropological Society of Washington, held in the month of April, 1889. In the discussion of the archeology of the District of Columbia, three papers, by W J McGee, Thomas Wilson, and S. V. Proudfit, respectively, bore directly on these rude objects. Up to this time, however, no one had essayed to do more than study the surface finds and phenomena, and consequently little was definitely known of the true history and relationships of the objects in question.

My own investigation began in 1889, and the results of the first few months' work in the bluffs of Piny branch, in the northern suburbs of the city, were published in the *American Anthropologist* for the year 1890. The work was resumed in the same place in the spring of 1890, and during that year several other localities were examined. The only sites extensively explored are one on Piny branch and another in the vicinity of the new Naval Observatory, on the western side of Rock creek.

Quite early in the progress of the investigations, which were carried on by means of trenching the deposits yielding the objects, it became apparent that the sites were ancient quarries, where the aborigines had obtained the material and manufactured implements of quartzite and quartz, and that the supposed implements were only the failures, rejects, or wasters unavoidably produced in shaping brittle stone by percussion, and having no significant relationship with archaic or paleolithic art. The work had been very extensive, and consisted in quarrying the bowlders from the heavy beds of Potomac age and in roughing out the implements to be made. On account of the dual nature of the work carried on, I have called these sites quarry-workshops. The important bearing of these investigations on a number of the problems of archeologic science makes it advisable to present them in considerable detail.

GEOLOGY OF THE LOCALITY

As a preliminary step to a study of the evidence of human industry on these sites, it is important that the geology of the vicinity be carefully reviewed. Fortunately this is an easy task, as the identification and relationships of the various formations have been recently made out thoroughly by Messrs McGee and Darton, of the Geological Survey. It is found that the only clastic formations with which the quarry phenomena are directly associated are Cretaceous, and we are therefore not called on to trouble ourselves about the significance of this relationship, since the association is necessarily purely adventitions. It is further ascertained that the other sedimentary rocks of the surrounding region are all older than those with which the works of man are known to be contemporaneously associated. The deposits with which remains of human handiwork are directly associated are mainly talus accumulations, the formation and modification of which have been going on for a long period and are still in progress.

The broad plateau bordering the city on the north is cut by Rock creek and Anacostia river and their tributaries. It is capped with sedimentary formations which extend far eastward and southward, covering the tidewater country; these are underlain by crystalline rocks, gneisses, granites, schists, etc (figure 1), well exposed by the deep scoring of Rock creek and its branches. On the western side of that stream the latter rocks rise to and form the surface of the country. The sedimentary rocks were laid down along the crystalline shore, which sloped gently eastward, in approximately horizontal strata, two formations in Mesozoic time and the Cretaceous period, known as the Potomac

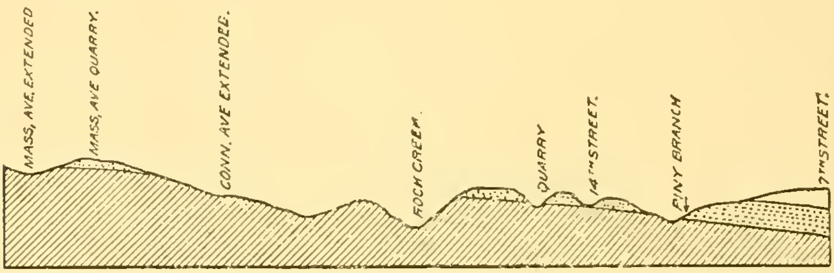


FIG. 1—General section across Rock creek and Piny branch valleys, showing gneissic formations and their relation to the overlying beds of Potomac gravels.

and Severn formations; two in the Eocene period, named in order of deposition the Pamunkey and the Chesapeake; one in the Neocene period, known as the Lafayette formation; and one in the Pleistocene, named after the Federal District the Columbia formation.

The Potomac formation rests on the uneven surface of the gneissic rocks exposed in Rock creek valley, and is composed to a great extent of coarse sediment and fragmental rocks, brought down mainly by the great streams that drained the highland. The lower members of this formation are usually of very coarse materials, and in the Rock creek region they consist largely of pebbles and bowlders of quartz and quartzite, well rounded by water action. The Lafayette formation, resting on the upper surface of the Potomac series in this region, is not to any extent concerned in the present study, although in some sections of the Potomac valley the heavy bowlder deposits included in it were utilized by the aborigines.

Especially heavy accumulations of bowlders occur along that portion of the old shore-line bordering the exit of the ancient Potomac

ROOTS OF A CHESTNUT TREE GROWING IN A BED OF SHOP REFUSE SEVEN FEET DEEP

Few pieces have not been broken or shaped by the hammer, and numerous thick leaf shape forms are in sight river from the highland and its entry into the sea, now the District of Columbia; and as the streams draining this shore-line after its elevation from the sea cut down through the sedimentary formations, these bowlders were exposed, and are now found outcropping in the sides of the valleys at the base of the sedimentaries and resting on the gneisses. Other beds of bowlders are found higher in this section, but none happen to be so well suited to the use of the primitive implement maker as those representing the work of the waves along the crystalline beach. The surface of the gneisses was somewhat uneven, sloping gently beneath the waves, and the bowlder beds laid down on this surface are of uneven thickness and not of uniform character when followed out horizontally, coarseness decreasing with distance from the river channel. The aboriginal inhabitant, seeking for stone suitable for his use, discovered these outcrops of bowlders along the bluffs of the Potomac and its tributaries, and soon ascertained that the deposits were heavier and the quality of the material better and more uniform in Rock creek valley than in any other section. This discovery led in time to subterranean search on the more favorable sites and finally to extensive quarrying, the evidences of which are now brought to light.

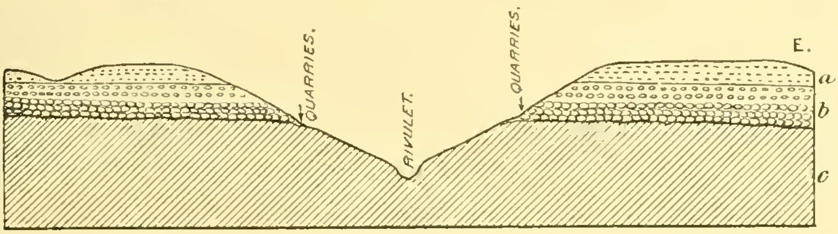


FIG. 2—Section of the ravine, showing formations and position of quarries.

Owing to the friable nature of the bowlder beds and of the gravels and sands overlying them, the terrace slopes bordering the streams (save where erosion had recently been particularly active) offered no good exposures of the bowlders in place, but were covered with deposits, often many feet in thickness, of gravelly talus derived from the crumbling edges of the strata. The bowlders contained in this overplaced deposit were the first to be utilized, and the work then extended to the bowlder beds proper, and the refuse of the quarrying was added to the creeping slope gravels or talus.

The section given in figure 2 shows the relation of the gneisses, the bowlder beds, and the superficial deposits of sand and gravel outcropping in the quarry ravine.

PINY BRANCH QUARRIES

Location of the Quarries

In passing out of the city by way of Fourteenth street extended, the bridge over Piny branch of Rock creek is reached at a point $1\frac{1}{3}$ miles beyond the present city boundary, Florida avenue. Here we are already in the midst of the quarry-shop sites, and the rudely worked stones may be picked up on all sides.

The quarries occur about half way up the wooded slopes north and south of the branch, on both sides of Fourteenth street, but the refuse has descended to the stream beds and is found everywhere in the over-placed gravels of the lower levels. The most extensive evidences of ancient working occur on the northern side of the stream west of the road. Here the terrace is upward of 100 feet in height and its faces extremely steep. The map presented in plate II serves to indicate the distribution of quarries over an area of about half a mile square. The bluffs at this point are capped with about 40 feet of the Potomac formation, clays, sands, gravels, and bowlder beds, the Neocene deposits of the Lafayette formation which forms the higher levels of the region having disappeared from the outer promontories, or being but slightly represented by obscure remnants. Beneath the Potomac beds the gneisses are exposed (figures 1 and 2) and may be seen at several

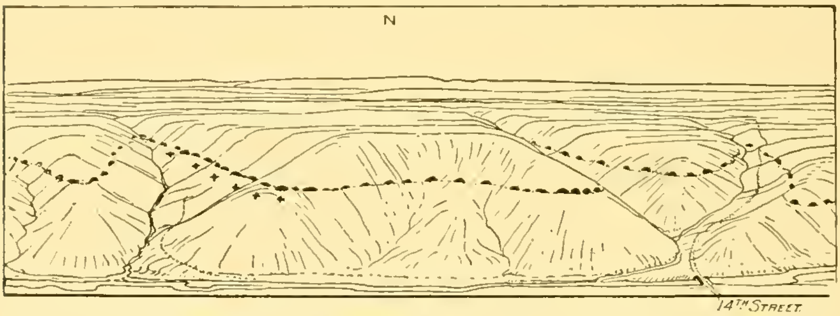
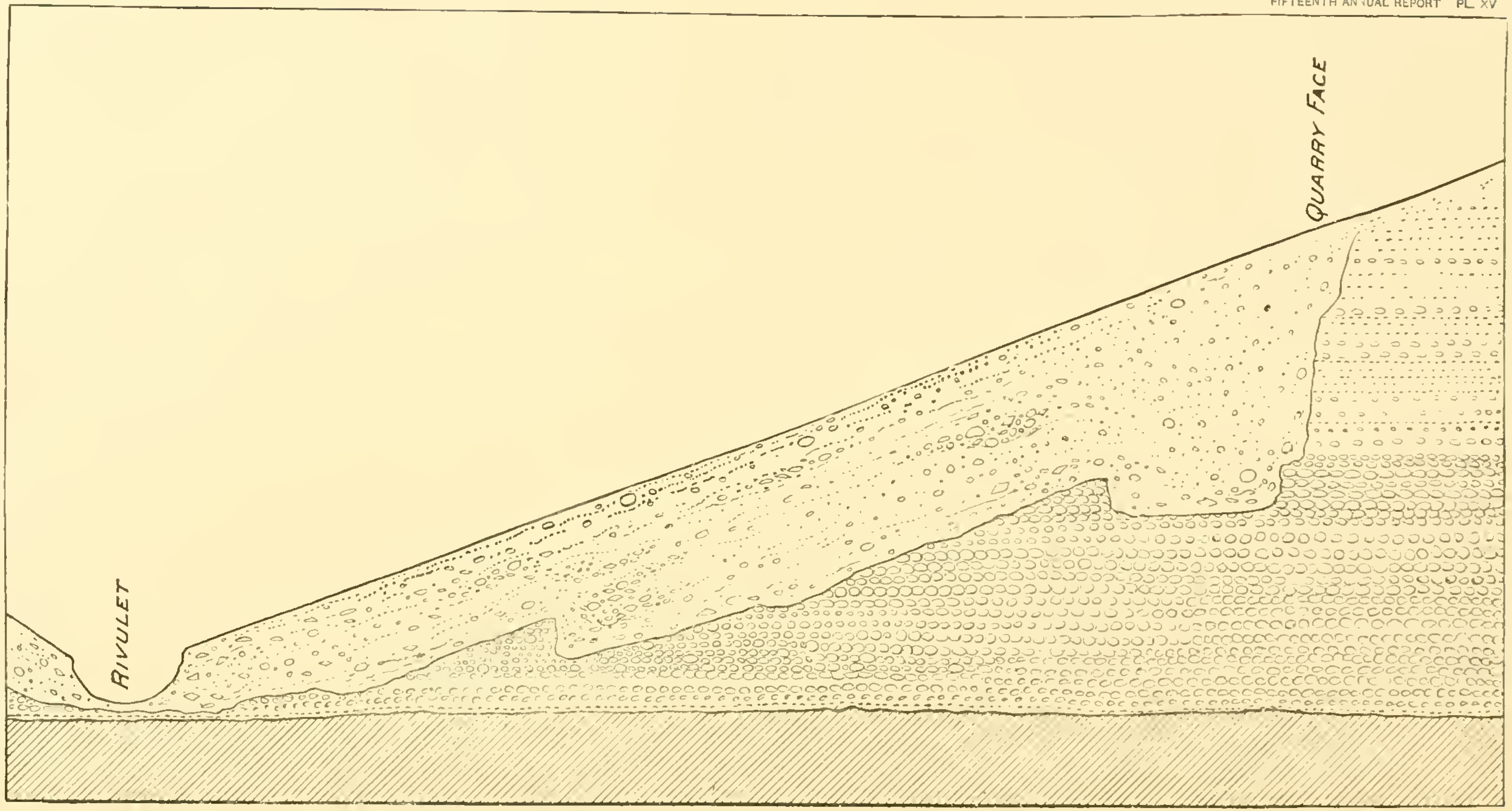


FIG. 3—Panoramic view of Piny branch quarry sites, looking north. The irregular dotted line indicates position of the quarries and the crosses mark the principal points of study.

points, especially about the bridge. They are more fully exposed farther down toward Rock creek, into which the branch flows half a mile below. The gneisses, as well as the Potomac beds resting on them, disintegrate and crumble on and near the surface through the action of various agencies, thus giving rather smooth though steep slopes on which the forest maintains itself with much uniformity. The surfaces are usually covered with a veneering of slope deposits composed of the disintegrated rocks and of vegetal mold, and this over-placed material abounds, up to the quarry level, in artificial débris. It was at first thought that this association of the worked stones with deposits of gravel might be of value as a means of determining the age or period of occupancy, but examination developed the fact that the gravel represented no definite period, its deposition extending from the present back indefinitely into the past.

In figure 3 a generalized view of the Piny branch quarry sites is depicted; it will give a comprehensive idea of the configuration of the



SECTION SHOWING DEPOSITS FILLING THE QUARRY EXPOSED BY THE THIRD TRENCH. QUARRY FACE 13 FEET IN HEIGHT locality. The view looks northward across the valley of the branch; a dotted line half way up the slopes separates the sedimentary and crystalline rocks, and in connection with it the quarry sites are indicated by dark figures. The sites examined by trenching are indicated by small crosses.

Operations on the Site

DISCOVERY AND RECONNOISSANCE

So far as known the first discovery of worked stones on the site of our excavations at Piny branch was made about 1880 by Mr De Lancey W. Gill, of the United States Geological Survey, who was engaged in sketching on the bank of the stream and by chance observed a flaked stone in the gravel at his feet. Subsequently Mr Gill came upon a number of heaps of quarry-shop refuse in the second ravine west of Fourteenth street, at the point selected in 1889 for our trenching operations.

In September, 1889, I visited Mr Thomas Blagden, owner of the property, to obtain permission to work on the premises, and learned from him that about the year 1878 a street contractor had been permitted to collect material for paving from these bluffs, and that various piles of refuse found by us on the surface were gathered together at that time, a portion only of the material collected having been carried away. At that time a narrow roadway was cut leading from the creek up the little ravine to the site of our recent labors. Mr Blagden subsequently informed me that while a boy, some twenty-five years ago, he had observed the great quantities of bowlders at this point, and desiring to know something of the reasons for their accumulation, had secured help to dig a trench, which was abandoned, however, before the bed of bowlder refuse was fully penetrated. I have no doubt that the evidences of former excavation discovered at the fiftieth foot of our first trench, and which caused us no little perplexity at first, is thus fully accounted for.

In beginning the examination of this site the first step taken was a careful examination of its topographic features with especial reference to such eccentricities of contour as might be due to the agency of man. Extensive working over of surface deposits, especially if the pitting were deep, would leave inequalities of profile which, if not obliterated or obscured by natural agencies, would be easily recognized as artificial. Such inequalities were readily found; indeed, they are so well defined in places that even the inexpert observer could not fail to detect them. It was partly on account of peculiarities of profile that excavations were undertaken at the spot selected, and the results have shown that these surface indications were not deceptive.

Toward the upper end of the ravine the elevations and depressions resulting from the ancient quarry work are more pronounced. Either the disturbances here are more recent than below or else the leveling agencies of nature have been less active.

THE FIRST TRENCH

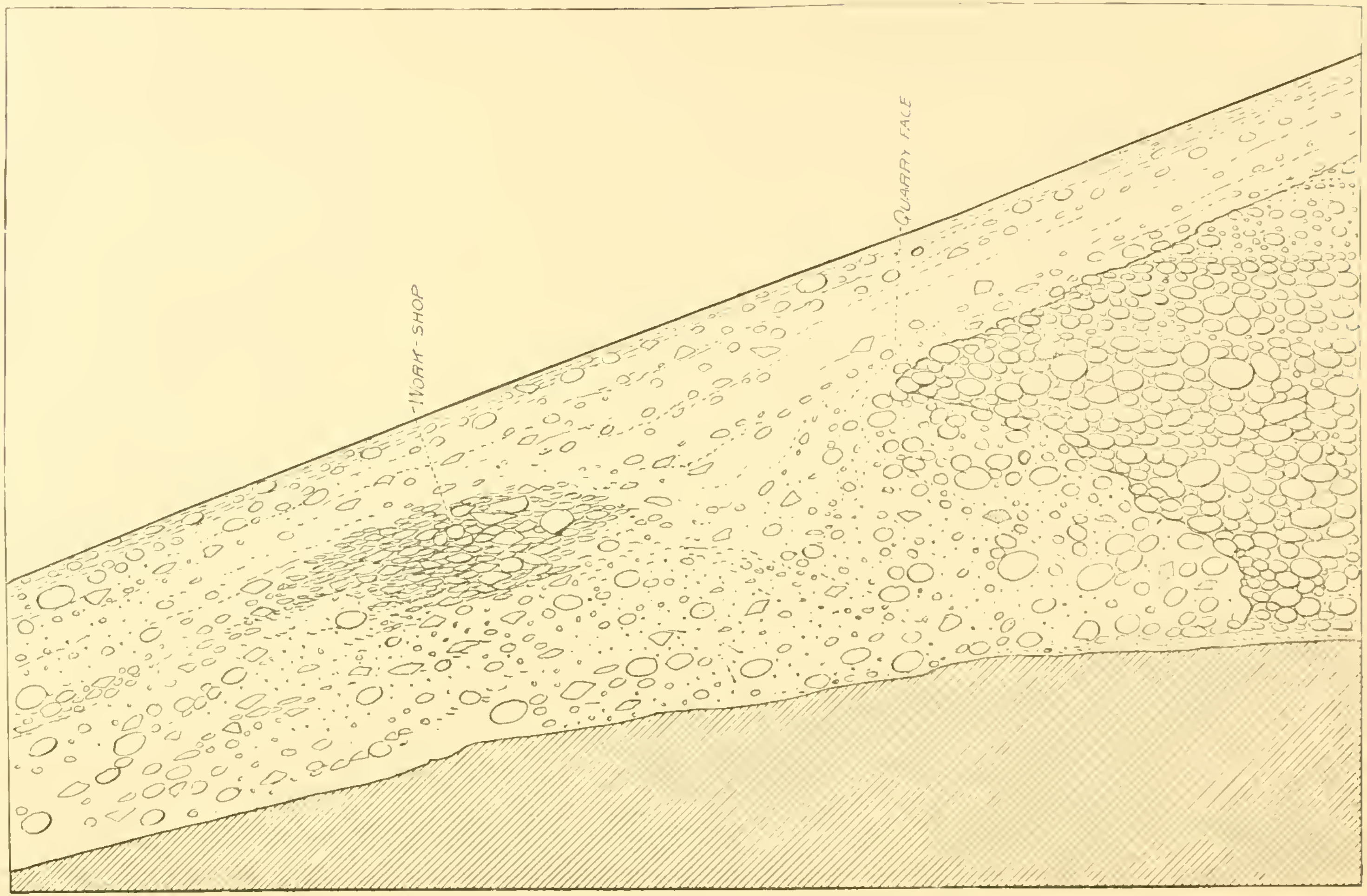
In selecting the position and course for a section through a series of deposits so extensive, and of which so little was known as to depth and mode and order of occurrence, there was considerable danger of missing the most instructive and vital spot. It seemed clear, however, that the section should cut the face of the slope from base to summit, and if necessary extend across the level surface of the spur and continue down the opposite side. This would in all probability reveal the true character of the art-bearing deposits; their relations to the geologic formations of the terrace, ancient and modern; the conditions of original deposition, and the effects of natural causes acting for an unknown period on distribution.

After looking over the ground carefully it was decided to go well up the ravine and rather beyond the apparent middle of the heavier deposits, so that other sections could be run if found necessary, or so that other investigators following should find a large portion of the area untouched. The sequel showed that a better selection could hardly have been made, and the results are so satisfactory, so far as the main points at issue in the investigation are concerned, as to make unnecessary the cutting of other complete sections.

The point selected for the beginning of the section was in the bed of the ravine, a few hundred feet from its junction with Piny branch, and where a line could be drawn from base to summit of the hill without serious embarrassment from the forest trees. This line crossed slightly to the left of the center of a gentle convexity in the profile of the lower half of the slope, thought to be due in a measure to deposits of artificial nature.

After a preliminary surface exploitation of the section, made to ascertain whether or not any considerable excavation would be necessary, a line was stretched on the surface of the ground, and to this numbered tags were fixed at intervals of one foot, to facilitate the accurate recording of data. To further serve the same purpose, a section of the hillside was drawn and divided into squares. For convenience of reference, this section was divided transversely into parts of 10 feet each. It was also arranged to make cross sections at intervals of 10 feet, representing the conditions exhibited in the front wall of the excavation; these were to be divided into square feet for record. This plan was substantially carried out, though modifications were made to suit various exigencies of the case. Sections were made at frequent intervals where increased interest demanded, all being scaled in the same manner. At every available point photographs of the vertical exposures were taken; and in connection with them detailed drawings were made recording character of soil and formations and manner of occurrence of relics.

Before describing the excavation, the conditions existing within the immediate channel of the rivulet at the base of the section may be



SECTION SHOWING THE QUARRY FACE EXPOSED BY THE FIFTH TRENCH

Bowlder bed undercut by ancient quarrymen at the right and shop refuse deposit at the left sketched. The channel was about 6 feet deep and 10 feet wide at this point; the section across it, including both banks, is shown in figure 4. The slopes of the terrace rise from the steep banks of this inner channel at an angle of from 20 to 25 degrees through a vertical distance of 60 feet, giving a distance (measured on the slope) to the summit ot about 160 feet on either side. This notch-like ravine is the result of a long period of erosion, which possibly extends far back into early Cenozoic or even Mesozoic time. It had much its present outline, and no doubt a greater part of its present depth, before man made his appearance in the region.

The area drained through this ravine is quite restricted, and, if wholly wooded, the work of erosion would be extremely slow, the refuse descending from the opposite sides so freely as to clog the channel, save at the time of great freshets. The clearing of the fields at the head of the basin has, in recent times, given some additional power to the floods, and the channel is now not only quite clear, but bears evi-

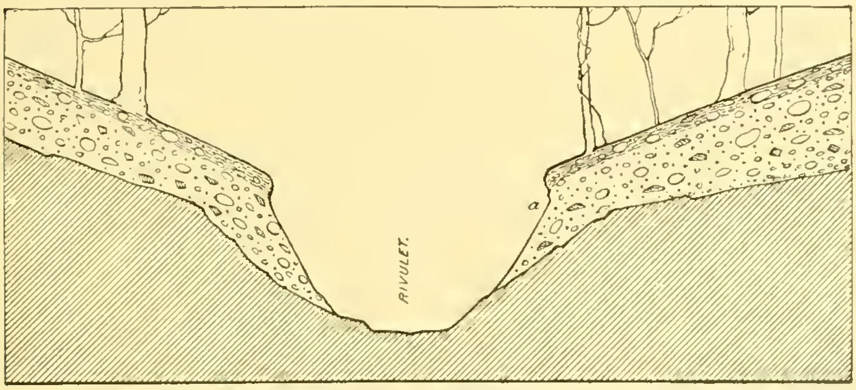


FIG. 4—Section across bed of rivulet at base of quarries.

dence of considerable recent deepening. The gneisses are exposed on the bottom and in the sides of the channel at the point crossed by our section, save where covered by the half-compacted art-bearing talus. The latter deposit is in places as much as 8 or 10 feet deep, and contains innumerable relics from the great shops along the slopes above on the right and left. An excellent illustration of the appearance of the art-bearing débris, from a photograph taken at a point about 30 feet below the initial point of the section, is given in plate III. Partially shaped implements and broken fragments project from the bank in great numbers. The exposure here is 8 feet in depth, but the deposits do not extend far into the bank, forming only a veil over the irregular surface of the gneiss. The latter is exposed beneath the left foot of the standing figure and slopes back from the rivulet bed at a lower angle than does the bank, as shown in the section, figure 4.

A general view of the ravine looking up from the beginning of the section is given in plate IV, and will serve to convey a clear impression of the scenic characteristics of this retired and charming spot soon to be overwhelmed by the growing city. The left hand of the standing figure rests on the spot at which the excavation in the bank began; here the art-bearing talus deposit covered the gneiss with a veneering hardly more than a foot thick: its character and contents are shown in figure 5. This is the first of the series of crosscuts or transverse sections, and represents the front wall of the excavation within a foot of the beginning of the trench. Partially shaped implements and artificial refuse, which may have come from any part of the slopes above, occur throughout the deposits at this point. Near the surface a leaf-shape blade of ordinary type was found, and at 15 inches in depth three others, more or less perfect, together with typical turtle-backs, were encountered.

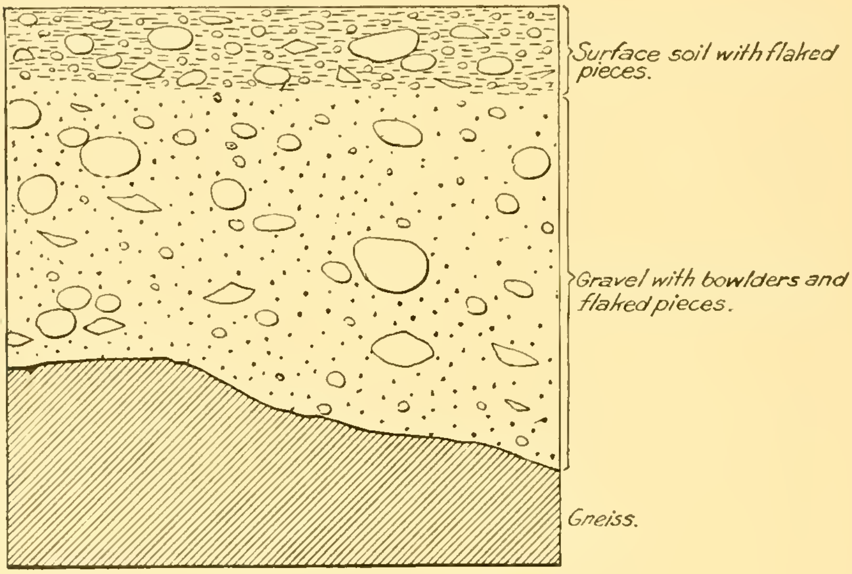
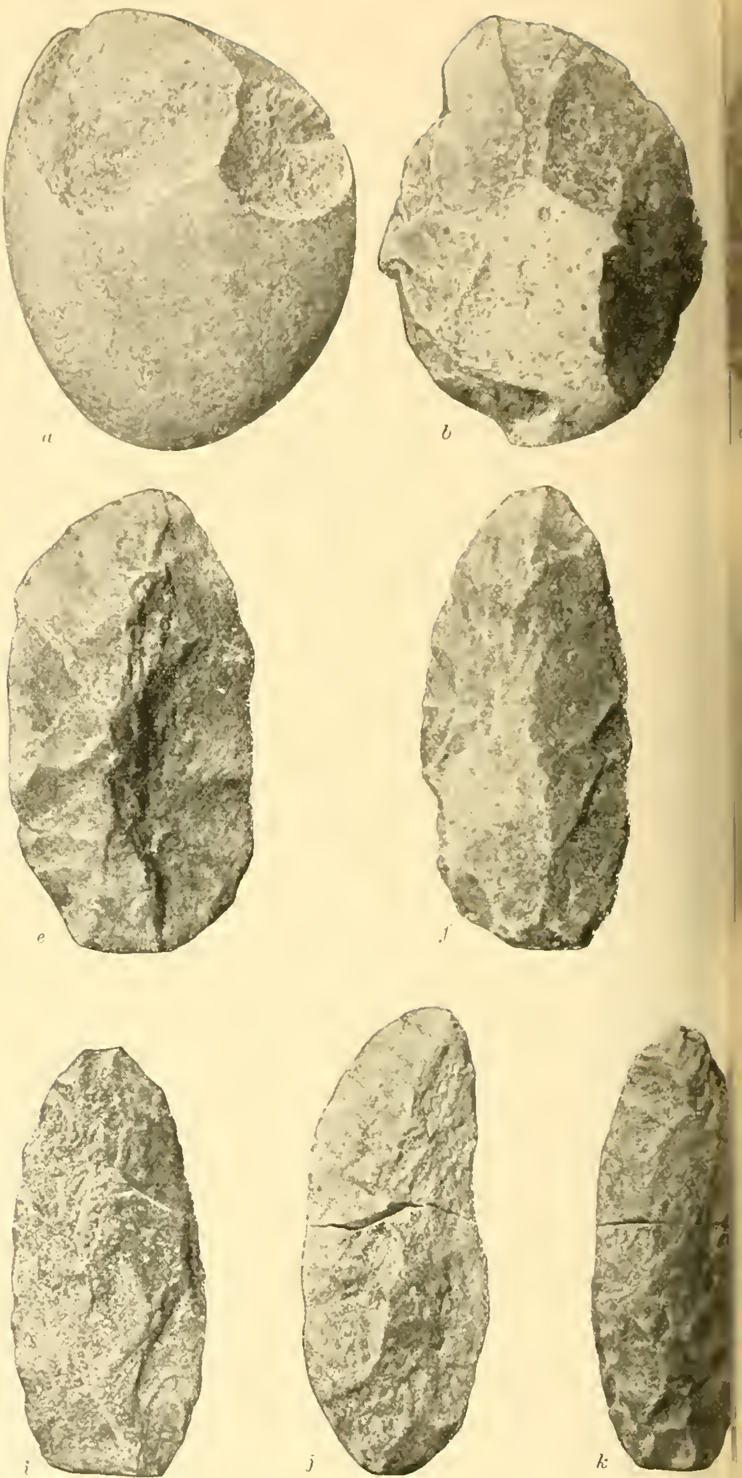


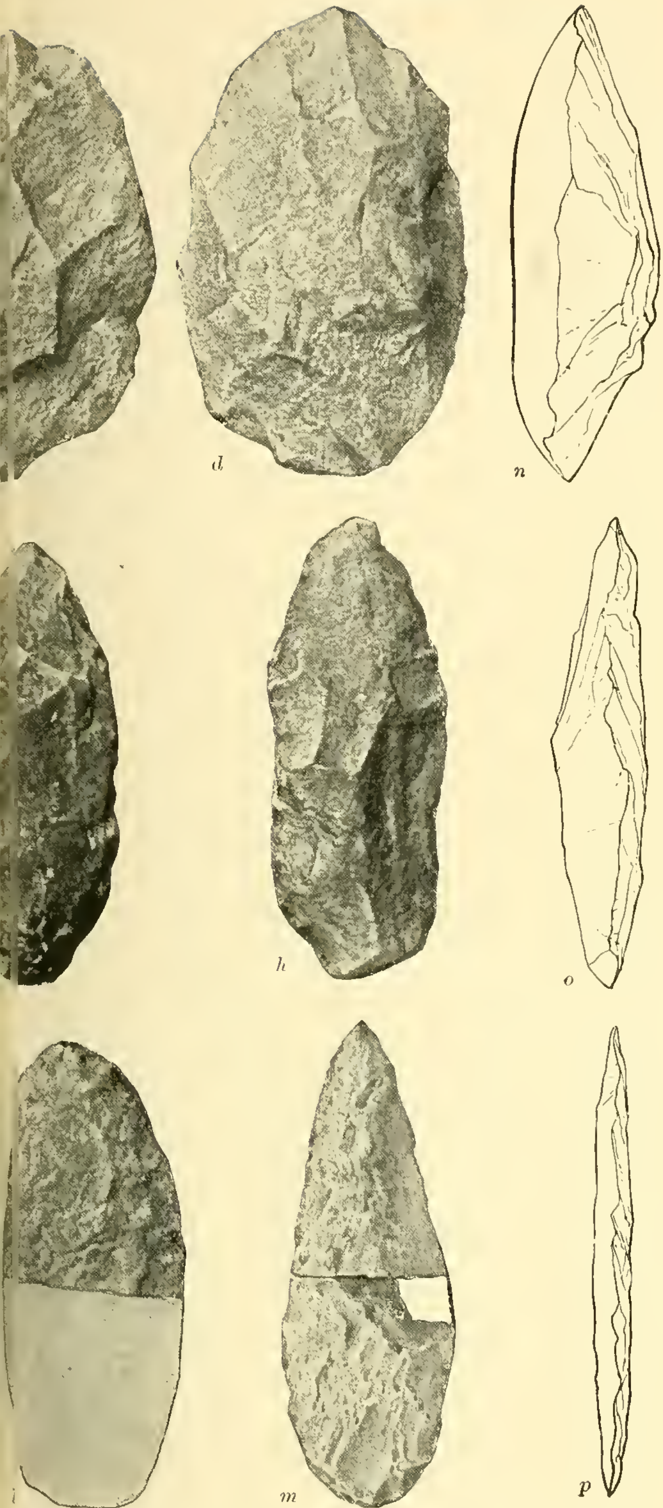
FIG. 5—Cross section at beginning of the first trench.

The exploitation pits (plate V), intended to determine something of the probable nature and extent of the work to be undertaken, were dug along the line of proposed excavation from the starting point in the ravine to the top of the terrace. It was observed that in the lower half the profile of the slope was convex, and that in the upper it was slightly concave. The convexity of the lower part, from the first figure leaning against the young tree to 20 feet beyond the third figure, is due to accumulations of refuse along the lower margin of the quarries, while the depression above (beyond the limit of the picture) is due to the pits left along the quarry face when the site was abandoned.

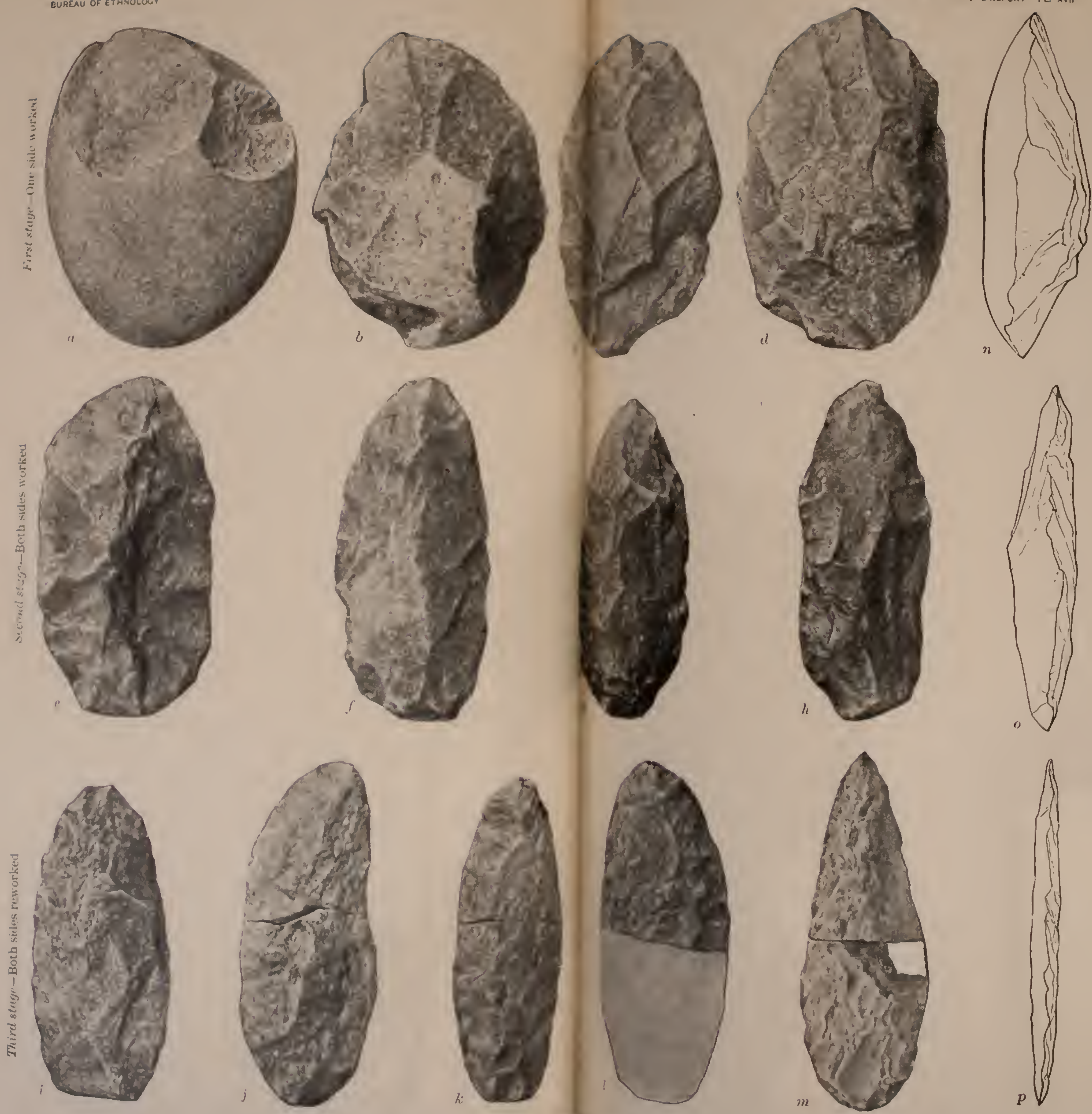
Continuing the excavation beyond the point at which the first cross section (figure 5) was taken, the art-bearing deposits became quite



QUARRY-SHOP REJECTS—PROGRESSIVE SERIES, BEGINNI



E)WLDER AND ENDING WITH THE THIN BLADE



QUARRY-SHOP REJECTS—PROGRESSIVE SERIES, BEGINNING WITH THE BOWLDER AND ENDING WITH THE THIN BLADE

shallow. The dark mold of the surface was about 4 inches deep, and between the first and tenth foot of the section yielded numerous flaked stones and many artificial fragments and flakes; beneath this and resting on the uneven surface of the gneiss was a foot or more of quite compact gravelly clay, containing a few pebbles and occasionally a small bowlder; at the base the deposit contained much mica, derived from the decaying gneiss on which it rests. In this lower gravel there were no traces of art. Up to the twentieth foot these conditions remained practically unchanged. It will be seen, however, by reference to the longitudinal section (plate VI), that the surface of the gneiss rises less rapidly than the surface of the slope, and that the talus gravels increase in thickness to 3 feet. These pass down into a layer of pink and white clay, which rests on the gneiss. Worked specimens were found as before in the top soil, and artificially broken bowlders occurred in the gravel a foot deep. In the lower part of the dark soil a small pocket or cluster of chips was found, and between the tenth and twentieth foot several chipped stones in various stages of elaboration were unearthed. The cross section at the twentieth foot is shown in figure 6. Throughout the gravel occasional bowlders were found, some reaching 6 inches in diameter. From the twentieth to near the twentyfifth foot the conditions and the contents of the section showed no important change. The dark soil reached a thickness of 8 inches, and was underlain by a bed of light sandy subsoil, not before differentiated, about a foot thick. Many partially shaped stones were found in these beds. Beneath this again were gravels and gravelly clays.

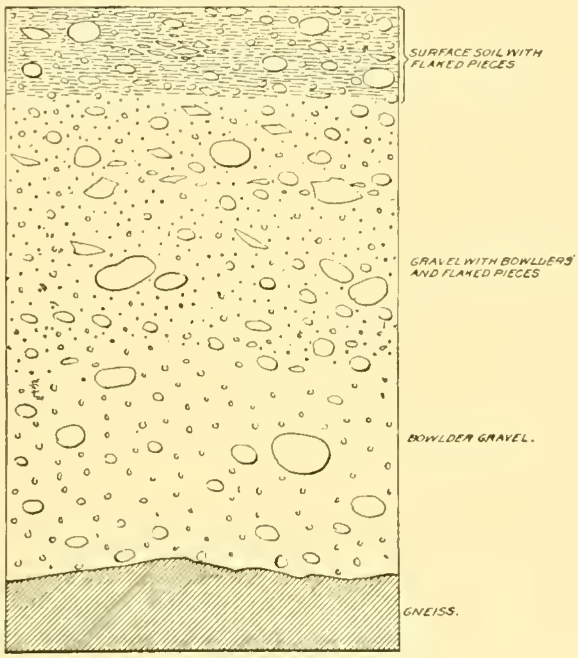


FIG. 6—Cross section at the twentieth foot.

At about the twentyfifth foot the conditions of the deposits were observed to change. The limit of the compact gravels and clays forming the base of the deposit was reached, and a mass of rather loose heterogeneous material was encountered. The edge of an ancient excavation had been reached, though this fact was not at first appreciated; for the idea of aboriginal quarrying had not yet been more than suggested, and the changes observed in the deposits were at first attributed to natural distributing agencies. In the light of facts subsequently observed, this body of heterogeneous material came to be recognized as part of the débris accumulated in an ancient trench, which was cut obliquely by our trench. The ancient trenching had been 4 or 5 feet deep at this point, and the side wall was quite broken and irregular, sloping at a low angle in some places and in others being vertical or even undercut. The digging had not penetrated to the gneiss surface at this point. The margin of the old trench is seen at *b*, plate VI. From this point (the twentyfifth foot) the work of excavation was carried through the quarry refuse and little by little many novel and striking features were brought to light, until at the eightythird foot the upper quarry face was reached.

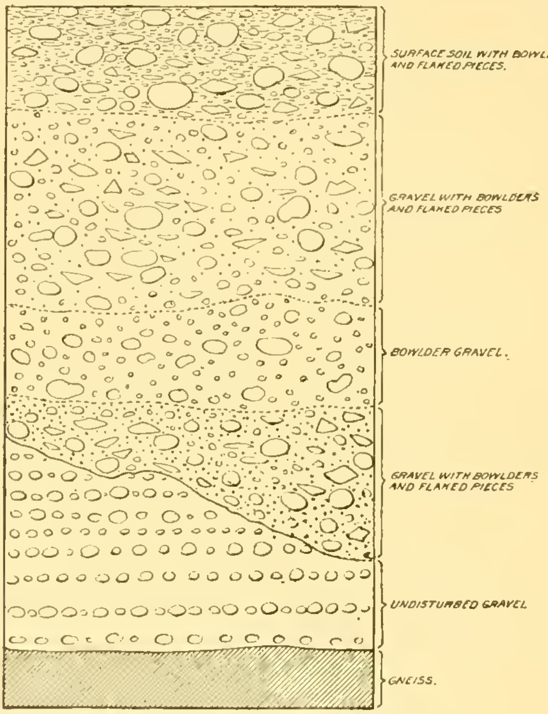
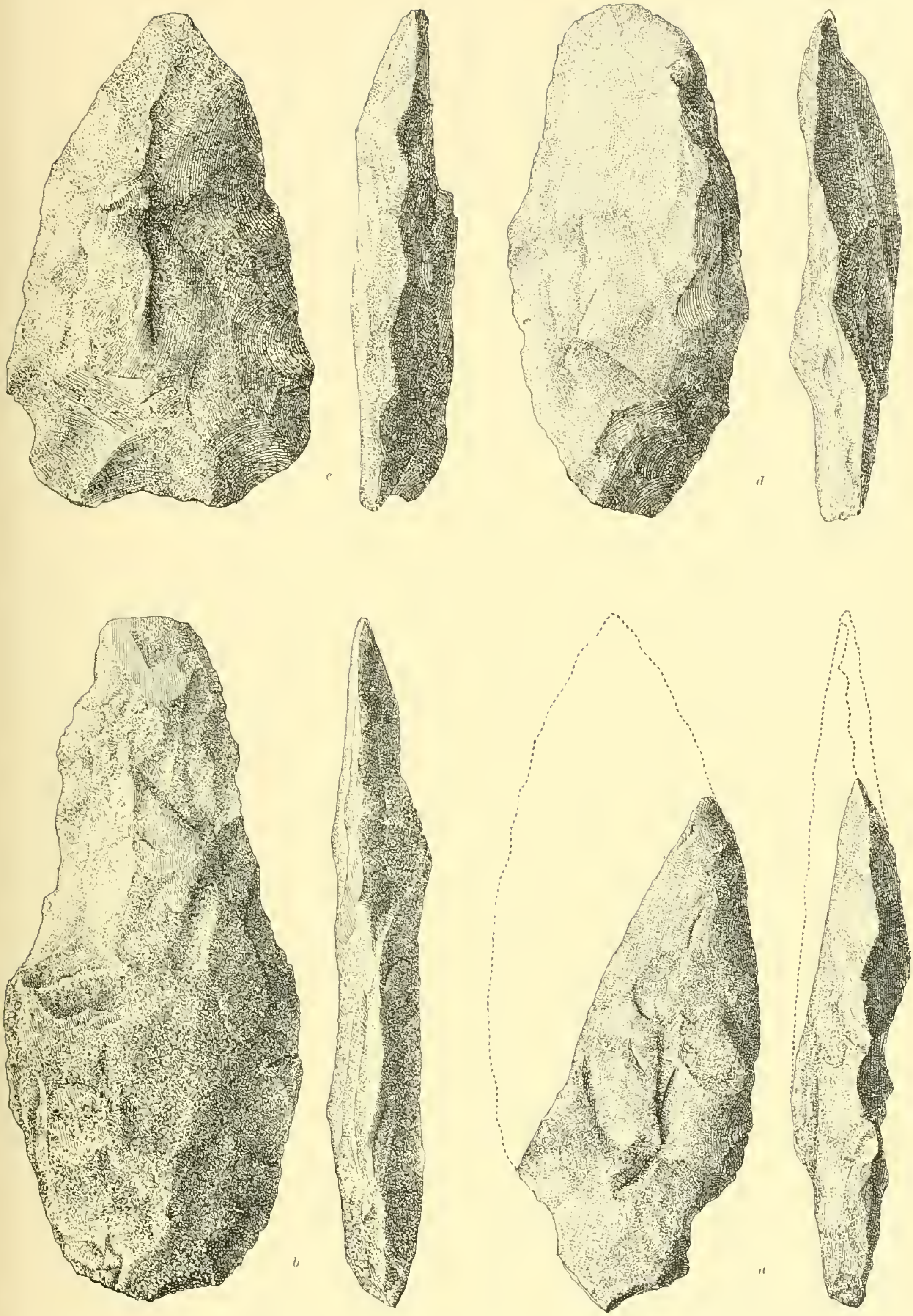


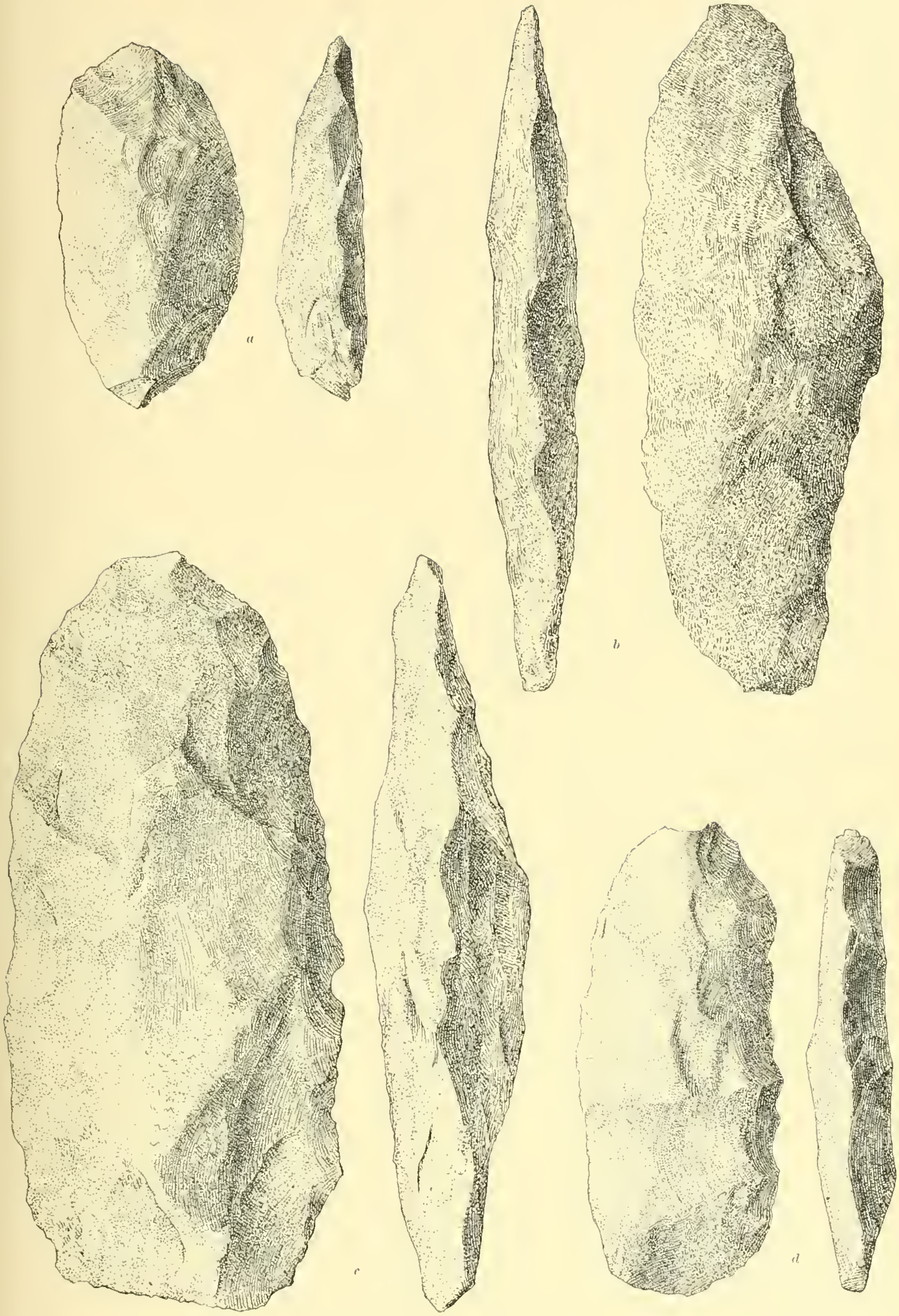
FIG. 7—Cross section at the fortieth foot.

Near the lower margin of the ancient digging a small percentage of artificial material was encountered, but before the thirtyfifth foot was reached the heterogeneous nature of the deposits began to be apparent. It became clear that nearly the entire mass from the surface of the ground to the gneiss floor, a thickness of from 6 to 12 feet, had been worked over by the primitive quarrymen. There was abundant evidence of the nature of the operations carried on both in securing and in working up the bowlders.

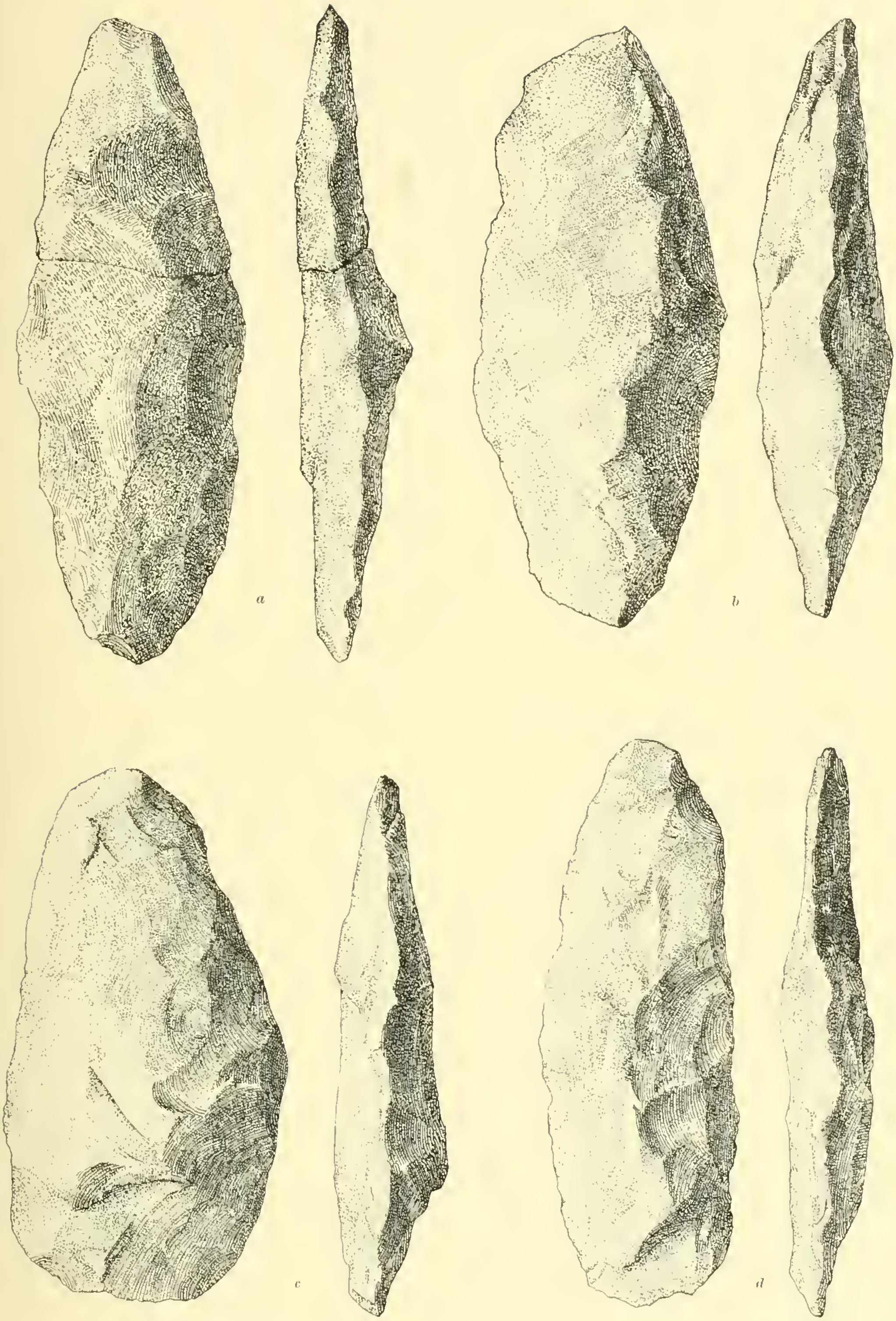
The cross section exposed in the front wall at the fortieth foot is given in figure 7. As might be expected in the refuse heaps of such a quarry there was little regularity and slight continuity in the deposits, so that the section exposed along the left wall of our excavation seldom corresponded closely with that along the right. The running section given in plate VI is not literal, but is drawn to express in a somewhat generalized way the conditions observed.



BLADE LIKE REJECTS FROM THE QUARRY-SHOP REFUSE—*a*, *b*, AND *c* SHOWING SLIGHT SPECIALIZATION (ACTUAL SIZE)



REJECTED BLADES OF MOST ADVANCED FORM FOUND IN THE QUARRY-SHOP REFUSE (ACTUAL SIZE)



REJECTED BLADES OF MOST ADVANCED FORM FOUND IN THE QUARRY-SHOP REFUSE (ACTUAL SIZE)

Between the fortieth and the fortyeighth foot the trench crossed, at about 3 feet from the surface, what had been a pit or transverse trench with sloping sides, between 2 and 3 feet deep. This had been filled with material previously worked over and containing much shop refuse. The character and relations of the deposits are well shown in the sections and photographs presented herewith.

The upper figure in plate VII represents a detailed study of the contents of the ancient pit as seen in the left wall of the excavation. Of this interesting exposure it was impracticable to obtain photographs, since the cutting was too narrow to permit the use of the camera; but the drawing was carefully made, and being supplemented by photographs of the face of the cutting at the fortieth and also at the forty-fourth foot, serves to assist in giving a satisfactory idea of the leading characteristics of the deposits. The bottom of the depression had been somewhat uneven when the filling-in began. The material, most of which consisted of fractured or partially flaked bowlders, had accumulated rapidly, and for a depth of 3 or 4 feet contained only a very small percentage of sand, clay, and gravel. Scattered over the bottom and sides was a layer of light, coarse sand which had descended from above and partially filled in the spaces between the bowlders and fragments; and throughout the mass, where the interspaces were filled at all, it was chiefly by coarse sand, small pebbles, and the flakes from the manufacture of implements.

A very decided bedding of these coarse materials was apparent, its curves following and repeating those of the bottom of the depression, but diminishing toward the surface. In the stratum of finer material overlying the coarser contents of the pit and in the dark loam of the surface there was also a slight sagging and thickening, indicating that the obliteration of the pit had been but recently accomplished.

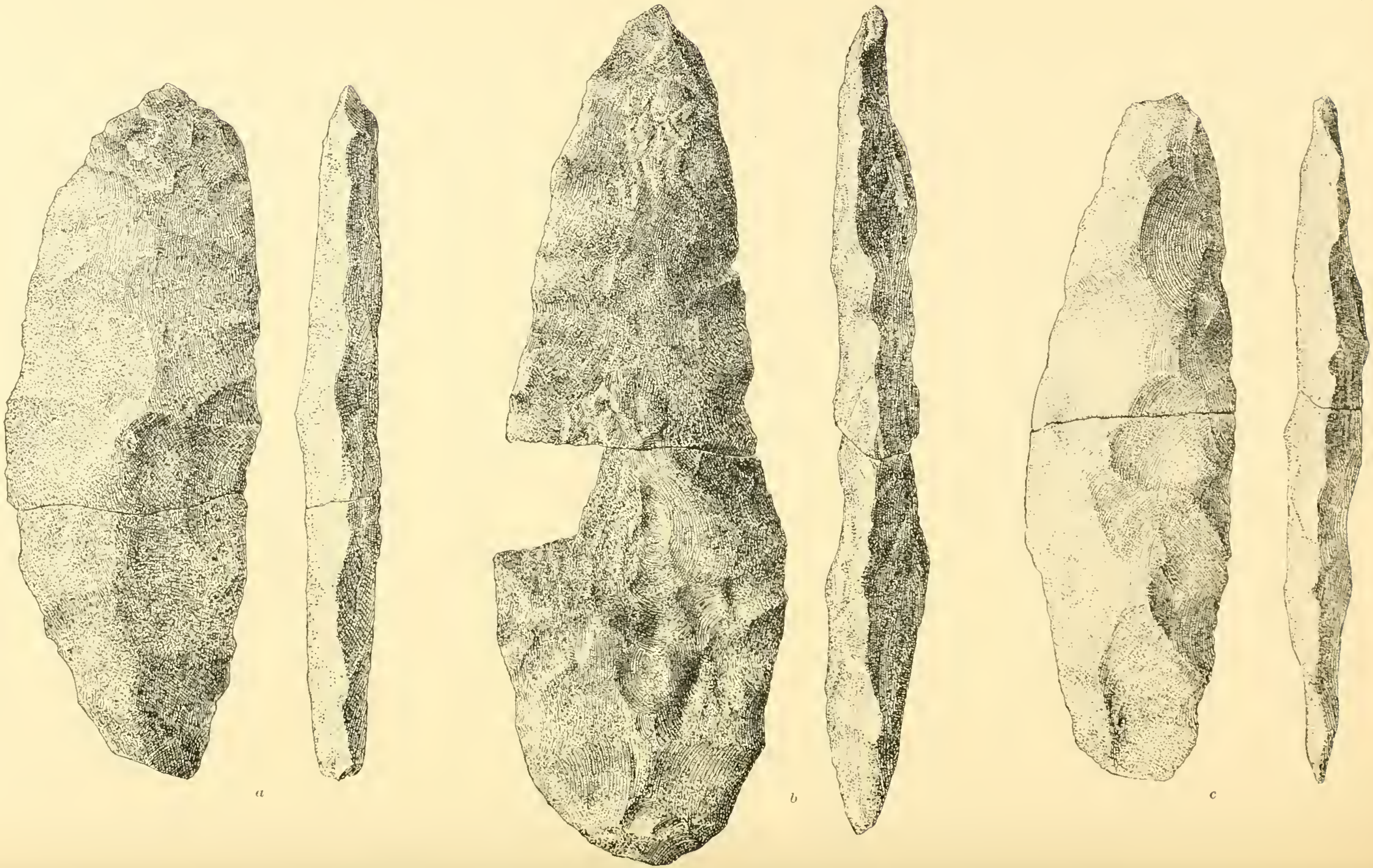
It was observed that the distribution of the filling materials was unequal, the coarser gravel and larger bowlders being lodged at the left in the section, which was the lower side of the ancient pit (*a*, plate VII). This was to be expected, for the source of supply of filling débris was from above, and as the tool maker worked over the material upon the slope the heavier pieces rolled down until stopped by irregularities of the surface. It was also noticed that the percentage of flakes and failures was greatest at the left side of the depression from the fortyfirst to the fortysixth foot, where the flakers, it would appear, must have occupied the pit margins.

That the work was done on this spot, and that little subsequent distribution has taken place, is clearly seen, as the failures and broken tools often lie together with the flakes struck from them. It is safe to conclude also that the accumulation was rapid. The accumulation of the finer and more compact bed overlying the contents of the pit was probably slower and was no doubt due partially to natural slope agencies, though it contains a large percentage of worked material; the darker soil of the surface was filled with shop refuse, most of which has not been far removed from the spot of manufacture. The cross sections are too limited in extent to show clearly the bedding of the accumulations, but they serve to illustrate the nature of the contents of the pits.

The conditions at the fortyfourth foot are given in (*b*) plate VII. By carrying the excavation to the right and left the outlines of the old depressions were found to be irregular and extended so far that I did not undertake to define them fully. It appeared, however, that our section had cut the deepest part of this particular depression. A photograph covering the rectangular space outlined by a dotted line in the section is reproduced in plate VIII. I am fortunate in being able to present such an illustration of the composition of the refuse at this point, as it affords evidence that can not be gainsaid, and the student may study the nature, conditions, and relations of the component parts with ease. The picture covers a space about 2 feet wide by 3 high, the top being 2½ feet below the surface of the ground and the bottom within a few inches of the deepest part of the ancient excavation. The unusual number of large bowlders is a notable feature, but it will be found that the broken and worked ones far outnumber the unbroken, and that several partially shaped tools are in sight, occupying positions no doubt very much the same as when dropped by the workman. A turtleback appears near the base beneath the large split bowlder; others are seen to the left and a little higher, while numbers are seen to be dropping out of the loose, open mass of refuse near the middle of the picture. The section abounds throughout with artificial material.

After passing the fiftieth foot the deposits exhibited the usual phenomena, and no features of exceptional interest were encountered until the seventieth foot was reached. The bottom of the old pits continued at about the same level, so that the artificial deposits became gradually deeper as we advanced. Occasionally small masses of the Potomac gravel (small bowlders and pebbles held together by an indurated sand matrix) were encountered, indicating the proximity of the ancient quarry face. The pitting had been carried down almost to the gneiss floor, which was here nearly level, being covered with a bed of sharp yellow sand from an inch to a foot thick. It was afterward ascertained that this layer of sand formed a part of the original Potomac deposits and separated the gneisses from the beds of bowlders above, as shown in the section. The artificial deposits, about 7 feet deep at the sixtieth foot, deepened to 10 or 11 feet at the quarry face 20 feet farther on.

Between the fiftieth foot and the sixtieth the refuse was distributed in alternating beds of gravelly earth and shop deposits, as shown in the general section. These beds constituted the refuse derived from extensive operations along the quarry face. After passing the seventieth foot the layers of refuse were inclined toward the quarry face, as indicated in the section.



BROKEN BLADES REPRESENTING THE MOST HIGHLY ELABORATED FORMS MADE IN THE QUARRY SHOPS (ACTUAL SIZE)

The quarry face (plate XIII) was encountered at about the eightieth foot, but sloped back in steps to the ninetieth foot and beyond. It showed a stratum, 10 feet or more in thickness, consisting largely of medium size quartzite bowlders embedded in a matrix of nearly pure sand, so indurated that the bowlders were extremely difficult to remove, and considerable masses of the conglomerate could be knocked down and removed without breaking up. The face was extremely irregular, indicating that when deserted the ancient quarrymen had penetrated to greatly varying depths; they had descended to the gneiss surface in excavations from 10 to 12 feet deep, had removed the bowlders by direct attack from above, from the front, and by undermining, and had selected and thrown out those best suited to the purpose of the flaker. Few of those left in the pits and dump had been more than tested by the removal of a flake or two. The work of shaping was in the main carried on about the margins of the pits out of the way of the quarryman. The earth, gravel, and undesirable bowlders were thrown back against the lower side of the pits, lodging in irregular beds sloping into the pits, as shown in the section.

Between the seventythird foot and the seventyeighth our trench passed through large pockets or masses of shop refuse. The largest body, consisting of tons of chips, failures, and broken bowlders, was confined to a space extending from 3 to 7 feet from the surface; smaller pockets of the same character were found as deep as 9 feet. The exposure in the sides and front of our trench showed these deposits clearly, and illustrations are selected from the fine series of photographs taken. Plate IX represents nearly the full height of the front of our trench at the seventyseventh foot, and plates X and XI illustrate the composition of the refuse in detail, showing a preponderance of rather large bowlders, most of which have been partially worked or broken to test the material. The portion shown in plate XI belongs lower in the section, extending down from the seventh nearly to the ninth foot in depth. Several shaped pieces are in sight. In plate XII we have a fine illustration of the clusters of shop refuse at about the eightieth foot. The clinging wet earth obscures many of the fine flakes, but enough is seen to indicate the very great amount of work done on this spot. The mass was made up of unshaped refuse and of shaped specimens, illustrating the whole range of quarry-shop work from the first flake to the rude thin blade; the latter, it was gradually learned, being the almost exclusive product of the flaking operations. A section showing the quarry pit and the face of Potomac bowlders is presented in plate XIII. This terraced face, receding in irregular steps, appears to have undergone little change since it was deserted by the prehistoric quarrymen. The bowlders are compactly bedded and retain their places with great tenacity.

The deepest work of which evidence was discovered was about 11 feet beneath the present surface. It is probable that when deserted the pit at the quarry face was much deeper, as considerable degradation of the slope must have taken place since the desertion of the quarries. In another trench farther up the ravine the quarry face was exposed to a depth of from 12 to 15 feet.

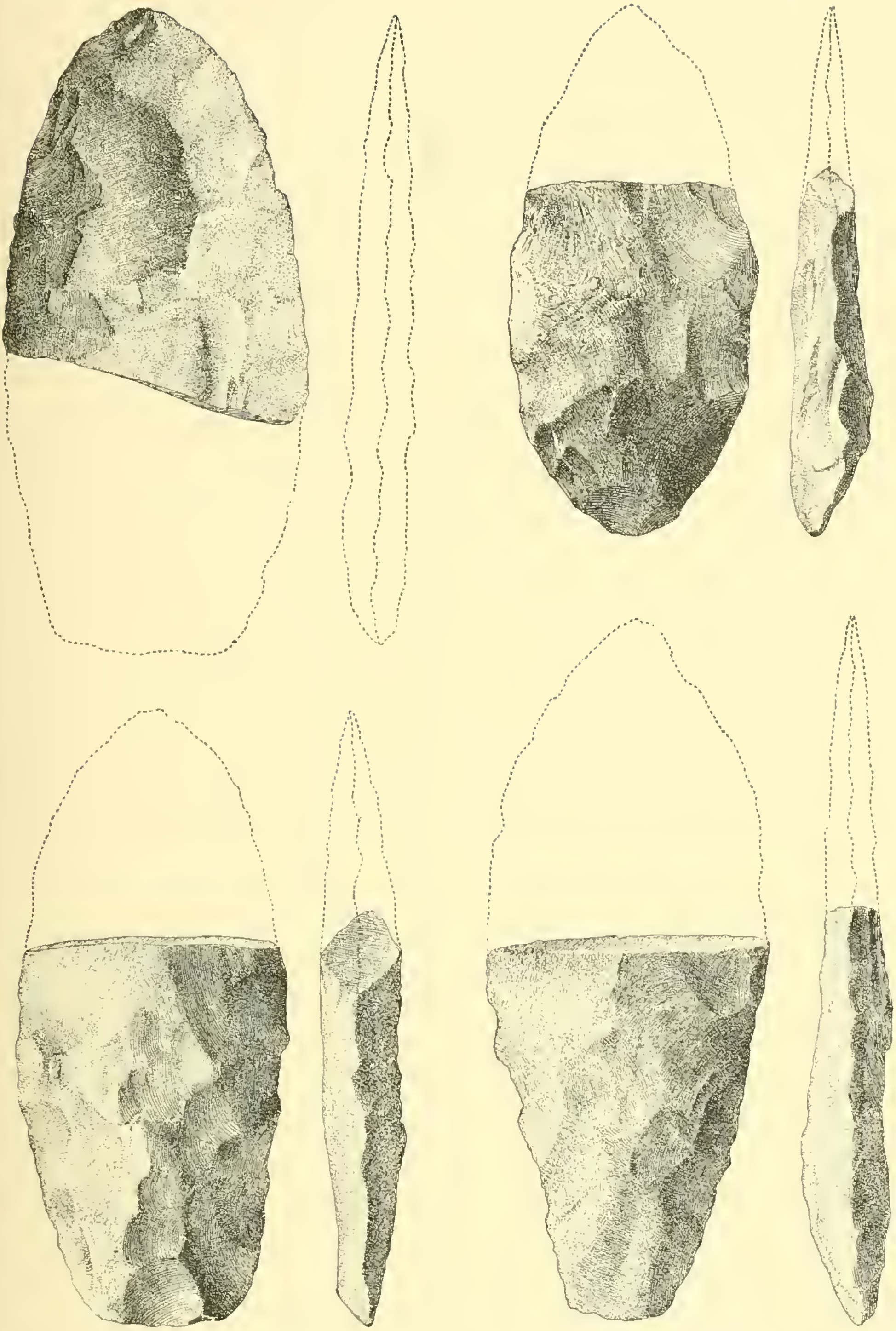
Plate CIII and the frontispiece, described in the supplement, serve to illustrate the probable conditions under which the work was carried on by the savage quarrymen. The miner with a strong wooden pike is seen dislodging bowlders from the bed; a second workman is breaking up a large mass of quartzite, and the flaker engaged in roughing-out the blades is seated near at hand. The life-size group from which these views were taken was prepared under the writer's direction for the World's Fair, in Chicago. The figures were modeled by U. S. J. Dunbar, sculptor, and were costumed after drawings published in the works of Hariot and John Smith, the assumption being that this work on Piny branch was done by the Algonquian tribes known to the colonists of Jamestown and Roanoke. However this may be, the work of procuring and working the bowlders is, I am convinced, correctly indicated by this group.

The quarry was about 60 feet wide where crossed by our trench, and was 3 or 4 feet deep at the lower margin and 11 feet deep at the quarry face. The bowlders, forming a large part of the mass worked over, had nearly all been tested for flakability by the removal of a flake or two, or had been more or less fully worked. All of the material removed from the trench was carefully assorted and studied by us, and the important results reached through its consideration will be given further on.

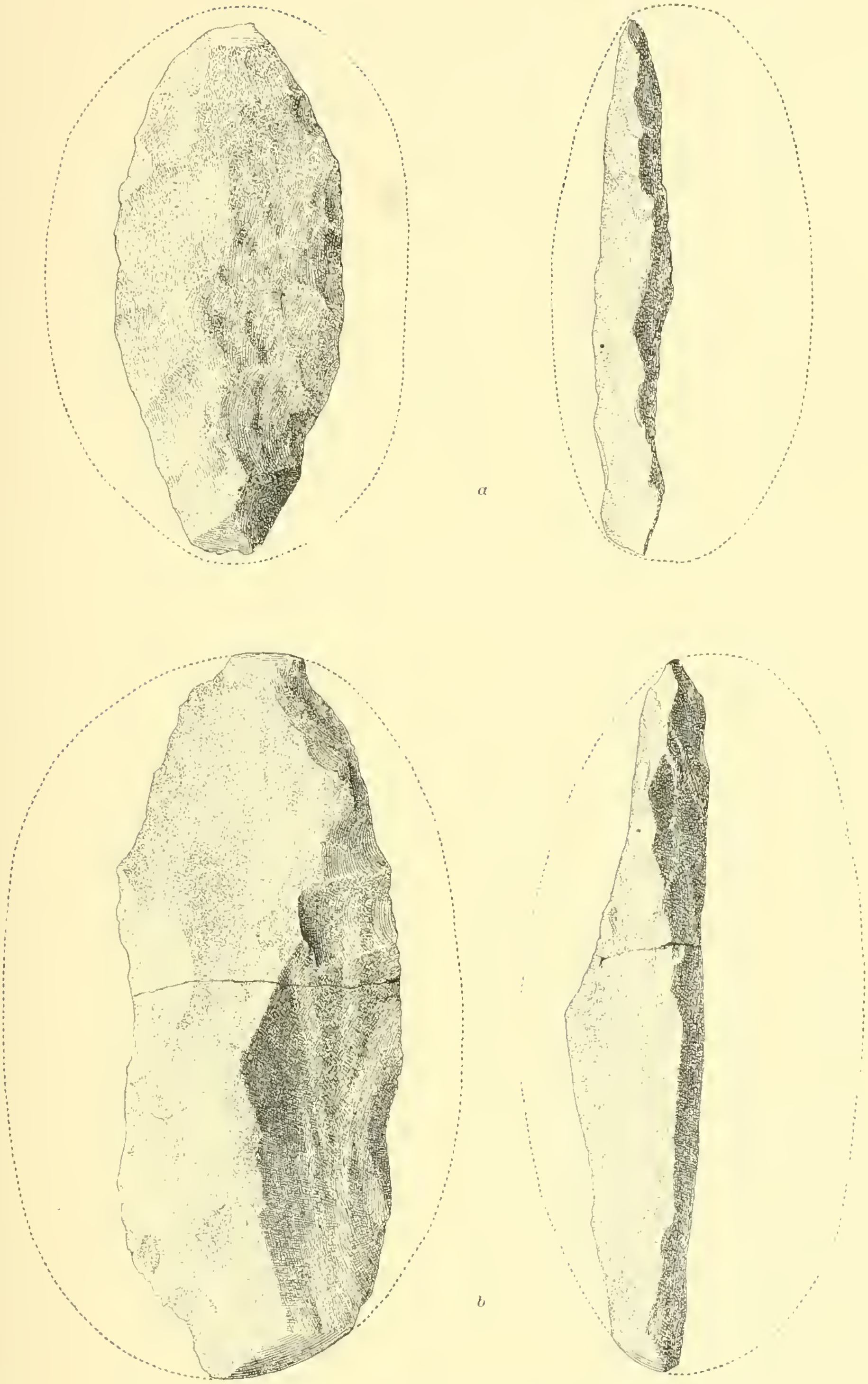
If we allow that the ancient operations were somewhat uniform in extent along the terrace face, say for a distance of 500 feet, the material worked over on this side of the ravine would amount to 100,000 cubic feet or more, and the number of bowlders secured and worked or partly shaped would reach millions.

THE TREE PIT

Lateral excavations from the first trench were made wherever the appearance of the refuse encouraged it, but the deposits did not vary in any important respect. About 10 feet north of this trench, opposite the sixtieth foot, stands a chestnut tree some 3 feet in diameter and rather massive at the base. For the purpose of determining the relation of this tree to the artificial deposits, an excavation was made uncovering nearly one-half of the roots to the depth of about 7 feet. The main root penetrated the refuse and passed through the undisturbed gravel and into the decayed gneiss beneath. The roots had made their way through the deposit of compact quartzite fragments, inclosing many of them almost completely (plate XIV) and assuming irregular distorted forms imposed by the angular stones. As a matter of course, the tree postdates the quarry period, as do other trees much older. In one of the ravines near Fourteenth street a white oak, at least 200 years old, grows in the same manner in a mass of shop refuse.



FRAGMENTS OF BLADES REPRESENTING THE MOST HIGHLY ELABORATED FORMS MADE IN THE QUARRY SHOPS



RELATION OF THE FLAKED BLADE TO THE PARENT BOWLDER (ACTUAL SIZE)

TWO SPECIMENS OF FLAKED STONE THAT, TOGETHER WITH THE LOWER SPECIMEN OF PLATE XXIII AND THE FLAKES MADE IN SHAPING THEM, WERE FOUND IN A SINGLE CLUSTER (ACTUAL SIZE)

The refuse about the roots of the chestnut tree contained more than the usual percentage of partially shaped tools, and several bushels of these, showing rude leaf-shape outlines, were collected. A photograph made shortly after beginning the excavation shows the inclosure of worked stones in the base of the tree and their prevalence in the mass of refuse (plate XIV).

THE SECOND TRENCH

A second trench carried across the old quarry in the spring of 1890 failed to furnish features of especial interest and added little to the fund of information acquired from the trench made the previous year. It was not expected, however, that this second excavation would expose extensive deposits of refuse or well-marked quarrying. The site was chosen in a depression, or incipient gulch in the slope, where no marks of disturbance could be detected, whereas the first trench was carried across a convexity in the face of the hill, which convexity bore every indication of being the result of artificial disturbance and accumulation. Having determined that surface appearances in the first case really indicated the conditions beneath the surface, the second trench was made where no indications of artificial disturbance could be noted. This trench was 100 feet north of the first. No well-defined shop sites were discovered, and evidences of ancient quarrying were quite meager. Artificial refuse was evenly distributed throughout the overplaced gravels to a depth of about 3 feet. These conditions would seem to indicate that the shallow depression in which the trench was dug had been filled from shops and quarries at the right and left, or perhaps from random working at higher points on the slope.

Excavation was begun in the rivulet bank, here about 6 feet high. The immediate bank was found to consist of a mass of refuse, well filled with broken bowlders and rejects and chips which exhibited a sort of rude bedding as if rearranged by the action of the rivulet or as if deposited on its successive though very narrow flood plains. Our trenching soon passed through these deposits. The gneiss which formed the bed of the stream rose rapidly beneath the loose mass forming the bank, and at 10 feet from the stream approached within 3 feet of the surface. From the tenth to the thirtieth foot the gneissic surface followed the slope of the hill at a pretty uniform depth of 3 feet; beyond this it passed horizontally beneath deposits of Potomac bowlders. Overplaced gravels from the tenth foot to the end of our trench contained but few artificial objects, and these did not occur at a greater depth than about 3 feet. These gravels for the most part were made up of a heterogeneous mixture of clay, sand, and pebbles, with occasional bowlders. Near the bottom they consisted principally of material derived directly from the disintegrating surface of the Potomac bowlder beds.

THE THIRD TRENCH

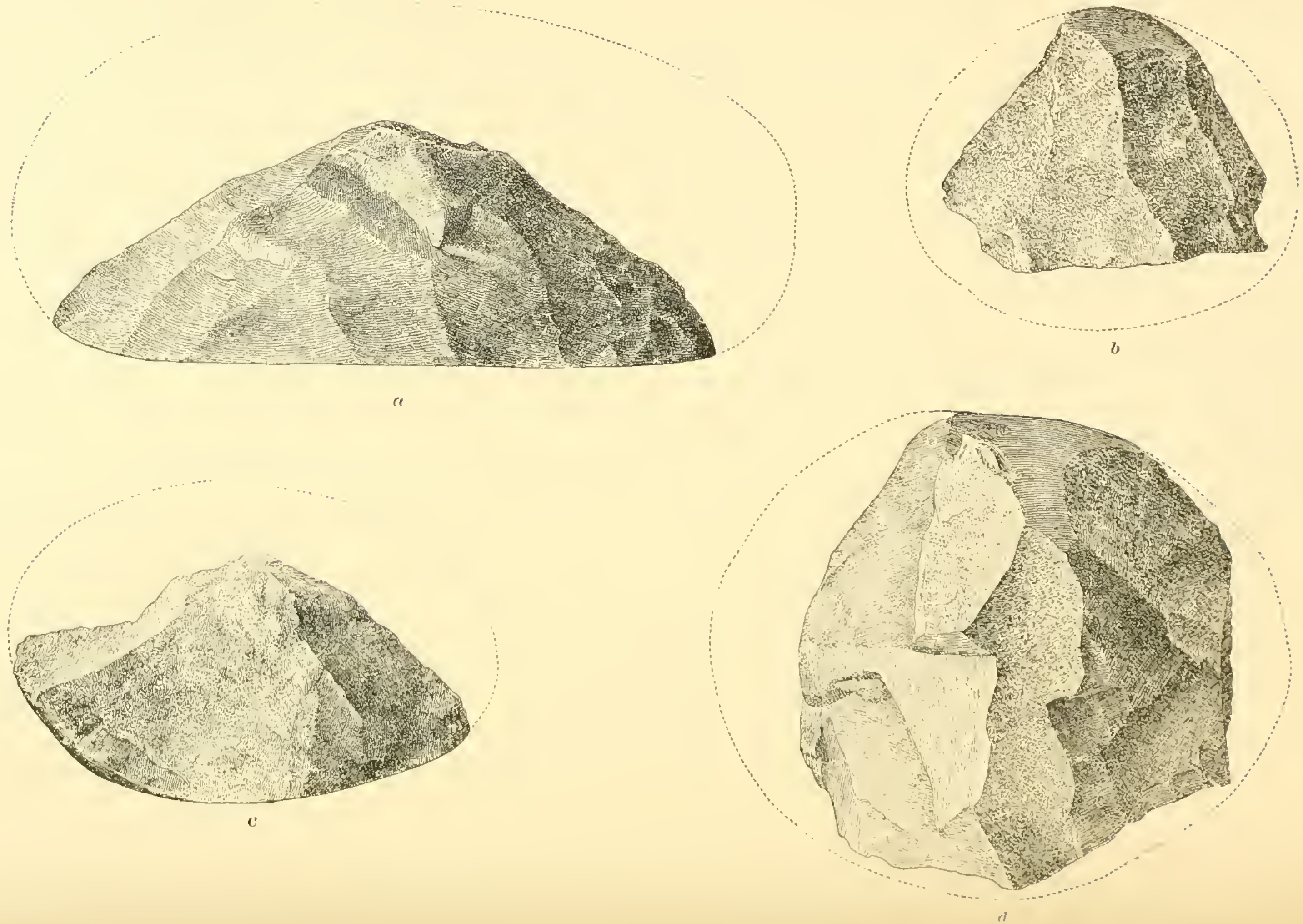
The site for a third trench was chosen with the view of securing evidence on two questions of especial interest. The first was the question of the relation of the ancient quarrying to the present bed of the rivulet; the second related to the significance of a series of depressions observed along the upper part of the slope a little above the quarry level (as determined at other points) and immediately below the upper margin of the terrace slope. The place selected was about 200 feet farther up the gulch than the second trench, and where the length of the slope was only 80 feet and the height about 40 feet. At this point the Potomac bowlder bed outcrops at or but little above the level of the stream bed, and it was thought that evidence of ancient excavation might be found so near the present bottom of the gulch as to indicate the comparative recentness of the work. Observations on this point are given in detail further on.

As to the other question, it was surmised that the depressions along the upper part of the slope marked the sites of ancient pits, and investigation showed that this surmise was not far wrong. The depressions are in all cases a little higher up than the old pits and above the bowlder bed level, and are apparently the result of miniature landslides, by means of which the original quarry pits were filled up.

The phenomena disclosed in this trench are quite interesting and may be given in some detail. Entering the bank on the level of the stream bed, we followed the surface of the gneiss for a number of feet. Within the first 10 feet patches of undisturbed Potomac bowlder gravel remained on the gneiss surface. At about the twentieth foot the bowlder bed began to thicken, and its upper surface rose with the slope of the talus. The bank of the rivulet was between 4 and 5 feet in height, and was composed of loose heterogeneous refuse, which, as the excavation advanced, was found to be rudely bedded with the slope as indicated in the section (plate XV). The loose refuse was from 5 to 7 feet deep, and rested on the gneiss or the uneven surface of the bowlder bed. Broken cobbles, rude rejects, broken embryo implements, and chips were pretty evenly distributed throughout the mass. At the twentyseventh foot the floor of the quarry made an abrupt descent of 3 or 4 feet.

In advancing beyond the twentyseventh foot the bottom of the ancient quarry rose but slightly, and at the fortieth foot it was 10 feet beneath the surface. The deeper parts were filled with loose material—clay, gravel, and bowlders—intermingled with which were a number of fragments including chips and broken, unfinished tools, but there was not here or in the vicinity any very decided evidence of chipping on the spot. The lowest point of this ancient pit was only 2 feet above the present bed of the gulch at the nearest point.

Between the thirtieth and the fortieth foot no features of particular interest were encountered. As shown in the longitudinal section, a number of pockets of shop refuse occurred between the twentyeighth foot and the thirtyfifth. These may have been shop sites, but had more the character of refuse descended from above into depressions or



CORE-LIKE FORMS FROM WHICH FLAKES HAVE BEEN TAKEN EITHER IN FUTILE ATTEMPTS AT SHAPING AN IMPLEMENT OR FOR USE AS IMPLEMENTS pits. The mass of material about these pockets and beyond, up to the fortyfifth foot, was comparatively barren of artificial refuse. The middle parts of the mass of filled-in material, as indicated in the section, is quite homogeneous, as if never worked over by man, and must have descended into the quarry pit en masse as a miniature landslide from above. It consists of loose, crumbling, sandy clay of reddish color—a characteristic of the higher-level beds—containing some gravel and occasional bowlders. Rather high up in the sides of the trench could be seen indications of old overplaced débris containing shop refuse and coarse materials, all of grayish color. Near the surface the overplaced gravel was again reddish and barren of art.

In approaching the fiftieth foot, pockets of shop refuse began to appear, and at from 4 to 6 feet deep and beyond the fiftysixth foot characteristic quarry-shop phenomena were encountered. Beds of clay and refuse of varying colors were seen dipping into the hill as the quarry face was approached. Nature distributes her materials with the slope, but art reverses this; as the earth is thrown out of a quarry pit it forms layers conforming roughly to the slope into the pit. The section exposed in this trench is given in plate XV.

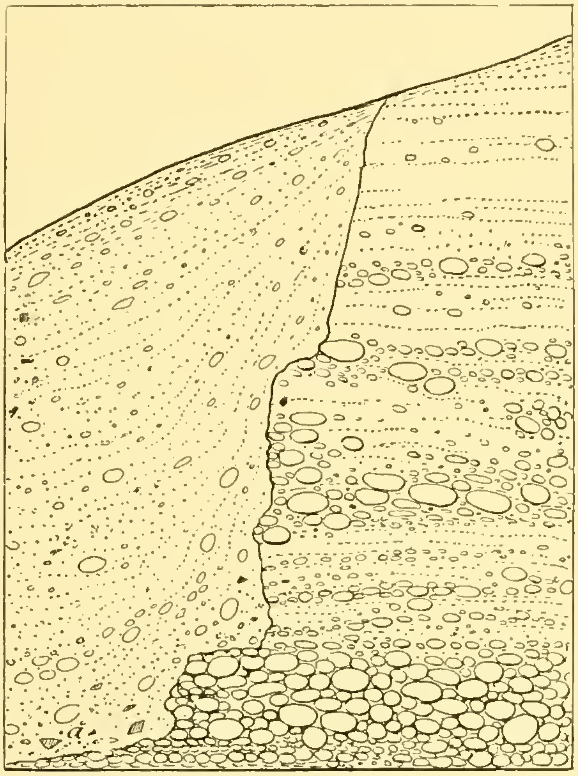


FIG. 8—Section of bowlder beds exposed in quarry face 13 feet in height.

At the fiftyseventh foot a descent of 2 feet was made into a deeper portion of the ancient quarry as shown in the section. At the sixtieth foot the bottom of the old quarry was 13 feet beneath the present surface, and at about the sixtythird foot the quarry face was encountered. When this was uncovered to the full width of our trench, the section shown in figure 8 was disclosed. Beginning at the top there were about 3 feet of overplaced slope material, dark above from the presence of vegetal mold and composed of sandy clay below; beneath this were the Potomac beds in place, comprising, first, about 3 feet of coarse loose-bedded sands of varied kinds, then alternating layers of sand, gravel, and bowlders, and at the base a compact layer of bowlders. The ancient workmen had penetrated this latter bed at this point only to the depth of a foot or two. On the bottom and against the quarry face were a few chips and chipped bowlders, but the mass of material filling up the ancient excavation was barren of art and consisted of a mixture of clay with sand and gravel, derived from the margins of the ancient pit chiefly by sliding from the overhanging front wall. This wall or quarry face as uncovered by us was only 12 or 13 feet high, but when the ancient miners deserted the spot it must have been very much higher, probably 20 feet if the period was recent and perhaps more if the time was remote. As already stated, the configuration of the slope showed that a slide had taken place, leaving a hollow just under the crest of the slope and giving a rounded mass on the site of the ancient digging. Beneath the highest part of this mass our trench disclosed the deepest point reached by the aborigines. The filling up by sliding en masse was thus shown by the surface configuration of the site as well as by the character of the filling material.

It appears that the bottom or floor of the ancient quarry was quite uneven, but its full conformation could not be made out from the disclosures of a trench 3 feet wide. In examining the sides of our trench in the vicinity of the ancient quarry face I discovered that our left wall had for several feet coincided here and there with the steep side wall of the ancient excavation.

The digging of this trench amply repaid the labor expended, as answers were obtained to a number of the questions presenting themselves. It was found, first, that the ancient quarrying was carried on at a level only 2 or 3 feet above the present bed of the rivulet, and second, that the trenches had been filled by sliding masses in such manner as to produce inequalities of the surface not yet effaced. In addition, the conclusions reached by a study of the other trenches were confirmed: 1, that there were well-defined quarries with quarry faces of considerable vertical extent in the Potomac bowlder deposits; 2, that little shaping was done in the deeper pits save that required in testing the quality of the stone; 3, that the only work in the shops about the excavations consisted in the roughing-out of leaf-shape blades; 4, that the ancient diggings were extremely irregular, much labor having been expended in exploitation and in reaching the heavier deposits of workable bowlders; and, 5, that undermining was by no means the exclusive method of reaching and securing the bowlders.

Study of this trench afforded a remarkable instance of the confusion possible in the association of works of art with gravel bluffs where workable stone was sought. Had the cutting for a roadway or other modern improvement been made along the side of this gorge the exposures in the walls would have shown "implements" embedded

SITE OF THE DUMBARTON QUARRY, SHOWING REFUSE-COVERED SLOPES DESCENDING FROM THE QUARRIES ALONG THE MARGIN OF THE CREST under unaltered gravels at a depth of 13 feet (*a*, figure 8). and it is thus seen that in such a cutting the detection of the true conditions might be next to impossible without careful and extensive excavation.

THE FOURTH AND FIFTH TRENCHES

A number of trenches were opened about the southwestern point of the promontory as indicated on the map. It was expected that these would throw light on various peculiar features of the topography, and also add to the information regarding quarrying and manufacture. The results are all that could be desired.

The fourth trench was opened on the rounded point of the promontory 300 feet south of the first trench, while the fifth was made a little farther around toward the east. The phenomena observed in these trenches were so nearly identical that I shall omit detailed mention save of the latter and more interesting.

The fifth trench furnished much of the evidence necessary to complete the story of the ancient quarries. The general conditions were uniform with those revealed in the first trench. At the thirtyfifth foot a pocket of shop refuse of unusual interest was encountered. As exposed by the trench (plate XVI) it was 4 or 5 feet in horizontal extent and perhaps 3 feet deep, and its upper surface was 2 or 3 feet beneath the surface of the ground. No part of the quarries, 30 feet across (measured on the slope) and from 6 to 9 feet deep, was entirely free from flakes and flaked stones, but the work of shaping had been carried on most extensively on this one spot. From the deposit upward of 40 blades, broken near the finishing stage, were recovered, though the search made was by no means exhaustive; fully one-fourth of the shaped pieces remained in the excavated débris. This pocket of refuse was not essentially different in any of its features from those encountered in the first trench, but it had somewhat more the appearance of a trimming or finishing shop than any yet seen. There were few large or rude pieces and the flakes averaged small; still no traces were found of specialized shapes, or even of well-trimmed edges or points. The highest form made was a roughed-out blade such as a majority of those found in caches.

The most interesting feature of this trench was its quarry face, which was encountered at about the fortieth foot. It was discovered that extensive undercutting had been done by the ancient quarrymen, and, as we advanced, the overhanging face was found to extend forward several feet, as shown in plate XVI. The phenomena of this quarry face are instructive in one important direction. They reveal, with more than usual clearness, a favorite method of the ancient quarrymen. The massive bowlder bed all around this promontory had been deposited on the gneiss. Entering the face of the bluff on the surface of this rock, rendered friable by decay, the overplaced stratum of compacted bowlders and sand was undermined, so that the quarrying of the bowlders became a comparatively easy matter. They were easily loosened and fell into the hand of the workman from the matrix of compacted sand, as clean and fresh in color as when deposited by the sea in Mesozoic times. By thus working on the gneiss surface, antler picks or wooden stakes sharpened by fire would serve to perform the work of undermining and knocking down, whereas our men found it a difficult task to penetrate the closely compacted conglomerate from its upper surface or from the front, even with the aid of steel picks.

THE SIXTH TRENCH

The examination of the third trench made it clear that in certain cases the ancient pits had been filled, or partially filled, by the sliding of sand and gravel from the quarry wall and from the bluff above. This fact led to the opinion that some of the unique features of conformation observed about the outer point of the terrace were, in a measure at least, due to slides brought about by quarrying operations. To one familiar with the ancient quarrying in this locality, the concavity on the horizon of the bowlder outcrop and the convexity of profile just below, as seen in the sections, would at once be attributed to human agency. In this case, however, the deformation is on such a scale that natural agencies could alone have accomplished the result.

On the southwestern angle of the spur, and at a level about 60 feet below the crest, there is a roundish hump or shoulder 100 feet or more across and rising perhaps 15 feet above what would seem to be a normal profile. This occurs just beneath the level of the bowlder outcrop, and thus has the appearance of a great dump heap to the quarries.

The character of the rocks forming the bluff is such that they disintegrate very gradually, and with ordinary activity of the erosive forces a slope of sufficient declivity to invite landslides would not occur. The question arose as to whether extensive quarrying on the face of the bowlder bed and the consequent undermining of the superposed beds of gravels and sands, here some 40 feet in thickness, might have brought about the sliding of a mass from above sufficient to produce the hump observed. The only possible means of arriving at a satisfactory solution of the question was by trenching. A series of excavations was made covering the profile of the spur from near the summit to the outer base of the convexity that gave rise to the inquiry. The section shown in figure 9 serves to indicate the position of these pits as well as the nature of the profile. The light portions represent the excavations made, and the dotted line at the top indicates the position of the mass supposed to have descended to form the hump. The results of the pitting may briefly be given: The pit at *a* was in shop refuse similar to that usually found in the quarry dumps higher up. The pit *b* was carried 13 feet deep through a mass of sand and gravel more or less disturbed, but apparently not by human agency. The material corresponded closely to that of the beds above the quarry level. Near the base, at 12 feet deep, numerous quartzite chips and

POTOMAC BOWLDER BED RESTING ON THE SURFACE OF DISINTEGRATED GNEISS EXPOSED IN GRADING U STREET, BELAIR HEIGHTS, WASHINGTON CITY fragments evidently of artificial origin were found. Analogous conditions were observed in pit *c*. Pit *d* on the quarry level passed through thin slope gravels, containing some artificial material, into the normal bowlder beds. Pit *e* disclosed the sands and gravel of the upper slopes.

Although the observations were not so complete as could be desired, the evidence secured supports the theory that sliding took place as a result of the quarrying operations, and that the protuberance on the slope below represents the transported mass. The presence of shop refuse in the lower pit, the occurrence of artificial flakes near the bottom of the mass of sand and gravel forming the hump, the absence of normal dump heaps and of quarry excavations along the bowlder outcrop above, all tend to confirm this conclusion. The movement of a large mass from the upper wall of the quarries would obliterate the quarries and carry the quarry refuse down in front of it to the position of pit *a*. These evidences, taken together with the apparently abnormal conformation of the spur, seem to be sufficient warrant for the conclusion reached.

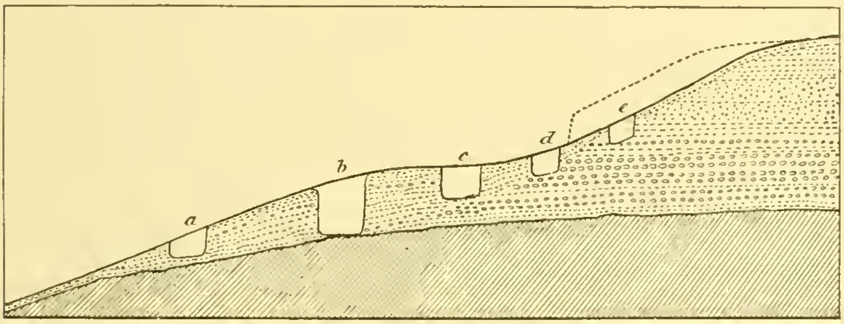


FIG. 9—Section exposed by trenching on outer angle of terrace. Flaked stones were found in pits *b* and *c* near the surface and near the bottom only.

Other Piny Branch Sites

East of the point just described the broad end of the terrace spur facing Piny branch is very steep, and few traces of quarry or shop work are to be seen; but lower down the slope, near the base, are masses of material that must have descended by sliding and creeping. Shop refuse is distributed through these masses and is found in the floodplain of the creek at the base. By stream action the flaked stones and refuse of flaking have been scattered through the recent floodplains of the whole valley below. On the eastern point or corner of the spur overlooking the Fourteenth street bridge over Piny branch there are numerous indications of ancient pitting on the bowlder-bed level, and shop refuse is plentiful. Following this level around the slopes of the ravines just west of Fourteenth street and across to the eastern side, the same phenomena are observed. The slopes of the bluff west of that in which the first trenching was done also bear evidence of having been extensively worked, and all around the bluffs as we approach Rock creek valley proper, rising gradually to the crests of the terrace spurs, flaked stones are found.

On the southern side of the branch quarries occur both east and west of Fourteenth street at nearly the same level. Much work was done near a spring at a point beneath the "house in the tree" and opposite Spring road, which extends eastward from Fourteenth street.

East of Fourteenth street the only quarry of importance is on the place of Mr W. J. Rhees. This is on Spring road, a few hundred yards from Fourteenth street, as indicated on the map. It is probable that in this vicinity many evidences of ancient quarrying have been destroyed by building, cultivation, and landscape gardening. In this direction the bowlder beds, dipping gently eastward, descended beyond the reach of primitive quarrymen.

PINY BRANCH SHOPS

General Features

As indicated in describing the quarry phenomena, shops in which the bowlders were flaked were established at convenient points about the pits, and the piles or clusters of flakes, failures, and fragments are very numerous. The undisturbed clusters are often lenticular in form as originally accumulated, and occur within the body of the refuse just as they were covered by quarry refuse in the progress of the work. Some of those exposed by the trenches have been described and illustrated incidentally in the description of the quarries, and something may now be said of such as were scattered over the surface of the site.

In the bank of the rivulet, about 100 feet higher up the stream than the initial point of our first trench, the caving in of the bank has exposed a large deposit of shop débris. It consists in parts of exceptionally small flakes, fragments, and failures, and was evidently a favorite shop to which much of the selected material from the adjacent pits was carried.[1] Other similar shops are found near by, but in most cases the spots are obscured by refuse from above, or are partially obliterated by the sliding or creeping movements constantly acting on the steep declivities.

Farther away from the pits are what I have termed trimming shops. These are on high points, on bits of level terrace, or on the level upper surface of the plateau. To these places bowlders and fragments, after testing or partial working, were carried to be further trimmed and possibly, in some cases, fully specialized. Small flakes and well-advanced broken blades characterize these spots. It is probable that lodges were pitched on some of these sites, and it would seem reasonable that

[1] During the examination of the site many scientific men visited the spot and examined the trenches and masses of fragmental quartzite, observing for themselves the nature and extent of the operations carried on by the ancient peoples. Among these were J. W. Powell, D. G. Brinton, Henry Balfour, T. C. Chamberlin, W J McGee, J. A. Holmes, G. K. Gilbert, C. H. Hitchcock, G. Brown Goode, O. T. Mason, Thomas Wilson, H. C. Mercer, and F. W. Putnam.

REJECTS FROM THE SOUTH MOUNTAIN R

RRY, SHOWING RANGE OF SHAPED

SERIES OF REJECTS FROM THE SOUTH MOUNTAIN [illegible] QUARRY, SHOWING RANGE OF SHAPED FORMS

the quarrymen should have established a considerable community in the vicinity. A dwelling site is said to have been observed on the level ground, now a meadow, at the head of the ravine, and there are some evidences of primitive dwelling on the terrace overlooking Rock creek west of Mount Pleasant.

The terrace-like spurs bordering the ravine in which the trenches were dug are covered with flakes and broken blades left by the workmen. These are not now in clusters, as must have been the case originally, but are distributed rather evenly over the surface, as if the growth of forests and other disturbing agencies had been long at work shifting them about.

The distribution of shops and shop refuse is shown on the map forming plate II.

Special Features

THE QUARRY-SHOP PRODUCT

Examination of the phenomena of the quarries and shops is naturally followed by a study of the articles produced in them. This is a subject of the deepest interest, and no pains have been spared to obtain full and wholly reliable determinations.

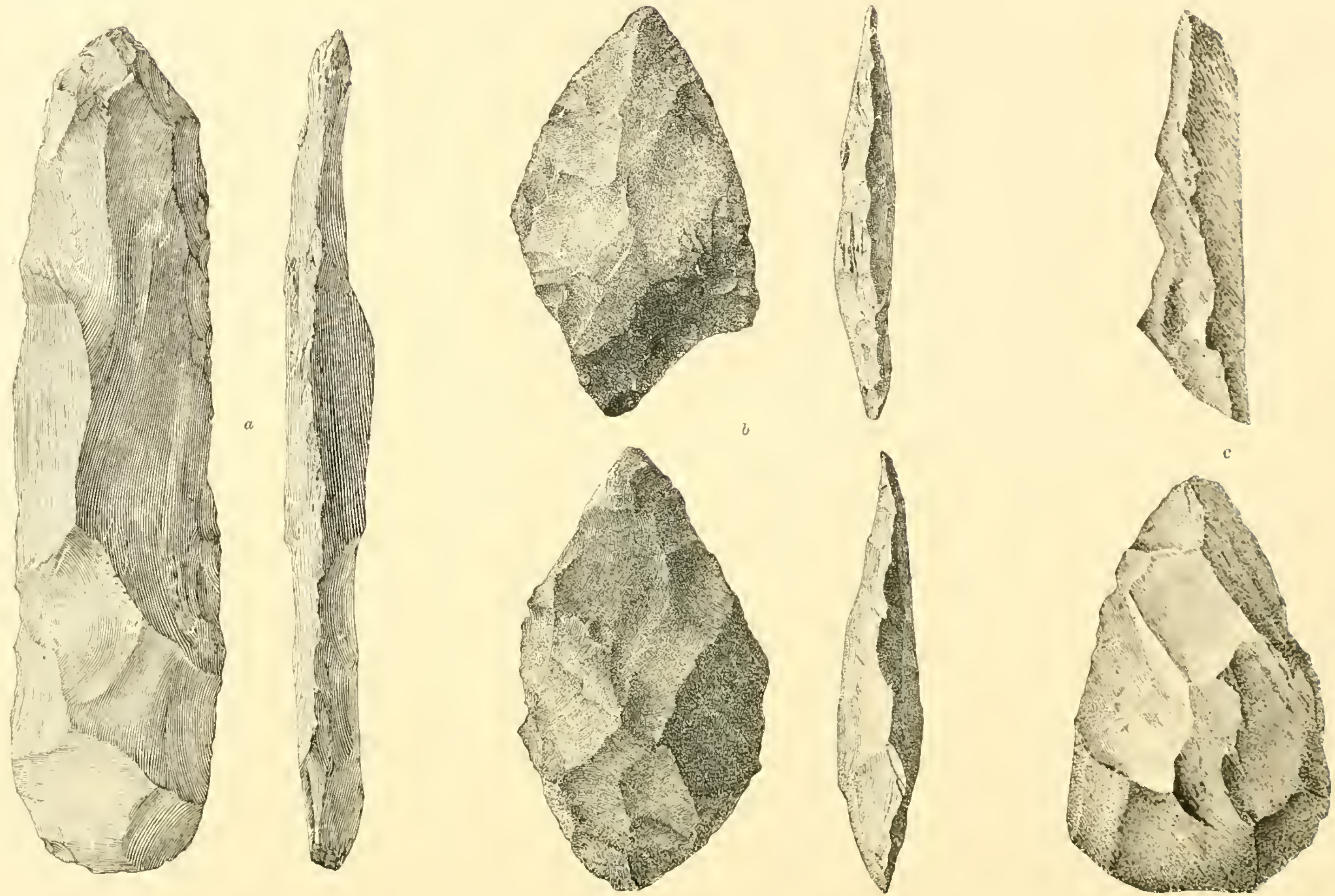
At first it was supposed that the rudely flaked stones found scattered over the sites of these quarries were bona-fide implements, and as such they found their way into literature, much speculation having been indulged in with respect to their age, to their use, and to the grade of culture to which they probably pertained. These and similar articles from the surface are still regarded by some as implements, and numerous specimens are still (1894) exhibited as paleolithic implements without any reason save that they somewhat resemble certain rude forms of European paleoliths.

Viewed in the light of the studies recorded herein, however, the roughly flaked stones are seen to be not implements at all, but the refuse of implement making, including many rejects or failures which, being partially shaped, indicate or suggest more or less fully the ruder forms of flaked implements used by primitive peoples, but which may not have even a remote resemblance to the final form to be made. It was observed that the work on the site was extremely limited in range; that it consisted in reducing the bowlders, or parts of bowlders, by flaking processes to thin leaf-shape blades, which were no doubt intended either for use as simple blades for cutting and scraping, or designed to be specialized, as occasion demanded, into arrowpoints, spearheads, perforators, and the like. So simple are the conditions that a dozen specimens may be made to illustrate the entire range of shaping work.

In plate XVII is shown a series of flaked stones, taken from this site, which includes all the ordinary forms of rejects and epitomizes the full range of shaping operations. Beginning with the bowlder *a*, from which two chips have been taken, we pass through successive stages of elaboration, reaching the most highly developed forms in *k*, *l*, and *m*—long leaf-shape blades. Profiles of type specimens representing three stage of progress are placed at the right. The upper is the true turtleback, the second the double turtleback or incipient blade, and the third the well-advanced blade. As would be expected, no good examples of the fully finished (roughed-out) blades were found entire on the site, and illustrations of approximately finished work had to be selected from broken specimens of which both halves happened to be recovered, or from the many single halves. In nearly all cases these blades have a broad and a pointed end, and an examination of many specimens indicates that these features were generally foreshadowed in the earlier stages of shaping and were kept in view throughout the progress of the work. The blades of most advanced type, represented by broken pieces only, vary from 2 to 5 or 6 inches in length, and are generally under 2 inches in width and less than one-half an inch in thickness. It was apparently requisite that blades to be acceptable should be measurably straight and symmetric, that they should have an oval lanceolate outline, that they should be within a certain limit of weight, and that the edges should have a bevel adapted to further elaboration by flaking processes. Only one piece was found that had certainly been carried beyond this simple stage; in this piece a rude stem had been worked out at the broad end, as in the ordinary spearhead. This specimen (*a*, plate XVIII) was found near the surface of a mass of shop refuse, but was without reasonable doubt part of the original deposit. Two other pieces (*b* and *c*) found at considerable depths exhibit slight indications of specialization of form. The specimen shown in *d* is hardly more than an ordinary failure, rejected on account of too great thickness or other eccentricity of shape.

For the purpose of conveying a clear notion of the nature of the final quarry form—the leaf-shape blade—I have brought together in plates XIX, XX, XXI, and XXII a number of the rejects that seem to approach the form striven for by the quarry-shop flaker. Some are entire blades, all of which exhibit more or less palpable defects of form (as judged by the standards made out by a study of the quarry-shop work and by the ordinary blades found so plentifully on village-sites). Others were broken near the final stage of the shaping, and in numerous cases both pieces were found where they had been dropped by the workman and covered up by the accumulating débris. It will be noticed that nearly all the whole pieces are excessively thick in some part, while some are crooked or defective in outline, and we may conclude that they were rejected on account of some of these shortcomings. We are, in my judgment, sufficiently warranted in concluding that most of those specimens now in fragments were broken in vain efforts to reduce the excessive thickness (as in *a*, plate XX) or to correct some defect in outline. Breakage was liable to take place at any stage of the work, the danger increasing, however, as the form increased in tenuity.

RHYOLITE CACHE BLADES FROM A GARDEN ON FROGMORE CREEK, NEAR BALTIMORE (ONE-HALF ACTUAL SIZE)



RHYOLITE BLADES FROM VARIOUS CACHES

a, Cache on South river Maryland *b*, Cache at Little Falls of the Potomac; *c*, Cache near Point of Rocks, Maryland

QUARTZITE CACHE BLADES FROM ANACOSTIA AND BENNINGS SITES, DISTRICT OF COLUMBIA

a, *b*, Phillips collection, *c*, Dowling collection

The excessive thickness so fatal to success results from the failure of flakes to carry sufficiently far back from the margin to overlap opposing flakes. In the process of shaping stones of varying degrees of availability by fracture, many eccentric forms are necessarily developed; and these peculiarities of failures, being due to common defects in the flaking qualities of the stone, are often repeated, giving to the superficial observer the impression that the particular form was the result of design. Thus, for example, there are many specimens having one flat side and one convex or pyramidal side. It happened in such cases that one side was reduced readily to the flattish or slightly convex surface desired, but that the other worked badly, giving a high peak which could not be removed. This form and the double-peaked variety are constantly repeated because the tendency of the flaking from a bowlder is strongly toward high apexes, great skill being required to prevent this result and to obtain just the proper convexity. To attempts to remove these high humps by violent strokes is due much of the breakage in all stages of the work. Examples of this class of failures are found on every shop site and need not be mistaken for finalities in shape.[1]

The incipient tools have very considerable range in size, the blade shown in *b*, plate XXI, being 5½ inches in length, while others reach upward of 6 inches. The smallest specimens found in the quarry-shops are a little under 2 inches in length. Plate XXIII is intended to indicate the relation of the roughed-out blade to the bowlder from which it was derived. Two examples are given, the profile being added in each case that the conditions may be understood fully. In the specimens chosen for illustration, both ends retain small areas of the original surface of the bowlder. The relation of the blade to the original bowlder is not at all uniform. The fracture was sometimes such that three-fourths or more of the mass was removed all from the one side before the desired degree of convexity of that side was obtained, so that the blade was finally derived from very near one surface of the bowlder, as indicated in the profiles. The occurrence of such specimens as this has led to the supposition that in some cases a number of blades were made from a single bowlder by splitting, and this is no

[1]During the period intervening between the completion of the work on Piny branch and the date of the present writing (five years), I have examined many other quarries in various parts of the country and close analogies were observed everywhere and even identical results where conditions were identical. I have also encountered in this period numerous illustrations of the baneful results flowing from a lack of appreciation of the nature of the quarry and shop work and of the rejectage always associated with it. One very earnest and intelligent gentleman, who had dwelt for many years in a flint-producing district where the fields were tilled with refuse of manufacture, had spent a great deal of time in gathering and classifying the varied forms of rejectage, supposing all to be implements. The result was truly astonishing. He had grouped similar forms together as so many varieties of tools and had worked out suppositions uses and was able to decide how some forms were shaped to fit the hand and others were designed for hafting. He had made excellent drawings and was ready to issue an elaborate and costly work. In his mind every shape was significant, and all fractures, such as come from necessity in all broken stones and are often remarkable, were indications of design, and the more eccentric accidents of fracture were evidences of consummate skill on the part of the workman.

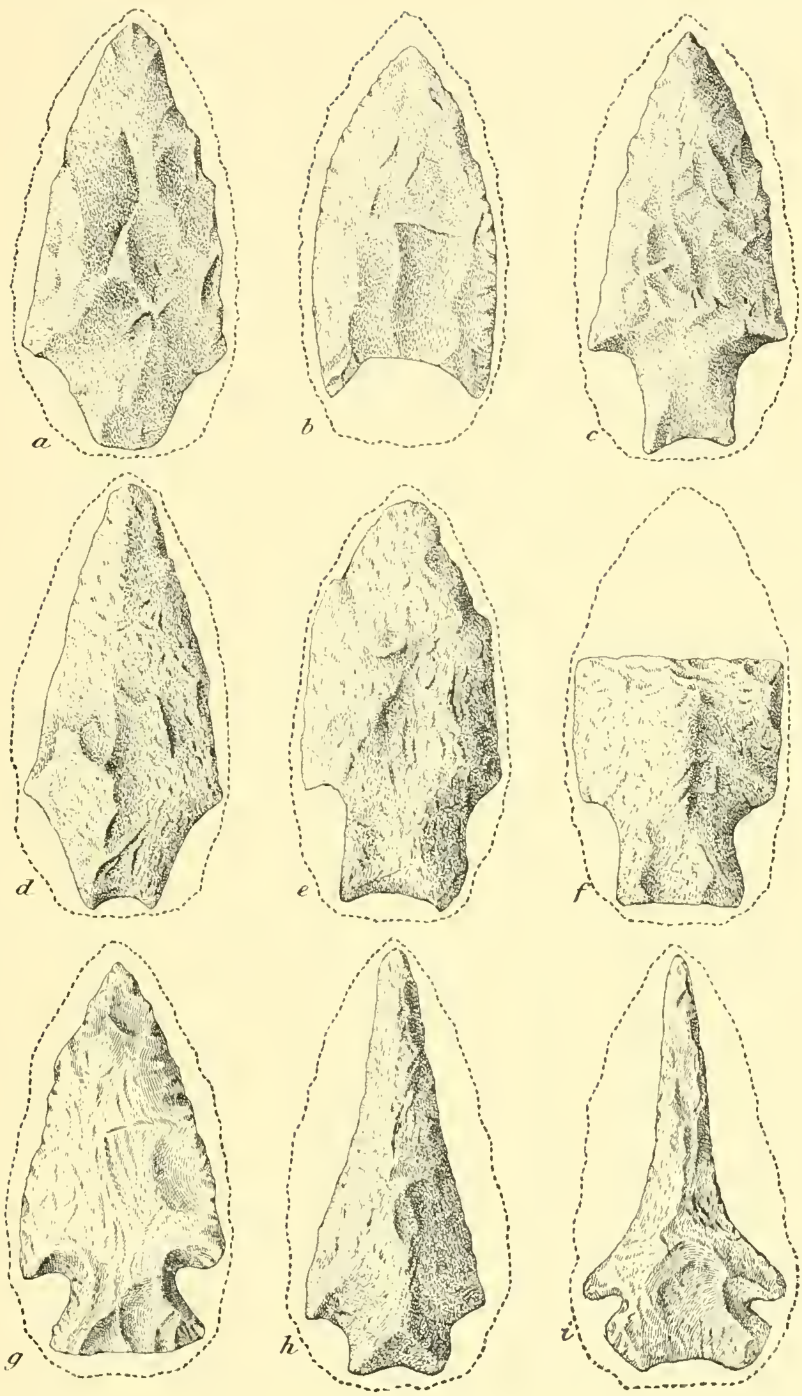
doubt correct where fracture was exceptionally favorable, but a bowlder did abundantly well in yielding a single specimen of the class roughed out on the quarry site.

In a majority of cases the completed blade retains no trace of the original surface of the bowlder, as the great number of blows necessary to obtain the desired shape removed it altogether; and in most cases, no doubt, the specimen was reduced to two-thirds or one half of the length and width of the bowlder. It is probable that the projectile point, 1½ or 2 inches in length, was often the entire result of flaking up a bowlder 3 or 4 inches long.

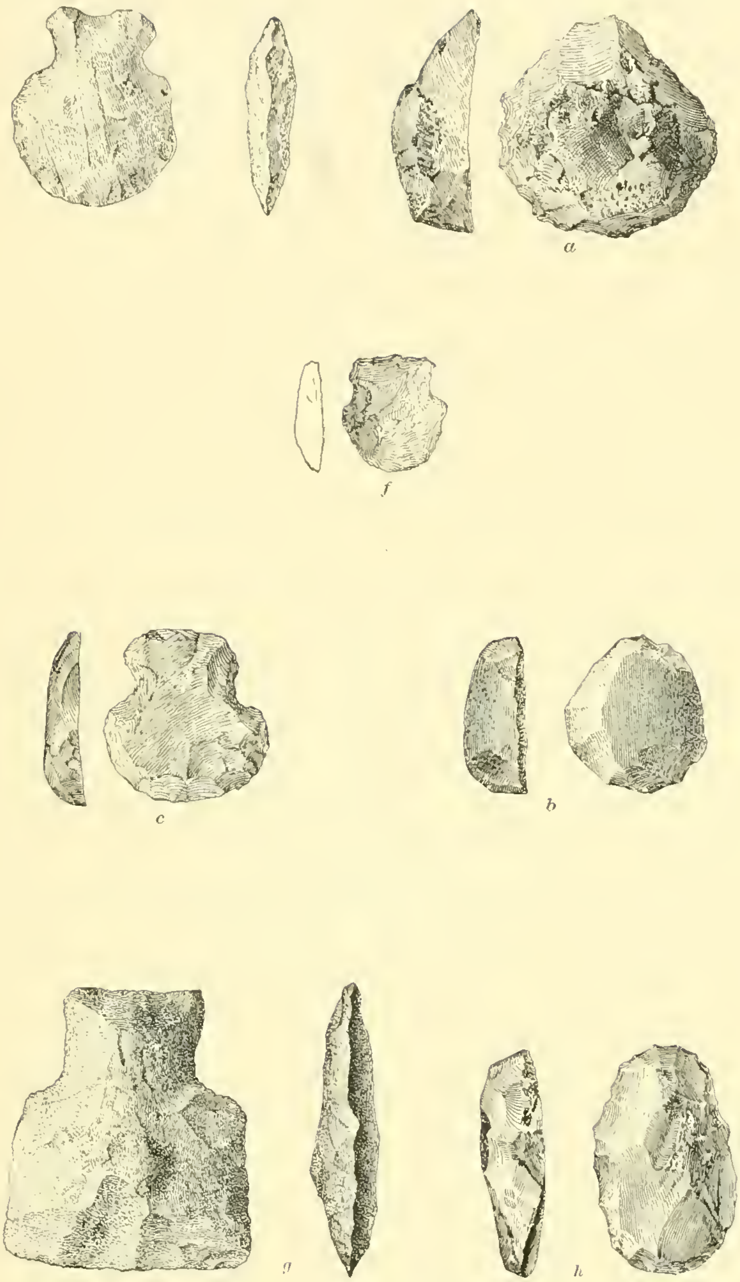
The various forms of worked stones are distributed throughout the mass of refuse, as would be expected in a quarry-shop. In many cases clusters of flakes are found, and with them the fragments and failures produced during a single sitting or by a series of sittings on the one spot. In *b*, plate XXIII, and in *a* and *b*, plate XXIV, three pieces are presented, illustrating three stages of progress, the first-mentioned specimen belonging between the other two. These were found, with the flakes derived from them, in a small cluster in the first trench.[1] The large specimen was rejected after having received a few blows from the hammer, the relief of the side flaked remaining too pronounced to warrant continuation of the work; the second piece was broken when both sides had been roughly reduced to approximate contour; while the third example was splintered after having reached almost the requisite thinness and contour. Thus we have, as the result of a few minutes' flaking, a series of forms representing the whole range of quarry-shop shaping operations and extending from the rudest to the most elaborate stage.

Occasionally we encounter specimens in which the flaking was carried all around the margin of the stone in such a manner as to give a number of steeply sloping facets. These have a close resemblance to what are known as cores, that is, masses of raw material from which flakes have been removed to be used as knives, etc. It is difficult to draw the line between the steep-faceted failure and the typical core form, as the one shape grades into the other. Four of these core-like pieces, the best and nearly the only specimens collected, are represented in plate XXV. It is impossible to determine whether or not they are really cores rather than mere failures of the blade maker. Certainly no use was made on the quarry or shop sites of flakes such as would be derived from them, for had such flakes been worked up on the site traces of the operations would have been left among the refuse. True, the flakes may have been carried away, as were the blades produced in the quarry, to be utilized or specialized elsewhere, but I have not

[1] It is quite possible that by a little careful work all the pieces of the bowlders used on this spot could have been recovered and the original form restored by fitting the bits together, but the true conditions were so patent that this was not considered essential. In subsequent years such restorations have been made in a number of cases, and notably by Dr W. A. Phillips, of Evanston, Illinois, who has in two or three instances restored the bowlder so fully that each part can be taken off in the order in which it was flaked by the ancient arrow maker of the gravelly shores of Lake Michigan.



RELATION OF SPECIALIZED LEAF-BLADE IMPLEMENTS OF VARIOUS KINDS TO THE ORIGINAL BLADE



SCRAPING IMPLEMENTS OF QUARTZ AND QUARTZITE (ACTUAL SIZE)

a b, and *c* have one flat side and a beveled edge *e f g* appear to be broken projectile points sharpened at the edge

been able to learn that the primitive inhabitants of the Potomac region often used flakes such as were taken from these objects, either in their original form as cutting or scraping tools or in the manufacture of projectile points, scrapers, and drills; nearly all specialized quartzite implements are fairly thick bodied and substantial. The great rarity of typical core shapes on these shop sites should also be noted as indicating the probability that ordinary high-peaked specimens are mere accidents of blade-making operations.

In some cases large bowlders have been broken and flaked in such manner as to suggest the notion that the detached pieces were intended to be used in implement making; but howsoever this may be, much experience has taught me that irregular masses of quartzite are much more difficult to manage—to reduce to the symmetric blade—than are the bowlders when the latter are of convenient size. It is different with more brittle materials, which may be worked up to good advantage from the angular mass.

In my very careful and prolonged efforts to determine the object of the quarry-shop work and the character of the product I studied the numerical relations of the various forms of rejectage with excellent results, which may be given in some detail.

In shaping implements by flaking there are necessarily failures at all stages of the work from beginning to end, as already shown, and these failures are susceptible of grouping into four classes: The first class includes tested bowlders, rejected in early stages of the work because of unfavorable material, adverse fractures, flaws, etc, which occur in countless numbers on the site; the second stage includes those considerably worked on one side and rejected because of palpable defects developed or brought out by that work; the third group includes such specimens as were flaked somewhat fully on both sides before it became apparent that further effort was useless; and the fourth class comprises the well-defined leaf-like blade. Now it was found by study of the shaped refuse that breakage under the heavy blows of the hammer took place at all stages of the work, and that nearly as many failures had resulted from breakage into halves or approximate halves as from imperfectly developing contour. I found, however, by segregating and comparing the varieties, that one group of halves had no corresponding group of unbroken forms, and I concluded that this group of halves represented the true quarry product.

The observations may be formulated as follows (the first series—the tested bowlders—being omitted because they were practically innumerable): In the first trench I found, of the second class (*n*, plate XVII), 380 whole specimens and 460 halves; of the third class (*o*), 250 whole specimens and 320 halves; and of the fourth stage (*p*), no whole specimens and 380 halves. The latter were halves of comparatively thin, well-shaped blades, and were not represented by any whole blades of like proportions. In other words, there were 380 half blades of a grade of advancement superior to that of the best entire blade. From this the inference was reached that all unbroken blades of this class were carried away. It would appear, also, that of the shaped stones no other varieties were carried away, since no other variety is without a full percentage of unbroken specimens, the presence of these in the refuse being sufficient evidence that they were not desired or removed from the site.

The determination that the leaf shape blade was the exclusive shaped product of these great quarries is of greater importance than at first appears. It affords the key to many of the most puzzling problems of flaked stone art. It settles the status of multitudes of rudely flaked stones formerly of enigmatical status, and enables us to tell the story of the cache and write for the first time the full history of the countless flaked implements scattered over the land.

TOOLS USED IN FLAKING

As has already been indicated, the flaking tools were probably bowlders selected for the purpose from the multitude of available examples. Though few were found that show any considerable evidence of wear, many specimens occur which are more or less battered, apparently by use. With multitudes of natural hammers of choice shapes and assorted sizes at hand, it was manifestly useless to shape special tools or to bring in shaped tools from the outside. The scarcity of well-shaped and much-used hammers in this quarry is a very notable fact, and has been the subject of much speculation. It is found that in other quarries, subsequently examined, these objects are very numerous, and this has led to the surmise that possibly hammers made of other material, such as buckhorn, were employed in flaking the bowlders. This, we must admit, is possible, but as the evidence stands today the matter must be left largely to conjecture.

Processes of Manufacture

Discussion of the processes of manufacture, of the destiny of the shaped product, and of other general topics might be left until the other quarries and shop sites are described, but can as well be taken up here, since the results obtained by a study of this group of quarry-shops are repeated in the other cases.

It has been mentioned elsewhere that the first step, after the removal of the bowlders from the bed by the quarrymen, was to test them for quality of material. As a rule, the removal of a single flake, or at most a very few flakes, enabled the expert workman to determine whether or not the stone was reasonably tractable. The selected material was removed to the shop sites, where the flaker took up the work.

The process employed in flaking appears to have been exclusively fracture by free-hand percussion, the act being a quick, firm stroke, regulated in force by the nature of the resistance to be overcome and by the result desired; no trace or suggestion of other kind of procedure was observed. The bold but unsymmetric outline of the forms

SERIES OF FLAKED FORMS ILLUSTRATING PROGRESSIVE STEPS IN THE MANUFACTURE OF PROJECTILE POINTS, ETC. FROM QUARTZITE BOWLDERS (ABOUT ONE-THIRD ACTUAL SIZE). OBTAINED FROM SHOPS AND VILLAGE-SITES ABOUT WASHINGTON CITY produced and the rather haphazard arrangement of the percussion points preclude the idea that any process capable of accurately adjusting the point of contact between the tool used and the article shaped could have been employed. At best such a method would certainly not be readily applicable to a stone of the refractory nature of quartzite. Though the manner of delivering the stroke seems sufficiently determined, the precise method of holding the stone shaped is left to conjecture. My own experiments have been conducted on the assumption that it was held in the hand. The account of flaking processes given in the following paragraphs is based on the belief that free-hand percussion with hammers of stone or other hard and heavy material was the exclusive or principal quarry-shop process.

Referring to the series of graded rejects illustrated in plate XVII, we observe that the process of manufacture and the steps of development

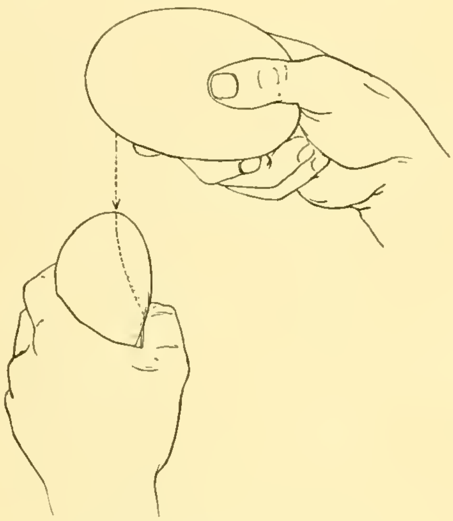


FIG. 10—First step in bowlder flaking.

were essentially as follows: Grasping a bowlder in either hand (supposing bowlder hammers to have been used), the first movement was to strike the edge of one against that of the other at the proper angle to detach a flake (figure 10). The second movement and the third were similar, and so on until the circuit was completed. If no false stroke was made and the stone had the right fracture, these few blows, occupying but as many seconds, gave as a result a typical turtleback—a bowlder with one side faceted by artificial flaking, the other side, save through accident, remaining smooth. If the removal of a single row of flakes was not sufficient, the work was continued until the one side was reduced to the proper degree of convexity, and the availability of the stone for further elaboration was made apparent. A type profile is illustrated in *n*, plate XVII. If the results thus far reached were satisfactory, the stone was turned in the hand, and by a second series of blows the remaining smooth side was flaked away (figure 11), when the result was a two-faced stone or double turtleback—the incipient blade. With perhaps a few additional strong strokes the rough stone began to assume the appearance of the final form. A type profile is seen in *o*, plate XVII. If at this stage, and, I may say, if at any preceding stage, the stone developed defects or unmanageable features (such as too great thickness, crookedness, or humps that could not be removed), it was thrown away, and thus became part of the refuse; and it would appear that all the entire specimens collected, since they were taken by us from the refuse, did develop some of these shortcomings. If, however, the form developed properly, the work was continued into the final stage, which consisted in going over both sides a

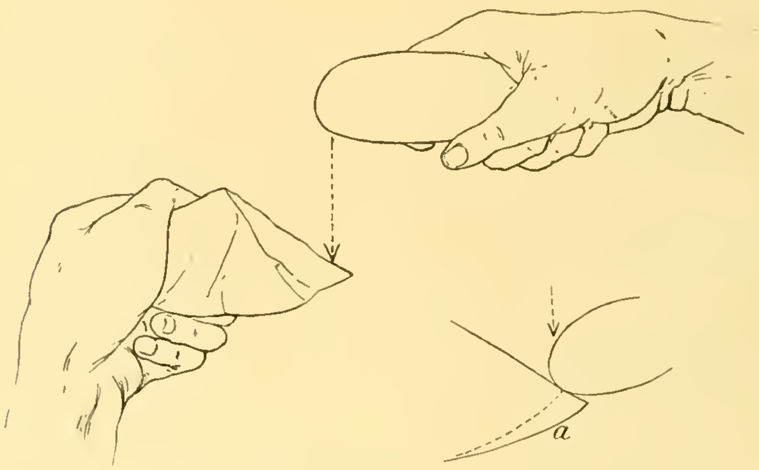
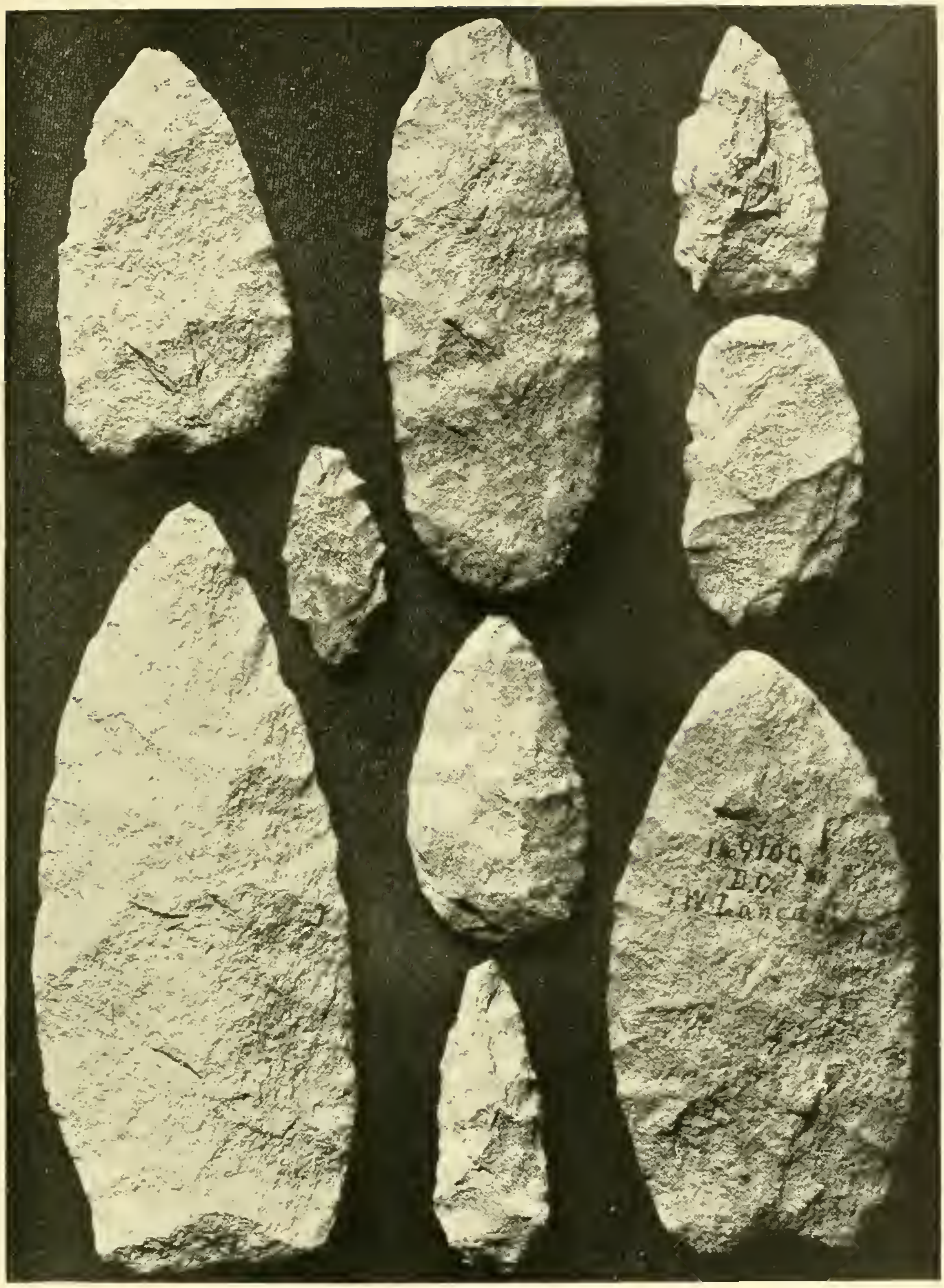
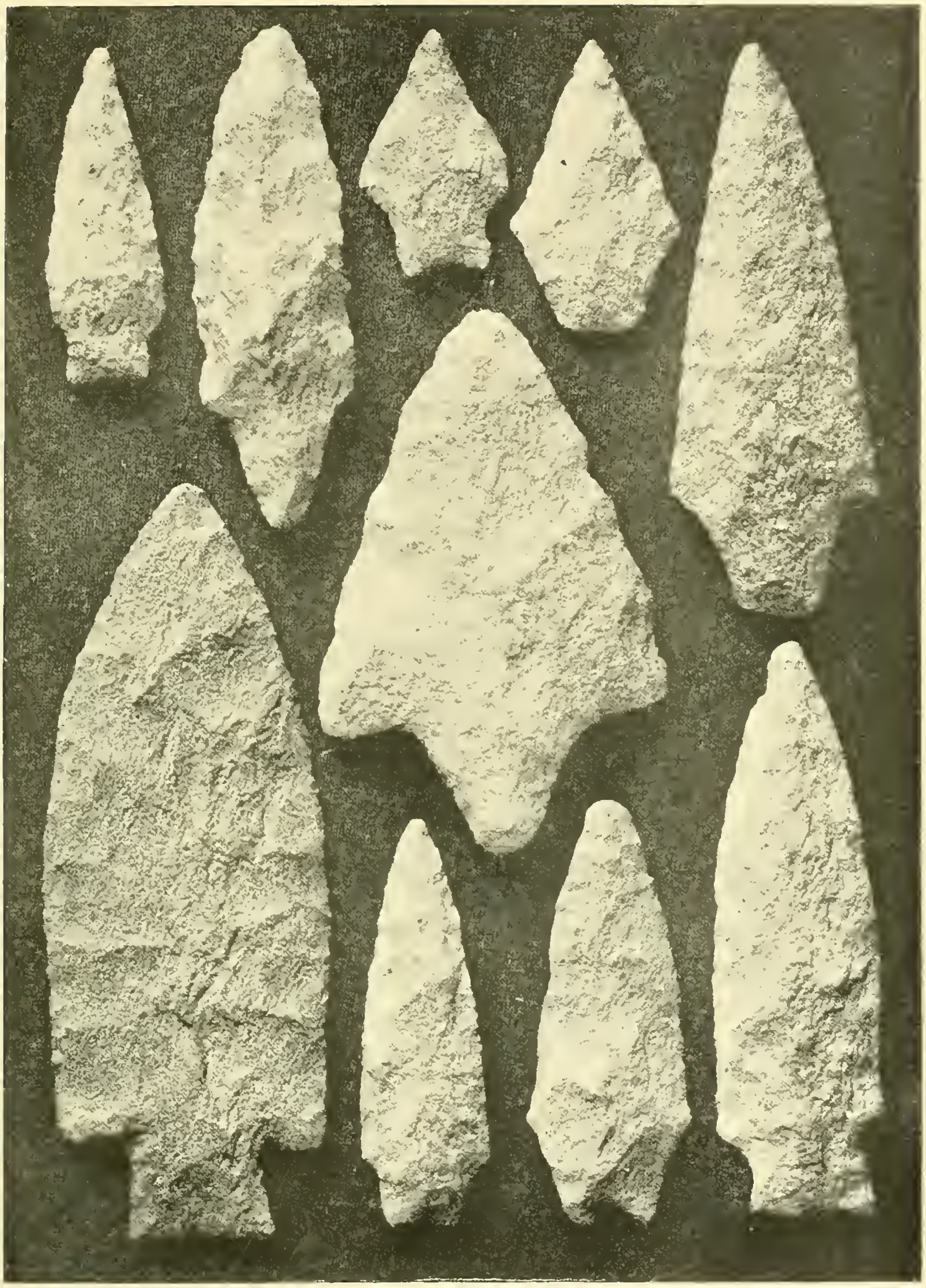


FIG. 11—Second step in bowlder flaking.

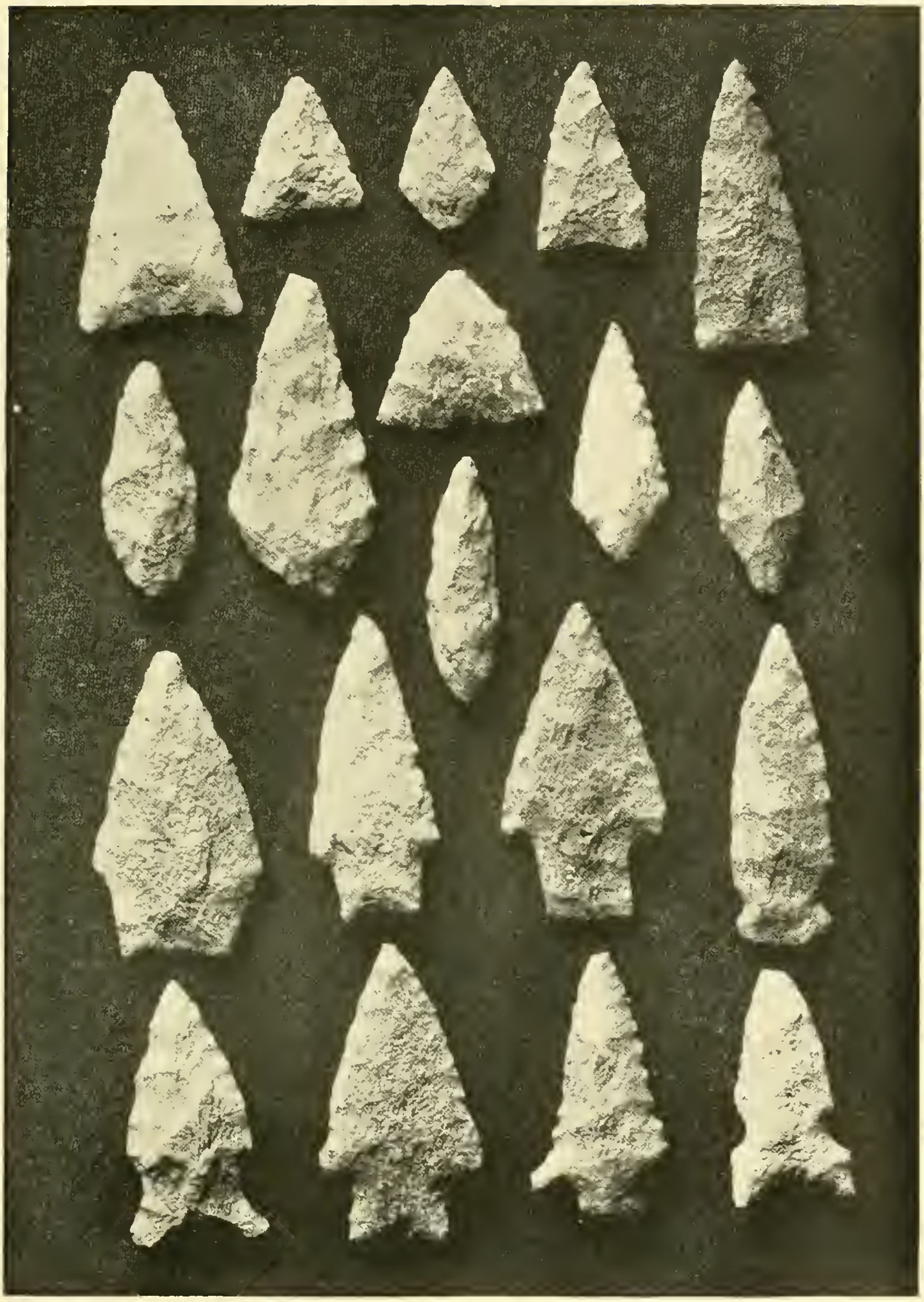
second and perhaps a third time, securing, by the use of small hammers and by deft and careful blows upon the edges, a thin, symmetric blade. A profile is given in *p*, plate XVII. Four broken specimens that must have been all but complete, for they are apparently more perfect than any whole pieces left on the site, are shown in *j*, *k*, *l*, and *m* of the same plate. It is important to observe that when the thin blade represented by these halves was realized, the work of the quarry-shop (and the only work of the quarry-shop, so far as shaping is concerned) was ended. The process and the machinery had accomplished all that was asked of them, and all that they were capable of accomplishing. The neat, but withal rude, blades, and these only, of the shaped products were carried away. Further work, additional shaping—and such there was in most cases, no doubt—employed other processes and was carried on in other fields. Flakes and fragments suitable for elaboration



QUARTZITE BLADES OF VARYING SIZE AND OUTLINE, MAINLY UNSPECIALIZED (ACTUAL SIZE). OBTAINED FROM POTOMAC VILLAGE-SITES



SPECIALIZED QUARTZITE BLADES, PROBABLY IN THE MAIN PROJECTILE POINTS. FROM POTOMAC VILLAGE-SITES (ACTUAL SIZE)



SPECIALIZED QUARTZITE BLADES, PROBABLY IN THE MAIN ARROWPOINTS, FROM POTOMAC VILLAGE-SITES
(ACTUAL SIZE)

into implements may have been selected for transportation, but no evidence of this is procurable.

The course of procedure just described I have investigated in the most careful manner, and by experiment have followed every step of the process, and have achieved almost every result. I have found that in reaching one final form I have left many failures by the way, and that these failures duplicate, and in proper proportions, all the forms found on the quarry sites. I was unfortunately prevented from carrying out these experiments as fully as desirable by permanently disabling my left arm in attempting to flake a bowlder of very large size.

I further find by these experiments—and the conclusion is a most important one—that every implement resembling the final form here described, and every blade-shaped projectile point made from a bowlder or similar bit of rock not already approximate in shape, must pass through the same or nearly the same stages of development, leaving the same wasters, whether shaped today, yesterday, or a million years ago; whether in the hands of the civilized, the barbarous, or the savage man.

It may be well here to define with some care the apparent limitations of the classes of procedure concerned in the manufacture of flaked tools. Direct or free-hand percussion by means of unhafted or hafted implements is the natural method of reducing large amorphous masses to something approximating the special shapes reached in the advanced stages of the art. It was probably the leading method utilized in very early times; but this process, even in the most skillful hands, has its limitations in certain directions. For example, blows can not be given with sufficient regularity to produce great symmetry of outline and desirable uniformity of flaking; and, again, when implements under treatment become attenuated, the sharp blow is extremely liable to shatter them. The skill of the artificers being equal, these limitations vary with the degree of brittleness and homogeneity of the material used.

Quartzite is extremely refractory, and the skill of the workman must have been tried to the utmost to carry the manufacture by the free-hand process to a stage of elaboration where the other methods would be operative. It is possible that some method employing indirect percussion may have followed that of direct percussion. By indirect percussion I mean the use of two tools, one the hammer and the other the punch, the latter being set on the exact spot to receive the impact or blow, thus eliminating the element of uncertainty characteristic of the free-hand blow, although necessarily lacking in percussive power. By one or both of these methods the blades were carried to such a degree of symmetry and attenuation that the artist was able to employ pressure to advantage. Then, by skillfully using a bit of bone or antler, he could carry the tool to the highest possible degree of specialization and finish. That the latter method was employed by the

Chesapeake tribes is clearly indicated by John Smith, who, speaking of a Powhatan warrior, says, "His arrow head he quickly maketh with a little bone, which he ever weareth at his bracert, of any splint of a stone, or glasse in the forme of a heart, and these they glew to the end of their arrowes."[1] This could not apply, of course, save where the bit of stone already approximated the proportions and especially the thickness of the article to be made.

Destiny of the Quarry Blades

Now, although the blades produced in the quarry-shops may without modification have been used for cutting, scraping, perforating, and other purposes, I am decidedly of the opinion that as a rule they were intended for further elaboration; this is rendered almost certain, first, by the fact that the most fully shaped broken pieces found on the quarry-shop sites are but rudely trimmed on points and edges, specimens of like grade being little fitted for use in cutting and scraping; and, second, that all the tens of thousands of specialized forms—spearheads, arrowpoints, and perforators—are necessarily specialized from such blades, as shown in a subsequent section. The quarry-workshop was naturally not a place for finishing tools, but one for roughing-out the material and selecting that fitted to be carried away for final shaping. A laborer engaged in such work in a pit in the forest would not be likely to throw aside the rough hammer used in fracturing cobble stones to take up and operate an entirely different kind of machinery, involving a distinct and delicate process. Being a reasoning and practical creature, he would carry away the roughed-out tools, the long, thin blades, to be disposed of or to be finished at his leisure and by whatsoever method experience placed at his disposal.

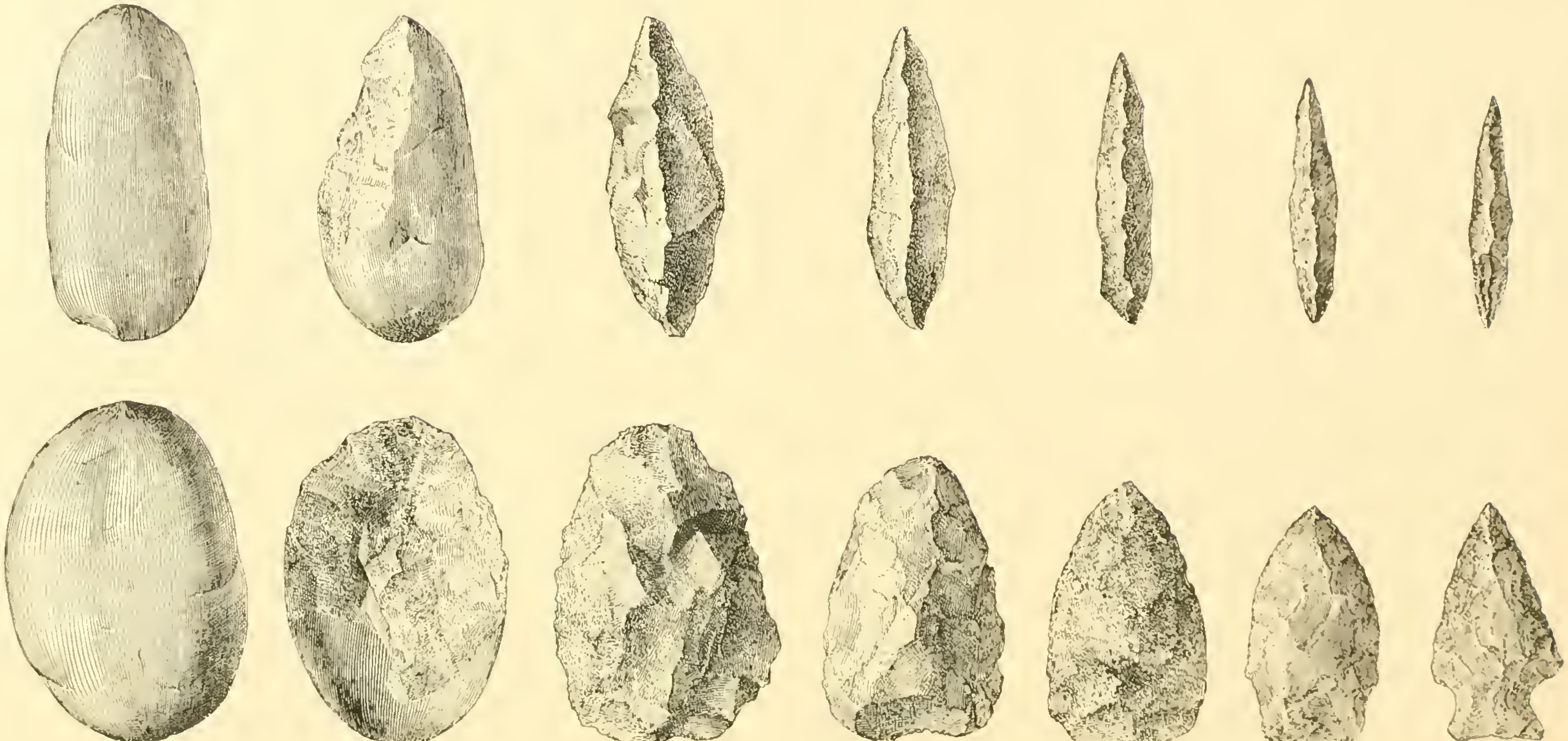
The quarries, being extensive, were worked somewhat systematically and the product was naturally of great importance to the people concerned. The blades made during a prolonged season's work were numerous and were carried to village-sites far and near for use, specialization, or trade. There would be in their history a period of transportation attended by storage, and this would explain the cache, an interesting feature of stone-implement phenomena, and one which involves just such blades as were produced in the quarry-shops.

THE DUMBARTON HEIGHTS QUARRY-SHOPS

Location

The second group of quarry-workshops to receive attention is located on the western side of Rock creek, a quarter of a mile north of the new Naval Observatory and a mile and a half southwest of the Piny branch site already described. The quarries occupy a narrow, heavily timbered spur of the Tennallytown ridge and overlook a deep and picturesque

[1] History of Virginia. Richmond, 1819, vol. I, p. 132.



SERIES OF FORMS ILLUSTRATING PROGRESSIVE STEPS IN THE MANUFACTURE OF ARROWPOINTS FROM QUARTZ PEBBLES, OBTAINED MAINLY FROM SHOPS AND VILLAGE-SITES NEAR ANACOSTIA (ACTUAL SIZE) ravine. On the plats of the new city subdivisions bordering Massachusetts avenue extended this locality is called Dumbarton heights.

Although hardly beyond the city limits, this site still retains the extreme wildness of a primitive forest and is penetrated by obscure trails only. The sound of the hammer is now constantly heard, however, even in the wildest spots, and suburban avenues threaten it on all sides. It will probably not be many years before the illustration given in plate XXVI, from a photograph taken early in the spring of 1891, will be the only memento of the primal wilderness now covering these hills. A fine rivulet, tributary to Rock creek, meanders the deep ravine, overlooked on the north by the quarry promontory and on the south by the observatory.

Geology of the Site

In its geologic features this locality corresponds very closely with the Piny branch site. A bed of Potomac bowlders caps the summit of the ridge, extending to a depth of from 1 to 25 feet, and resting on the somewhat uneven surface of the gneissic rocks. The main ridge, with which this spur connects by a narrow and very slightly depressed saddle, rises toward Tennallytown, nearly 200 feet higher, and is composed of sands, gravels, and bowlder beds of more recent age. The outcrops of bowlders in the gulches and slopes have been worked in many places by the ancient quarrymen. On the spur or promontory examined the bowlders outcrop at a level of 280 feet above tidewater, which is 50 feet higher than the exposures on Piny branch. This difference is probably to some extent an index of the slope of the ancient gneissic beach or sea bed on which the Potomac bowlders were laid down. The bed resting on the gneissic surface seems to have contained a larger percentage of workable bowlders than any of the superposed deposits. This led to the almost exclusive working of this bed by the ancient peoples, who must have familiarized themselves with all exposed deposits of material.

The beds containing quartzite bowlders are at this point upward of 20 feet in thickness, but the workable material is confined to a few feet at the base, with scattering specimens in gravel deposits at higher levels. The bowlders sought and worked here are almost identical in every respect with those quarried on Piny branch. The deposits, however, present some points of difference. At the latter point the bowlders were pretty uniformly bedded, and the sands and gravels associated with them exhibited distinct traces of horizontal bedding; but on Dumbarton heights the bowlders are distributed pretty uniformly throughout a matrix of tough argillaceous sand, presenting the appearance of heterogeneous dumping, rather than of regular bedding by aqueous agencies.

Portions of the deposits were here in a most favorable condition to be worked, as they occupied the summit of the ridge and were exposed to view over the surface of the entire crest. The bowlders were obtained by entering the hillside on the gneissic floor as well as by pitting the bowldery surface at various points. The latter method was extensively followed at the western end of the outstanding ridge, which is nearly flat for a width of 75 feet or more. This relation of the bowlder deposits to the surface of the ground had an important bearing on the preservation of the evidences of ancient work. On the sloping surfaces the pits are entirely obliterated by the descent of refuse from above, but on the upper surface they are still distinctly visible.

The worked-over surface is everywhere irregular, but the depressions are in no case more than a few inches in depth. It is probable that as a rule they were not deep when deserted by the ancient workmen, as one pit would be filled by refuse from another as the work went on. Such pits as were left open on the upper surface of the ridge would at first fill rapidly by falling in from the sides, but the rate of filling would decrease with the decrease of depth, and when a degree of shallowness like that observed at present had been reached, the compacted cobbles would have something of the stability of an artificial pavement; and where the position did not admit the accumulation of vegetal mold, centuries might pass without perceptible change. On steep sites, as in some parts of Piny branch, the friable overhanging deposits must have descended rapidly into the old quarries, obliterating all traces of the pits in a very short time.

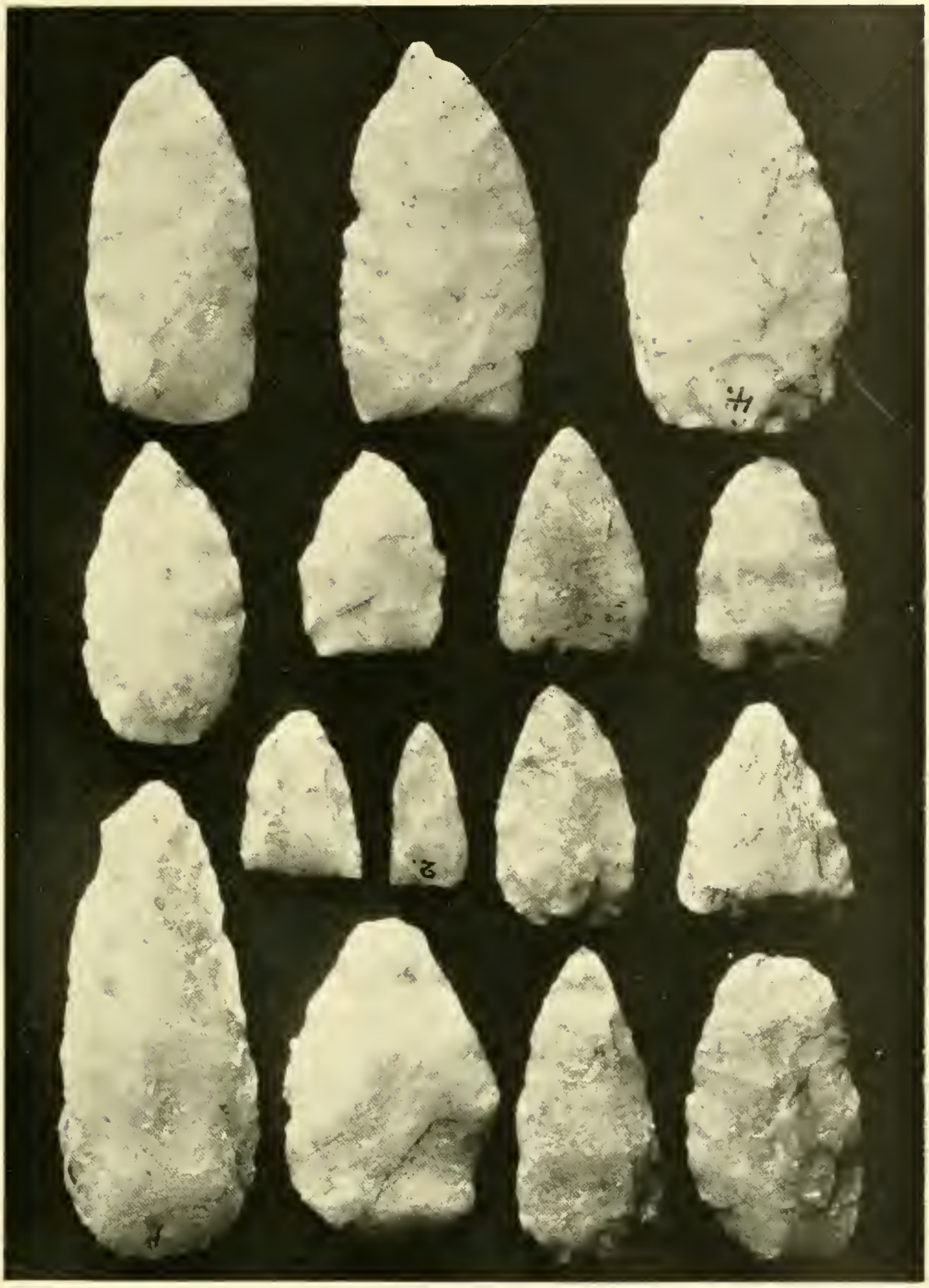
Distribution of Quarry Pits

On the map the crest of the promontory resembles the human foot in profile. The ancient quarries were located mainly on the heel, where they covered an acre or more. A little work was done along the sole of the foot, and several pits 2 or 3 feet deep had been dug at other points.

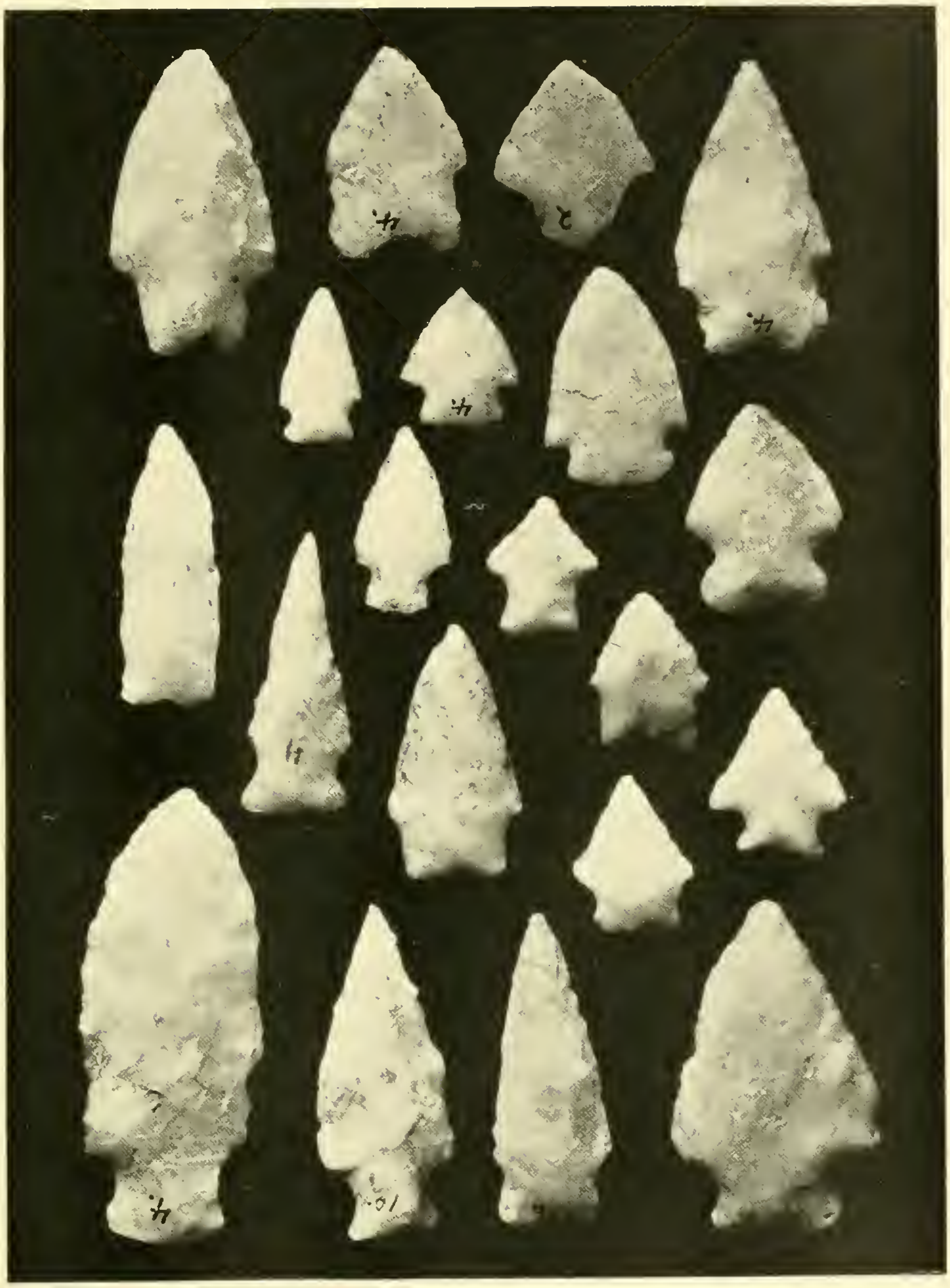
As the ancient work was prosecuted along the crest and margins of this promontory, the shop and quarry refuse is largely distributed over the slopes and has descended to the bed of the creek on the south and into the ravines and depressions on the other sides. The most striking feature of the promontory is its mantle of broken bowlders, admirably shown in plate XXVI. The whitish bowlders appear in strong contrast with the somber hues of the forest and its carpet of brown leaves and dark mold.

Trenching

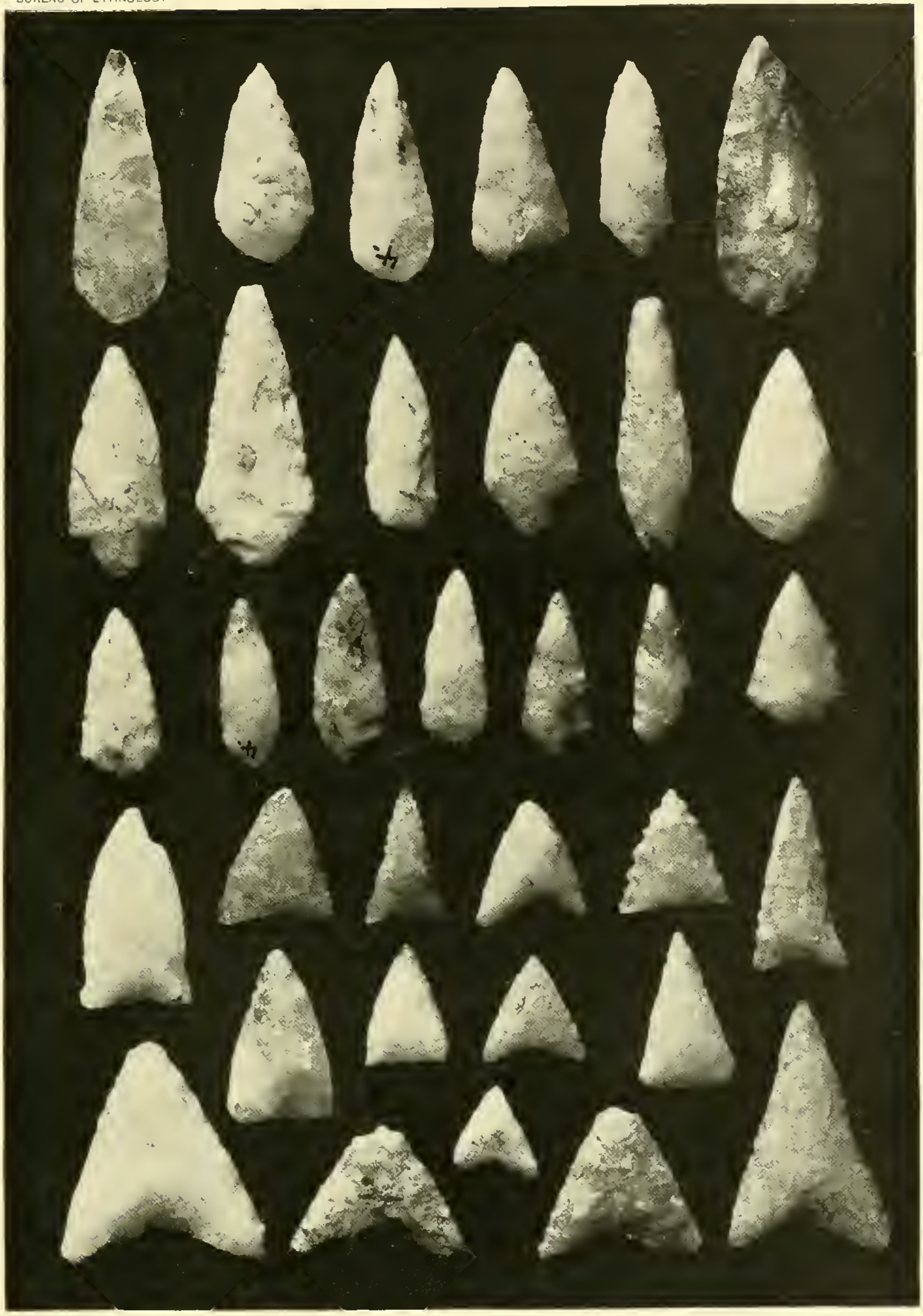
The western projection of the quarry spur bore the most decided traces of ancient operations, and was therefore chosen as the best place to begin the work of trenching. Beginning near the extreme southwest end of the crest, near the upper surface of the gneiss rocks and at the base of the capping of bowlders, a trench 3 feet wide was carried horizontally into the gently sloping hillside. Beyond the first 10 feet the digging was not continuous, but consisted of a line of short trenches with intervals of a few feet. For about 40 feet but little of



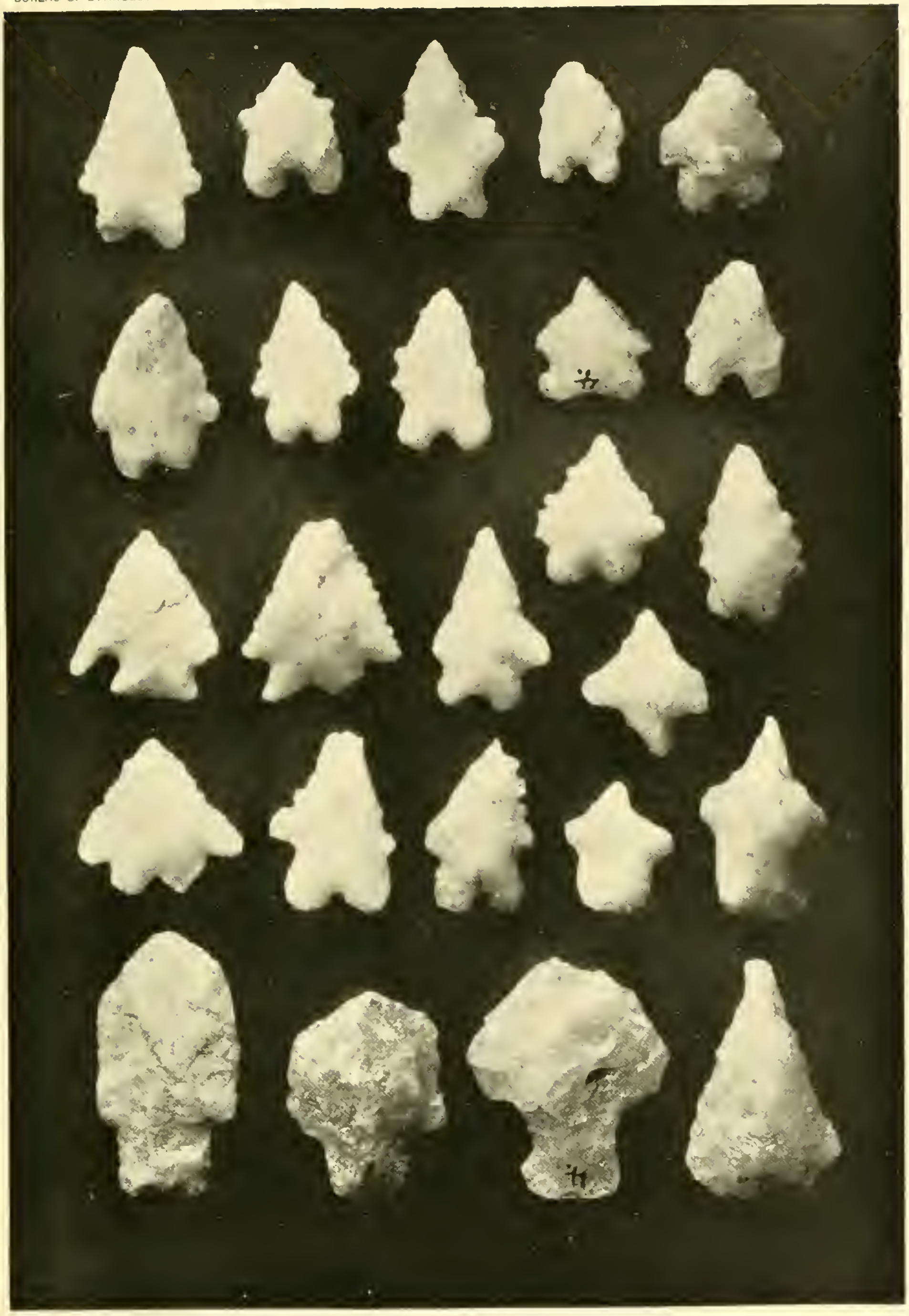
QUARTZ BLADES SHOWING LITTLE OR NO TRACE OF SPECIALIZATION, OBTAINED MAINLY FROM POTOMAC VILLAGE-SITES (ACTUAL SIZE)



SPECIALIZED QUARTZ BLADES, PROBABLY IN THE MAIN ARROWPOINTS, OBTAINED FROM POTOMAC VILLAGE-SITES (ACTUAL SIZE)



SPECIALIZED QUARTZ BLADES, PROBABLY IN THE MAIN ARROWPOINTS, OBTAINED FROM POTOMAC VILLAGE-SITES (ACTUAL SIZE)



QUARTZ ARROWPOINTS OF ECCENTRIC SHAPES, OBTAINED MAINLY FROM POTOMAC VILLAGE-SITES
(ACTUAL SIZE)

particular interest was encountered. The mass, to a depth gradually increasing to 8 feet as we advanced, consisted of earth and gravel, intermingled with shop refuse. This rested on the uneven floor of the old quarry, composed of the undisturbed, firmly compacted bowlder-bearing gravels. The ancient workmen rarely penetrated, save on the outer margins of the quarry, to the gneiss bed.

At the fortyfifth foot a pocket of refuse, containing broken bowlders, failures, broken blades, and flakes, in considerable quantities, was exposed. This was at a depth of about 3 feet. The conditions were identical with those of the Piny branch sites as the quarry wall was approached. The characteristics of the exposures in the trenches may be summed up in a few words. The quarry débris consists of a heterogeneous mass of sandy clays, sand, gravel, bowlders of quartz and quartzite, and shop refuse, all well compacted and difficult to penetrate and remove with pick and shovel. The shop refuse includes broken bowlders up to a foot in greatest dimension, rejects representing all varieties of failures, unfinished tools broken at various stages of development, and numberless flakes. These are generally distributed throughout the mass of quarry débris, but at intervals clusters or pockets were encountered, where considerable shaping had been done at a single sitting or on a particular spot.

The quarry face was reached at a distance of about 55 feet from the beginning point of the trenching. It was, at the point reached, quite abrupt, being nearly vertical for about 5 feet. The full depth was about 7½ feet. At other points, exposed in various lateral trenches, the old quarry face was found to be very poorly defined. It would appear that the ancient quarrymen did not work with any considerable regularity or system. Numerous excavations had been carried into the sloping face of the hill, and had been abandoned near the crest. The series of terminations constitute an irregularly scalloped and variously inclined quarry face. A detailed description of the numerous short trenches, opened at various points along the margin of the promontory crest, need not be given. The conditions are uniform, and at no point was the ancient work so extensive as where the first two trenches were dug.

In one of the side trenches a good deal of charcoal was found, and at the depth of about 6 feet a charred log more than 10 feet long and in places a foot in diameter was encountered. It rested on or near the bottom of the ancient excavation, and consisted of a shell of charcoal, the interior uncharred portion having been entirely replaced by sand, which had found its way through the crevices. There is no reason to suppose that it was used by the ancient quarrymen in their work, or that it was anything more than a log which, having fallen into the deserted pit, was burned by forest fires. Charred wood and small masses of charcoal were found, but man's agency was not necessarily involved in their production.

The nature of the quarrying, the processes of implement shaping, and the quarry product correspond closely with those of the Piny branch site, and a description would but repeat what has been already said in the previous section.

OTHER ROCK CREEK SITES

North of the Dumbarton heights quarries the bowlder beds occur near or on the summits of the hills, and traces of ancient manufacture are occasionally seen. On a high point less than a quarter of a mile west of the crossing of Connecticut avenue and Pierce mill road, much shop refuse is found. This is within a few hundred yards of the Rose hill soapstone quarry, and represents the extreme limit of the Potomac bowlder deposits in this direction.

The new Naval Observatory on the ridge south of the quarry just described is built on an ancient quarry site. Quarrying, apparently on a limited scale, was carried on in the banks of the ravine now occupied by the power house, as the excavations for foundations and drainage exposed quantities of the chipped bowlders.

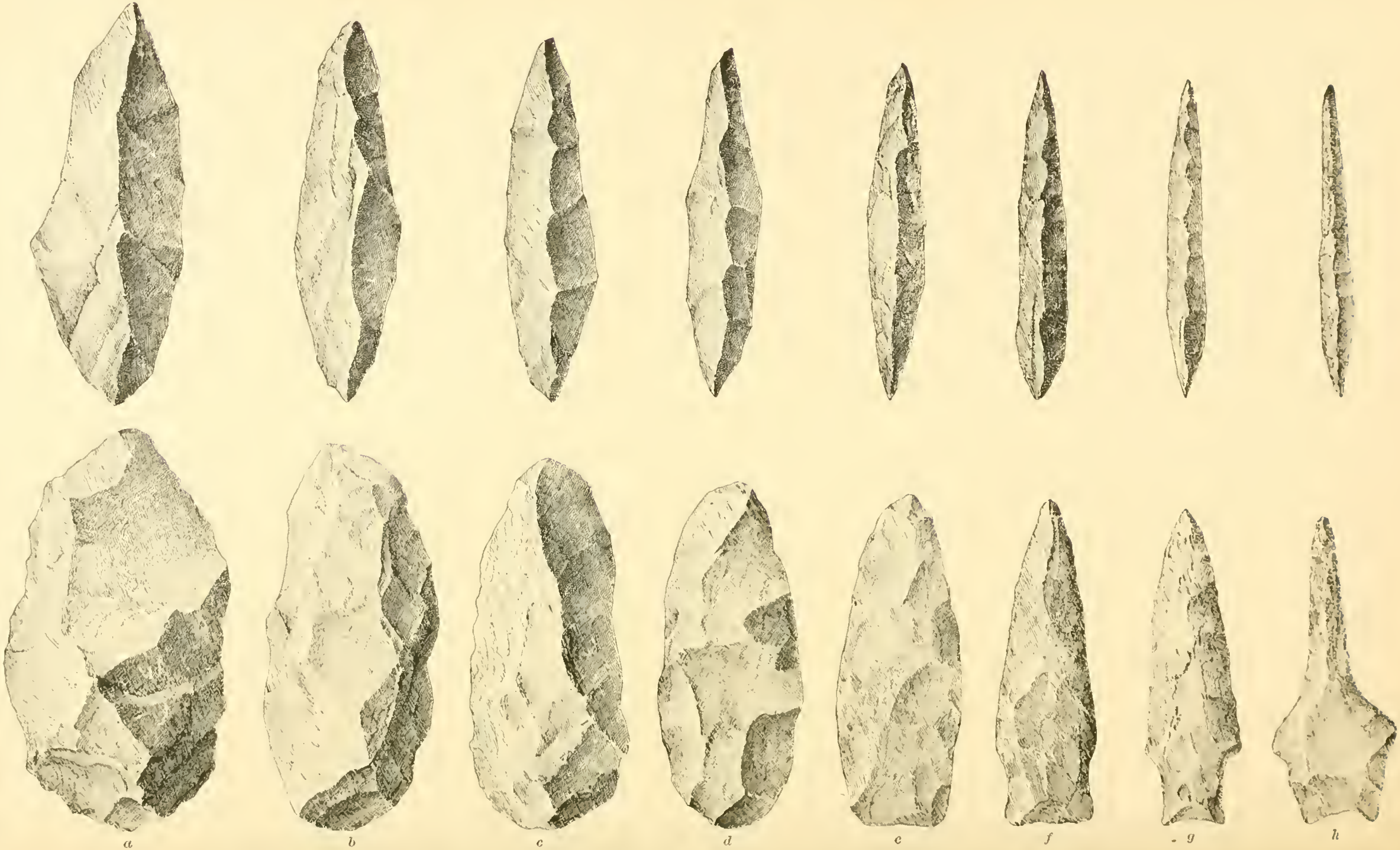
The bluffs of Rock creek within the suburbs of the city are lined with sites on which the ancient bowlder worker established his shops. The work was everywhere the same, save that as a rule quarrying was not carried on to such an extent as to leave traces of the pitting. On both sides of the creek at the crossing of Massachusetts avenue the refuse of bowlder flaking is strewn over the slopes from base to summit of the bluffs. The cutting of U street at a point overlooking the Massachusetts avenue bridge on the east has exposed an excellent section of the base of the Potomac bowlder beds. A portion of the exposure is shown in plate XXVII. Beneath the bowlders is the crumbling surface of the micaceous gneiss. Considerable flaking was done on the surface at this point, and clusters of flakes and failures occur on the slope back of the seated figure. Beyond is the valley of Rock creek and the heights on the west. In the Zoological park, a little farther up the valley and connecting around the faces of the Mount Pleasant bluffs to the Piny branch site, are numerous spots on which considerable work was done.

It may be added that on the level upper surfaces of the plateau occupied by Mount Pleasant and by neighboring suburbs there are traces of aboriginal occupation, consisting chiefly of finished, often broken flaked implements of ordinary varieties, and rarely of pecked and polished tools.

SHOP SITES OF THE MIDDLE POTOMAC VALLEY

FALLS SECTION OF THE POTOMAC

A study of the manufacture of stone implements in the Potomac region would properly include an examination of the thousands of



SELECTED FORMS ILLUSTRATING PROGRESSIVE STEPS IN SHAPING RHYOLITE IMPLEMENTS

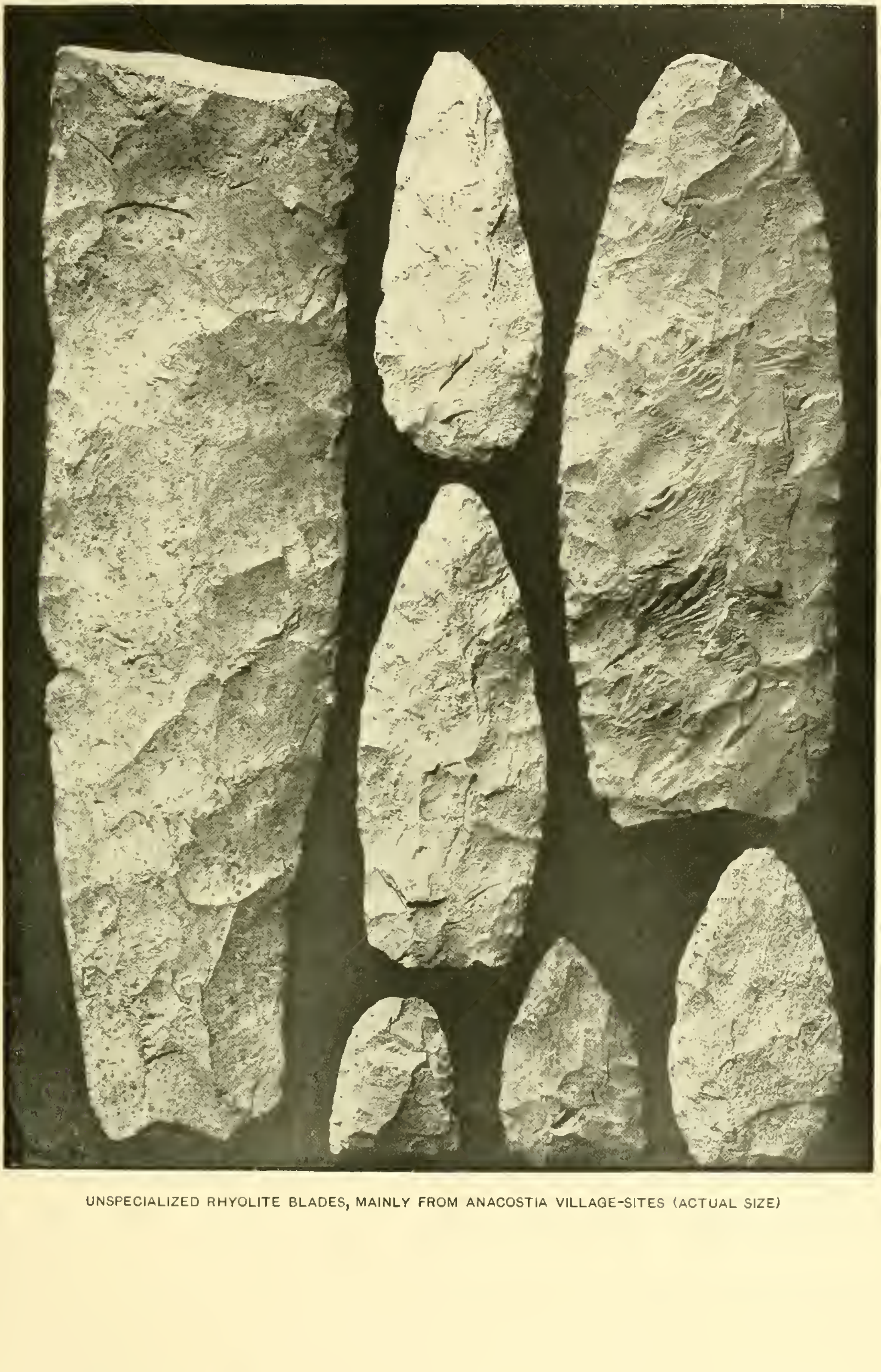
a, *b*, *c*, and *d* are quarry-shop rejects, *e*, *f*, *g*, and *h*, are from village sites in the lowland. Profiles are shown in the upper line sites up and down the river and in the affluent valleys on the east and west, but there is a great degree of sameness in the materials employed and in the work done. While a few typical localities thoroughly studied illustrate the whole subject, the presentation will not be complete without a brief sketch of the whole field.

Investigations in the ancient bowlder quarries of the Rock creek valley were concluded in June, 1890, and attention was at once turned to the study of related phenomena in the surrounding region. That portion of the Potomac between the head of tidewater and Great falls—about 10 miles of the most interesting and picturesque part of its course—possesses very considerable archeologic interest. The natural phenomena are quite distinct from those of Rock creek, and as a consequence there is a distinct class of archeological phenomena. The falls portion of the Potomac was evidently a great fishing resort for the aborigines, where at one time or another every available site was occupied for more or less permanent dwelling. The section was rich in the materials most utilized in native art. All kinds of rocks were found; there were bowlders of quartz, quartzite, and slate; fragments of these and other rocks; veins of quartz suitable for use in arrow making; rounded masses of traps and metamorphosed slates, the favorite materials for making grooved axes and celts; soapstone in extensive beds; clay, and occasional bits of rare stones brought down from the distant mountains. The deposits of bowlders were not of a nature to encourage extensive quarrying as on Rock creek, but the varied resources were fully and constantly drawn on by the dwellers by the river. In cases the villages were distributed over beds of river drift which furnished nearly every variety of stone and in many forms; and the art products of such a site, as picked up by the archeologist, are varied in the extreme. There were considerable deposits of bowlders on the northern terraces from Georgetown to above Cabin John bridge, and quartz was everywhere.

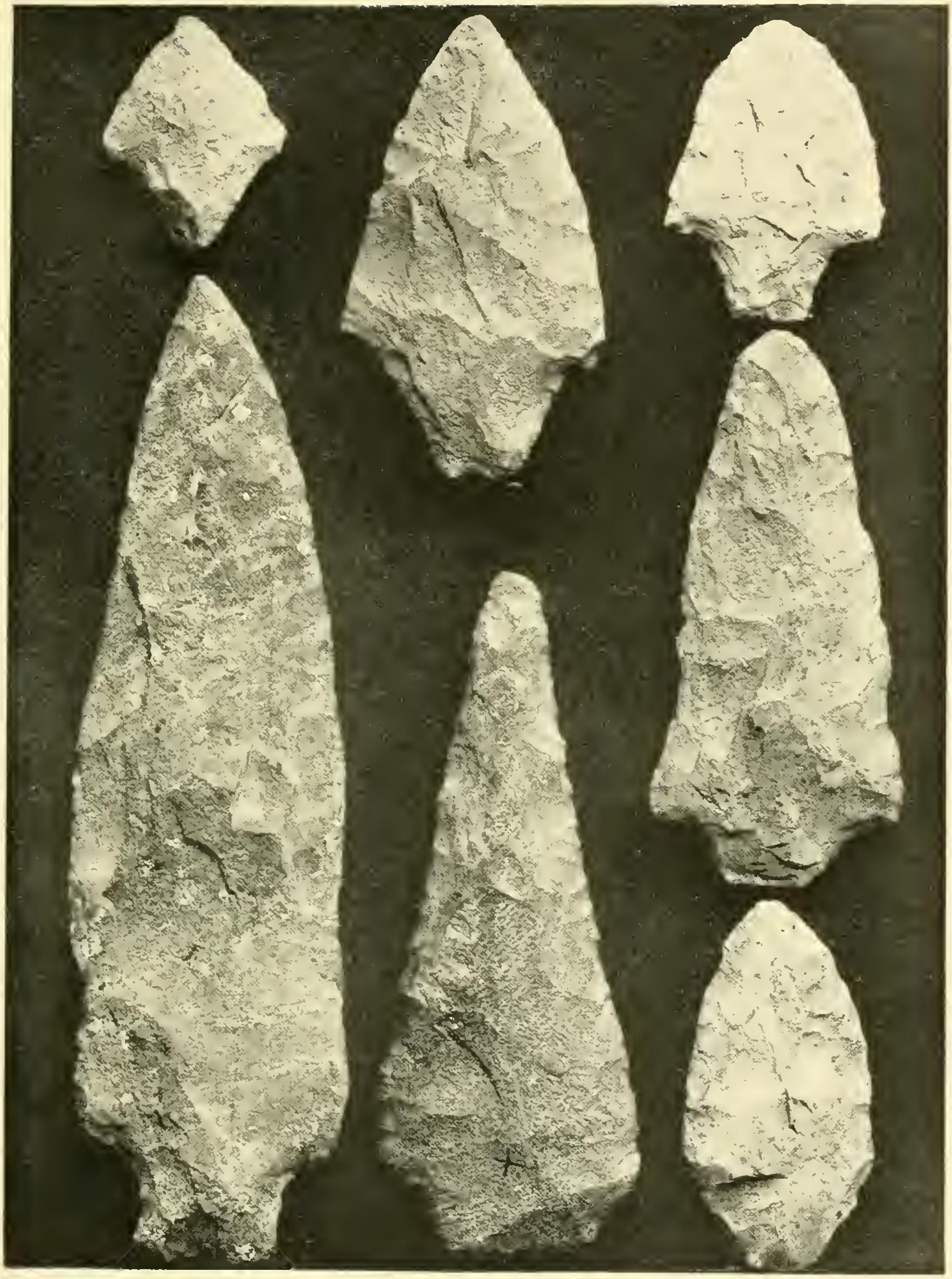
The most notable sites of the fishing villages are in the vicinity of Little falls. Some are on the terraced bluffs overlooking the river on both sides, while others are on the floodplain, only a few feet above high tide or above the ordinary river current, being swept freely by every spring freshet.

On the left bank of the river, almost at the foot of Little falls and about a quarter of a mile below the bridge, is a site that may receive particular attention. The floodplain is here several hundred feet in width, extending from the river, at the point where tide and cascade meet, back to the canal. This floodplain has been carved by the river out of the gneiss rocks, the scarred surface of which retains enough soil to encourage vegetation; the young growth develops during the summer, to be torn up by the freshet of the following spring. A portion of this plain, over against the canal and just above the antiquated Eades mill, half a mile below the bridge, was so free from invasion by the waters and had accumulated so much soil that a small patch has been plowed and planted during recent years. In the spring of 1880 the great flood swept the site, tearing out pits and trenches and denuding the field of its soil. This spot was soon after this event visited by collectors who obtained numerous spearheads and arrowpoints, with some other well-fashioned relics. In the spring of 1890 I visited the site and found many objects of art and observed some interesting facts. Mainly the objects found were rude, representing that part of the art products not desired by collectors of specimens, but such as are essential, along with the more finished things, to the story of the occupancy of the site and the pursuit thereon of native arts and industries. The river had in former years deposited on the corrugated surface of the plain numbers of worn and partially worn stones of every variety. At one point was a bed of well-rounded bowlders containing many flakable pieces. Living on this site, surrounded by banks of gravel and heavy beds of bowlders, the savage artisan did not need to quarry the material from which to flake his projectile points and his knives. He gathered them at his lodge door, and with deft hand carried them through all the stages of manipulation from the first flake to the finished implement. Quartz and quartzite were freely used, and the soil is filled with the refuse of manufacture. The rejects are identical in every essential respect, so far as the rude stages are concerned, with those of the Piny branch quarries. But here at home the work was carried further; here the various forms were specialized, the points were affixed to the arrowshafts and spears, and here, within the limits of the village at which they were made, they were used and lost. Knives and scrapers and perforators and drills were made and used, and were lost or broken and left with the other village refuse.

On this site were found the fine-grain tough stones utilized for axes and chisels. They were selected by the primitive artisans from the heaps of drift, in shapes resembling the art form desired. They were broken and flaked, if need be, into approximate shape, and were then battered or pecked into final form and ground and polished according to custom or need. Specimens were collected illustrating every step from the beginning to the end of the process. Along with the other forms, several picks and chisels of the variety used in cutting soapstone were discovered. Their presence is explained by the fact that near at hand occur outcrops of soapstone, and an ancient quarry has been observed near the Virginia end of the bridge and within a stone's throw of Little falls. Hammerstones, whetstones, pestles, mortars, as well as fragments of ordinary Potomac pottery and pieces of soapstone ornaments and vessels, were found. It would seem that every form of relic known in the Potomac region, from the rudest turtleback to the most finished tool of polished stone, occurs on this site—a site, it should be remarked, so modern in its period of occupancy that it is still swept by the annual freshets. Numerous illustrations of articles from this site will appear in subsequent sections of this paper.



UNSPECIALIZED RHYOLITE BLADES, MAINLY FROM ANACOSTIA VILLAGE-SITES (ACTUAL SIZE)



SPECIALIZED RHYOLITE BLADES, PROBABLY LARGELY KNIVES AND SPEARPOINTS, MAINLY FROM ANACOSTIA VILLAGE-SITES (ACTUAL SIZE)

An important village-site occurs on the high terrace overlooking the northern end of the bridge, formerly occupied by Freeman's greenhouses, now the property of the Baltimore and Ohio railway company, and another site yielding great numbers of relics is situated on the Donaldson place, high above the river on the southern side.

In June, 1890, my attention was called to a series of chipped stones obtained from the farm of Thomas Dowling, about a mile above Cabin John bridge and 8 miles from Washington. The collection was made by Thomas Dowling, junior, and included many of the rude forms common on the quarry-shop sites already examined, as well as a number of well-finished implements. During a visit to the locality it became apparent that this was an ordinary shop site, which bore also considerable evidence of having been occupied for dwelling. The site is a hundred yards beyond the Dowling gate, on a terrace, the summit of which is about 20 feet above the Conduit road and 160 feet above the Potomac. Back of the terrace, which is but a few acres in extent, the hills rise gradually to their full height of some 350 feet above the river. The surface of the terrace is somewhat uneven, and is covered with rocks of varying sizes, including many bowlders and masses of quartzite with irregularly shaped remnants of other varieties of stone. Much of this material was utilized by the aborigines. It is to be noted that the available material supplied by this site does not correspond closely to that of the great quarry sites of Rock creek. The hills above furnish but few workable bowlders until we go far back from the river. During the early Pleistocene Columbia period these lower terraces were subject to river overflow and thus received accessions of bowlders and fragments of rock from the up-river country, but this material is inferior, both in quantity and in quality, to that of the Potomac formation. It does not appear that extensive quarrying was carried on in this locality, as the deposits would not warrant it.

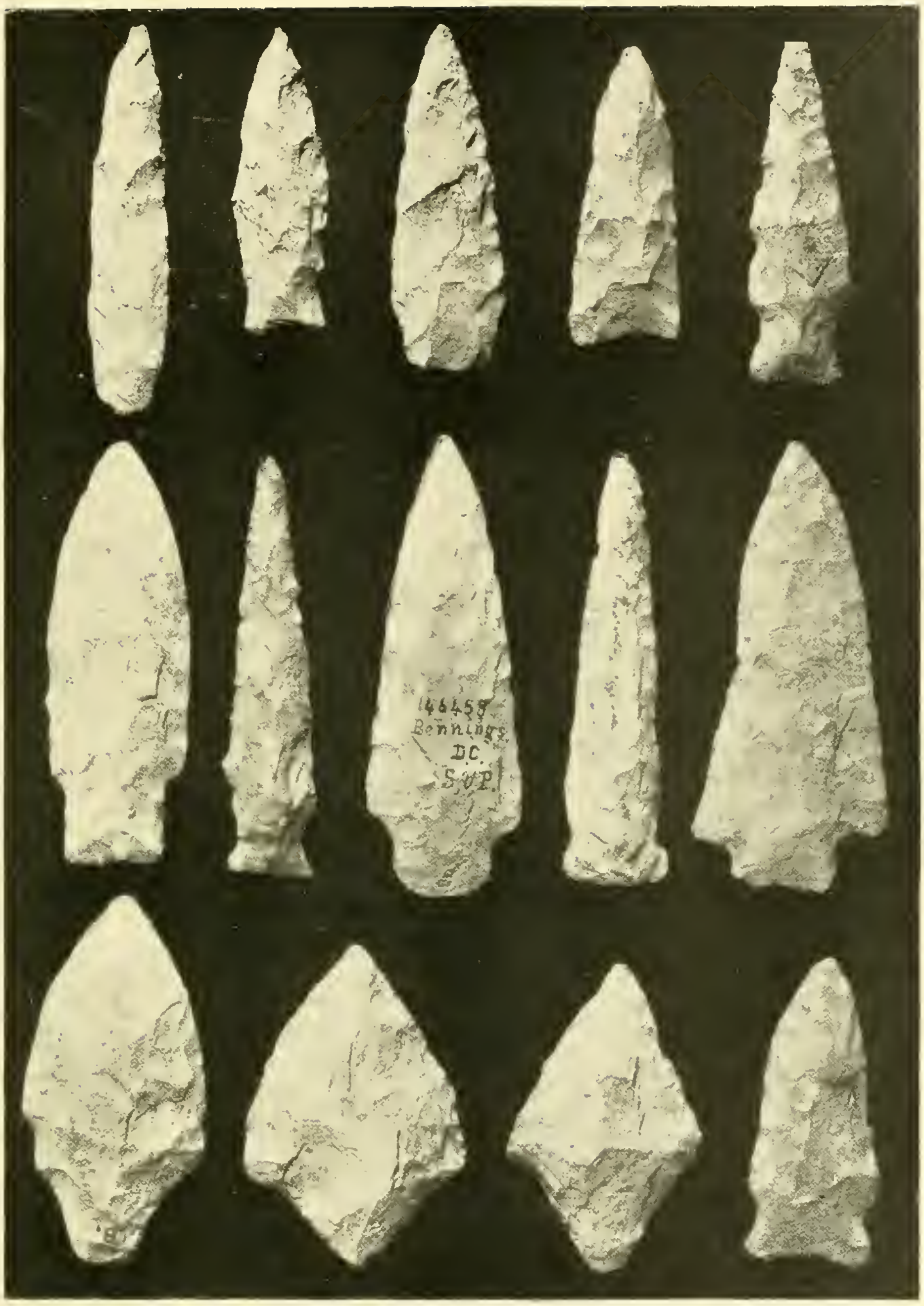
ANACOSTIA VALLEY

The estuary of Anacostia river varies from one-quarter to three-quarters of a mile in width in its lower course, but just above Bennings bridge it becomes quite narrow. It is bordered for the most part by low alluvial terraces which rise from the water to the base of the slopes of the plateau, here reaching nearly 300 feet in maximum height. In places low bluffs composed of Columbia gravels approach the river banks, and in the angle between the Anacostia and the Potomac the Columbia formation occurs in terraces varying from a few feet to nearly 100 feet in altitude; on these in the main the city of Washington is built.

The only members of the Columbia formation of particular interest in this study are the bowlder-bearing gravels. These are extensively exposed in places, and in the vicinity of the navy-yard reach a thickness of 20 feet or more, though the bowlders are not generally suited to the use of the implement maker. They are often of quartzite and of a suitable size for flaking, but the material is not sufficiently glassy, and they are so scattered throughout the great mass of gravel that quarrying was not encouraged. Workable bowlders were weathered out in considerable numbers, however, and these were used by the aborigines. Quartz bowlders and pebbles were also found in plenty, and in some localities were sufficiently abundant to lead to extensive manufacture. Such a locality occurs on the left bank of the river near the Pennsylvania railway bridge. Here the terrace gravels are filled with workable pebbles, and many rejects and also many finished points are found on the sites, which were dwelling places as well as implement factories. The turtlebacks are often very minute, being in many cases less than an inch in length. Although the inhabitants of the tidewater section of Anacostia river were thus well supplied near at hand with the ordinary varieties of stones, they probably found it advantageous to visit the hills higher up when an unusual supply was called for.

The Potomac bowlder beds, which furnish the best materials in the region, outcrop around the slopes of the hills bordering the northwestern branch of the Anacostia, 10 miles up. In the vicinity of Riggs mill, 3½ miles above Hyattsville and a mile northwest of the Maryland Agricultural College, the manufacture of quartzite tools was carried on quite extensively. It has not been ascertained definitely that quarrying was resorted to, but there is a strong probability that such was the case. The bowlder beds are very heavy at this point, and agriculture is much impeded by the millions of rounded stones that come to the surface in the fields. A small percentage of quartz pebbles are intermingled with those of quartzite. The heaviest deposits of bowlders occur in the middle slopes about the mill, and the refuse of manufacture is found everywhere. The conditions are much the same as on the Rock creek sites. Here, however, all stages of the shaping process are represented, from the tested bowlder with one or two flakes removed to the finished arrowpoint and spearhead. Many pieces have one side worked, others have both sides rough flaked, and a very large number are reduced almost to the typical quarry blade. There are here more broken blades—that is, of those apparently almost completed—than at any other point yet examined. At least a hundred were found in an hour's search.

It is worthy of special note that on these sites a considerable amount of specialization was carried on, and some finished points are found, while there are many fragments of those evidently broken in trimming the edges and tips and in adding the notches; this was not true of the Rock creek quarries. This difference is accounted for by the fact that the Anacostian sites were habitable in places, and traces of encampments where finishing shops were probably established are found at a number of points. The occurrence of implements and projectile points of exotic materials on several of these sites is satisfactory proof of the presence of dwellings.



SPECIALIZED RHYOLITE BLADES, PROBABLY LARGELY PROJECTILE POINTS, MAINLY FROM POTOMAC VILLAGE-SITES (ACTUAL SIZE)

RHYOLITE ARROWPOINTS, MAINLY FROM POTOMAC VILLAGE-SITES (ACTUAL SIZE)

Many similar sites occur at corresponding localities on the other branches of the Anacostia. There is little doubt that the inhabitants of Nacochtank resorted to the quarries of Rock creek and Piny branch; for great numbers of leaf-shape blades of quartzite, as well as of quartz and rhyolite, are found on the chain of sites extending all the way from Bennings to a point opposite Alexandria.

THE TIDEWATER POTOMAC

The Potomac formation, which yields the great body of workable bowlders, extends far down the river, but is found to yield smaller amounts of available materials as the distance from Washington increases. The outcrops are generally at considerable altitude above the river, and at many points on the lower levels there are deposits of bowlder-bearing material derived from the erosion of the Potomac beds. This redistribution is now going on, so that everywhere there are more or less extensive accumulations of workable bowlders. The superior formations, the Lafayette and Columbia, also yield considerable workable stone, which is reassorted and redistributed by the river. There are in places deposits of exceptionally heavy bowlders of limited extent as far down as the confluence with Chesapeake bay. About the mouth of the Wicomico, for example, bowlders are found in large numbers. On Popes creek and along Port Tobacco river the gravels furnish many bowlders of all sizes, which were extensively used by the shell-bank peoples for mortars and mullers, and for shaping both small and large implements. The valley of Zakiah creek, in Charles county, is noted for the great number of arrowpoints and spearheads to be found on its banks; while the gravels are well supplied with workable pebbles of quartz and quartzite, suitable for the implement maker.

On the western side of the river, from Rosslyn to Potomac creek, and extending far back into the hills, extensive deposits of bowlders are exposed. In all of this district no quarries have been observed, although it is probable that in hundreds of places bowlders have been obtained by excavation; but it would appear that the deposits outside of the immediate vicinity of Washington were nowhere sufficiently rich in workable material to encourage quarrying on a large scale. Workshops are, however, found throughout this region, and refuse corresponding in every respect to that of the great quarries is widely distributed.

Especially notable sites are the high terraced points about Mount Vernon and on the island of Chopawomsic, several miles below. From the former Mr William Hunter has made extensive collections, now for the most part owned by the National Museum, and it is not unusual to see collections of quartzite and quartz points from the neighboring fields offered for sale to visitors at Mount Vernon. At Chopawomsic a bed of bowlders outcrops near the upper end of the island only a few feet above low water. The débris of manufacture of quartz and quartzite tools is very plentiful on the island, and large collections have been made of these, and of finished implements as well, by Mr W. H. Phillips, of Washington. The débris of flaking duplicates the refuse of the quarries in character.

There is hardly a village-site on tidewater Potomac where quartz pebbles were not found and worked, and the workshops are innumerable. It is evident that manufacture was carried on wherever the proper material was obtained, and it is equally clear that the processes employed and the articles produced were uniform throughout.

SITES IN JAMES RIVER VALLEY

The manufacture of quartzite and quartz implements was carried on very extensively in all the principal valleys draining into the Chesapeake on the west. They are found scattered over the country, and on the more fully occupied sites along the rivers the store of arrowpoints and spearheads seems next to inexhaustible. The great collections made by M. S. Valentine, esquire, and his sons, in the James and neighboring valleys; of Mr C. M. Wallace, mainly about the falls of the James, and of J. H. Wrenshall, on Dan river, bear testimony to this.

Nearly all of the stones along Moccasin and Gillys creeks below Richmond are of sandstone or soft quartzite, unsuitable for arrow making, and very few chips are found along the banks of either. The banks of Shockoe creek are composed mostly of quartz and hard quartzite pebbles, and the bed of the creek is filled with them. If any quarrying was ever done here, no traces of such work have survived the changes due to grading for various improvements. It is probable that the aborigines did very little digging, as the creek would wash out more stone than they could well utilize. On the surface, and especially on the slopes of the park of "Chimborazo," quartz and compact quartzites exist in great plenty, but it is useless to seek for evidences of aboriginal work now.

Near the ocher mills, about 5 miles above the mouth of the Appomattox, as also at points on the opposite side of the river, pebbles of quartz occur in the greatest profusion. On the bluff back of the mills the ground is covered with flakes and spalls, and it appears that much work was done here.

On a bluff 30 feet high between Gravelly run and the mouth of Baileys creek the ground in the few places where it is exposed is covered with small flakes and chips. It seems to have been a village-site, or at least a place where the implements were finished after being blocked out elsewhere.

QUARRIES OF THE HIGHLAND

MATERIALS QUARRIED

In a brief and necessarily imperfect manner the history of stone flaking within the valleys of the tidewater region has been sketched in the foregoing pages. Incidentally it was shown that much of the material

ESSIVE STEPS IN THE SHAPING OF LEAF-BLAD

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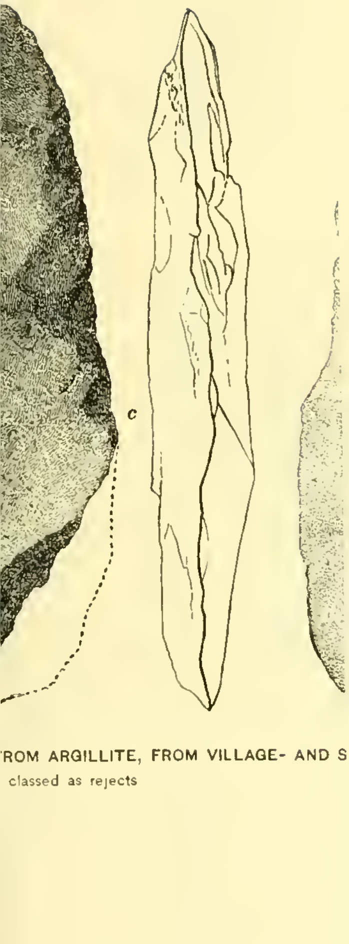

ROM ARGILLITE, FROM VILLAGE- AND S

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SELECTED FORMS ILLUSTRATING PROGRESSIVE STEPS IN THE SHAPING OF LEAF-BLAD[illegible]ENTS FROM ARGILLITE, FROM VILLAGE- AND SHOP-SITES AT POINT PLEASANT, PENNSYLVANIA

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employed in the tidewater region for stone implements was not indigenous. It will now be desirable to study the origin and manufacture of the exotic materials so extensively employed by the natives of the lowland.

The local materials were not of the best varieties, including little else, as I have shown, than brittle quartz and refractory quartzite. The other materials sought in the highland at distant points are rhyolite, jasper, argillite, and flint. All are found in limited quantity as pebbles in the tidewater portions of the valleys in which they occur in place in the highland, and the refuse left by arrow makers is found sparsely scattered over the valleys. This refuse is closely analogous in its forms with corresponding refuse resulting from the shaping of quartz and quartzite pebbles. In some manner the natives of the lowland acquired a knowledge of the location of the deposits of these materials in the highland, and quarries were opened and worked and transportation of the material, shaped or partly wrought, became an important industry.

LOCATION AND PRODUCT

Rhyolite Quarries

First in importance of the exotic materials used by the inhabitants of the lowland is a variety of rather coarse-grain rock found in South mountain, a high group of ridges extending from near the Potomac at Harpers Ferry to the southern side of the Susquehanna at Harrisburg, Pennsylvania. It is an ancient eruptive rock of the acidic class, occurring interbedded with other formations and outcropping in narrow belts parallel with the trend of the range. It is generally bluish gray in color, though sometimes purplish, and is often banded and mottled by what may be regarded as flow lines. Dark varieties closely resemble slate, and the structure is often somewhat slaty. Generally it is flecked with light-colored crystals of feldspar, by which character it is easily recognized. Its fracture is often uncertain on account of a shaly or laminated structure, but it is capable of being worked more readily into large and long implements than any other of the several varieties of rock found in the upper Potomac valley.

The history of the discovery of this material may be of interest to archeologists. On taking up the study of the tidewater region it was observed that at least one-fourth of the implements collected were made of a gray slaty stone. These objects were in the main knife-like blades, projectile points, drills, etc, of usual types of form, though occasional ruder pieces and flakes were found. In a very few cases larger masses of the rock were reported, one weighing several pounds having been obtained from the banks of the Potomac opposite Mount Vernon. It was of compact flakable stone, and although of turtleback type had somewhat the appearance of a core or mass from which flakes had been removed for shaping small implements. It may have been used or intended for use as an implement, although this is not probable. It is shown in figure 12. A much larger piece, an oblong blade-like mass, was found by Mr J. D. McGuire in the Patapsco valley. Such shapes are very common in the quarries, and are often mere rejects of the blade maker.

For several years the source of this stone remained unknown. Members of the Geological Survey were engaged in examining parts of the Piedmont plateau drained by the Potomac, and I appealed to them to keep a lookout for the stone. In the summer of 1892 Professor

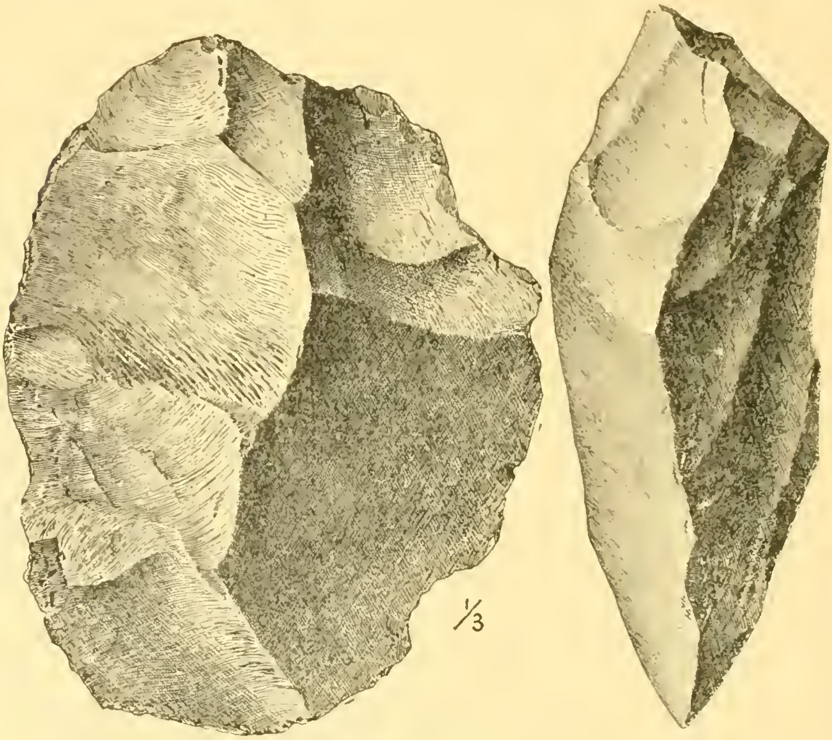
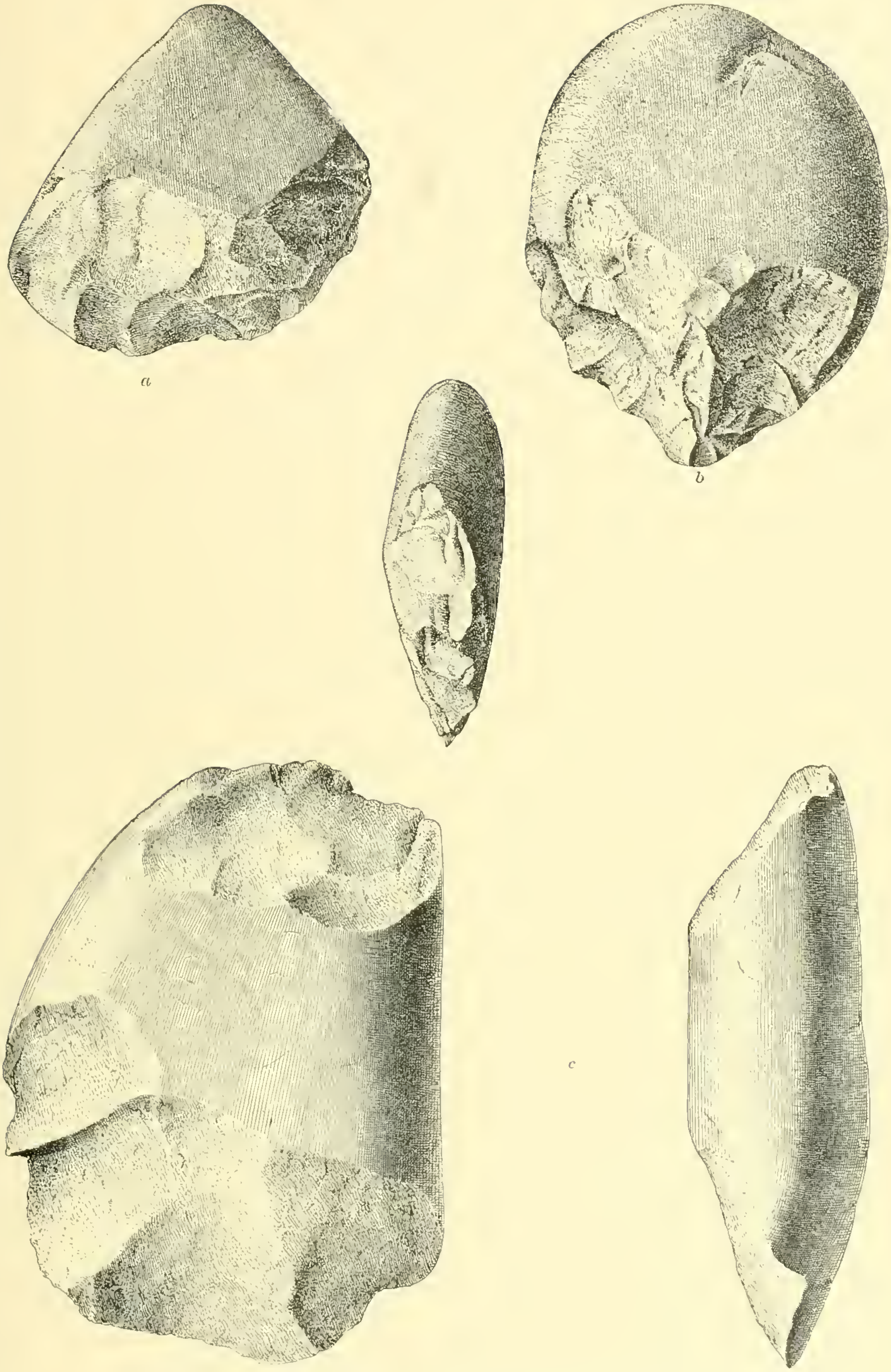


FIG. 12—Fragment of rhyolite from the Potomac, 10 miles below Washington.

G. H. Williams, of Johns Hopkins university, an assistant geologist on the Survey (whose untimely death in 1894 was a serious loss to science), reported its occurrence in South mountain, and in the autumn he and Mr Arthur Keith, of the Geological Survey, furnished me with a map of the formations so far as outlined at that time. The outcrops extended in broken narrow belts through Maryland and Pennsylvania, as already mentioned.

Early in November, 1892, I set out in search of the quarries. Taking a team at Keedysville, Maryland, I crossed the mountain ridge at several points, finding excellent outcrops of the rock at many points, but no trace of aboriginal operations appeared until I reached Maria



SHARPENED BOWLDERS FROM POTOMAC VILLAGE-SITES (ACTUAL SIZE)

Furnace, Pennsylvania, on a branch of the Monocacy, 10 miles southwest of Gettysburg. Here the mountains rise abruptly and to great heights from the narrow stream bed, and the rhyolite forms a large part of the rocky mass. A cluster of flakes was observed on the roadside some 2 miles above the railway crossing, and extensive aboriginal quarries were soon found on the mountain side half a mile up the northern slope.

During the first visit only a preliminary examination was made. The ancient workings observed cover several acres of the wooded mountain side. The pitting is not pronounced, although traces of disturbance are readily recognized and the entire soil is filled with broken masses of the rock and the refuse of blade making. Near the lower margin of the quarries a small patch had recently been cleared and planted in peach trees. Here countless numbers of the partially shaped pieces were to be seen, and in an hour I had my wagon loaded with turtlebacks, broken blades, and hammerstones. The rock tends to break in flattish forms, and the rejects indicate that the blades made here averaged long and thin as compared with the shapes made from the compact bowlders of the tidewater region.

As in all the quarries so far examined, blade making was, so far as the refuse indicates, the almost exclusive work of the shops. Plate XXVIII is devoted to the illustration of specimens of successive grades of development, from the mass of raw material reduced to convenient size for beginning shaping operations to the long slender blades almost as fully developed or advanced as are the blades found in the caches and on the village-sites of the lowland.

No evidence was found of attempts at specialization of form, and there is not the least doubt that finishing operations were conducted subsequent to transportation to the villages in the valleys. Shops where many small flakes were found contained fragments of unspecialized blades only. The hammerstones were not numerous, and were as a rule rather unsymmetric globular masses of greenish-gray eruptive rock—probably a diabase.

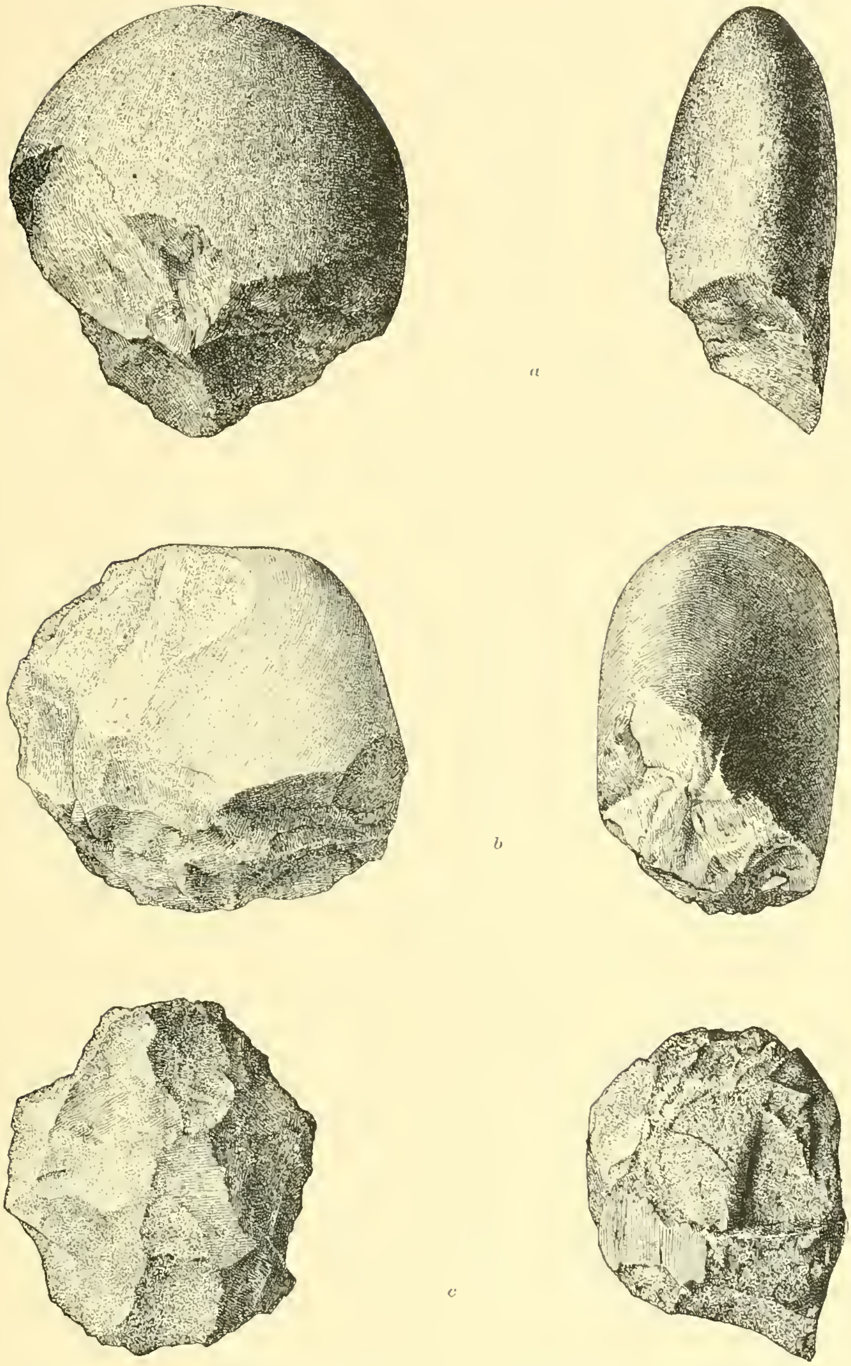
These and probably other quarries of South mountain were the centers from which the natives distributed rhyolite over a vast area including 20,000 square miles or more of the Chesapeake-Potomac region. The quarry examined is 75 miles northwest of Washington, and was readily accessible to the inhabitants of Potomac and Patuxent rivers. The amount of material transported was very great, and the industry must have been a most important one, frequent journeys to the mountains of Pennsylvania being a necessary feature.

By a study of the range of quarry elaboration it is readily determined that the chief product was a blade corresponding to the products of other quarries, and differing only as a result of the difference in material. It has already been mentioned that multitudes of specimens derived from this or other similar quarries in the mountains are scattered over the tidewater province. In a few cases flaked masses have been seen weighing a number of pounds, much larger than would ordinarily be carried to points distant from the quarry. It is possible that in cases they are derived from water-transported masses.

As would naturally be expected, a great many blades of the roughed-out type are found in the lowland. Several caches have been reported, and in plates XXIX, XXX, and XXXI examples from a number of these are given. Through the kindness of Colonel W. H. Love, of Baltimore, I am able to present the remarkable set of blades given in plate XXIX. The cache, plowed up in a garden on Frogmore creek, near Baltimore, contained eight pieces, three of them being broken. The entire blades range from 7 to nearly 11 inches in length, and in form are very narrow and thin, with straight sides, and with the usual broad base and acute point.

The boldly flaked and handsome blade presented in *a*, plate XXX, was obtained, with several others like it, by Mr Brewer on South river, Maryland, from a few inches beneath the surface of the ground in a grove near his house. The two specimens *b* and *c* are of very different type, and the former is slightly specialized, rude notches having been broken in the sides near the base. These are from a cache of about a dozen pieces found near a village-site on the floodplain of the Potomac a few hundred yards below Chain bridge.

Very much like the preceding, though ruder, were a number of blades found by Colonel W. H. Love on an island at Point of Rocks, Maryland. I introduce these specimens here, as they clearly indicate what must have been a common practice with the South mountain quarrymen—the carrying away from the quarries of hoards of bits and roughly trimmed blades of rhyolite. The island has in recent years suffered much from the great floods that now and then devastate the valley, and a few years ago an ancient village-site of considerable extent was exposed by the removal to a few feet in depth of the surface soil. Pottery and stone implements of usual types were found, and at one point Colonel Love discovered what appeared to be a flaking shop, as many bits of broken rock flakes and chipped pieces were scattered about. Partly buried in the soil was a flattish stone a foot or more across and 2 or 3 inches thick, on and about which, as well as scattered through the soil near by, were numerous bits of rhyolite, a dozen or two being of the type shown in *c*, plate XXX, while others were ruder and some were mere flakes and fragments. Scattered about were a few finished and partially finished arrowpoints. The relation of these to the squarish stone, the presence of hammerstones, and the fact that the upper surface of the stone was considerably roughened and picked into holes by sharp points led to the surmise that possibly this was a shop, the stone being the anvil on which the fragments of rhyolite were placed to be shattered or shaped. I am at a loss, however, to understand just how such appliances could be utilized in the work of flaking. A



SHARPENED AND BATTERED BOWLDERS FROM POTOMAC SHELL HEAPS (ACTUAL SIZE)

sketch indicating approximately the relation of the cluster of partially shaped fragments to the large stone is presented in figure 13.

Flint Quarries

Flint does not occur in any considerable bodies within convenient reach of the tidewater region. Pebbles are found in limited numbers in the various bowlder deposits and along the stream courses. Limited masses of the rock occur in the limestone formations of the Piedmont plateau; and one considerable outcrop of the rock in Highland county, Virginia, is known to have been worked by the natives. In May, 1893, Mr Gerard Fowke, of the Bureau of Ethnology, at my request made a reconnoissance in the region to verify the reports of extensive aboriginal quarries in Crabapple bottom, Highland county, and furnished the following notes:

"On a spur that rises to a height of 200 feet, just west of the village of New Hampden, a large amount of flint has been released by the decomposition of the limestone in which it was embedded. It is mostly in the form of small nodules or fragments, although some of it is interstratified with the limestone. Over a considerable area on the

Fig. 13—Supposed anvil stone and cluster of slightly shaped bits of rhyolite.

northern end and at the top of the ridge, the earth has been much dug over by the aborigines for the purpose of procuring the stone. Most of the pits remaining are quite small, few larger than would contain a cartload of earth. The largest are on top of the ridge, where a few have a depth of 2 to 3½ feet, with a diameter of 20 to 30 feet. The latter cover an area of about an acre; the others are so scattered that it is difficult to estimate their extent. There is no outcrop of stone at any point where digging has been done, and it appears that the searchers for the material had learned that the flint nodules and fragments were distributed through the soil excavated for them in such spots as proved to contain them in greatest abundance, making no effort to quarry out the stone in which they occur. At various places on the summit of the ridge the flint projected above the ground, and there it had been battered off with stones; but there is no evidence that quarrying was resorted to.

"Such portion of the hill as is not in timber has a heavy blue-grass sod, and the ground is visible only in a few small spots where animals have burrowed. Flint chips and flakes were found at several of these. At the foot of the spur at its northwestern terminus is a spring, around which these indications of manufacture are abundant; and it is reported that before the grass had become so thick a great many broken or unfinished implements were picked up. Spalls and chips are abundant in the face of the bank around the spring, but it can not be ascertained except by excavation how far they extend. So far as could be learned the space covered by this workshop seems too limited to have been utilized for flaking more than a small part of the flint that could have been obtained by the amount of digging apparent; it may, however, be more extensive than reported, or there may be others in the vicinity which have been overlooked. This can be determined only by researches at such points as seem favorable for the location of arrowpoint factories."

It is a notable fact that the existence of these quarries was known and recorded at a very early date, as the following extract from Maxwell's Historical Register, Richmond, 1850, will show:

On the lands of Mr John Sitlington, in Crabbottom, Highland county, there is an area of perhaps 100 acres all dug over in pits. This was the great treasury of that dark clouded flintstone out of which the Indians made those arrowheads of that color found all over our state. The rock there is in great perfection, and in inexhaustible quantity. It would surprise anyone to see what labor had been expended here and what vast quantity of the rock obtained. Here was the red man's California.

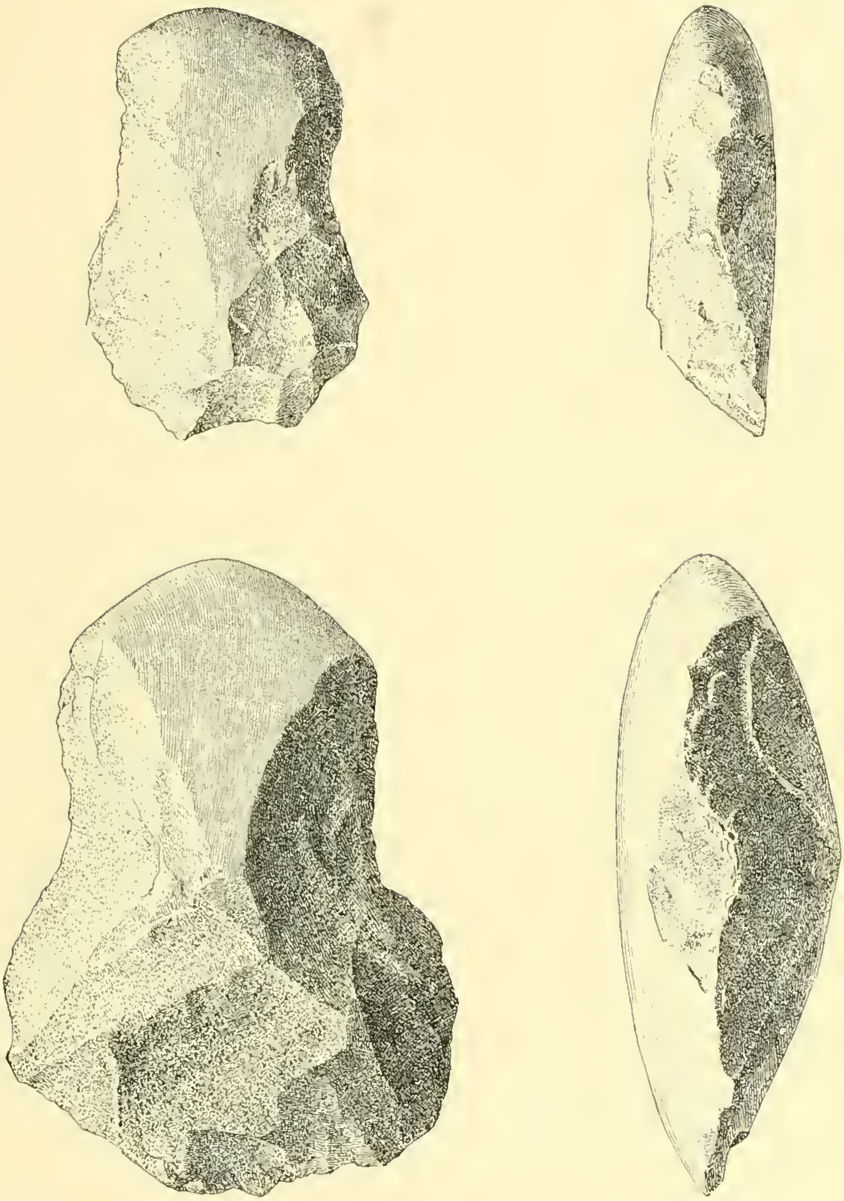
Flint implements occur so sparingly over the great tidewater areas that it seems hardly likely that extensive quarries existed within easy reach of the lowland peoples. No caches have been recorded, and it seems unnecessary to illustrate the forms of implements, which do not differ in type from those of other materials. In the Potomac valley above Harpers Ferry the village-sites yield flint arrowpoints and spearheads, mostly black in color, in very considerable numbers.

Jasper and Argillite Quarries

Although these materials were used by the tidewater peoples, and although some of the articles found were undoubtedly derived from quarries, the exact location of these sources of supply can not be determined. It is not improbable, however, that the quarries in Berks and Lehigh counties, Pennsylvania, furnished the material. Implements and other articles of these materials are later referred to.

Caches

It will be observed that the leaf-shape blades made in the quarries are identical in character with the hoard or cache blades so well known all over the country. There can be little doubt that these hoards are



RUDE AXES MADE BY SHARPENING AND NOTCHING QUARTZITE BOWLDERS BY FLAKING, FROM POTOMAC VILLAGE-SITES (ACTUAL SIZE)

deposits of blades produced in the quarry-shops or on sites furnishing supplies of the raw material and transported and stored for utilization or trade. Few caches of the quartzite blades have been reported from the tidewater country. It is much more common to find deposits of blades of other materials not obtained in the region, and therefore brought from a distance by quarry workers or traders. At the mouth of South river, Maryland, near the banks of Selby bay, four hoards have been found, and are now for the most part in the collection of Mr J. D. McGuire. Two are of argillite and one of jasper, brought, no doubt, from workshops in Pennsylvania, some 150 miles away, and one is of rhyolite, probably from the quarries on the head of Monocacy creek, in Pennsylvania. A fifth cluster, consisting of eight fine, long blades, was found in a garden near Baltimore, and is now owned by Colonel W. H. Love of that city. Five examples appear in plate XXIX. Still another hoard, consisting of six long, slender blades of slaty South mountain rhyolite, was obtained by Mr H. Newton Brewer, from his farm on South river, Maryland. An illustration from this cache is given in *a*, plate XXX. A cache of a dozen blades, found on a village-site at Eades mill, below Chain bridge, is represented in *b*, plate XXX, and a similar lot from an island in the Potomac, below Harpers Ferry, is illustrated in *c* of the same plate. Nests of quartzite blades are reported from different parts of the Potomac valley. One, consisting of six pieces, all slightly specialized, was obtained from a village-site in Anacostia by Mr W. H. Phillips (*a* and *b*, plate XXXI); a second (*c*, in the same plate), owned by Mr Thomas Dowling, junior, contains four or five blades, and is from Bennings; and a third, now in the National Museum, is also from the vicinity of Washington. Others reported from Potomac creek and elsewhere have been scattered by collectors who did not appreciate their importance. We can not say in any case that the quartzite blades found in caches had their origin in the Washington quarries, for identical forms were produced on numberless sites throughout the region yielding the raw material, but, in the nature of things, the greater quarries would be more frequently represented in the caches than the smaller.

The quarry-shop type of blade is not confined to the cache or to cache finds. It is found widely distributed over the country on village-sites, fishing stations, etc. These objects are plentiful on village-sites in the region producing the raw material in plenty, and decrease rapidly in numbers as we recede from that region. Thus a village-site on the Anacostia yields hundreds of these blades, while a similar site on the lower Potomac may not yield half a dozen. They are found in considerable numbers in such places as the bluff village-sites about Mount Vernon and the great shell fields of Popes creek, where beds of workable bowlders are convenient. The cache is not a necessary result of the quarry, but the quarry explains the cache.

Chapter III

FLAKED STONE IMPLEMENTS

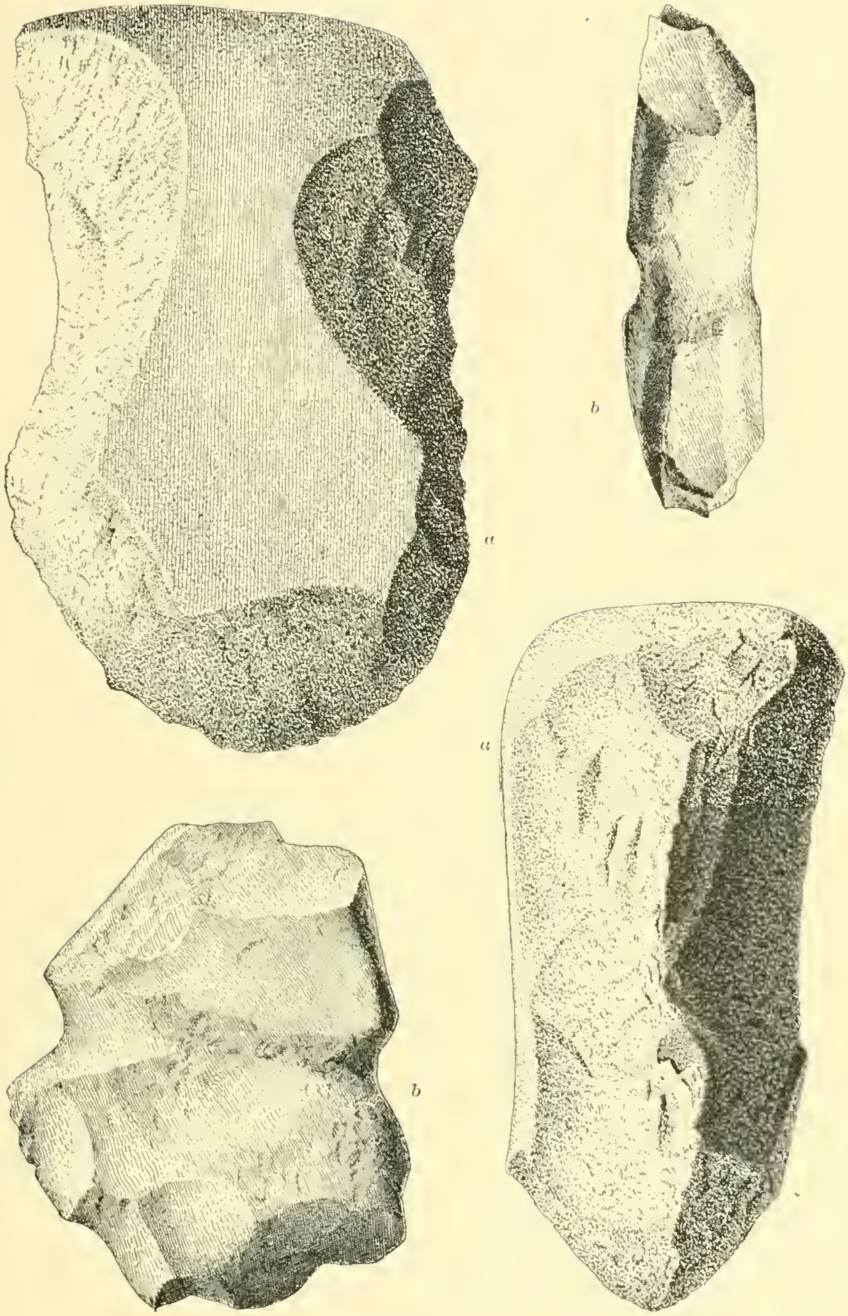
GENERAL FEATURES

The treatment of this division of the subject will be brief. since the object of the present paper is chiefly to develop the history of the great industries connected with quarrying, manufacture, and distribution, rather than to discuss the finished implements and their uses. Up to the present time a rational account of the earlier stages of the work of the aboriginal artisans, of the history of the implement up to the point where its functions as an implement began, has not been given. The finished objects have been voluminously discussed by many authors, but this discussion began in the middle of the subject as now developed and is thus incomplete and unsatisfactory. Unfinished forms and rejects have not been clearly distinguished from implements proper, and much time has been wasted in classifying and finding uses for objects that are not implements at all.

Attention has already been given to the destiny of the blades produced in such great numbers in the quarry-shops and in the workshops scattered over areas affording the raw material. From these sites were distributed, often in unfinished condition, the innumerable specimens found in caches and on dwelling, hunting, fishing, and other sites all over the tidewater country. The processes of elaboration, by means of which the blades are roughed-out and prepared for final shaping, have already been considered at some length.

We are not able to say at just what point in the shaping of the blade or implement from quartzite and each of the other stones (for the point would not be uniform with all varieties) the percussion processes ceased and the pressure processes took up the work. It was certainly later in the quartzite than in any of the others, because of its coarse grain and exceeding toughness and the consequent lack of thin and sharp edges on which the pressure tool must take hold. The pressure methods were applied somewhat as indicated in the following paragraphs.

In the method mostreadily available for the final steps a blank form or a flake having the approximate shape was held firmly between the fingers and thumb of the left hand. A firm piece of bone having a rather thin edge or angle like that of a three-cornered file was taken in the right hand and set upon the sharp edge of the stone and at right angles to it so firmly that a slight cut or notch was made in the bone, then, with a quick, firm movement of the right hand, met by a similar



RUDE AX-LIKE IMPLEMENTS FROM POTOMAC VILLAGE-SITES (ACTUAL SIZE)

a, made by sharpening and notching a quartzite bowlder; *b*, made by sharpening a rude grooved ax

movement of the left, the bone was made to move across the edge of the stone (figure 14), in doing which it took with it a flake, varying in length, width, and depth with the skill and power of the workman, the nature of the stone, etc. A rapid repetition of this operation,

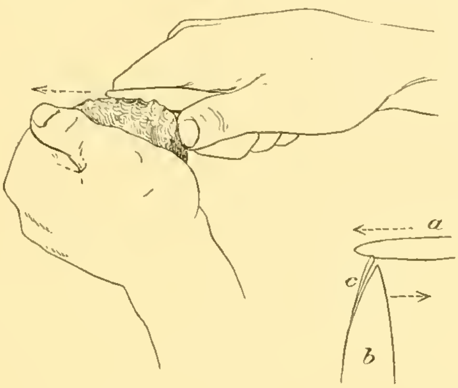


Fig. 14—Flaking by pressure, a bone implement being used.
a the bone tool, *b* the stone, *c* the flake.

accompanied by a proper resetting of the tool, quickly reduced the piece, if it worked readily, to almost any desired outline. The same result was obtained in various other ways, but always by means of suddenly applied or spasmodic pressure. The blank form may have been held down by the fingers on the edge of a stone, as shown in figure 15, and the point of the bone held in the other set so as to

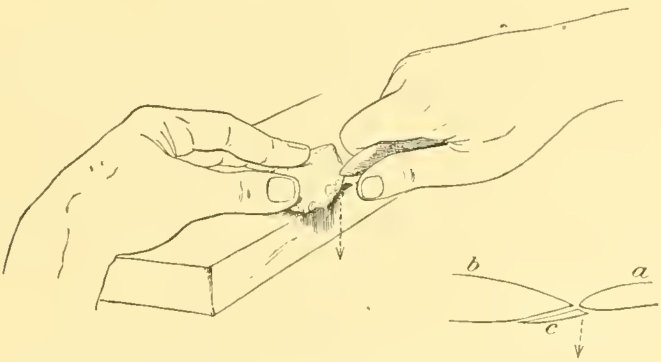


Fig. 15—Flaking by pressure, a bone point being used, the implement to be shaped resting on a support.

catch the edge of the stone to a width corresponding to that caught by the notched bone in the other position, when a quick downward pressure upon the flaking tool would remove the flake. Again, in larger work, where greater force was required to remove the flakes, a tool long enough to place against the arm or chest of the operator may have been used. In this way much additional force could be thrown into the spasmodic movement. Another device, practiced by some tribes, consisted of a notched or forked bone or pincers, which was set upon the sharp edge of the blank and given a sudden twist, thus removing the flake.

These operations apply exclusively to implements of leaf-blade type and to minute forms of other origin. The various ruder and heavier varieties of tools were shaped by percussion exclusively.

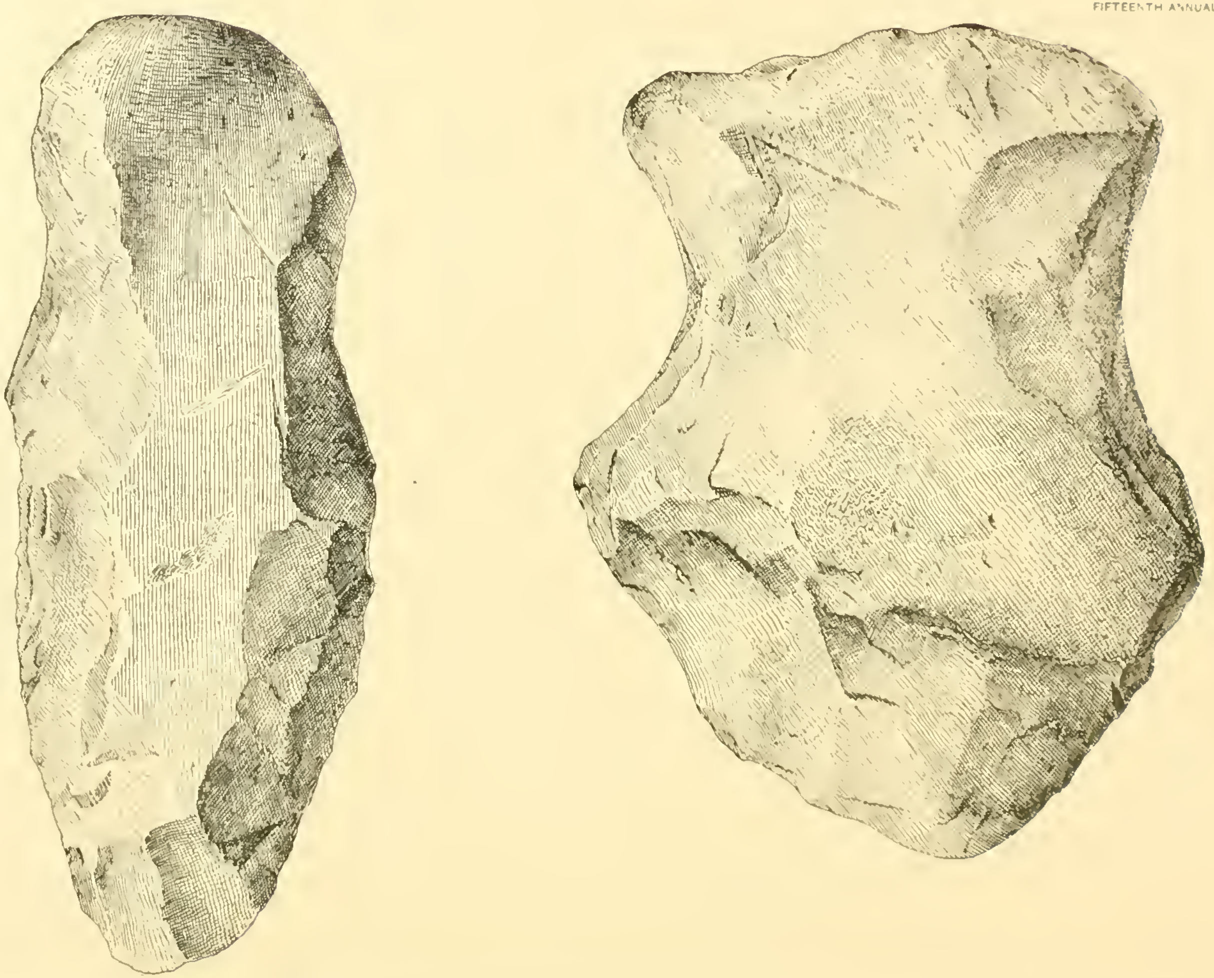
The flaked implements of the province may be arranged in two great groups: One consists of small and well-shaped forms, such as knives, drills, scrapers, and projectile points, almost universally employed by the native tribes; the other comprises heavier and ruder tools, generally made on or near the site of intended use, and probably rarely carried about the person or transported to any great distance. The latter class includes bowlders sharpened at one end by removing a few flakes, giving a cutting edge or a pick-like point; bowlders and other stones, often large, similarly sharpened, and in addition notched at the sides for hafting; as well as quite heavy bowlders, or other compact bits of rock, rudely notched for hafting, designed for use probably as hammers or sledges. A unique group of this class of implements was developed in connection with the quarrying and shaping of steatite. It includes digging tools and picks of large size and often of rude shape, and of cutting tools of chisel-like character, shaped by flaking but often sharpened by grinding. These are fully illustrated in a subsequent chapter. We may also add sledge heads and hammers used for breaking up the rock in rhyolite, jasper, and argillite quarries, and such flaking hammers and other large tools and utensils as are in cases shaped by fracture.

Implements of the first-mentioned class originated in the quarries and in scattered shops, and were not easily made, save from material of good flaking qualities; the latter could be made of ordinary surface bowlders and of coarse, inferior stone. The former are almost universally distributed; the latter are found but little beyond the sites yielding the raw material. The former are light, thin, and symmetric, and have their genesis mainly through the leaf-shape blade; the latter are heavy, thick, and not necessarily symmetric, and never reach a high degree of elaboration.

IMPLEMENTS OF LEAF-BLADE GENESIS

TYPICAL CHARACTERS

Perhaps none of the products of aboriginal art are better known than those which may be grouped under this head and which are referred to as knives, drills, scrapers, and projectile points. Their employment must have been general, as their dissemination is almost universal.



RUDE AXES OR PICKS MADE OF QUARTZITE BOWLDERS SHARPENED AND NOTCHED BY FLAKING, FROM POTOMAC VILLAGE-SITES (ACTUAL SIZE)

Their number is beyond estimate. Their most important characteristic is their general shape, nearly all being referable to origin through the leaf-shape blade. Fill out the outline of almost any specimen, large or small, and the blade form is restored (plate XXXII). As a rule they are thin, a necessary condition for projectile points (save the most minute forms, which are merely sharp bits of stone) and a convenience in the case of knives, scrapers, and drills, which were carried more or less about the person. The typical scraper, with one side flat and the other sharply beveled, is an exception; it is illustrated in plate XXXIII, *a*, *b*, *c*, and is a rare form in this region. Another form of scraper is of leaf-blade genesis, as seen in the same plate, *e*, *f*, *g*, and in *f*, plate XXXII, which illustrate a prevailing form of scraper made by sharpening the broken end of a spearhead. Other exceptions to the rule are minute drills and other points made from bits of angular stone so small and so approximate in shape that systematic shaping was unnecessary. All of the implements of these several classes are designed to be set in handles or in the ends of shafts.

It is the common practice to speak of spearheads and arrowpoints as if they belong to well-distinguished classes, but the line can not be drawn between them with any degree of clearness. The larger forms were, in general, doubtless used as spearheads and the smaller for arrowpoints; yet it is probable that a large percentage of specimens of medium size were used in either way as occasion required. These implements were also equally serviceable for other purposes, and any of them may have been hafted and used for cutting, scraping, or digging. The slender-shafted perforator or drill, evidently adapted to boring stone, wood, bone, and the like, and in numerous cases bearing evidence of use, may also have served at times as a projectile point. The line separating these classes of objects into functional groups is therefore somewhat arbitrary, although convenient for descriptive purposes. In presenting illustrations I shall not attempt to separate them fully by function or manner of use. It is better to arrange them in groups by shape and size. One group may include simple blades of the larger sizes, unspecialized forms, which may have been used for various purposes; a second, the larger stemmed and notched specimens which served largely as knives, scrapers, and spearheads; a third, the medium-size specimens, mainly spearheads; a fourth, the smaller varieties, used mainly as arrowpoints; a fifth, drills, and a sixth, scrapers. These groups will be reviewed briefly in the order named, but in presenting the numerous illustrations further on the grouping is based principally on material in order that form genesis and peculiarities due to material may be better indicated. The grouping by shape is made secondary.

The materials found in this region did not encourage great elaboration. Quartzite was tough and coarse-grained; quartz was extremely brittle. The forms are, therefore, not elaborate and do not compare in refinement with those of the interior where flint was abundant. Rhyolite was hardly less tractable, but flint and jasper admitted of much higher refinement.

There are somewhat marked variations in the shape of objects of like class, material, and size, and this is possibly due partly to the presence of different tribes or families within the district. Though there is some tendency toward localization of particular shapes, all forms are, so far as I can learn, pretty well distributed up and down the province. Many of the differences in detail of shape may have their origin in causes operating within the limits of a particular district or within a single tribe. Of possible causes of variation may be mentioned differences in method of hafting, differences in use, variations in models, or the tendencies of individual taste.

BLADES—BLANKS, CUTTING IMPLEMENTS

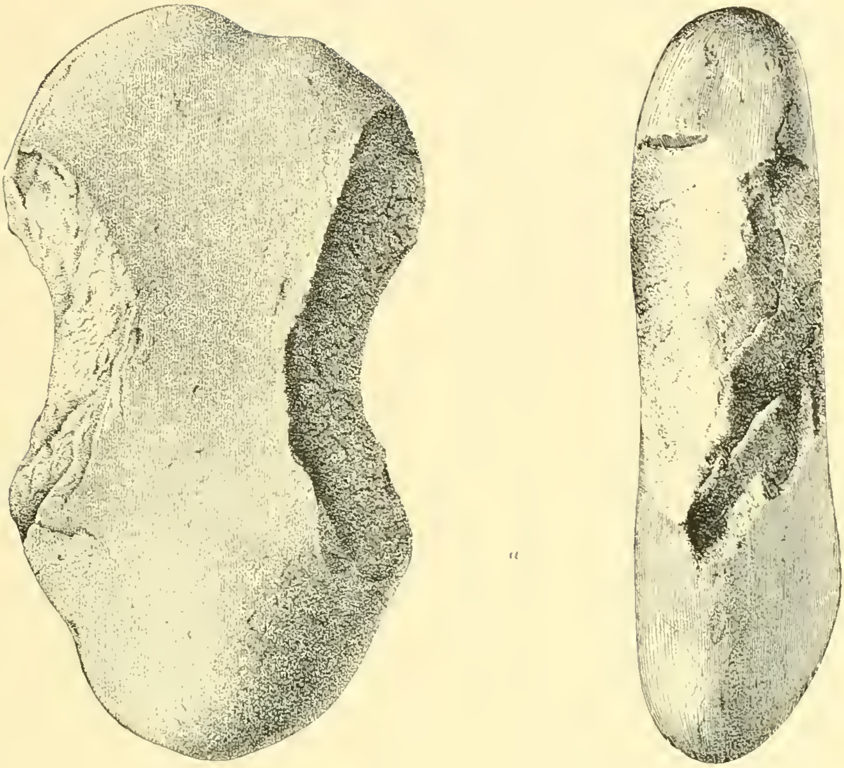
It is the fashion to speak of the leaf-shape blades as knives; but no one can say of any particular unspecialized blade, save where it shows signs of use, whether it was a finished tool intended to be used in this form as knife or scraper, or whether it was simply a blank awaiting the pleasure of the elaborator. It was not necessary to stem or notch the knife blade for hafting, as the haft could be made the full width of the blade, but the projectile point had to be trimmed down or notched at the stem end to accommodate it to the width of the slender shaft in which it was set. The large size of some of the stemmed and notched forms would seem to preclude the notion of their use as projectile points, yet it is not safe to say that any one of these objects was not used or could not have been used, on occasion, by some of the warlike natives of the Chesapeake province as heads for their spears or javelins.

It is a matter worthy of note that colonial writers rarely mention the use of stone knives, while shell and reed knives are many times referred to. One mention of the former may be given. Smith,[1] speaking of medical practices, makes the following remark: "But to scarrifie a swelling, or make incision, their best instruments are some splinted stone." This may, of course, refer either to elaborately shaped implements or to mere flakes or sharp fragments. Plate XXXV illustrates blades of quartzite; plate XXXIX, blades of quartz, and plate XLIV, blades of rhyolite.

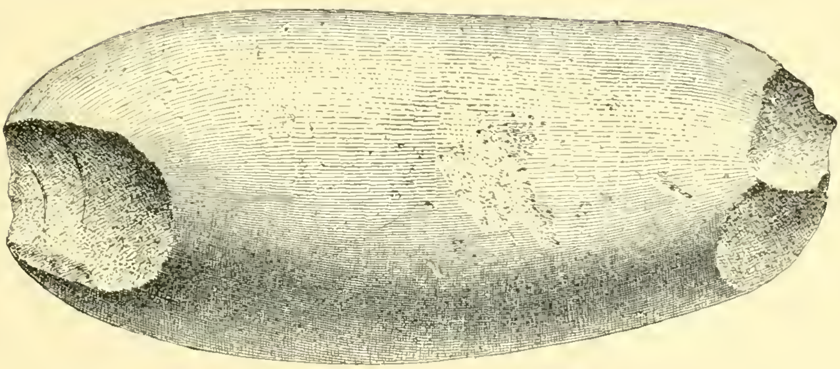
SPECIALIZED BLADES—PROJECTILE POINTS, ETC

Under this head may be placed, for convenience of description, all medium and small size points having outlines specialized for hafting, since all such may have been used for arrowpoints or for heads of spears or javelins. Colonial writers make frequent mention of the use of arrows by the Chesapeake peoples, and spears and javelins are occasionally referred to. Smith describes a variety of forms in the

[1] History of Virginia, Richmond 1819, vol. I, p. 137.



a



b

SLIGHTLY MODIFIED QUARTZITE BOWLDERS USED AS IMPLEMENTS, FROM POTOMAC VILLAGE-SITES (ACTUAL SIZE)

following extracts: "They (the Powhatan Indians) vse also long arrowes tyed in[to] a line, wherewith they shoote at fish in the rivers. But they of *Accawmacke* vse staues like vnto Iauelins headed with bone. With these they dart fish swimming in the water."[1] The Susquehannocks, inhabiting the upper Chesapeake, used arrows "fiue quarters long, headed with the splinters of a white christall-like stone, in forme of a heart, an inch broad, and an inch and a halfe or more long."[2] The Powhatan Indians pointed their arrows "with splinters of christall, or some sharpe stone, the spurres of a Turkey, or the bill of some bird."[3] Father White mentions the use of spears by some of the Maryland Indians.

It appears from the writings of Smith and others that great numbers of arrows were used, and that the natives expended them on occasion without apparent reserve. The manufacture of the points was undoubtedly a matter of great and vital importance to these people, and much time and labor must have been expended in procuring, roughing-out, and transporting the material, and in shaping the implements.

The projectile points of the Chesapeake province have a wide range in form and size. This is due in a measure to the widely diverse nature of the materials used and to the wide range of use, and partly, no doubt, to the fact that numerous tribes of people have occupied the region or have bequeathed to it their peculiar art forms. Projectile points are fully illustrated in subsequent plates.

NARROW-SHAFTED BLADES—PERFORATORS OR DRILLS

The so-called perforator or drilling point is a feature of importance in the flaked-stone art of the Chesapeake. These objects are derived, as are the projectile points, from leaf-shape blades produced in the ordinary workshops, and are of like form in all materials. They were probably used in some sort of hand drill, e. g., the pump drill in use among many tribes; and it is not uncommon to find specimens with the points rounded and worn smooth by use; yet we are not at all certain that they were exclusively used as drills, or that they are not really a variety of projectile points well adapted, on account of their shape, to use in drilling. The delicacy and brittleness of many specimens must have unfitted them for use in the drilling of hard substances. Examples in quartzite, quartz, and rhyolite are presented, along with the projectile points, in accompanying plates.

SPECIALIZED BLADES, ETC—SCRAPERS

Scraping tools were constantly required in the arts of the savage tribes, and the forms developed are uniform over a wide extent of country. In many sections special shapes were made for dressing skins,

[1] History of Virginia. Richmond, 1819, vol. I, p. 133.
[2] Ibid, p. 120.
[3] Ibid, p. 132.

shaping wood, and related uses. The most common type is a short, often rather thick, discoid blade or flake with blunt end, beveled by minute flaking from one side, which is usually flat, the other side being convex; this gives a keen and strong scraping edge. This form must have been set in bits of wood or bone after the manner of the woman's knife of Arctic peoples. These objects are, as a rule, not of leaf-blade genesis. Another variety was often made by sharpening the broken ends of projectile points. Implements of this class are usually of leaf-blade genesis. They were set in handles after the manner of ordinary knives, and are notched for that purpose (plate XXXIII, *e*, *f*, *g*). In three years' work in the tidewater region I have not obtained more than two or three well-specialized specimens of each of the classes; other collectors, however, have been more fortunate.

A very few specimens are found of imperfect semilunar shape which may have been hafted as scrapers or knives. Those brought to my attention are so rude that it is not possible to say whether they are designed shapes or only freaks of eccentric flaking.

LEAF-BLADE IMPLEMENTS GROUPED BY MATERIAL

For the reason that satisfactory separation of the various classes of leaf-derived implements—knives, scrapers, drills, arrowpoints, and spearheads—can not be made, I have brought together a series of plates and figures illustrating the whole group as developed in the three materials best representing the native work of the region. In each case plates illustrating successive steps in form development of the individual are given, while the other plates and figures are intended to convey an idea of types of form and range of shape and size.

QUARTZITE IMPLEMENTS

The quartzite implements here represented are derived almost wholly from bowlders, and in the main passed through the leaf-blade stage. The material does not admit of great elaboration or refinement of form. The larger varieties, presumably spearheads, prevail, yet all types of form known in the whole range of material appear. In numbers the quartzite tools, taking the whole Chesapeake-Potomac tidewater area, are perhaps inferior to quartz.

Plate XVII illustrates a series of steps in the individual form development of the average projectile point, beginning with the bowlder and passing forward to the leaf-shape blade—the extent of the quarry-shop elaboration; and plate XXXIV illustrates the complete morphology of the fully specialized implement of this class. It is not assumed that all or any of the seven or eight specialized specimens passed through exactly the forms indicated by the blades and rejects preceding them, these being selected merely to indicate in a general way the course of progress from the raw material to the final forms. The beginnings

a b c

SERIES OF SPECIMENS ILLUSTRATING PROGRESSIVE STAG

d e f

NG OF CELTS BY FRACTURING, BATTERING, AND ABRADING

a *b* *c* *d* *c* *f*

SERIES OF SPECIMENS ILLUSTRATING PROGRESSIVE STAGES IN THE SHAPING OF CELTS BY FRACTURING, BATTERING, AND ABRADING

may have been in large or small bowlders, fragments, or flakes, but all must have passed through kindred transformations.

Plate XXXV contains a few examples of the leaf-shape blades, the outlines varying from the oval to the imperfectly ovoid form, with one point sharp and the other blunt, the ratio of length to width also varying. These are the forms produced in the quarry-shops and in other roughing-out shops. As a rule they show traces of the bold work of the free-hand flaking, and the untrimmed edges and points bear strong evidence that they were not yet ready to be devoted to any use. They are rarely above three-eighths of an inch thick. They are found occasionally in caches, but generally on village-sites where the plow turns them out of the soil along with other classes of relics. Plates XXXVI and XXXVII illustrate many excellent examples of the specialized forms of leaf-blade genesis. They include pretty nearly the full range of what may be, with approximate accuracy, designated projectile points. It happens that none of the scraper or perforator forms are included, but these are rare in quartzite.

QUARTZ IMPLEMENTS

Quartz implements were derived from the raw material, chiefly in two forms: first, vein rock, procured from outcrops or by quarrying; and, second, water-worn pieces in the form of bowlders and pebbles, obtained from surface accumulations, outcrops of gravel, or from quarries. The former was used in the highland and down to the margin of the vein-bearing crystalline rocks—a line somewhat outside of the present fall-line. The latter was the great source of supply to dwellers in the lowland. It is not possible to distinguish implements made from the two forms of the stone save where portions of the water-worn surface are preserved. This rarely occurs in a well-finished piece, but vast areas are sprinkled with the wasters of manufacture, all indicating failures in blade making from pebbles. Notwithstanding the fact that bowlders and pebbles are nature-selected material—that is, those bits least weakened by flaws and seams—they are still extremely liable to shatter under the hammer.

Years of study in the tidewater country have led me to the conclusion that pebbles were the source of at least three-fourths of the quartz implements there found. The vein quartz is much more difficult to use, being hard to reduce to the blade form, while the pebbles are readily reduced. An evolution series is given in plate XXXVIII, the upper line showing profiles of the specimens represented in the lower line. Plate XXXIX contains a series of blades such as were derived from the working of pebbles. The range of form and size is not great. The largest are rarely so much as 4 inches in length and an inch and a half in width; the smallest are very minute. In shape the ordinary leaf-like blade is most common, some are long and slender, others wide and triangular, while a few are approximately discoid. Some of these may have been completed implements, for they are well finished and very handsome, while others, as clearly indicated by the crude surfaces, irregular edges, and blunt points, are blanks intended for further elaboration. A few of those illustrated may be rejects, as they are rather thick and clumsy.

If the blades shown in plate XXXIX were elaborated a little more by means of the bone flaker, edges and points trimmed and delicate notches cut, we should have about the series of specialized implements illustrated in plate XL. These represent some large specimens, which may be knives or spearheads, and a number of smaller size, probably arrowpoints.

Plates XLI and XLII include a pretty wide range of the smaller points, and, so far as photographic representation is capable, convey a complete idea of the Potomac valley forms. The majority of the specimens are from the collection of Mr W. H. Phillips. The long lozenge forms, occupying the upper part of plate XLI, are very plentiful and often extremely neat in finish and graceful in outline. Below are triangular forms, also very pleasing in appearance; and in plate XLII notched forms and various eccentric shapes are seen.

RHYOLITE IMPLEMENTS

The South mountain rhyolite quarry and its phenomena, and the transported masses, fragments, and blades referable to it, have received attention on earlier pages. It is now necessary only to present an epitome of the varied and interesting articles of this material that may be classed as finished implements. This brittle stone was shaped almost exclusively by flaking processes, and the final forms were in nearly all cases derived through the leaf-shape blade. The massive, or laminated, free-flaking stone encouraged the making of large blades, and the range of size in the finished objects is considerably above that of any other tidewater material. The texture was too coarse to encourage elaboration, and the specialized forms include very little beyond the simple blades and spearheads and arrowpoints and an occasional perforator. The order and manner of development of the average blade-derived implement of rhyolite are well shown in the series of drawings presented in plate XLIII. The quarry forms extend to *d*, and the cache and disseminated forms appear in *e*, *f*, *g*, and *h* (side views below, profiles above).

As shown in a preceding section, the cache blades of this material are often long and highly attenuated, and few examples of flaked blades east of the Appalachian ranges surpass in size the fragmentary specimen shown at the left in plate XLIV. Just what this blade should be called may not be determined, but it seems that such a specimen was more probably designed to be hafted as a symbol of authority or as a ceremonial object than as an implement to be used for any practical purpose. The contour of the fragment preserved would seem to

GROUP OF CELT-AXES FROM THE TIDEWATER REGION (ABOUT ONE-THIRD ACTUAL SIZE) indicate that the original could not have been much short of 12 or 13 inches in length. Blades of this general class are all very thin, rarely exceeding three-eighths of an inch in thickness. The plate contains six other blades of varying length and outline. The two larger specimens are from the Anacostia site, near the Pennsylvania avenue bridge; the others are from various points in the vicinity of Washington.

In plate XLV a number of partially or wholly specialized forms are shown. They may be classed as knives or spearheads. Spearheads are well represented in plate XLVI, and many smaller projectile points of varied form are seen in plate XLVII. They repeat in a great measure the quartz and quartzite shapes.

FLINT AND JASPER IMPLEMENTS

As already remarked of the use of flint in another place, it does not seem necessary to dwell at length on implements of this material, since they are comparatively rare, and but repeat the forms seen in other materials.

Jasper also has a somewhat meager interest in the tidewater province. Although the sources of this material are not definitely determined, it is safe to conclude that certain large and boldly flaked cache forms found in the Chesapeake country were derived from material in the mass and not from the small blocks or pebbles sometimes found in the gravel deposits of the lower Susquehanna and lower Delaware valleys.

The only quarries of jasper so far brought to public notice are those discovered and examined by Mr H. C. Mercer, of the University of Pennsylvania. They are located in Bucks and Lehigh counties, Pennsylvania. In these localities there is evidence of extensive quarrying and of considerable shaping operations. There can be no doubt that much of the jasper and many of the jasper tools found so plentifully in the Delaware and Susquehanna valleys came from these quarries or others of the same mineral belt, and it is highly probable that the hoards of blades and some of the larger flaked implements of the tidewater country came from these distant sources. It was probably difficult to secure jasper sufficiently massive to permit of the manufacture of such blades, and these objects must have represented much labor on the part ot the makers. A noteworthy hoard of large jasper blades was obtained trom a cache in a field near the mouth of South river, Maryland, 120 miles from the nearest known quarry. It may be noted, however, that no known quarry produces jasper of the dark-green color characterizing these specimens, which are now in the cabinet of Mr. J. D. McGuire, of Ellicott, Maryland.

ARGILLITE IMPLEMENTS

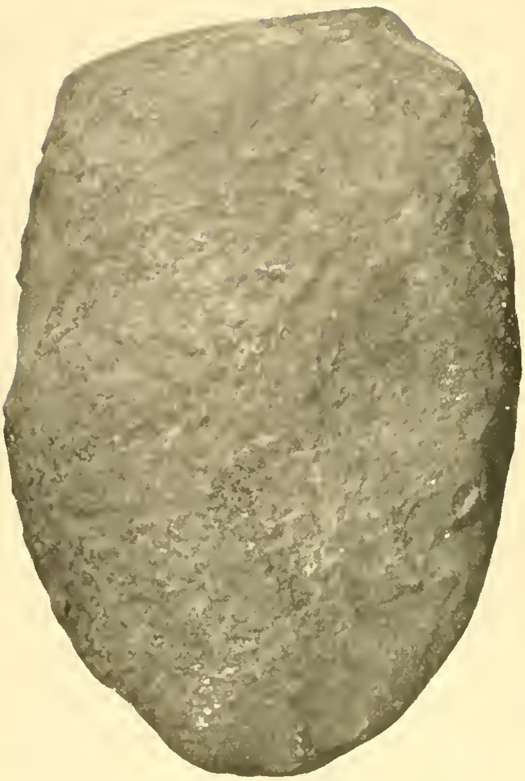
The conditions of the occurrence of argillite objects and implements in the Chesapeake province correspond very closely to those characterizing the occurrence of jasper. The objects are blades, mostly of the cache type, with an occasional specialized implement. The only source of this material known to have been extensively utilized by the ancient peoples is on Delaware river some 25 miles above Trenton. Here there are quarries and roughing-out and specializing shops, and the refuse clearly indicates the manufacture of just such blades as those obtained from caches and on village-sites on the shores of Chesapeake bay. Caches of similar blades are found in many parts of Pennsylvania and New Jersey, and there can be no doubt that the products of the Berks county quarries were extensively disseminated over the Delaware and Susquehanna valleys, and that some of them were owned and stored in the usual hoards, even so much as 150 miles south of the source of supply.

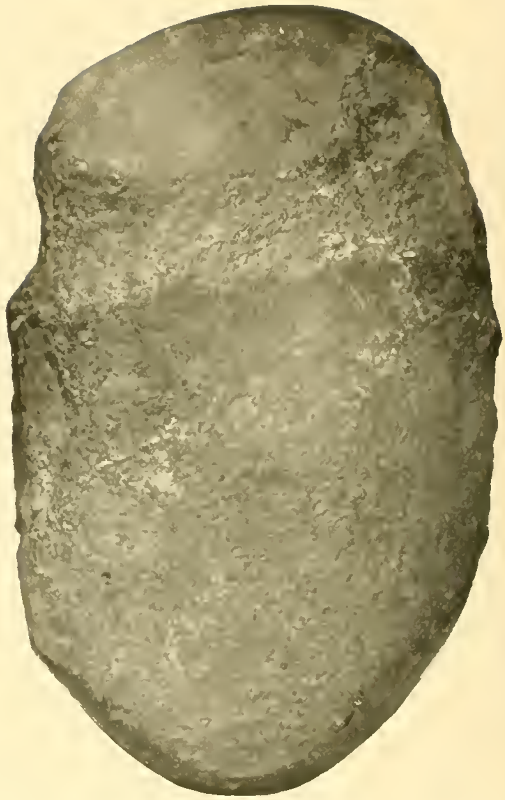
In order that the evidences of manufacture as represented by the argillite quarry refuse may be compared with corresponding features in the other quarries, a series of the rejects from the Point Pleasant (Pennsylvania) shops and associated village-sites is represented in plate XLVIII. An examination of the specimens of cache clusters from South river, Maryland, makes clear their close relationship with the forms produced in the quarry.

RUDE FLAKED IMPLEMENTS

Besides the thin forms of flaked implements which have their genesis through the blade-like blank, or through flakes or fragments of like conformation, there are many heavy forms, some of which may be regarded as extemporized or emergency tools, since they appear to have been made to supply temporary or exceptional wants, or for use largely on or near the spot of manufacture only. They may be grouped for description under the following classes: 1, hatchet-like tools, made of bowlders by striking off a few flakes, thus giving a rude edge or point; 2, ax-like implements, made like the first but having notches broken in the sides to aid in attaching a handle; their uses were probably cutting, hoeing, and the like; 3, picks and digging tools, much like the preceding and used in quarrying soapstone, as well as in other similar uses; 4, slightly notched bowlders, used as hammers and sledges; 5, hammerstones. Where bowlders were not plentiful, implements of corresponding classes were made from ordinary fragments of stone. It seems probable that these ruder implements were in many cases devoted to the same uses subserved by several more highly finished forms, and no doubt specimens could be selected connecting the lower with some of the higher forms by a graduated series. It is the intention to include here only such classes or groups of utensils as are made ready for use mainly by processes of fracturing.

The hatchet-like tool, made mainly of bowlders by striking off a few flakes from one end, is found in great numbers in many parts of the region. Though belonging to late times it is extremely archaic in type. It would seem to approach more nearly the proper idea of a paleolithic





SERIES OF SPECIMENS ILLUSTRATING PROGRESSIVE STAGES IN THE S

HE GROOVED AX BY FRACTURING-BATTERING-ABRADING PROCESSES

SERIES OF SPECIMENS ILLUSTRATING PROGRESSIVE STAGES IN THE S[illegible]F THE GROOVED AX BY FRACTURING-BATTERING-ABRADING PROCESSES

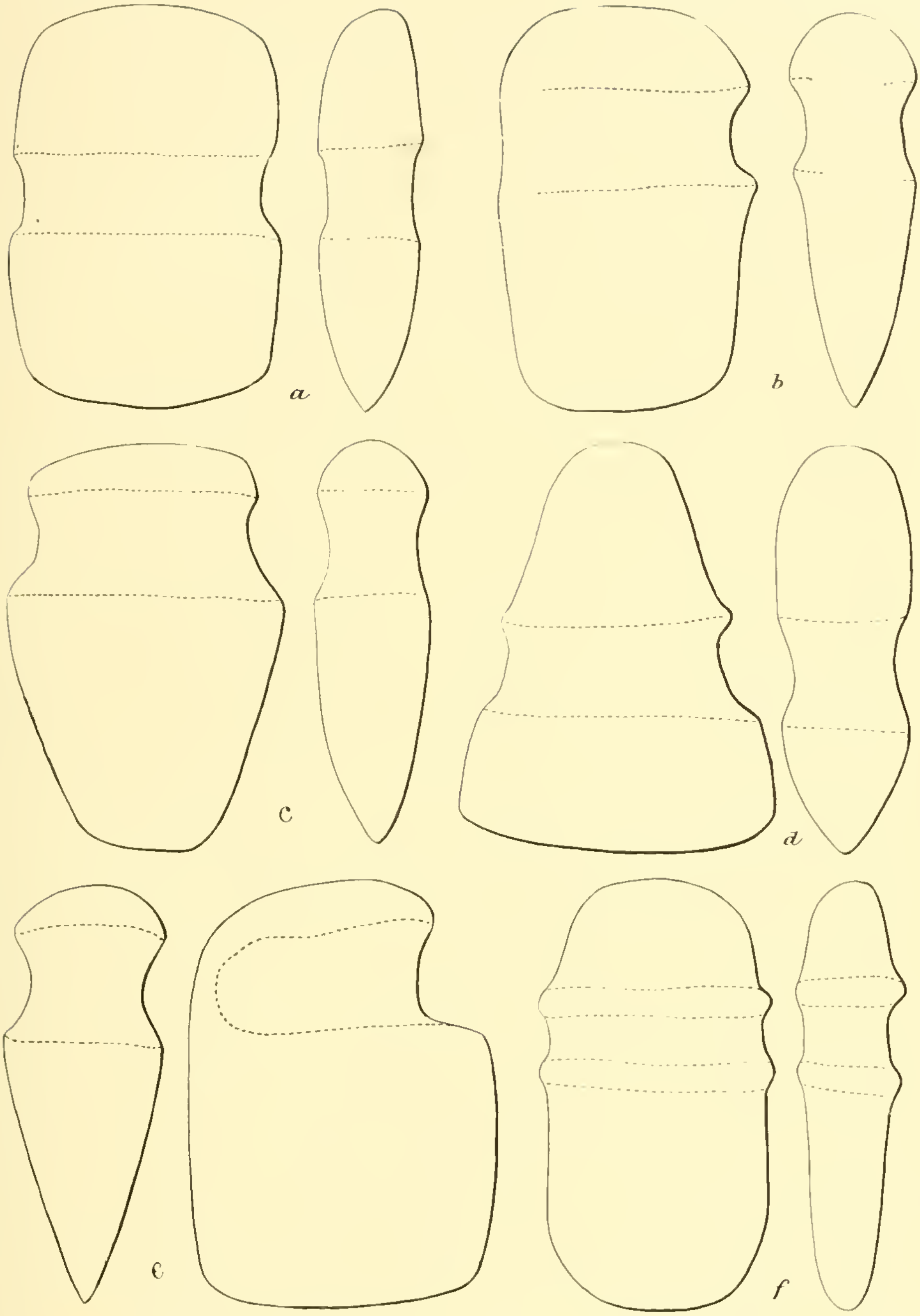
tool than any other known form, as hardly more than half a dozen blows were ever expended in elaborating its shape. It is found on fishing village-sites and elsewhere all over the bowlder-yielding districts. At Rock point on the Potomac, 80 miles below Washington, the shell banks and village-sites are literally strewn with these objects, and they are found by hundreds in the great shell bank at the mouth of Popes creek. The bowlders used were obtained in the vicinity in each case. These tools were apparently intended to be held in the hand, as there is usually insufficient space for hafting, and the unmodified end is round and well suited for grasping. Their great number and very wide utilization sufficiently indicate that they served some important function in the arts and industries of the fisher people. To cut up fish, to break bones, to open oysters, and to cut wood may be regarded as possible uses. I have selected several specimens, shown in face and profile in plates XLIX and L, to illustrate the various forms. Typical examples appear in *a* and *b*, plate XLIX. Specimen *a*, plate L, is of medium size and usual shape, and *b* and *c* are more elaborately flaked and have a greater appearance of battering or of use in rough work than is usual; the latter are rather exceptional forms. Many have broader edges and longer bodies. A specimen sharpened at both ends and probably intended for hafting is shown in *c*, plate XLIX. It is not unusual to find implements of other varieties, such as polished axes, which have become much worn or have ceased to be valued, sharpened by a few heavy strokes as are these bowlders. This form grades almost imperceptibly into the notched axes, picks, and hoe-like forms, as will be seen by reference to succeeding illustrations. These tools are identical in shape with thousands of the rejects found in our quarries where a few flakes were removed to test the material of the bowlders. They are identical also with specimens published by some authors as paleolithic implements. The sharpened bowlder tool is distinguished from the bowlder reject by the aid of the following observations: 1, it is found on the sites where implements were used, i. e., on village-sites and in shell heaps; 2, thus found it has evidently been obtained and removed from the deposits of bowlders, generally near at hand; 3, as found on village-sites and in shell heaps it often shows signs of use; 4, the same form in the bowlder-flaking shop is evidently one of the necessary forms of bowlder-flaking rejectage and never shows traces of use. The quarry reject is associated with its complement of refuse and related forms, whereas the implement on the site of use stands alone. The implement also presents suggestions of specialization when studied in numbers, but the quarry reject conforms to no one well-defined type of form. A similar form is found also in the soapstone quarries, where it was employed as a quarrying and cutting tool. It thus appears that objects of this general type, this essentially paleolithic type, may, in the Potomac valley, be either (1) quarry rejects, (2) a common variety of village-site tool, or (3) a quarry tool; but found in the vicinity of Washington, where bowlders were used by tens of thousands in blade making, the chances are a hundred to one that they are rejects of blade making.

It may occur to some that possibly this village site tool was produced in the quarries and that the rejected forms of like type are the rejects resulting from its manufacture. That this is not the case may be inferred from the facts that it usually occurs in the immediate vicinity of supplies of bowlders, and that it could be made of bowlders of inferior material, such as are found in countless places all over the Potomac region. By those who have studied the various forms on the ground, the idea that it is in any sense connected with the quarry work would not be entertained.

The notched ax is found scattered over an extended area which includes all the western tributaries of the Chesapeake. It is especially abundant in districts which, like portions of the Potomac valley, are supplied with abundance of large bowlders. In some localities these tools are quite numerous, and on sites such as the Popes creek shell heaps they are obtained by scores. As a rule they are extremely rude, and seem like tools intended for temporary rather than permanent use. They were certainly not sufficiently valuable to be transported to any great extent, and I have seen few that show pronounced marks of use. They were usually made by striking off half a dozen chips from one end of a flattish, oblong bowlder and by breaking rude notches in its sides, as shown in plate LI. The appearance is mostly that of a very elementary form of the grooved ax, the notches evidently having served to facilitate hafting. They could have been used for chopping, for digging and hoeing, or for cutting up game and breaking bones. In very many cases the edge is made by removing the flakes from one side of the bowlder only, leaving an adz-like profile. It is hard to say whether the haft was attached with the edge at right angles to the handle, as in our adzes or hoes, or whether the blade was placed as in our ax. Some idea of the variety of forms taken by these tools is conveyed by the specimens shown in plates LII and LIII. Occasional specimens show considerable elaboration, and it is quite possible to assemble a series showing a complete gradation from the simplest notched ax to symmetrically shaped and well-finished forms of grooved axes.

All of the forms referred to as picks, and which pertain largely to the quarrying and working of soapstone, are abundantly illustrated under the head of cut-stone implements, with which they are placed, not because they are themselves in any sense cut stones, but because they were employed in cutting the soapstone and because it seems better that all phenomena pertaining to that interesting and important subject be kept together. To obtain a complete notion of the ruder forms of flaked-stone implements it will therefore be necessary to turn to the pages treating of steatite.

A few other implements of correspondingly rude character are shaped exclusively by flaking, though in many cases continued use



OUTLINES OF GROOVED AXES ILLUSTRATING THE RANGE OF FORM COMMON IN THE TIDEWATER REGION

has given them the appearance of pecked, abraded, or polished forms. In *a*, plate LIV, we have a hammer or sledge—a flattish bowlder notched on the sides for hafting. The flat face is shown at the left and the profile at the right. The smaller objects of this class may have been used for sinkers and the larger possibly for anchors, for sledges, or even for weapons of war and the chase, and, properly hafted, would have been as highly effective as the more elaborately finished articles. The lower figure in this plate is an oblong bowlder that was probably hafted as a sledge, and the ends have been fractured by use. Examples of this class sometimes show traces of wear by the haft.

The foregoing varieties of rudely flaked stones are those most characteristic of the inhabited sites, including fishing grounds, shell heaps, and village-sites generally, in the Potomac and Chesapeake valleys.

Chapter IV

BATTERED AND ABRADED STONE IMPLEMENTS

GENERAL PROCESSES OF MANUFACTURE

The term pecked implements is used to designate such articles as owe certain of their more marked characteristics of form to the battering processes of bruising and crushing by successive blows—the bushing or bush-hammering of modern stone workers. The aboriginal stone worker produced this effect largely by means of pecking the object undergoing manufacture lightly with a suitable stone tool. The process is a tedious one, and especially so in the hands of a novice, but the skilled operator with proper stone and suitable tools soon defines a groove or removes an excrescence.

The battering processes do not generally stand alone, but are associated to greater or less extent with (1) flaking, which, when employed, precedes the pecking, and (2) grinding and rubbing which follow it. Percussive drilling of hard stone is a variety of battering, and rotary drilling and sawing go with the auxiliary process of grinding. Implements shaped largely by battering are so often finished by abrasion that the term "polished stone implements" is often applied to the entire group, but as I desire to deal here mainly with the more decidedly dynamic shaping agencies, abrading will not be referred to save as an auxiliary process.

All, or nearly all, primitive peoples with whom we are acquainted understand and practice the art of shaping stone by battering and its auxiliary processes. Archeologists have reached the conclusion, from a study of certain groups of prehistoric remains, that the battering-abrading operations belong to a somewhat advanced stage of human progress, and that their employment was preceded by a period in which fracturing processes alone were practically used. This is probably in a broad way true of the race, and is certainly true of many peoples or nations. The reason for this order must be sought in (1) the nature of the operations involved, (2) in the materials available to primitive artisans, and (3) in the capacities and needs of men.

Of the four leading shaping acts, which may be designated as fracturing, battering, abrading, and incising, it may be hard to say which is the most elemental. However, the ease with which, or the order in

GROUP OF GROOVED AXES FROM POTOMAC-CHESAPEAKE VILLAGE-SITES

which they would come into actual use would not depend on the simplicity of the single act, but, supposing materials and needs uniform, on the ease with which they could be made to produce desired results. Without going into details, which I have discussed elsewhere,[1] it may be stated that although the flaking act is not more simple or elemental than the others it is not decidedly more difficult, and that it has an enormous advantage over them in being capable by a single operation—a simple blow—of producing effective and constantly needed implements for cutting and piercing, whereas the other acts must be repeated many times without marked results, and repeated in such manner and order as to bring about a result not comprehensible save through long periods of experiment. Therefore, I conclude that where materials are favorable the powers and wants of men will tend most decidedly to the adoption and general practice of the flaking processes in advance of the other stone-shaping processes. At the same time it would seem that there need be assumed no great gulf between the two classes of operations. It is indeed hard to see how one could exist for a long period without the development of the other. Assuming that in general flaking is the first to be utilized, we can understand how the other process would be suggested to man. When a mass of stone is to be broken and flaked into shape, a flaking stone or hammer is called for. This hammer in use becomes bruised and gradually takes upon itself a purely artificial shape—the result of battering. If irregularly ovoid, it is in use turned between the thumb and fingers until its periphery becomes symmetric. Viewing this result it would seem but natural that the workman should understand and apply to producing other shapes the processes by means of which the tool in his hand is reduced to specialized shape. Again, the stone flaked, if it be somewhat tough, is often battered on the edges by the hammer in vain attempts to remove flakes, so that portions of the surface are changed in contour and exhibit the battered character. It seems remarkable that such operations should go on for long ages producing visible results without attempts to utilize the means of modifying shape thus distinctly suggested. At any rate the time did come when primitive men recognized the adequacy of battering as a means of shaping stones. Natural forms were first modified in use and the operations came to be understood and applied. Battering, called in its typical development pecking, was resorted to as a means of increasing the adaptability of available forms to ordinary needs, and a new and important group of shaping operations sprang into existence.

The tidewater country furnishes much evidence on the practice of this branch of the shaping arts among a rude seminomadic people. On ancient sites we find artificially modified water-worn rocks—bowlders and pebbles of hard and tenacious materials—cast away at all stages of the shaping operations from the first traces of pecking, where the

[1] Proceedings of the American Association for the Advancement of Science, Madison meeting, 1893, pp. 289-300.

work of removing an objectionable lobe or projection was just begun, to the stage where the traces of natural contour are all but obliterated. We find also specimens that have passed into the wholly artificial state, into symmetric and perfected tools, as well as others which have been modified by use, reshaped, reused, and practically worn out. Similarly we observe various worked stones of tough and hard varieties in which the pecking has been preceded by flaking. In some cases the whole surface has been flaked over, and in other cases projecting portions only have been removed. Examples are found in which the battering process has been merely commenced, and others on which the work has gone so far that only the deeper flaked conchoids are traceable. Of course many wholly artificial and highly finished articles have passed through this series of operations, preserving no record of their earlier morphology.

SPECIAL PROCESSES

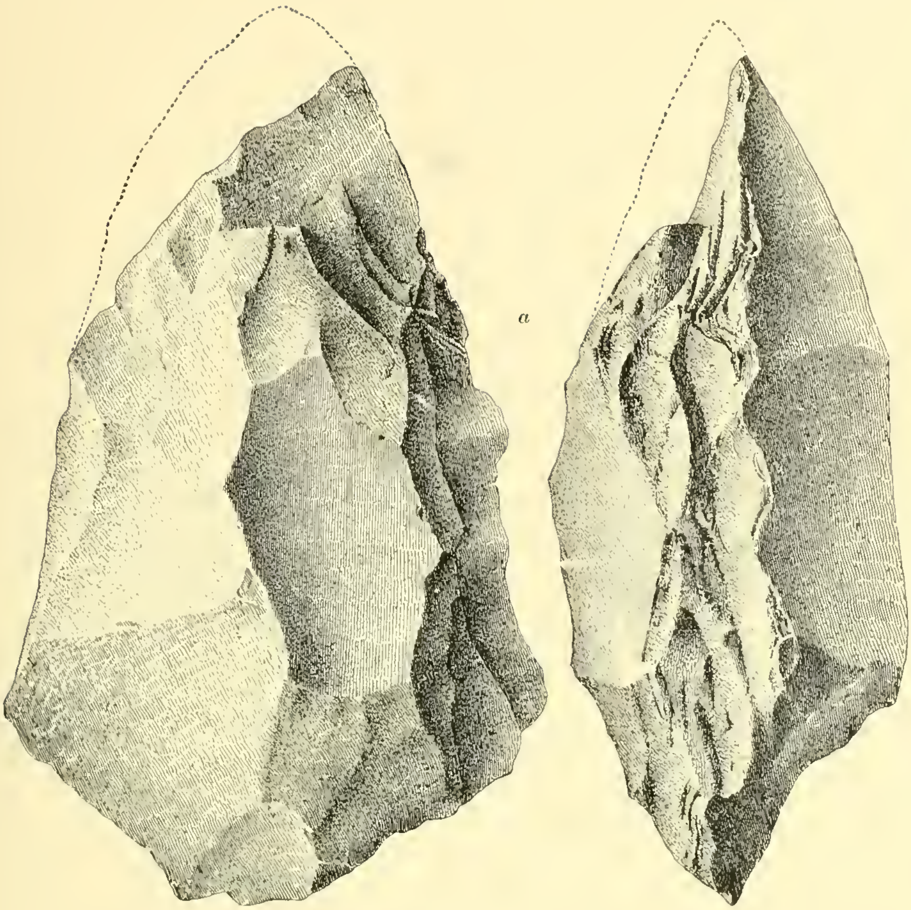
CLASSES OF IMPLEMENTS

With a people so simple and primitive as those inhabiting the tide-water country, the range of pecked and polished implements and other objects is not great. Two standard forms employed by them in common with nearly all the native peoples of America are the celt or hatchet and the grooved ax. These are too well known to call for presentation except in so far as they may be needed in explaining the processes of manufacture or in indicating local peculiarities of shape. Besides the two leading forms there are pestles and mullers, mortars, picks, chisels, pierced tablets, winged ceremonial stones, plummet-like forms, beads, and pipes; to these we may add hammerstones and grinding and polishing stones. Few of these objects occur in large numbers, and a very small percentage only of any variety exhibit high elaboration or neat finish. The artificial shapes of many of these objects are due largely or entirely to the effects of use. Illustrations of several classes of forms are given in the accompanying plates.

So far as I have been able to learn, no example of the carving of a human figure or animal form has been discovered in this whole province, a circumstance confirming the story of the potter's art as well as the records of colonial times, which indicate that although the peoples cultivated maize and were an able and enterprising race they were in many respects not far removed in matters of art from the base of the American culture scale.

MATERIALS USED

The materials employed for shaping by the battering processes must possess a high degree of toughness combined with the hardness necessary to effective use when finished. Quartzite, quartz, flint, chert, and various other brittle forms of rock are ill fitted for reduction by pecking, and were not extensively used for highly finished tools. Granites



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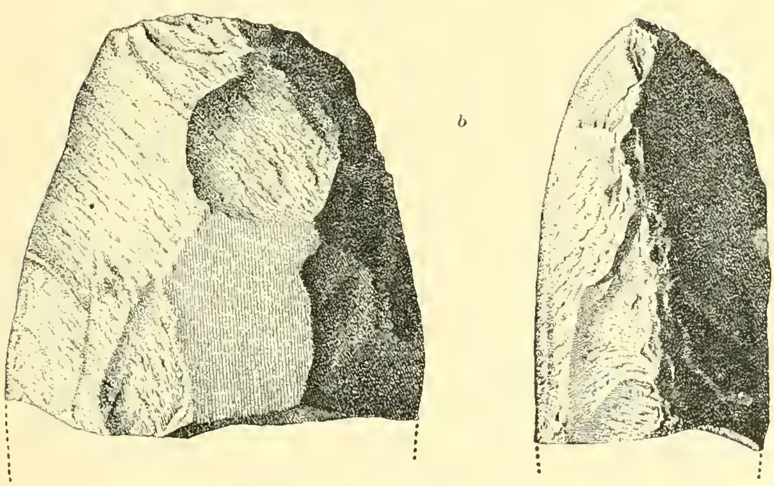

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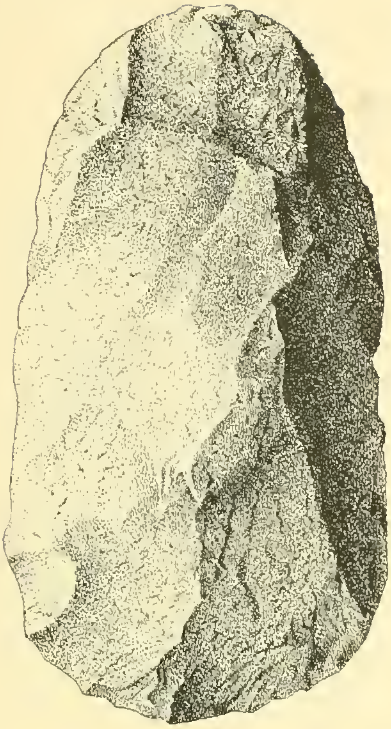
FLAKED SPECIMENS ILLUSTRATING THE REJECTAGE OF CELT MAKING; RUDE FORMS FROM SHOP NEAR LURAY, VIRGINIA; THREE-FOURTHS ACTUAL SIZE



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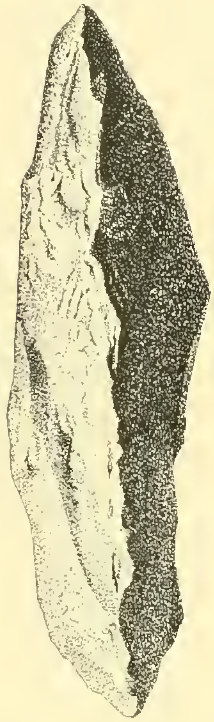

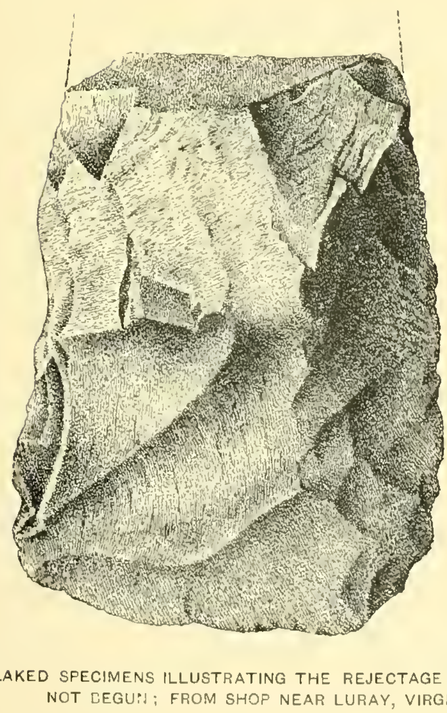

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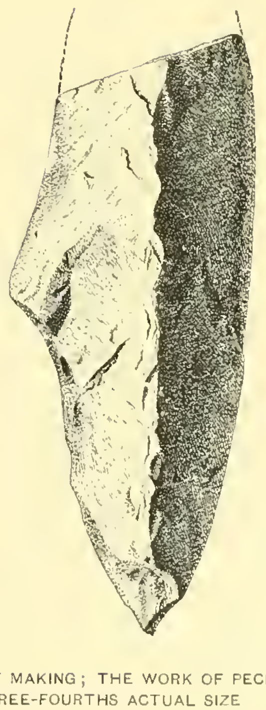


FLAKED SPECIMENS ILLUSTRATING THE REJECTAGE OF CELT MAKING; THE WORK OF PECKING NOT BEGUN; FROM SHOP NEAR LURAY, VIRGINIA; THREE-FOURTHS ACTUAL SIZE

and certain varieties of eruptive rock were preferred; these are heavy, hard, tough, and fine grained. The tidewater country furnishes none of these rocks save such as were brought down in fragmentary form by the rivers and deposited along their banks. The search for materials was not confined to the tidewater country but extended far up into the hills and ranges on the west. Shapes approaching the form desired were selected when possible, and the water-worn pieces often had the double advantage of being already approximate in shape as well as especially compact and durable. The exact source of the raw material used in any given case is difficult to determine, (1) because the pieces used are commonly erratic, and (2) because the implements and other articles made are of a nature to be treasured and hoarded up and of a size permitting ready transportation. Perhaps 75 percent of the implements made were of the compact basic volcanic rocks of the Piedmont region, and 80 or 90 percent were made from the water-worn masses or bowlders.

EXAMPLES OF THE IMPLEMENTS

The manufacture of pecked implements can not be studied so readily and satisfactorily as can that of flaked stones, for the work was not often so extensive as to lead to the opening of quarries and the development of permanent workshops where evidence could accumulate, yet we are still able to secure full information with respect to the processes and steps of manufacture. Village-sites in the vicinity of deposits of the raw material yield ample evidence as to the nature of the various operations.

Two series of illustrations presented herewith will suffice to show the processes and progress of the shaping of pecked tools. These series (plates LV and LVII) are composed of a number of different specimens selected of a size and shape to represent as nearly as possible the appearance that would be assumed at successive stages of progress by a single specimen undergoing manipulation.

The evolution of the celt is shown in plate LV. The first three specimens are rejects or unfinished forms thrown aside during the process of shaping. We begin with a water-worn stone, 1, approximating in general outline the tool to be made. A few flakes have been removed, making the edges thinner and sharper and thus saving a large amount of pecking. In 2 the surface has been gone over roughly with the pecking hammer, reducing the ruggedness; in 3 the pecking is well advanced, and in 4 the grinding is well under way; 5 represents a specimen well polished and with marks of use, and 6 is a celt that appears to have been much shortened by use and resharpening.

The range of contour is not great in these simple tools, yet there are marked variations in proportion; thus we have cylindrical, flat, pyramidal, and pointed forms, and there are always local variations indicating differences in people, material, functions, etc. In plate LVI a group of celts from the tidewater village-sites is presented.

A series of forms illustrating the development of a grooved ax is shown in plate LVII. These specimens were obtained from village-sites in the neighborhood of the head of tidewater on the Potomac. On account of the length of the series I have omitted the bowlder which would naturally precede the artificially shaped series. The first figure represents an early stage in the work of shaping. The side shown has been flaked into shape save at the top where a portion of the bowlder surface is still seen. The work of pecking away the irregularities has extended over most of the surface, and the deeper conchoids at the edges, and one or two some distance from the margin, are still visible. The opposite side is less fully worked, the original surface of the bowlder being less than half removed. The groove has not been commenced save perhaps as indicated by a very faint depression at the left. In this rudimentary state it is difficult to determine, save by the general outline, whether a celt or a grooved ax was to be made.

In the second example the bowlder chosen was originally much nearer the general outline desired than in the first case. Little flaking had to be done. The groove is already well under way, although fully one-half of the original surface remains untouched either by the flaking or by the pecking hammer.

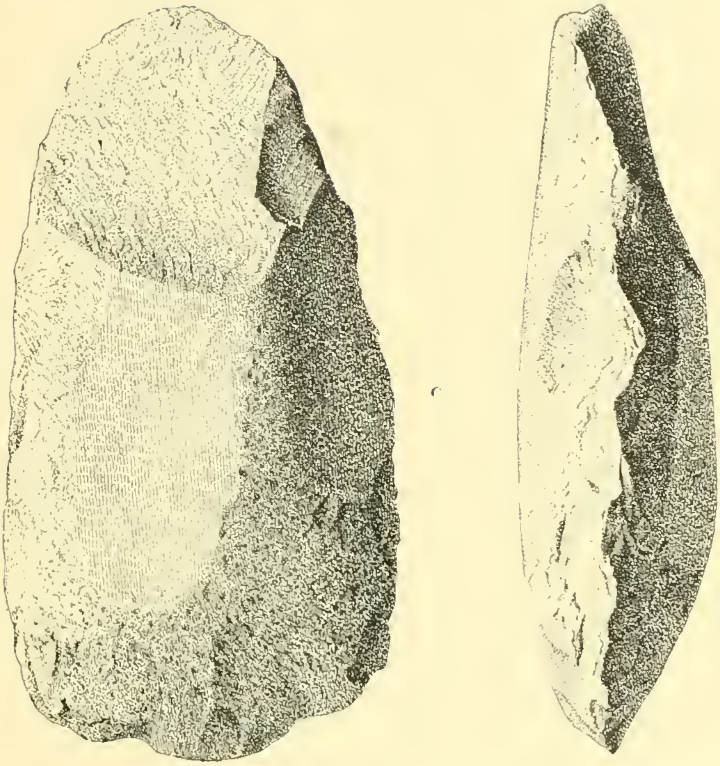
In a third specimen, omitted from the series to reduce its length, the battering operations are well advanced, small portions of the original surface only remaining. There is a freshness and crudeness about the work, indicating that the specimen, if regarded as complete, had not yet been devoted to use.

The next example (the third illustrated) bears evidence of use, and was probably finished, though the edge has been broken by accident or flaked for remodeling. It is somewhat crude in surface, and retains small patches of the original bowlder surface.

The fourth specimen figured is apparently a finished implement, though bits of the bowlder surface still appear. The battered surface has been considerably rubbed down and the edge has been ground.

The last specimen of the series is a highly elaborated and well-finished specimen, purely artificial in every part. The battered surface is entirely removed by abrading operations, and the blade and the groove are well polished—first by the finisher and second, no doubt, by use. A final specimen, originally in the series, but omitted for want of space, shows much evidence of use and repeated sharpening of the edge. The blade is shortened and blunted, and the poll is well worn. In size the axes of this region vary from less than 2 inches in width by 3 in length to 6 or 7 inches in width by 12 in length. Their shapes are probably less varied than those of many other regions, yet the extremes of shape are very wide apart. The series of outlines presented in plate LVIII will serve to convey an idea of the range of form.

A broad distinction in shape is based on the manner of hafting. In one group the groove extends entirely around the implement, while



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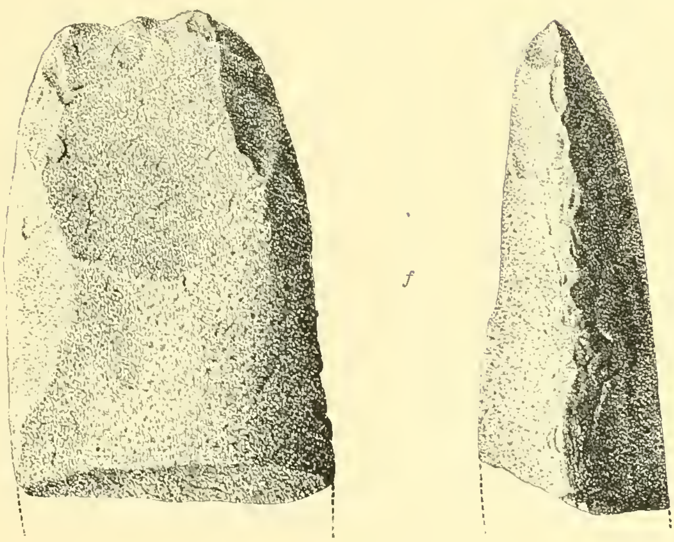

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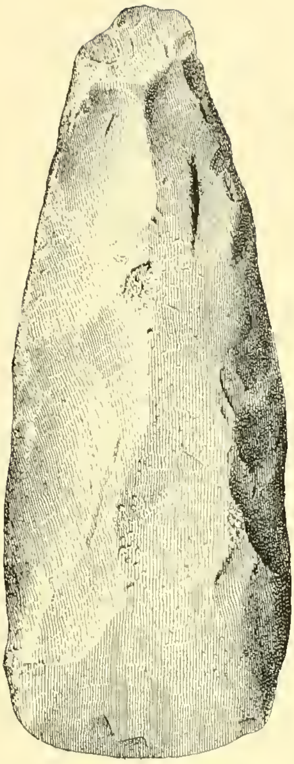
SPECIMENS ILLUSTRATING THE REJECTAGE OF CELT MAKING; THE WORK OF PECKING BEGUN; FROM SHOP NEAR LURAY, VIRGINIA; THREE-FOURTHS ACTUAL SIZE



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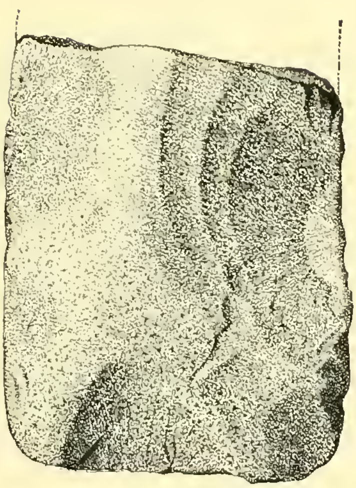

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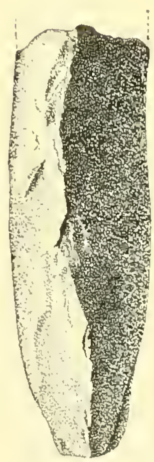


SPECIMENS ILLUSTRATING THE REJECTAGE OF CELT MAKING; THE WORK OF PECKING WELL UNDER WAY AND GRINDING COMMENCED; FROM SHOP NEAR LURAY, VIRGINIA; THREE-FOURTHS ACTUAL SIZE

in another group one lateral edge is straight, being so arranged as to permit the wedging of the haft band. There are specimens, however, varying so far from the type forms as to bridge the gap between types. The specimen seen in *a*, plate LVIII, is flat and rectangular in outline, with encircling groove in the middle; *b* is similar, but with groove more shallow on one margin, and placed about one-third of the way from the top; *c* has a wide encircling groove near the top and a narrowing toward the point; *d* has the groove very low on the shaft and the blade is wide at the edge; *e* has one straight side for wedge hafting, and a wide projecting shoulder below the groove in the opposite edge; *f* has the groove bordered by low ridges all around.

A very good idea of the appearance and range of form of these implements may be gained from the numerous examples brought together in plate LIX. These specimens belong partly to the National Museum and partly to the collection of Mr W. H. Phillips. Nearly all are from the village-sites of the Potomac valley.

MANUFACTURING SHOPS

Pecked, ground, and polished implements were made in large numbers by our aboriginal tribes, but not in such abundance as were the flaked tools. They were in a measure luxuries, requiring time and skill in manufacture, and serving no purely utilitarian purpose that could not be served almost as well by the products of pure flaking—a shaping process many times more economical of time and labor than the battering-grinding processes. As a result of this relation of the two great classes of processes, the phenomena of manufacture observed by the archeologist present many decided differences.

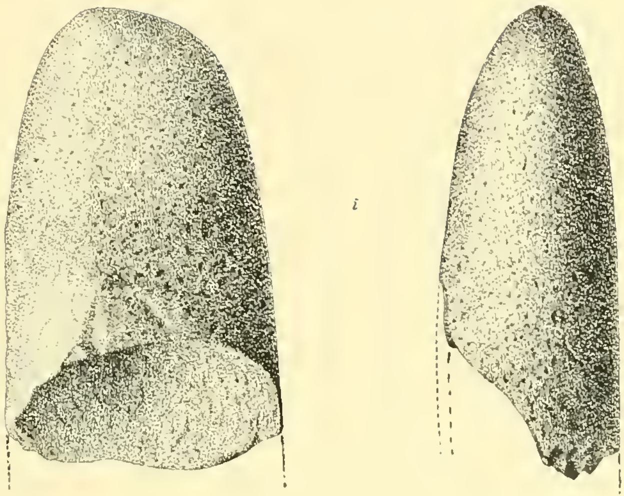
The manufacture of implements in large numbers required abundance of material, the deposits of which had to be uncovered and then broken up and removed, and this resulted in the opening of quarries and in the accumulation of large bodies of débris. This is true of the manufacture of flaked and cut-stone implements, as we have seen, but the battered-abraded tool used in limited numbers usually had a sporadic or random origin, suitable pieces of stone being picked up and utilized; the amount of the product depended very considerably, no doubt, on the plenitude of convenient pieces of stone. Rarely, therefore, do we find sites where the making of these forms was carried on extensively. The phenomena of manufacture by pecking and grinding, being scattered, have not been so well understood as the phenomena of flaking.

The variety of stone most used for the manufacture of celts and axes is a compact, greenish-gray trap or trap-like rock derived originally from the highlands of Maryland and Virginia, but obtained by the aborigines very largely from the bowlder beds of the tidewater rivers near their exit from the highland or at other points higher up the streams where partly rounded fragments had been deposited in large numbers. A great deal of shaping was done on the various village-sites about the Little falls of the Potomac and on other streams at the crossing of the fall-line.

The most striking example of this class of site yet observed is located in Page county, Virginia, 2½ miles east of Luray. The spot was first visited by Mr Gerard Fowke in 1892; but his report,[1] dealing with evidences of dwelling and mound building, contains slight mention of the phenomena referred to here. The site, which must be that of an important aboriginal village, occupies several acres of bottom land located on the eastern side of Pass creek, a few hundred yards above its confluence with Hawksbill creek. The only notable topographic feature of the site is a mound some 3 feet high and 200 feet in diameter, in which Mr Fowke found human remains in almost incredible numbers, besides occasional implements and utensils deposited with the dead. There are many graves scattered over the terrace, a row of eight, each containing decayed human bones, together with implements and earthenware, having been freshly disturbed by the plow at the time of my visit. The materials utilized in implement making by the inhabitants were derived from great accumulations of pebbles, bowlders, and partly water-worn fragments of rock occurring in the banks and bed of the stream and now exposed where the floods have torn channels through the alluvial bottom; and probably also from deposits of similar but rather coarser materials outcropping in the face of a terrace which rises to a considerable height from the eastern margin of the narrow bottom. On the village-site about the mound the phenomena of manufacture are more or less confused with those of utilization, but separation of the varied features is in the main possible and easy. The evidence of manufacture consists of large quantities of rejectage, comprising broken masses of stone, tested bowlders and rejects of all stages of development, together with flakes and hammerstones. The phenomena of dwelling are—aside from the mounds and graves—arrowpoints and spearheads, drills, worn celts and axes, pitted stones, mortars, pestles, and pottery.

Two principal materials were utilized and two distinct classes of implements were made, leaving equally distinct varieties of rejectage. Quartzite was utilized in making the ordinary flaked tools, mostly projectile points, and the ground is filled with turtlebacks, flakes, and broken blades of material, duplicating the rejectage of the well-known tidewater sites. The greenish-gray trap or trap-like rock was employed in the manufacture of battered-abraded tools, mostly celts, and the flat ground about the mound and extending from the stream back to the base of the terrace is strewn with the rejectage. This stone occurs in bowlders and irregularly water-worn masses in the banks of the stream and scattered over the floodplain, but not to any extent in the higher-cut terraces which represent the Lafayette period. It was assumed, therefore, that the implement rock had a local origin

[1] Archeologic Investigations in James and Potomac Valleys. Bull. Bur. of Eth., 1894.



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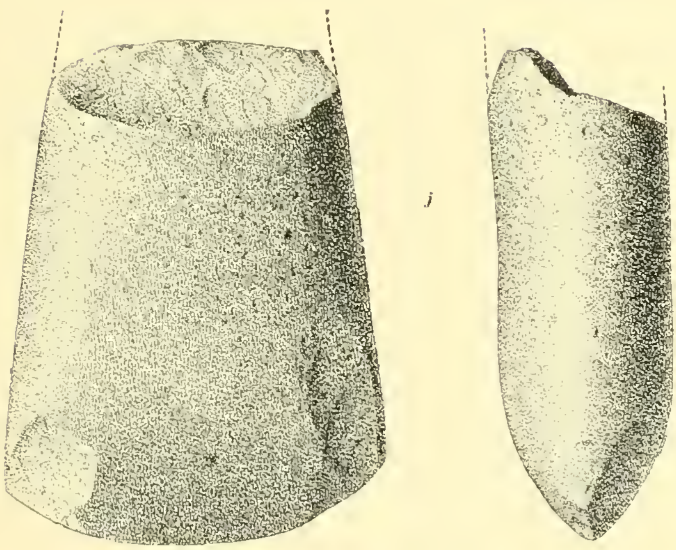

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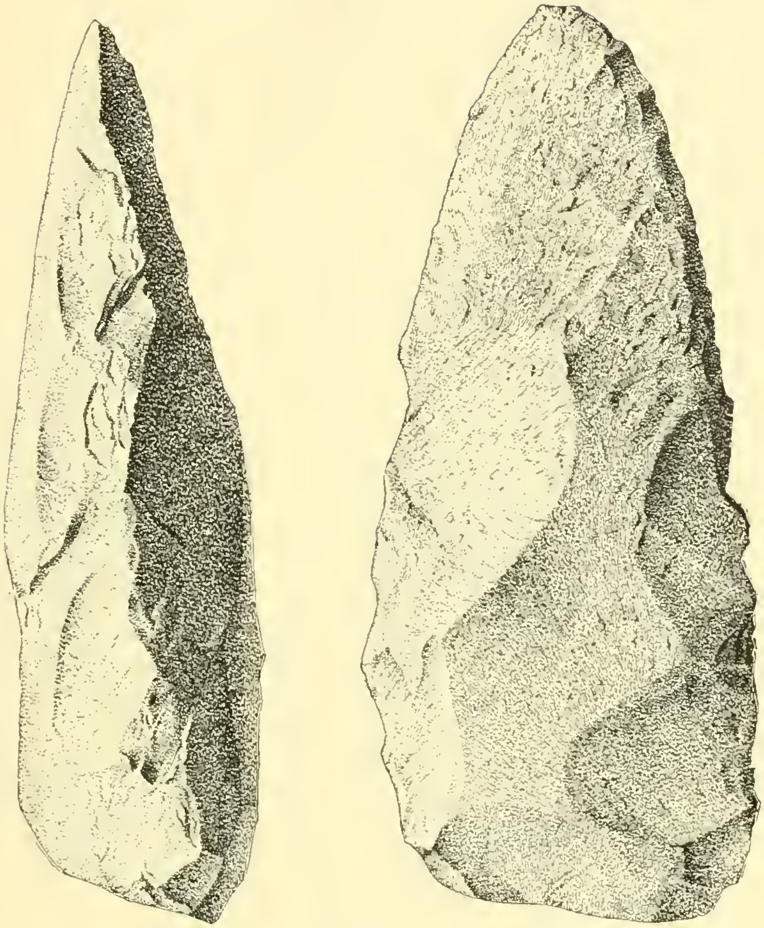
SPECIMENS ILLUSTRATING BREAKAGE IN CELT MAKING; PECKING AND GRINDING WELL ADVANCED; FROM SHOP NEAR LURAY, VIRGINIA; THREE-FOURTHS ACTUAL SIZE



SPECIMEN ILLUSTRATING ROUGHED-OUT CELT, VERY THICK AT THE LOWER END; FROM SHOP NEAR LURAY, VIRGINIA; THREE-FOURTHS ACTUAL SIZE

This object might readily be taken either for a reject of leaf-shape blade-making or for a completed implement of one of the larger varieties; but, found on a celt-making site, it may safely be classed as a reject of celt making. It is a typical celt blank, defective, however, in having insufficient thickness of poll and at the same time too great massiveness at the broader edge. The latter condition would have made the pecking necessary in producing an edge very prolonged and laborious

somewhere within the drainage of Pass creek. Mr W J McGee, who accompanied me to the spot, undertook to trace the material to its source and met with almost immediate success. Observing that the particular variety of stone did not occur to any notable extent in the beds of neighboring streams, he followed Pass creek to the forks, and there found it confined mainly to the bed of the middle fork. Ascending this, he soon encountered a body of intrusive rock, a rather coarsely crystalline diabase, not identical save in parts with the rock used by the Indians, which is of finer grain and has the appearance of a sedimentary slate or shale altered by contact with the intruded mass. It appears, as remarked by Mr McGee, that the spot occupied by the village was probably the only spot to be found on which this stone could be found in forms well suited to the needs of the implement maker, and at the same time in sufficient quantity to make extensive manufacture possible. It is not improbable that the village came to be located here as a result of the discovery of these conditions.

It was found that in nearly all cases the work of shaping by the battering-abrading processes was preceded by flaking the rounded masses into approximate shape. Rejects representing all stages of the work of flaking, pecking, and grinding are found in numbers. There is the bowlder or mass with a few flakes removed in testing, or the shattered fragments resulting from breakage under the preliminary testing or shaping blows; there are hundreds of rejects representing early stages of manipulation, the thick turtleback forms duplicating in general appearance the corresponding rejectage of projectile-point making; there are the approximate blade-like forms but rarely approaching thinness; there are many pieces broken under the flaking hammer at all stages of the work; there are also many specimens in which the pecking has just begun, and others more advanced, and these stages are represented by much breakage under the pecking hammer; finally, there are the completed implements with ground edges and surfaces, in which the pecking and grinding has to a large degree obliterated the conchoids of flaking.

Although the celt is usually classed with the pecked and polished implements, it is readily seen that on this site flaking was of greatest importance as the main difficulties were encountered, the chief shaping work accomplished, within the flaking stage. The pecking removed excrescences and added to symmetry, and grinding reduced the edge to an even curve and uniform bevel. Grooved axes also were made on this site, but to a less extent, the operations being well represented, however, in the rejectage and in numerous finished implements occurring on the site.

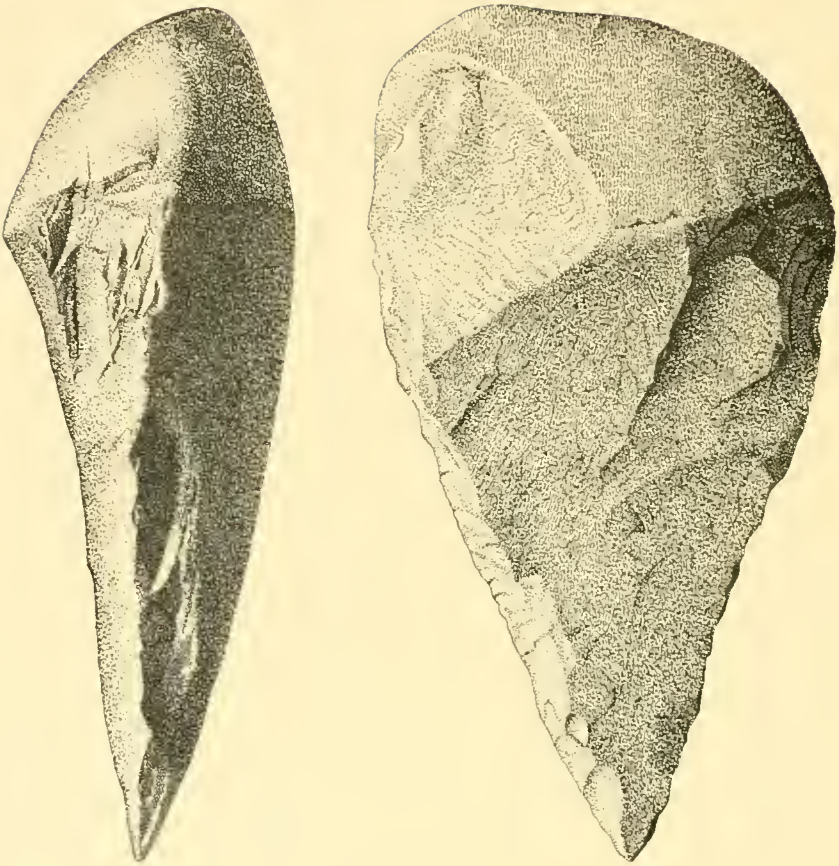
The series of specimens presented in plates LX to LXIV illustrate a progression from incipient stages through a succession of rejects, fragments, and unfinished forms to broken specimens of well-finished tools. The reference letters are continuous through the set of plates.

The first step—the testing and shaping of the crude mass—though represented by much rejectage, is omitted for economy of space. An illustration of a slightly advanced stage is given in *a*, a thick, clumsy form, rejected no doubt on account of the breaking away of portions of the upper end. A half blade representing a somewhat more advanced stage is given in *b*, in which a portion of the water-worn surface remains; and *c* and *d* illustrate further progress in flaking out the thick blade. In *e* and *f* the battering has begun, the former having been rejected probably on account of defective shape at the upper end, and the latter having broken under the hammer. In the fragment *g* the pecking was well under way, and in *h* much of the surface has been pecked and the edge with portions of the sides ground. In this case the flaking seems to have been so successful that little pecking intervened between the roughing-out by the flaking process and the finishing by the grinding process. The specimen shown in *i* is the upper end of a well-advanced specimen, and *j* is the blade of what must have been a perfected implement. It is, of course, impossible to say whether these latter pieces were broken during the finishing operations or in use.

COMPARISON OF CELT MAKING WITH BLADE MAKING

A comparison of the rejected forms produced in celt making as practiced in such shops as that of Pass creek with corresponding forms from the flaked-blade shops such as those of Piny branch will prove instructive. In general appearance the rejects of the two sites are very much alike. At a glance we see that the form constantly kept in view in both cases is of leaf shape, one end being decidedly pointed and the other broad and abruptly terminated. We observe, however, that in the flaked group—the leaf-shape group proper—the *pointed* end was designed to be finished for use, and that in the group shaped by flaking, pecking, and grinding—the celt group—the *broad* end was designed to form the edge of the implement, and this distinction can be traced in the rejectage back toward the inceptive stage by the difference in degree of attention given to the two ends. In the one case the narrow end was to be specialized for use and the broad end for hafting; in the other, the broad end was to be specialized for use and the narrow end for holding or hafting. In general, we may say that rejectage in the one class was the result of too great thickness, and in the other class of (in many cases) too great thinness. Two excellent examples of failure in celt making resulting from too great thickness at the broad end and thinness at the small end are shown in plates LXV and LXVI.

As made on the Pass creek site, the grooved axes were roughed-out by flaking pretty much as were the celts, rude notches being broken in the sides as the only possible contribution of the flaking process to the groove making. In plate LXVII specimens of axes are given, showing traces of the conchoids of flaking, though the implements are well advanced through the subsequent pecking and grinding stages.



SPECIMEN FROM CELT SHOP NEAR LURAY, VIRGINIA; PROBABLY REJECTED ON ACCOUNT OF DEFECTIVE WORK WITH FLAKING HAMMER; POSSIBLY AN IMPLEMENT INTENDED FOR LOCAL USE; THREE-FOURTHS ACTUAL SIZE

Plates LXVIII and LXIX are devoted to the illustration of the hammerstones of this site. They are interesting as representing all the forms used in flaking, as well as pecking and grinding, on a site where nearly every form of tool was made and where every shaping process was employed. I do not consider it probable that any fully satisfactory separation of the specimens used for one purpose from those habitually employed in another can be made, though it is to be expected that each process separately practiced would lead to pronounced specialization. The first specimen of the series (*a*, plate LXVIII) is a water-worn pebble modified by crushing and flaking of the edges, probably in part or wholly by use, while *b* retains little of the natural surface, and at least a part of the flaking was manifestly designed to give shape to the object. The specimen shown in *c*, plate LXIX, is a stage further advanced, the surface being partly battered into roundness, and *d* is still more highly specialized. The last specimen of the series, *e*, has been much reduced by pecking and perhaps, in part, by abrading, and exemplifies the pitted hammerstones characteristic of the eastern United States.

MISCELLANEOUS PECKED IMPLEMENTS

As already remarked, the pecked and abraded implements of the tidewater province comprise few objects aside from the celt and the grooved ax. Several varieties are represented, but the numbers are limited and the shape and finish, save in a few rare exceptions, are rather rude. The accompanying plates, from LXX to LXXV, inclusive, illustrate such varieties as I encountered during the period of my investigations. Numerous more perfect implements of several of the classes have been found, but they are now out of my reach.

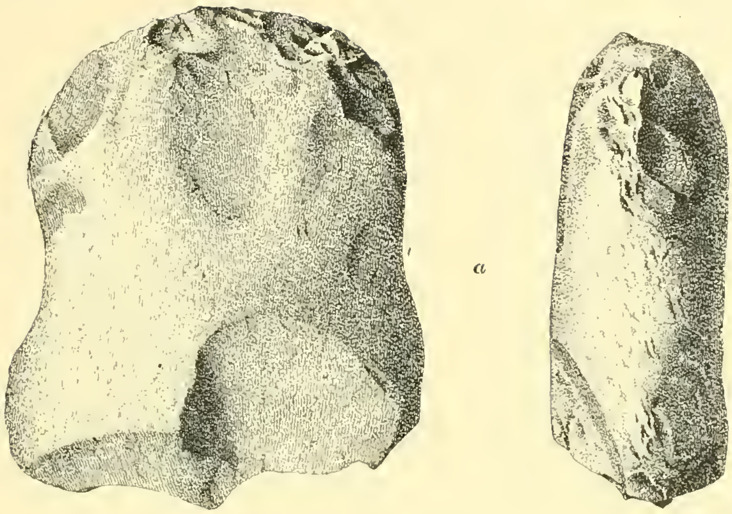
Plate LXX contains four examples of perforated tablets, two having two perforations and two having one each. The fragment *a*, made of gray slate, is from the Potomac near Washington and is covered with apparently meaningless engraved figures. The specimen shown in *b* is of red-banded slate and was obtained from the great shell deposit at the mouth of Popes creek, Maryland. The large specimen *c* is of banded slate and was found in the highland in Virginia. The small fragment *d* is from the District of Columbia.

Four examples of winged ceremonial stones are illustrated in plate LXXI. The roughed-out form *a* was obtained from a village-site at Little falls, and the other specimens, all fragmentary, came from the vicinity of Washington.

The pitted stones and mortar shown in plate LXXII are from the great shell heap at the mouth of Popes creek, and are common forms. The same may be said of the upper figure in plate LXXIII. The pestle shown in *b* was found on a village-site at Halls landing, Patuxent river; the pestle *c* was picked up in a field above Little falls, and the sinker came from a village-site near Little falls.

Of the peculiar stones illustrated in the upper figures of plate LXXIV I will not venture to say more than that they are apparently abrading implements, but whether they were for the shaping of stone tools or the dressing of wood, bone, or thongs can not be determined. The material appears to be a dark-gray eruptive rock. The lower specimen is of a somewhat gritty stone and was probably a simple grindstone. All are from sites about the head of tidewater on the Potomac.

The hammerstones brought together in plate LXXV represent the varieties most common on the village-sites of the province. All are from the tidewater Potomac. The smaller specimens in the upper line are of quartz and the others are of quartzite.



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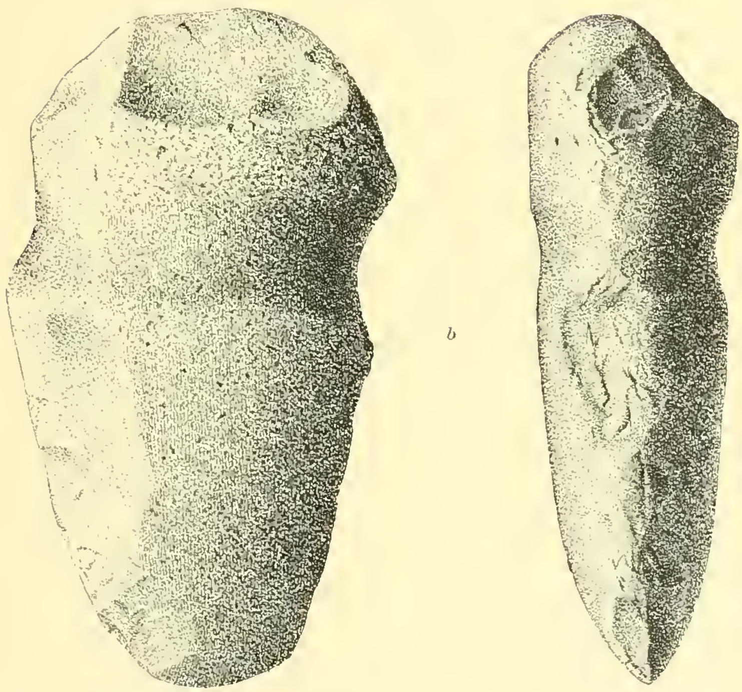


b

SPECIMENS ILLUSTRATING THE MANUFACTURE OF GROOVED AXES; FROM THE CELT SHOP NEAR LURAY, VIRGINIA; THREE-FOURTHS ACTUAL SIZE

Chapter V

INCISED OR CUT STONE UTENSILS

SCOPE OF THE TOPIC

This chapter is made to include two distinct yet necessarily associated groups of phenomena: 1, all that relates to the origin, manufacture, nature, use, and historic significance of utensils shaped by the incising methods; and, 2, all that relates to the utensils and implements employed in the shaping operations. In order that the whole subject of the manipulation of the softer varieties of stone might appear together as a unit in this place, the various flaked, battered or pecked, and polished implements used in quarrying and carving were passed over with mere mention in the sections to which they strictly belong, and are presented in some detail in the following pages, with a series of illustrations.

PROCESSES AND MATERIALS

Under the head of cut stone we have to deal with but few materials, and only one of these (steatite, or soapstone) was of importance in the native art of the tidewater country. Mica, serpentine, clay-slates, and others of the softer calcareous and argillaceous rocks were sparingly shaped by the process in some sections. The shaping operations were necessarily confined to narrow limits by the lack of effective cutting tools. Steatite and like soft and tough massive substances were cut with pointed pick-like tools and by edged, chisel-like blades, probably in most cases set in some sort of handle for direct free-hand operation, or with other classes of handles, to be operated with the aid of a mallet of bone or of antler or wood. Mica must have been cut with sharp edges or points, such as are furnished by the fracture of glassy varieties of stone.

Subsidiary to the incising processes in the shaping of soft stones are several of the other processes, such as sawing, drilling, scraping, and grinding.

USE OF MICA

So far as we can learn, mica was not extensively used by the Chesapeake-Potomac peoples; but it can not safely be affirmed that it was not used in some quantity in nearly any given locality, since the material is not sufficiently durable to be preserved, save under very favorable conditions. Mica does not occur in forms suitable for working within considerable distances of tidewater sites. It is said to have been worked by the natives in several counties of southern-central Virginia and in Pennsylvania and the Carolinas. The processes of mining, as observed in the mines of North Carolina, appear to have been much the same as in the quarrying of steatite. The deposits were uncovered and the massive crystals were broken up with hammers and the best sheets secured to be used for mirrors, or cut into desired shapes for ornaments. In the spring of 1893 Mr De Lancey W. Gill went to Mitchell county, North Carolina, under my direction, to collect materials representing the ancient mica-quarrying industry for the Columbian Exposition at Chicago. Numerous quarrying implements resembling those used in the soapstone quarries were found, and the excavations are reported to be quite as extensive as in any other class of the aboriginal quarries of the east.

STEATITE UTENSILS

CHARACTER, USE, AND DISTRIBUTION OF THE MATERIAL

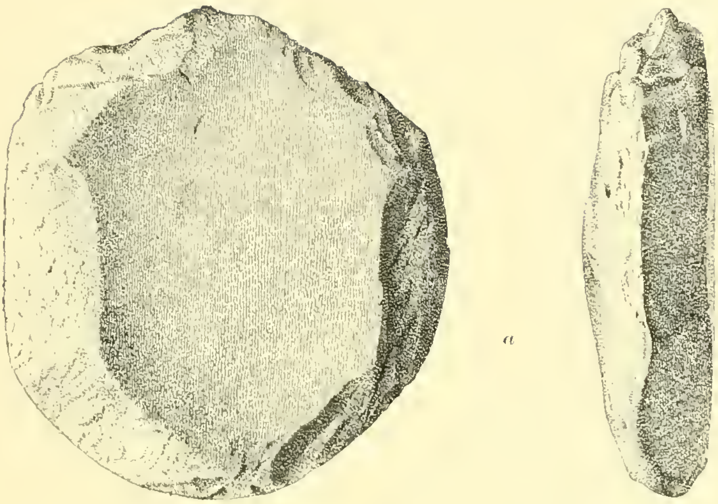
Steatite (or soapstone) was used somewhat extensively by the natives of the tidewater country in the manufacture of pots, dishes, and cups, as well as of smaller articles, such as pipes and ornaments. It was obtained along the western border of the tidewater country, either from the surface or by quarrying, and the articles made are scattered over the entire province, occurring somewhat less frequently as we pass outward toward the Atlantic shore-line. The larger objects were extremely heavy and their transportation was necessarily limited largely to the waterways.

Steatite is of common occurrence over a wide belt of territory extending through the New England states and continuing down the Atlantic slope to Alabama. In Maryland and Virginia the best-known deposits occur along the eastern border of the Piedmont highland, often within the border of the tidewater area. Its geologic relations and character are now pretty well made out.

Being a tenacious rock, it resists erosion and is consequently well exposed in stream banks, in cliffs, and on the crests of hills and ridges. The outcrops have been worked by the aborigines in innumerable places in Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New Jersey, Pennsylvania, Maryland, Virginia, the Carolinas, and Georgia. More recently the whites have mined it extensively, and many of the quarries originally worked by the Indians have been reopened for commercial purposes, and the traces of the ancient operations thereby partially or entirely obliterated. At the same time this work has resulted in calling the attention of students of archeology to the subject and in giving them an excellent opportunity for investigating the ancient industry.

SURFACE INDICATIONS OF QUARRYING

As a rule the surface indications of the ancient operations are not distinctly marked. The pittings are commonly not very deep; on



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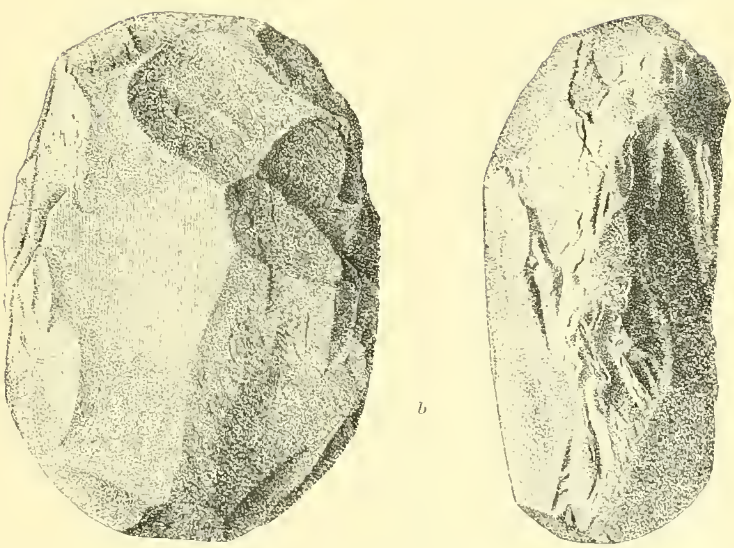
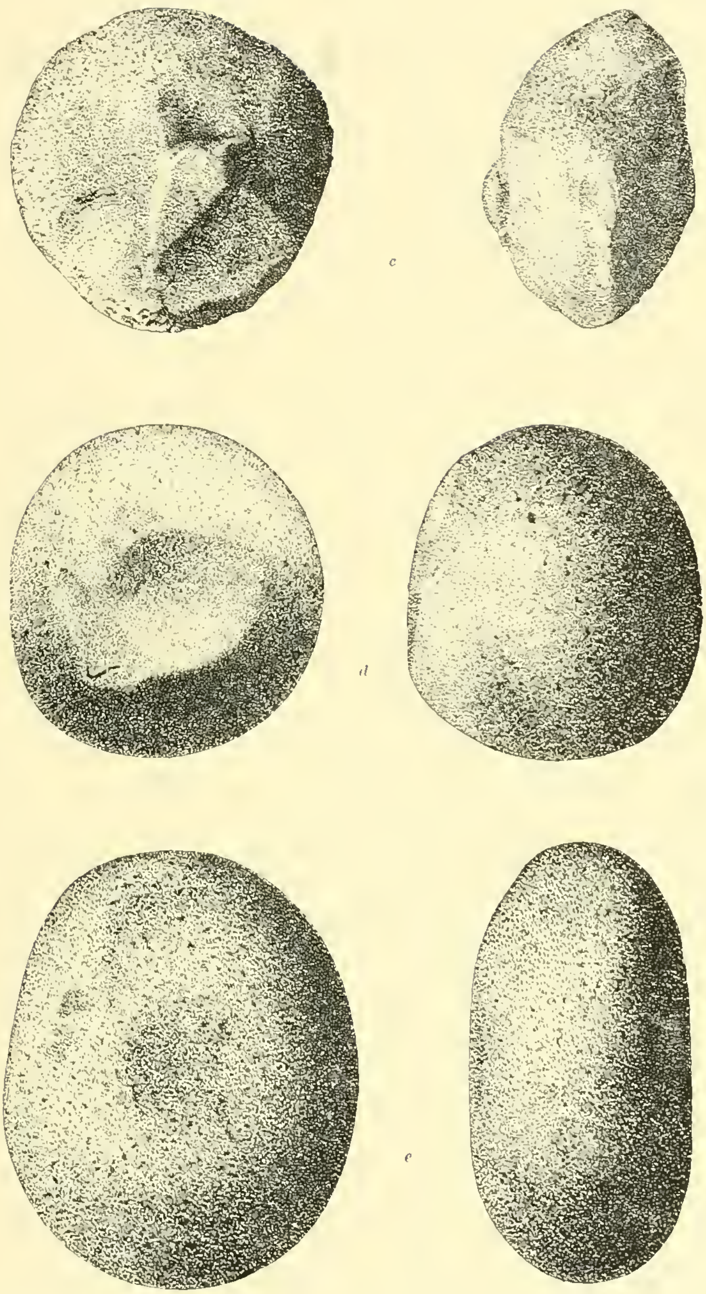


b

HAMMERSTONES FROM THE CELT SHOP NEAR LURAY, VIRGINIA; THREE-FOURTHS ACTUAL SIZE



HAMMERSTONES FROM THE CELT SHOP NEAR LURAY, VIRGINIA; THREE-FOURTHS ACTUAL SIZE

slopes where filling-in takes place rapidly they are wholly obliterated. Few instances occur in which the depressions now remaining are more than 2 or 3 feet deep. The diameter of the pittings does not generally exceed 20 or 30 feet, yet in cases they had the form of trenches or chains of pits extending for hundreds of feet along the strike of the deposit. Mr Fowke describes an excavation seen by him near Culpeper, Virginia, which is 150 feet in diameter and of undetermined depth, being filled with water and débris.

SPECIAL INVESTIGATIONS

Early Knowledge of Steatite

The use of soapstone by the native races is frequently mentioned by early writers, but no information is given of the acquisition and shaping of the material. One of the earliest accounts of the work in this country is that of Mr Paul Schumacher, who discovered typical quarries in the state of California. His illustration of the quarry face, with its partly developed nodes of the stone, published in the eleventh annual report of the Peabody Museum, would equally well illustrate the operations in our eastern quarries. The vessels and other articles produced are very numerous and differ widely from eastern forms.

Subsequently, Dr Elmer R. Reynolds, of Washington city, made some studies in the Rose hill quarry near Washington, and published a paper on the subject in the thirteenth annual report of the Peabody Museum. About this time Mr F. H. Cushing, representing the Smithsonian Institution, made extensive excavations in an ancient quarry in Amelia county, Virginia, and prepared a model of the exposed quarry surface illustrating the various phases of cutting out the incipient vessels. No report of his work was published, save a note in the *American Naturalist* for 1878.

In 1882 an important paper by Mr J. D. McGuire on the soapstone quarries of Maryland and the District of Columbia was read before the Anthropological Society of Washington, an extract of which is published in the second volume of its transactions. The present writer's preliminary paper on the Connecticut avenue quarries appeared in the *American Anthropologist* for October, 1890.

A very interesting and extensive quarry was discovered in about the year 1877, on the ground of Mr H. N. Angell, near Providence, Rhode Island, and a note describing the phenomena observed appears in the *American Naturalist* for 1878. These phenomena are essentially identical with those of more southern localities.

A like example was observed on the farm of J. T. Case near Bristol, Connecticut, in 1892, and excavations were made therein by Marshall H. Saville for the Peabody Museum. Many interesting specimens were obtained, not differing materially from those of other quarries. Vermont has furnished a similar example, and Pennsylvania abounds in such quarries. According to Charles H. Stubbs, in a note in the Smithsonian Report for 1882, an important quarry is located near Christiana, Lancaster county, in the latter state.

Explorations conducted for the Bureau of Ethnology during the years 1890–1894 extend from the Patuxent valley in Howard county, Maryland, to the southern borders of Virginia. I made it a rule in this as in other departments of field work to visit and examine as many sites as possible, and then to select certain favorable examples for detailed study, making these the types of groups of phenomena too extensive to be fully gone over. Excavation has been undertaken at but two points—the Rose hill or Connecticut avenue quarry, near Washington, and a quarry near Clifton, Fairfax county, Virginia, 22 miles southwest of Washington.

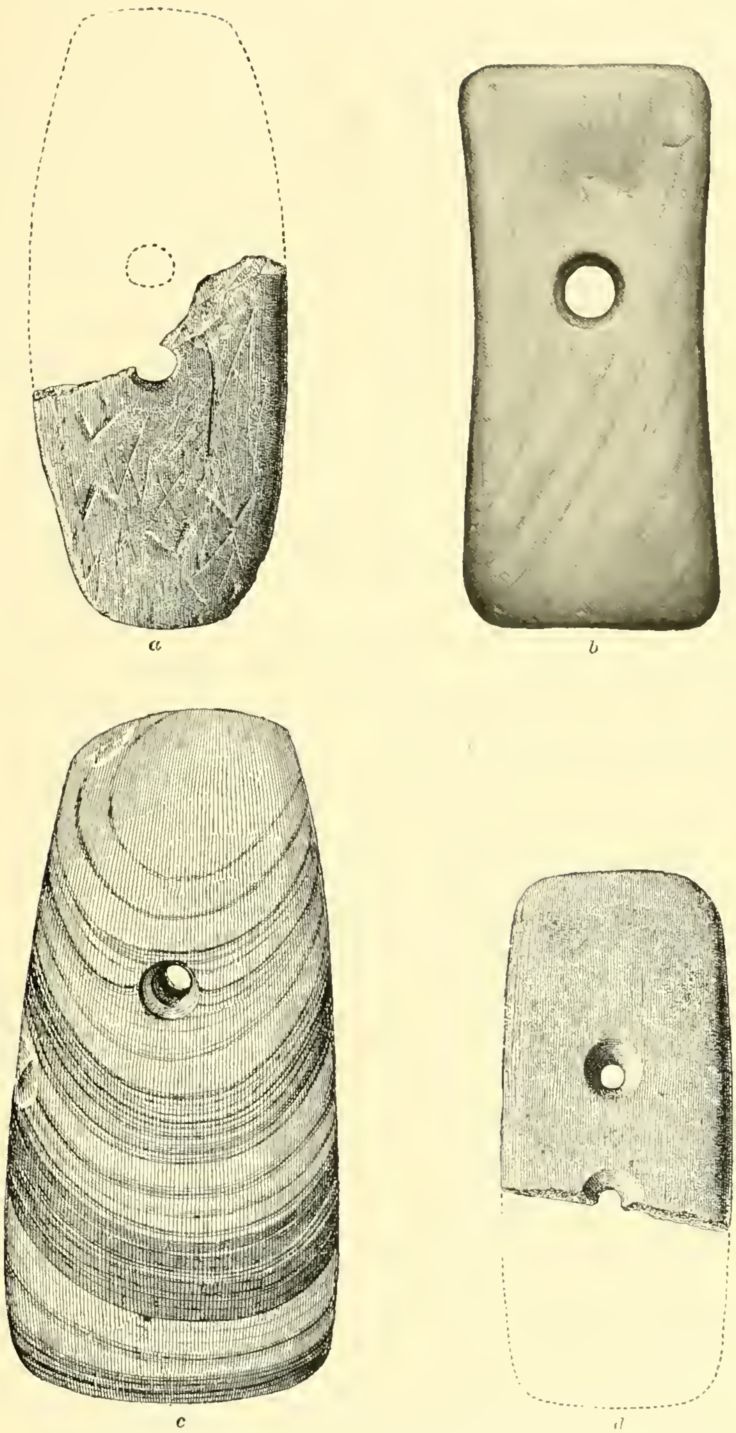
Development of the Quarrying Industry

The early occupants of the Potomac region, in their search for materials capable of serving them in their simple arts, probably discovered and attempted to utilize loose masses of the soft and tough stone known to us as steatite or soapstone. The progress toward its extensive utilization was no doubt very slow, and unless previous knowledge of such stone had been gained elsewhere, must have continued for centuries. Step by step the peculiar qualities and adaptabilities of the material were developed and diligent search was made for it throughout the highland. When the convenient loose masses were exhausted, the rock in place was attacked where it outcropped in the stream beds and on the hillsides, and partially detached portions were pried or broken off; then the process of uncovering followed and the quarrying industry was initiated. Sharp stones were employed to cut off projecting pieces, and finally cutting tools were made and improved, so that the solid stone could be removed to considerable depths.

We are not able to discover just what devices were employed in the preliminary quarry work. The earth was probably loosened with wooden pikes and with picks of stone and antler, and was thrown up with the hands or carried out in baskets of bark or cane, or in skins. As the quarrying advanced the older pits were filled with the débris, and evidences of the operations were much obscured. It is only when the pits are fully cleaned out that we come to realize the full nature and extent of the ancient work. Our excavations brought to light surprising evidences of the energy, perseverance, and skill of the native miner, and showed the practice of an art totally distinct from that carried on in the bowlder quarries of Piny branch.

Mining and Shaping Operations

The method of conducting the quarry work was substantially as follows: When a sufficient area of the solid stone had been uncovered, the



PERFORATED TABLETS OF SLATE; THREE-FOURTHS ACTUAL SIZE

a, *b*, and *d*, from tidewater Potomac, and *c* from middle Potomac

workmen proceeded with pick and chisel to detach such portions as were desired. If this surface happened to be uneven, the projections or convexities were utilized, and the cutting was not difficult; if the rock was massive and the surface flat, a circular groove was cut, outlining the mass to be removed, and the cutting was continued until a depth was reached corresponding to the height of the utensil to be made; then, by undercutting, the nucleus was detached or so far severed that it could be broken off by means of sledges or levers. If the stone happened to be laminated, a circular groove was cut through at right angles to the bedding, and the discoid mass was removed without the need of undercutting. If the conditions were favorable, a second disk was cut adjoining the first, and then a third, and so on, pretty much as the housewife cuts up the thin layer of dough in biscuit making.

In cases where the floor and walls of a well-developed quarry are fully exposed, as in the Clifton and Amelia county quarries in Virginia, the details of ancient operations are clearly displayed. In cases it is seen that the task of cutting out the mass was just begun when operations in the quarry closed, while in others it was well under way and the bulbous nuclei stand out in bold relief. In cases where undercutting has taken place the rounded form resembles a mushroom on its stem and is ready to be removed by a blow; while in many other cases we see only roundish depressions in the quarry surface, in the bottoms of which are stumps or scars indicating that removal of the mass had taken place. It often happened that the work of cutting was stopped by the discovery of defects in the stone. In very many cases defects were not discovered until too late, and the operations of removal at the last moment became abortive; instead of breaking off at the base, as was intended, the cleavage of the stone was such that the body split in two, leaving a portion remaining attached to the stem. The drawing presented in plate LXXVI will give a more satisfactory idea of the whole range of phenomena than can any mere description.

A notable feature of the cutting out of these masses of stone is the attendant shaping of the mass, which was rudely sculptured as the work went on, the contour of the vessel being approximately developed. Although I have seen no good examples of this class, it is confidently stated by others that rude nodes were carved at opposite ends of the mass as incipient handles, and that excavation of the bowl was begun, so that when severed from the stem the vessel was already well under way.

Quarry Product

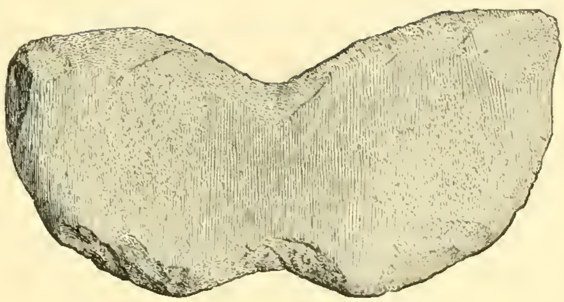
So far as I have observed, the quarries rarely yield evidence of the prosecution of any other shaping work than that of obtaining the rounded bodies of stone and the partial development of vessels. Pipes, sinkers, ceremonial stones, and ornaments were made by the same people, but mostly no doubt from choice bits of stone carried away for the purpose, or perhaps often from fragments of vessels broken in use.

About the quarries and in the quarry débris are specimens exhibiting every stage of the vessel shaping work; irregular fragments and well-rounded masses just as cut from the quarry, but usually showing some defect of texture or shape, explaining their desertion or rejection; other pieces partly shaped before the defects became apparent; and very many specimens broken by the blows of the shaping tools, as illustrated in plate LXXVII; so that every step of the work and every phase of the shaping operations are fully represented. The rough-dressed shapes vary a good deal with the different quarries, though on the whole there is decided uniformity in the work as carried on throughout the soapstone belt. Final forms, as shown by village-site remains, are limited to shallow trays or dishes, trough-like forms, and deep basins. Nowhere in eastern United States were pots made of the deep globular form so common in California.

A prevailing shape in the Potomac-Chesapeake region is an oblong basin with ear-like projections or handles at the ends. The largest specimens are about 25 inches in length. The width is often hardly more than half the length, and the depth averages perhaps one-half the width. This form may have been suggested by wooden dishes or mortars of like shape, examples of which are still in use among some of the Algonquian tribes. Other forms approach more nearly a circular outline, as viewed from above, and these usually have greater depth. In cases the outline is somewhat rectangular. Roughed-out cups of small size are sometimes found.

The handles of steatite vessels differ much in size and shape as well as in position. Some are placed near the margin or rim, but others, where the vessels are deep, occur low on the profile. The accompanying illustrations (plates LXXVIII, LXXIX, and LXXX) convey accurate notions of many details.

The form development of a vessel of ordinary character is illustrated in plate LXXVIII. The ovoid nucleus as cut out of the quarry appears in *a*, the handles being only slightly suggested. Excavation of the bowls was begun by a series of pick strokes outlining the basin, as seen in *b*, a core-like elevation remaining in the center until removed by continued cutting, as suggested in *c* and *d*. The form of the roughed-out vessel as developed in the quarries is quite fairly indicated in *e*. In some cases the excavation began with a pit in the center and was carried outward by successive strokes toward the rim; and in very many cases the work was unsystematic and crude, as is well shown in plate LXXIX. In specimens found on the surface of the ground the tool marks are much obscured by weathering, but in those from a depth they are as fresh as if made but yesterday. The cutting implement was in some cases pointed or spike-like, but generally had a chisel-like, though rounded, cutting edge half an inch or more in width, leaving impressions such as are shown in plate LXXIX, which illustrates two somewhat



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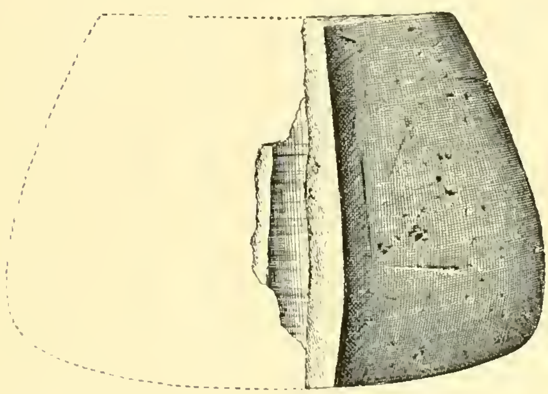

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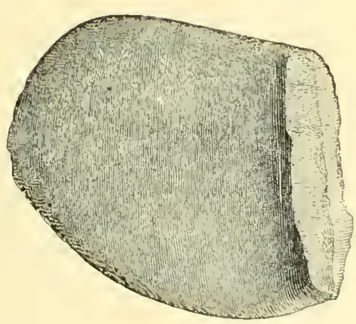

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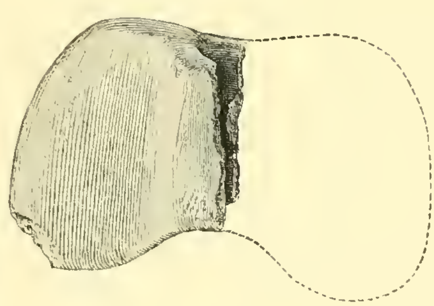


d

WINGED CEREMONIAL STONES FROM THE VICINITY OF WASHINGTON, D. C.

a, 3¾ inches in length; *b*, 2½ (?) inches in height, *c*, 2 inches in height; *d*, 1½ inch in height

small rejects from the Connecticut avenue quarries. This edge was sometimes rather rough and uneven, leaving scratchy lines, suggesting a flaked rather than a polished tool. The character of the work varies a great deal; in some cases the strokes were bold and professional in appearance, in others timid and uncertain. Three excellent examples of roughed-out vessels are shown in plate LXXX; *a* and *b* are from quarry sites, where they were rejected and deserted, while *c* is from a village-site at College Station, Maryland, several miles from the nearest quarry. These specimens show decided differences in shape of bowl and placement of handles.

IMPLEMENTS USED IN QUARRYING AND CUTTING

Character of the Tools

The tools and utensils employed in the quarrying and shaping of steatite may be reviewed with considerable care, since they prove to be, as far as brought to light, largely of classes peculiar to the work and hitherto practically unknown to archeologists.

It is safe to assume that there were many implements of wood as well as bone and antler used in uncovering and removing the stone that have wholly disappeared. These hypothetic utensils would no doubt include levers, pikes, mauls or mallets, picks, hoes, and shovel-like tools.

Naturally very many of the tools used were of stone, and these are found in considerable numbers on the quarry sites and on shop and village sites in the vicinity. There is no clear distinction to be drawn between those used in quarrying and cutting out the raw material and those employed in shaping the vessels, yet it may be assumed that in general the heavy, rude tools were for quarrying and that the more delicate, sharp-edged or pointed tools were for shaping and finishing. The heavier tools consist of rounded sledge-like masses used for driving wedges and for breaking off portions of the stone, of heavy wedge-like stones, often much battered as if from blows by heavy sledges, and of pick-like forms, some rude, others well shaped by flaking and pecking. One variety of the picks is roughly grooved by flaking and pecking, and another has a plain shaft, often a little curved as if to be attached to a handle somewhat as our picks and adzes. In several of the quarries we have found ordinary grooved axes, most of them having been remodeled or resharpened by flaking to make them efficient in picking and cutting; then there is a large class of chisel-like tools of varied sizes and shapes, sometimes improvised from stones of approximate proportions slightly flaked or ground to effective points, sometimes flaked out of the raw material, which is generally a greenish-gray basic eruptive rock obtained from the highland, and possibly by quarrying.

Generally these tools were made by skilled hands and are developed into such highly individualized shapes that we are compelled to allow that the industry in which they were employed was one of importance and long standing. Nearly all the forms are represented in the several plates accompanying this chapter.

The number of the tools and their importance to the steatite-working peoples is illustrated by the following observations: Around a single pit located in a plowed field on Patuxent river, and nearly obliterated by successive plowings, I found during a single visit some 30 entire and broken implements, and from the excavation in the quarry near Clifton, Virginia, nearly four dozen of the chisel-like tools, some broken and some entire, were found.

Manner of Using the Tools

There are three or four ways in which the cutting tools could have been used. The simplest was that of holding the pointed stone in the hand or hands, and thus striking the potstone. This would, however, be a most unsatisfactory method and would hardly be applied where opportunity was afforded for superior methods.

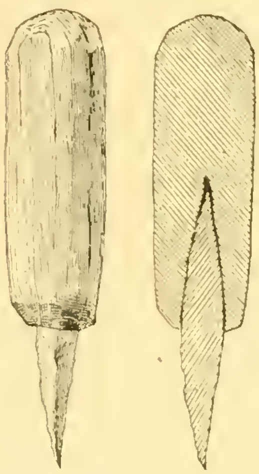
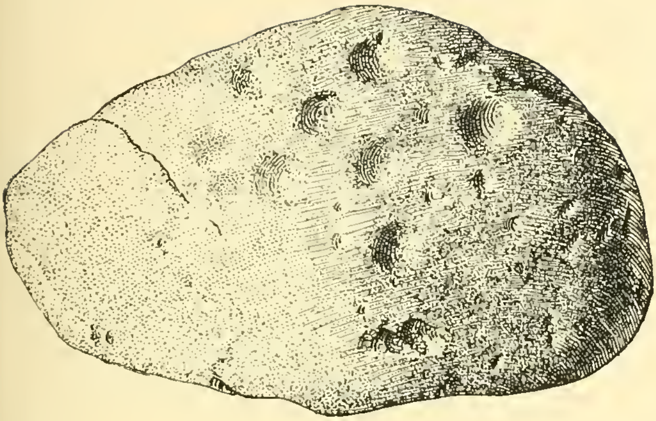


Fig. 16—Probable manner of hafting the smaller chisels.

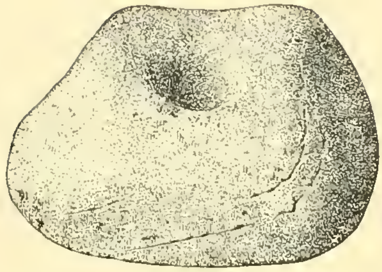
Another manner of use was that of setting the sharpened stone or chisel in a short handle of buckhorn, and striking this with a stone or billet of wood. The chisel marks left in many cases suggest this method very strongly, and the heavy end of the tool as found is usually furnished with a short and rough-flaked point suitable for setting in a handle, as suggested in figure 16. Many specimens of this class are too minute to be utilized in any other way, and some are slightly notched as if mere knives.

A third method is that of hafting the pointed stone as an adz or ax is hafted. The grooved tools were undoubtedly used in this way, and many of the grooveless forms could have been attached as is the ordinary primitive adz. This would give much greater efficiency in all the work of cutting and roughing-out, and the boldness and irregularity of the stroke marks left on the quarry face and on the detached masses and partly finished vessels make it practically certain that this was the manner of their attachment. With short handles, such as indicated in figure 17, effective and very neat work could be done, and it may be remarked that such a tool could be handled in the cramped quarters in which the cutting was often carried on almost as conveniently as could the chisel driven by a mallet.

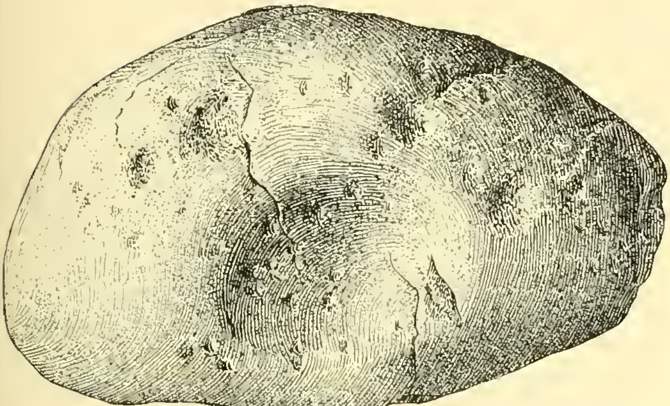
Among the chisels there are numerous slightly curved forms, some with one ground point that could have been hafted as in *a*, figure 17, and others with two points that may have been mounted so as to make both points effective, as in *b*, figure 17. The shortest two-pointed tool, a



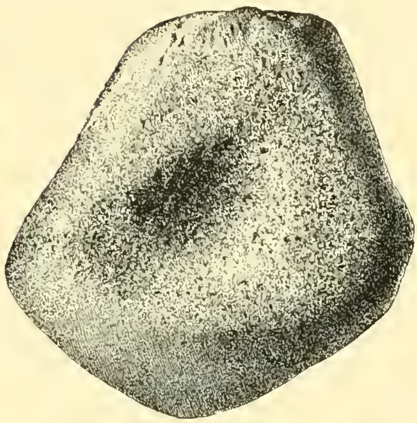
a



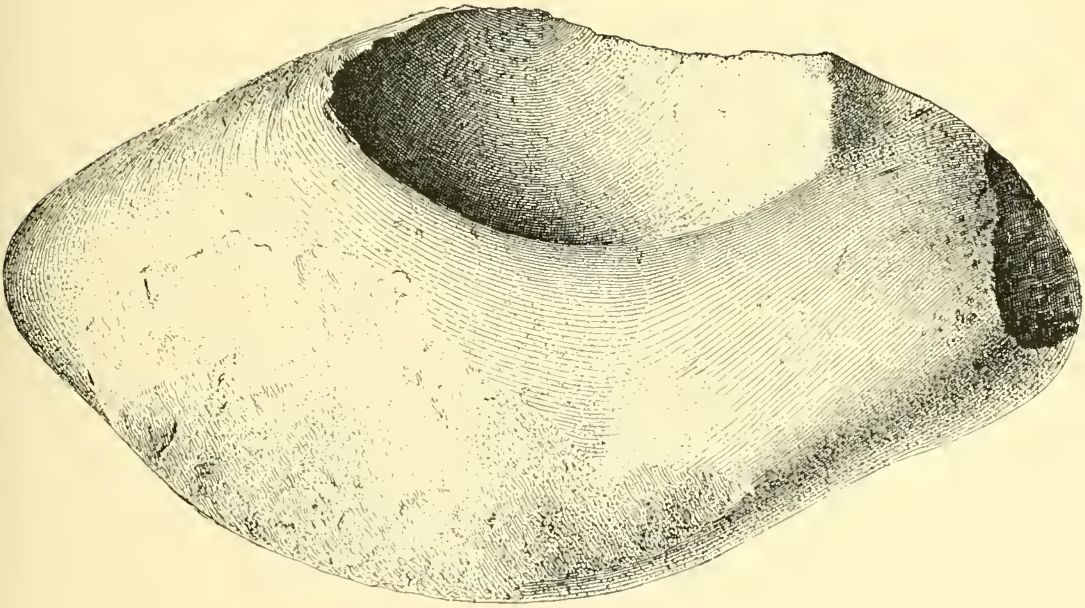
c



b



d



e

PITTED STONES AND MORTAR FROM TIDEWATER VILLAGE-SITES

a-b, one-third actual size; *c-d*, *e*, one-half actual size

very neat and delicate specimen, is hardly more than 3 inches long, while the largest is 11 inches in length.

STEATITE QUARRIES

THE CLIFTON QUARRY

The most interesting example of the soapstone quarries examined by the Bureau during the progress of the work described in the present paper was the Hetzel-Hunter quarry, near Clifton, in Fairfax county, Virginia. Late in the fall of 1893 Mrs Margaret Hetzel, of Clifton and Washington city, communicated to Professor O. T. Mason, of the National Museum, the fact that in prospecting a soapstone deposit near

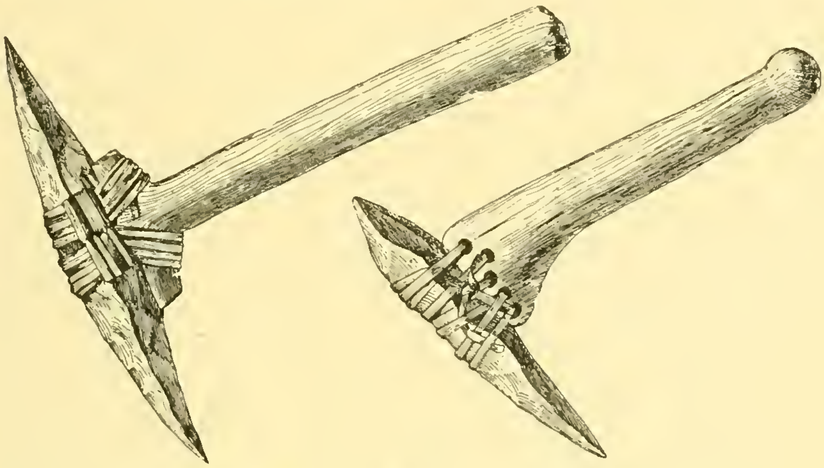


FIG. 17—Probable manner of hafting the single-pointed and the two-pointed chisels or picks.

Clifton the owners had discovered traces of aboriginal operations, and expressed a desire that the Smithsonian Institution should undertake an examination. This was reported to me by Professor Mason, and the quarry was put on the list for examination so soon as the field season of 1894 opened. Late in March the work was taken up, and Mr William Dinwiddie was sent out with instructions to clear out the ancient excavations in such a way that, if possible, the entire floor and the quarry faces would be exposed for study and photography. This was done in the completest possible manner, and in a few weeks a most striking illustration of the enterprise and skill of our aboriginal tribes was exposed to view. A trench or gallery some 25 feet wide and reaching in places a depth of 16 feet had been carried into the face of the hill to a distance of 60 or 70 feet, and a second pit, inferior in dimensions, had been opened beyond this. Almost the entire excavation had been carved out of the solid steatite by means of stone picks and chisels, and all the evidences of the cutting and sculpturing—even the whitened surfaces of the tool marks—were as fresh as if the work of yesterday.

The quarry is located on a small branch of Bull run, 2 miles northwest of Clifton and 22 miles a little south of west of Washington city. The steatite outcrops in the bed and banks of a small rivulet, crossing it at right angles, and seems to be an irregular bed or stratum intercalated with the gneiss of the Piedmont formation. It varies from 20 to 40 or 50 feet in thickness, and has a nearly north-and-south strike and a dip of from 70° to 80° toward the west.

The ancient peoples probably began work by removing detached or partly detached masses from the stream bed, and then little by little followed the ledge up and into the steep hillside toward the north. This hill is a spur of a low ridge on the west, and is some 40 feet in height. It slopes off rapidly to the junction of the quarry rivulet with another branch two or three hundred feet below. The surface is covered with soil and disintegrated gneiss.

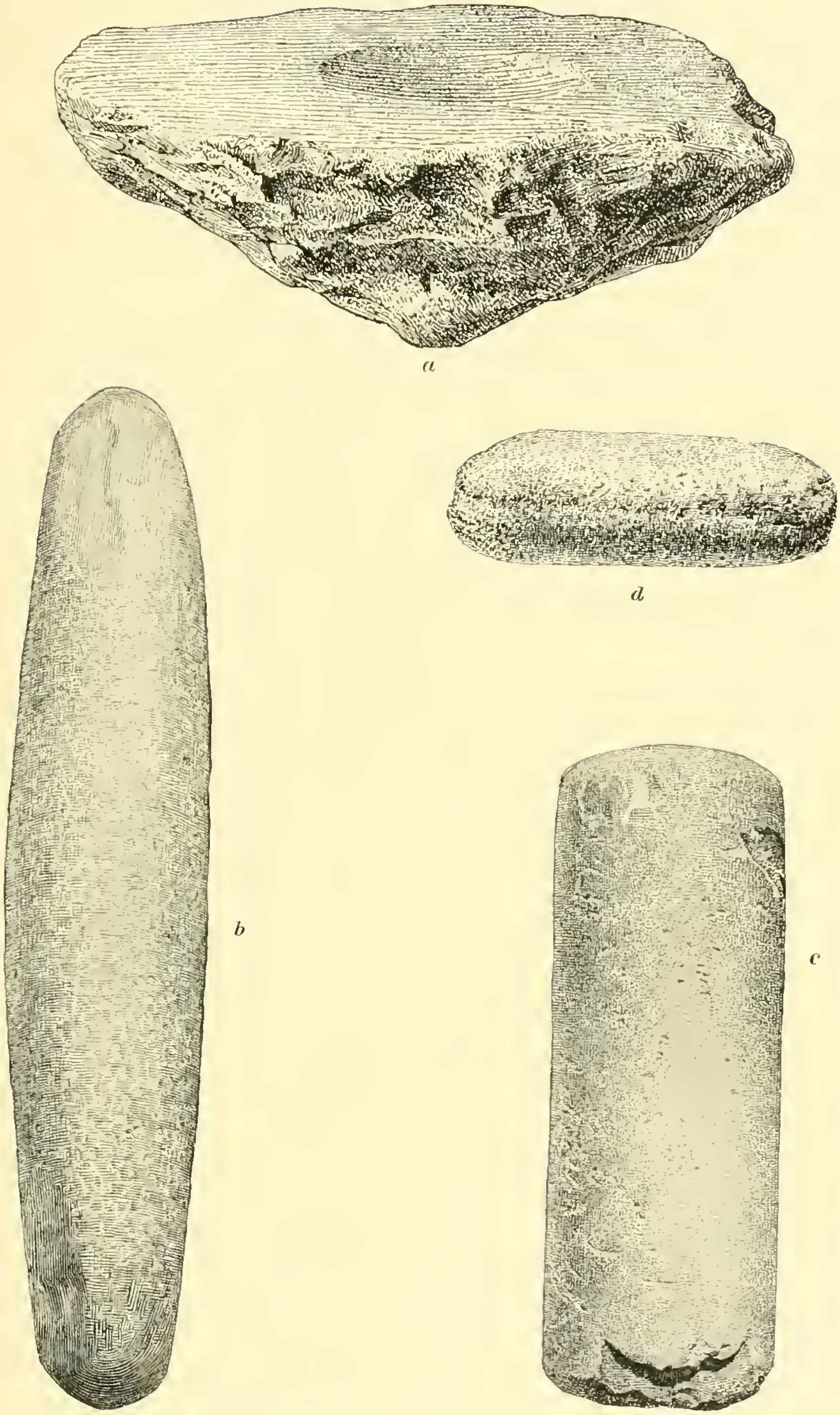
Our investigations developed the fact that there had been two main pits or excavations—a long and wide gallery mentioned above, and higher up a second pit about 20 feet in diameter and 8 or 10 feet deep connecting with the first but lying at the left, as indicated in the accompanying sketch map, figure 18.

So completely were the ancient excavations filled up that inexperienced eyes would hardly have detected anything unusual in the appearance of the rounded slope of the hill. The main trench was marked by a slight depression toward the upper end, and the débris accumulated low down along the sides formed barely perceptible convexities. No doubt the excavations had been largely filled as the work advanced, and material from the upper pit had helped to obliterate what remained of the main final depression.

The location of the upper pit was indicated by a shallow depression some 20 feet in diameter and 2 or 3 feet deep, where modern exploiters had sunk a prospect hole. This pit had been left open, and its position high on the hill had prevented rapid filling.

When the Bureau began its work of excavation the owners of the quarry had already uncovered a portion of the ancient quarry floor, which rises from the stream bed at a low angle, so that at 30 feet it is about 10 feet above the stream and not more than 4 or 5 feet beneath the slope surface. But little stone had been removed by the ancient workmen, although evidences of excavation and cutting were distinctly seen, and a few stumps, scars, and bulbous chiseled masses appeared at the upper edge.

Soon after beginning work the floor was found to descend into numerous pits and depressions where the superior quality of the stone had led the quarrymen to persist in their work. The general level of the floor was maintained for a distance of some 70 feet back into the hill, and the deeper pittings at the back reached 15 or 16 feet beneath the



MORTAR, PESTLES, AND SINKER (?) FROM THE TIDEWATER PROVINCE

a, $11\frac{5}{8}$ inches in length; *b*, 14 inches in length; *c*, 7 (?) inches in length; *d*, 3 inches in length

profile of the slope. Much impure stone had been cut away in efforts to reach the purer masses, and this was a most laborious work. But it is safe to say that one-half or three-fourths of the excavation was accomplished by cutting out, with chisels and picks, the solid and massive steatite. The whole surface, with its nodes and humps and depressions, covered everywhere with the markings, groovings, and pittings of the chisel, presented a striking example of the effectiveness

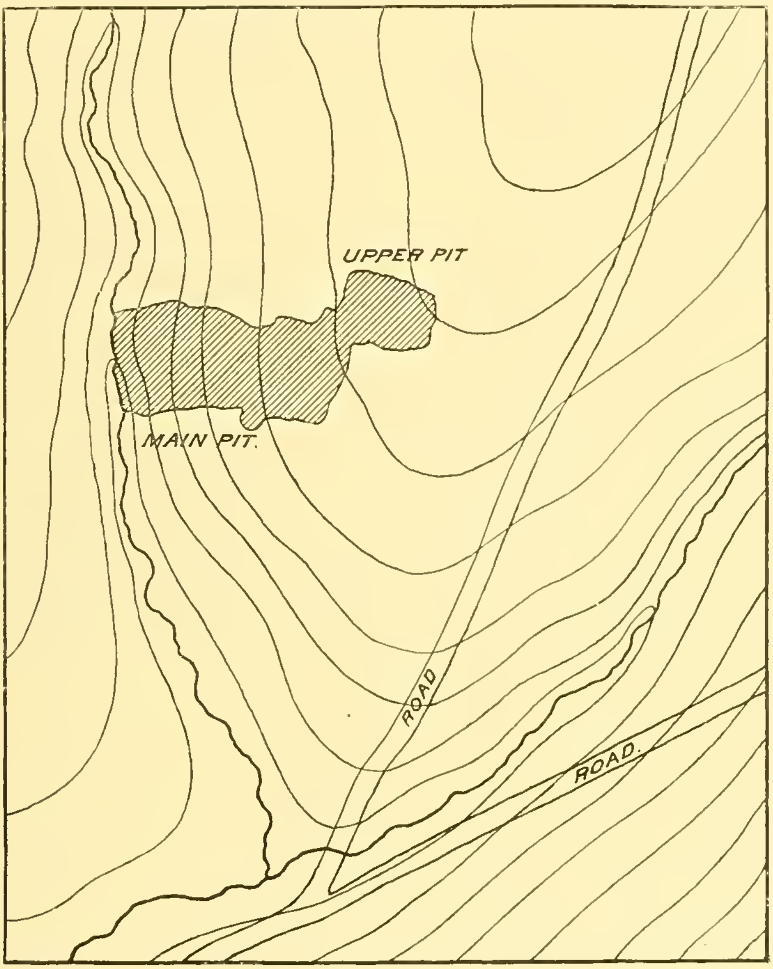


FIG. 18—Sketch map of the Clifton quarry; scale about 50 feet to the inch.

of native methods and the persistence of native efforts. A view of the quarry, after it had been thoroughly cleaned out and swept, is shown in plate LXXXI. The photograph was obtained by erecting a platform 20 feet in height in the stream bed at the foot of the quarry. The deepest part of the pitting is at the back, where the figure of a man may be imperfectly made out. The farther extension of the quarry is indistinctly seen at the left beyond the measuring rod. The irregularly noded and pitted surface is rather imperfectly shown in the picture. The width of the seam of workable stone is indicated by the width of the quarry, and the change in direction at the farther end of the main pit seems to have been due to a change in the character of the stone.

In plate LXXXII I have brought together a number of the cutting implements selected from the two or three score recovered. Many examples are of small size and show varying degrees of finish. Those shown are of a dark-gray eruptive rock and have been carefully shaped and finished. The larger specimen *a, a* has been ground into nearly symmetrical shape and has a fine conical point. The chisel *b, b* was flaked into general shape and both ends were reduced by grinding to excellent flattish cutting edges. The smaller specimen *c* has a neatly sharpened point and is wide at the opposite end, and like the smaller example *d*, which is obscurely notched near the top, was probably set in an antler handle for use as a chisel. Among the finds was a well-shaped and much-used hammerstone of quartzite, which had probably served to trim and sharpen the cutting tools.

Traces of an old village-site were discovered on the stream bank, a hundred yards or more below the quarry, and here various objects of steatite, including a partially shaped but broken pipe, were found. The more ordinary dwelling sites of the operators of this quarry were doubtless on the larger streams below, and probably extended far down the Potomac. This quarry can not be a great many miles from the "antimony mines" reported by the native guides to the English who first explored the Potomac. The fact that these peoples were enterprising enough to work an "antimony mine" suggests the probable identity of these Indians with the workers of the soapstone mines as well as of the quartzite quarries of the general region.

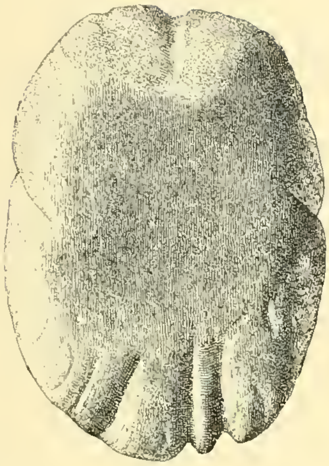
THE CONNECTICUT AVENUE QUARRIES

Extensive deposits of steatite are found within the limits of the District of Columbia, but only one locality presents abundant traces of ancient operations. This site is by some called the Rose hill quarry and by others the Dumbarton quarry. It is situated on Connecticut avenue extended, 4 miles from the Executive Mansion, three-fourths of a mile east of Tenallytown, and a mile and a half from each of the two great quartzite-bowlder quarries already described.

Literature

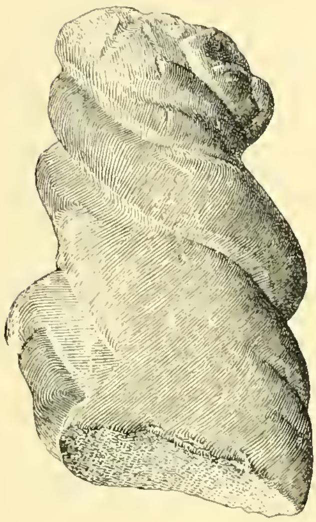
The quarries in this locality seem to have been first studied by Dr Elmer R. Reynolds, who in 1878 published[1] a careful description of the

[1] Thirteenth annual report of the Peabody Museum, 1878, p. 526.

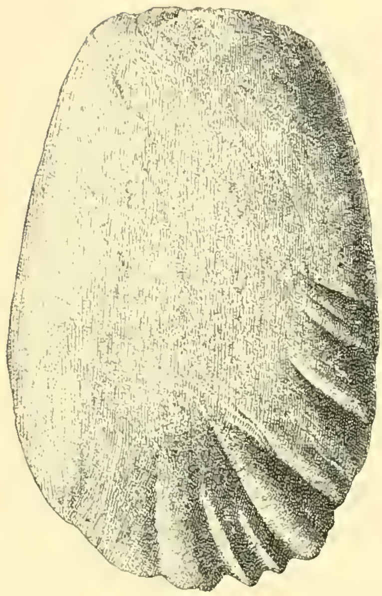


a

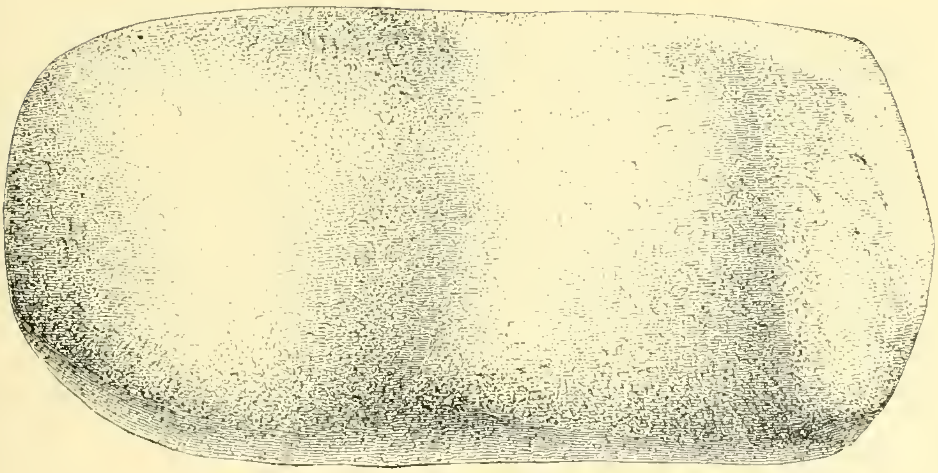
a



b



c



d

ABRADING STONES FROM THE VICINITY OF WASHINGTON, D. C.

a, b, c, three-fourths actual size; *d*, actual size

site and of the articles collected by him. About that time visits to the site were made by Dr Charles Rau, Professor O. T. Mason, Mr F. H. Cushing, and others, and extensive collections of articles, mainly from the surface of the ground, were made. Mention is made by Dr Reynolds of excavations conducted by these gentlemen, but no definite information on this point is on record. Mr Cushing informs me that slight excavations were made on the southern hill. A paper published by Mr Louis A. Kengla, formerly of Washington, gives considerable additional matter, accompanied by illustrations of fragments of vessels obtained in the District of Columbia.[1]

Site and Surface Indications

The mass of steatite exposed on this site, being firmer and tougher than the gneisses with which it is associated, gave rise, as erosion progressed, to two very decided prominences, separated by a sharp ravine cut by a small stream, tributary to Rock creek, known as Soapstone creek. The natural exposures are confined to the bed and the steeper banks of the stream and to the crests of the hills, the latter rising in somewhat conical form—the one on the southern side of the ravine to about 80 feet and the one on the northern side to fully 90 feet above the stream.

The northern hill has a rounded, oblong summit, in which the steatite is exposed or approaches very near the surface for a length, nearly north and south, of more than 100 feet and a width of 20 or 30 feet. The rock seems to be bedded with the greatest length of the crest, and consists of nearly vertical, more or less massive layers of steatite. The slopes of the hill are covered with deposits of disintegrated gneiss and vegetal mold, and consequently the gneiss with which the steatite is surrounded and interbedded is in no place visible. The whole site is thickly covered with forest trees and underbrush.

In 1891 the extension of Connecticut avenue led to the removal of the lower portions of both hills, as indicated in the sketch map *a*, plate LXXXIII, the cut in the southern hill exposing portions of the strata to a depth of 60 feet, and obliterating a number of the ancient pits. The steatite brought to light by the grading is, however, of very poor quality and unfit for commercial purposes, which is true also of the entire deposit, as indicated by the cessation of recent quarrying operations conducted by the Hunter brothers. A section of the two hills appears in *c*, plate LXXXIII.

The evidences of ancient pitting are confined chiefly to the summits of the hills, but no one can say to what extent the exposures of soapstone in the sides of the ravine were worked. The southern bank of the stream has recently been excavated to a considerable depth by the Hunter brothers, and the original configuration is somewhat destroyed;

[1] Archeology of the District of Columbia, Washington, 1883.

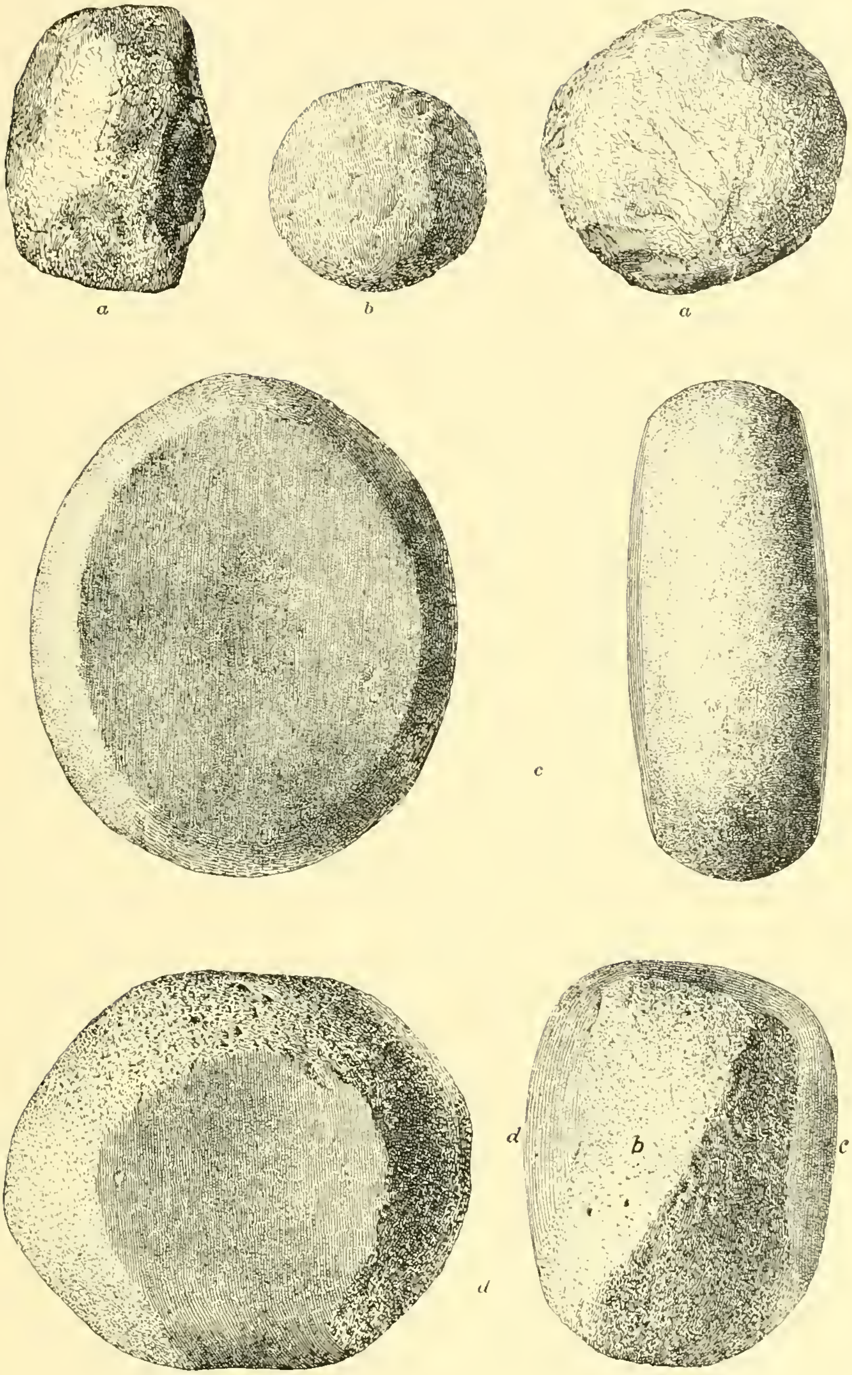
but on the northern side there is an obscure excavation of considerable dimensions that may be at least partially due to aboriginal operations. Pits sunk in the sides of the hills would soon be filled by débris descending from above, but on the crests they would necessarily remain clearly marked for a long period of time; their obliteration in the latter case would depend on the very slow accumulation of vegetal mold or of wind blown material. In any attempt at estimating age from mere appearances, therefore, the relation of the excavation to the surrounding surface must be considered; this has already been pointed out with some degree of care in describing the quartzite-bowlder quarries.

The excavations undertaken under my supervision were confined largely to the summit of the northern hill, as the ancient quarries had there remained wholly undisturbed save by the normal agencies of nature. A row of pits, forming almost a connected trench, extended along the crest and for a short distance down the northern end of the hill. There were five well marked depressions in this series, the outlines being irregular (see plate LXXXIV). All were less than 25 feet in diameter, and the greatest depth was not above 2 or 3 feet. Dr Elmer R. Reynolds describes one pit on the southern hill as being over 3 feet deep. The heaps and ridges of débris thrown from the pits by the ancient miners extended along the sides of the row of pits, and were not above a foot in height. This débris consisted for the greater part of earth and irregular masses of steatite. Among the latter were found many fragments of unfinished vessels and rejects of various kinds. Shallow depressions, marking the sites of ancient pits, occur along the sides of the crest on the southern and western slopes of the hill.

Excavations Made

Our examinations of the Connecticut avenue quarries were commenced by carrying a trench across the southern pit of the series on the northern hill. This exposed portions of the ancient quarry face on the southern, eastern, and western sides, while the northern edge of our excavation penetrated the full depth of the ancient quarry, which was here not more than 4 or 5 feet.

Beginning with the deepest part of this first trench, a wide trench was carried northward along the chain of ancient pits. Cross trenches were dug at frequent intervals, and others were subsequently dug on the southern slope. In all, not less than 800 square feet of the ancient quarry floors were exposed and cleared off, and a very good idea of the nature of the ancient quarrying was obtained. The principal pits were worked to a depth of from 2 to 6 feet by the aborigines, and the bottoms and sides present the irregular appearance necessarily produced by prying out such masses of potstone as the quarrymen were able to detach. A view taken in the main trench is shown in plate LXXXV,



HAMMERSTONES FROM POTOMAC VILLAGE-SITES; THREE-FOURTHS ACTUAL SIZE

a, quartz, *b*, *c*, *d*, quartzite

and a section across one of the pits is given in *b*, plate LXXXIII. The beds of steatite are quite massive, exhibiting irregular lines of cleavage; the quality is, however, in the main, rather inferior. A sketch plan showing the trenches made on the quarry site is given in plate LXXXIV.

As in the quartzite-bowlder quarries, little evidence remains of the methods of quarrying. Tools of the classes already referred to were no doubt used to loosen and remove the earth and to pry up masses of the stone. Heavy rounded stones and hafted sledges served to break up the larger pieces and to detach projecting portions. In several places on the floor and sides of the quarry the surface of the potstone shows the usual pick marks, and in one place a slight grooving was seen where the work of dividing a large block had begun. The exposed surfaces seem for the most part to represent cleavage planes, and until solid massive rock was encountered the laborious process of cutting was uncalled for.

So far as the evidence obtained on the site shows, work was confined almost exclusively to procuring material for use in vessel making, but apparently the pots were not often shaped or even partly shaped in place, to be afterward detached by undercutting and wedging as observed in many other places. It appears that as a rule the rough block was first obtained, then trimmed down to the approximate size and form, and afterward hollowed out ready for the finishing operations, which were in most cases conducted elsewhere. There were naturally many failures from breaking, from splitting along partially developed cleavage planes, and from imperfections in texture; and many hundreds of these failures yet remain on the site, in the pits, in the heaps of débris, and scattered far down the slopes of the hill and along the stream bed.

Tools Recovered

The tools with which the work of quarrying was accomplished were sought most assiduously. It was expected that they would, in a measure at least, correspond to the tools known to be used by the modern Indians of the region, as many steatite pots are found on ordinary village-sites. This was found to be the case to a limited extent only. It was found that the tools used were, as a rule, made for and especially adapted to the work, which is unlike any other industry of the aborigines. The implements prove, therefore, to be in a measure unique, forming a class of their own.

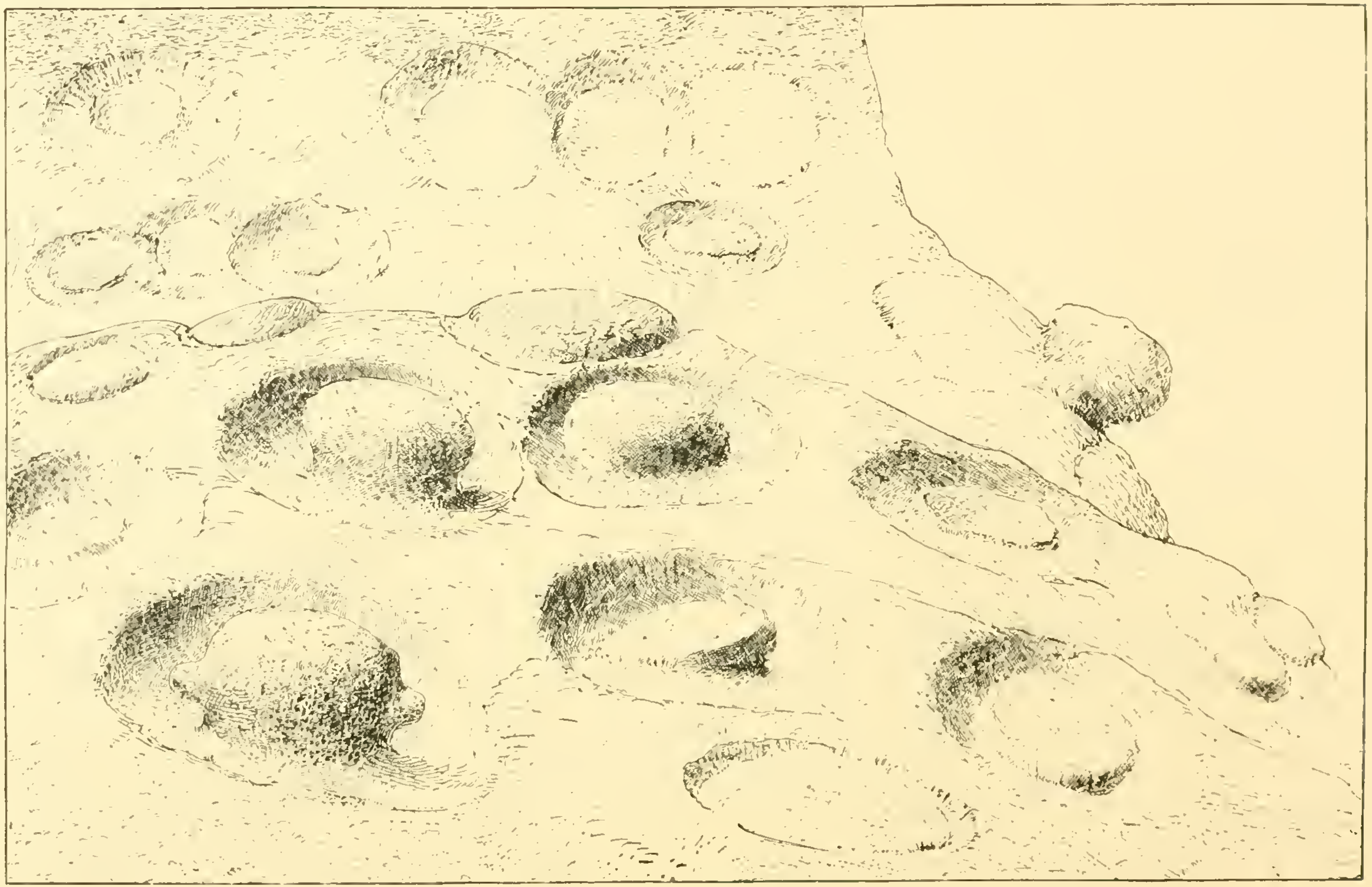
The remoteness of the site and the rugged conformation of the hills on which the quarries are located render it improbable that the locality was used for dwelling or for any other purpose than that of quarrying and shaping the potstone.

The tools found all pertain to quarrying and to roughing-out the vessels, and may conveniently be divided into three classes: 1, those improvised on the spot for local temporary use; 2, those made for the purpose on distant sites; and, 3, those pertaining originally to other uses, brought from the villages and utilized in the quarries. A majority are of the first of these classes. They are, as a rule, quite rude, and were derived from quartz veins and bowlder beds in the vicinity of the quarry. Specimens collected approach as nearly a paleolithic type as any tools found in the Potomac region. Nothing more primitive is possible. The hills and slopes in the vicinity abound in outcrops of vein quartz, which breaks up into angular fragments. These are now so plentiful on the neighboring fields as to burden agriculture. Such angular fragments were gathered for use in the quarries. Some were already well adapted to use, while others were slightly trimmed, to give them better points and edges. Illustrations of these tools appear in figures 19 and 20.

FIG. 19—Rude pick of quartz, slightly sharpened by flaking.

A number of angular masses of quartz were discovered that were not apparently adapted to any use and that showed no signs of having been used. They may be fragments of larger masses broken in use. A few bruised cobbles were found that must have been utilized in some way in the quarry work.

It is not considered necessary to take further notice of specimens showing no decided evidence of design or use, or that do not by their natural conformation show especial adaptation to use. The objects of quartz that show evidence of shaping by percussion are all of one type. They are thick, angular masses, weighing a pound or more; one end is brought to a short, sharp point, and the other is somewhat rounded, as if to be held in the hand or hands for striking. Of the



SURFACE OF A SOAPSTONE QUARRY SHOWING VARIOUS PHASES OF THE CUTTING OPERATIONS

In the Clifton quarry an area of upward of 2 000 square feet is covered with these evidences of ancient industry same general shape are two picks made from quartzite bowlders and resembling heavy-pointed turtlebacks (figures 21, 22). In no case

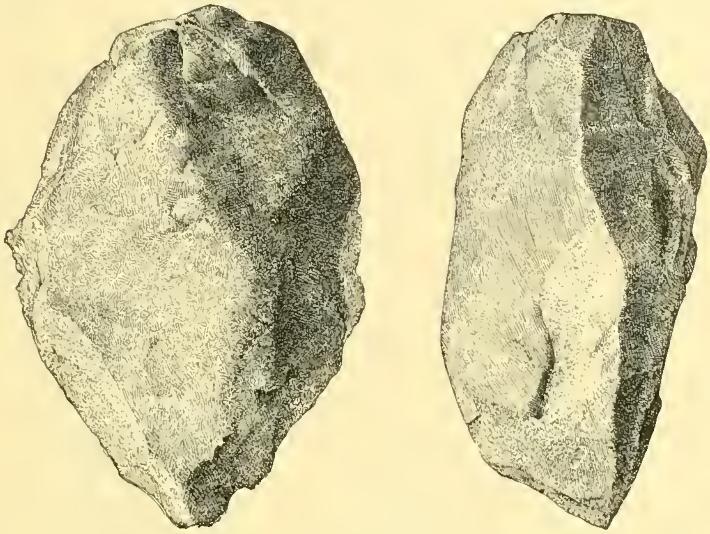


FIG. 20—Rude pick of quartz, slightly sharpened by flaking.

does the form of these tools suggest the attachment of a haft, although such attachment would probably be feasible.

Three chisel-like tools were found in the main trench on the summit of the hill. They are of peculiar types, and we may fairly assume that

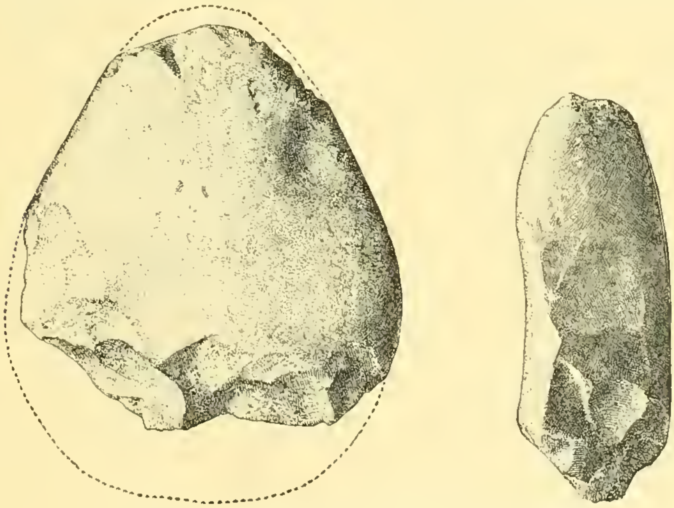


FIG. 21—Rude pick made by sharpening quartzite bowlder.

they were made for use in the potstone shop. One made of gray eruptive rock is blade-shaped and has a fine chisel-like point or edge. It is shown in *a,a*, plate LXXXVIII.

Another specimen (illustrated in *b,b*, plate LXXXVI) is of greenish-gray slaty-looking eruptive rock, very slightly altered by chemical changes. It is rather rudely chipped along both sides, and the point has been made quite sharp by grinding. Properly hafted as a pick, or as a chisel to be driven by a mallet, this little celt would have been a very effective tool in shaping and trimming the vessels. As it stands, without hafting, it is too small for effective use. A small chisel from the southern hill is given in *c,c* in the same plate.

From the soil that filled one of the shallow pits on the southern margin of the crest of the hill, a chipped tool of unusual shape, given in *a,a*, plate LXXXVII, was obtained. It resembles somewhat the drills or perforators of the same material found on village-sites, but is larger, ruder, and less symmetrical, and was probably made especially for use in the trimming of soapstone vessels.

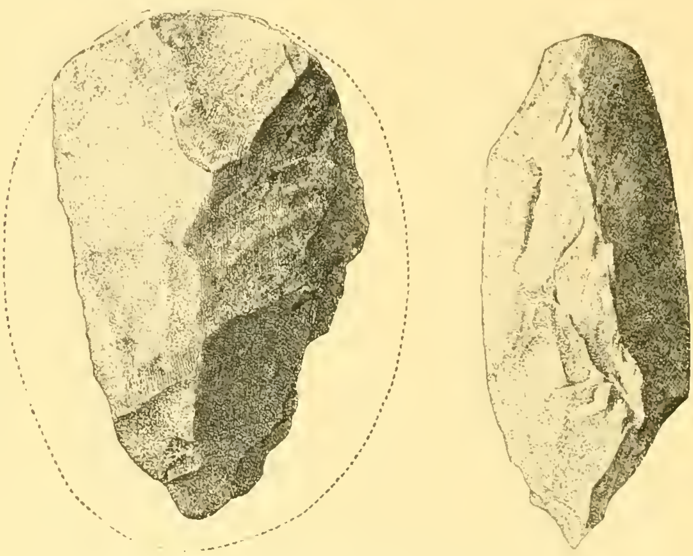
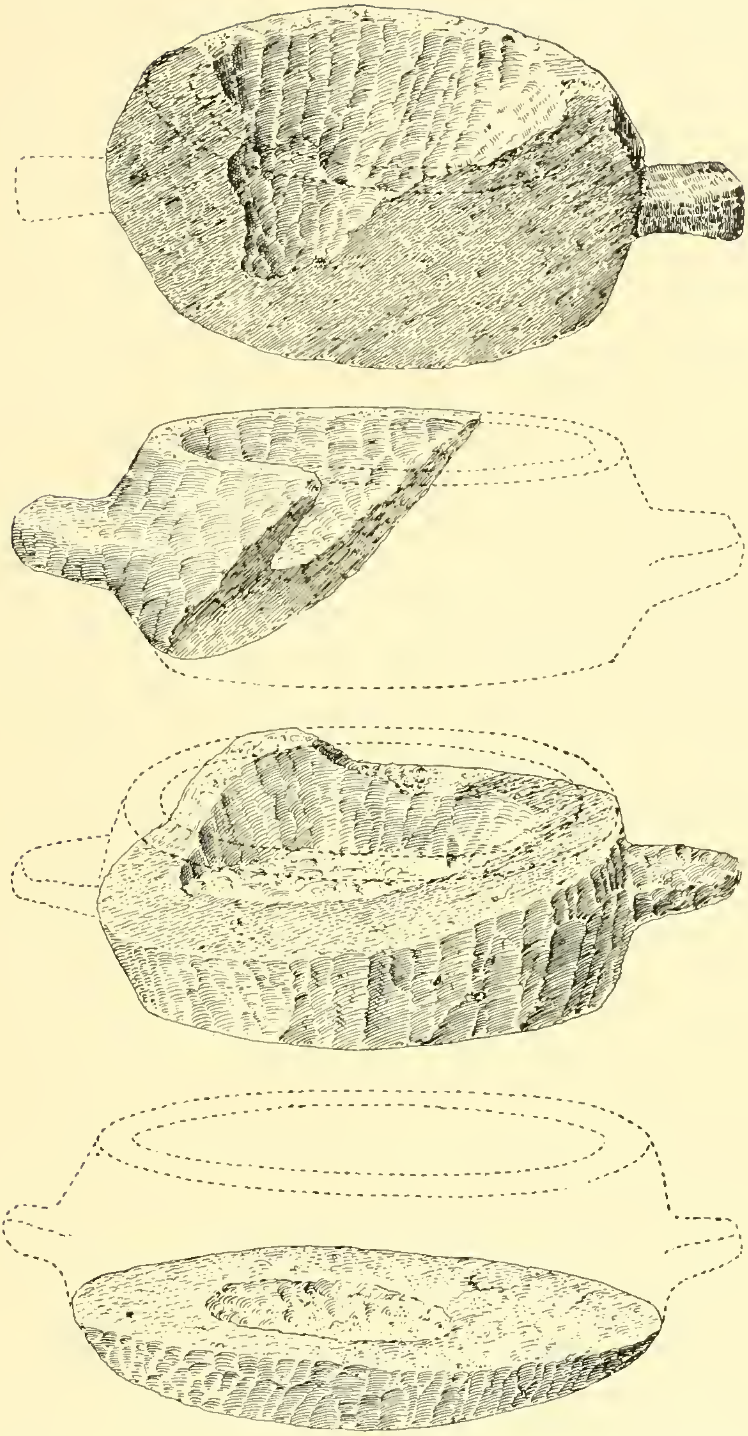


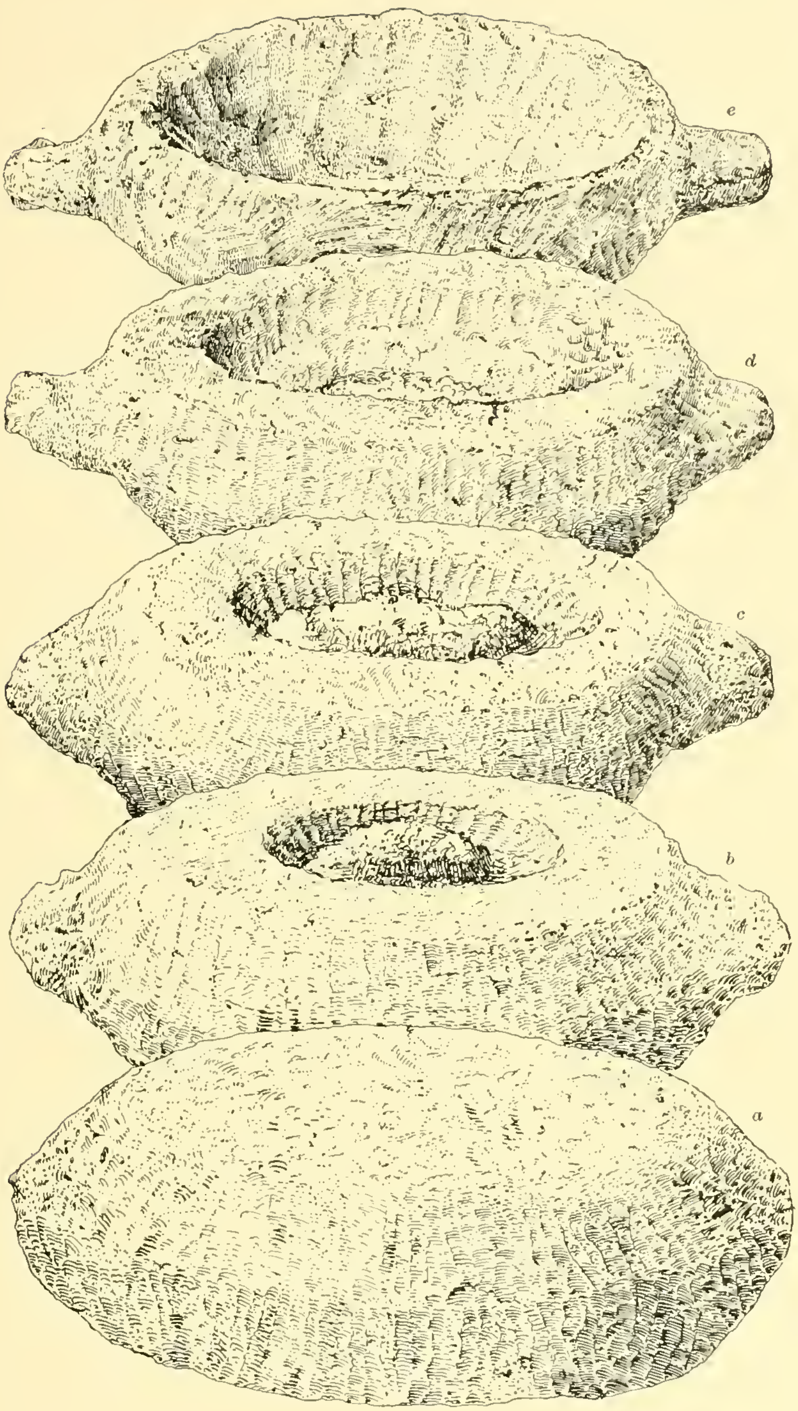
FIG. 22—Rude pick made by sharpening quartzite bowlder.

Another is made of a blackish argillite-like rock that has become gray on the surface through oxidation of some of its constituent minerals. In its general configuration it is somewhat like the quartzite blades produced in the quarry-shops of the district, but it differs from them in having a chisel-like point or edge. This edge is somewhat oblique and shows but little evidence of use, although chemical changes in the stone may have obliterated such evidence. It is shown in *b,b*, plate LXXXVII.

A quite perfect specimen of this class, having a well-rounded body and neat, sharp edge, was picked up on the southern hill; it is shown in *d,d*. A much larger example of the same class was brought to light by the grading operations along Connecticut avenue, on the eastern



INCIPIENT VESSELS BROKEN DURING THE SHAPING OPERATIONS AND LEFT WITH THE QUARRY REFUSE; FROM THE CLIFTON QUARRY; ABOUT ONE-THIRD ACTUAL SIZE



SERIES OF FORMS SHOWING STEPS IN THE STEATITE-SHAPING PROCESS RANGING FROM THE OVOID MASS CUT FROM THE QUARRY TO THE ROUGH FINISHED VESSEL; FROM THE CLIFTON QUARRY; ABOUT ONE-THIRD ACTUAL SIZE

slope of the southern hill (plate LXXXVIII). A nest of four well-shaped chisels, two of which appear in plate XCI, was discovered by me near the summit of the hill; all were sharpened by grinding.

One of the most important finds made during the excavations at this place was a large grooved ax of the wedge-hafted type (*a*, plate XCII). It was found in one of the shallow pits on the southern margin of the hilltop, a foot from the surface and resting on the surface of the soapstone in place. There is no doubt that this tool was used by the ancient quarrymen in dislodging, and possibly in trimming, the masses of stone. Its edge shows considerable wear, apparently from use as a pick, and its surface irregularities are filled with steatite. Its weight and shape would make it a very effective tool. If proof that the workers of these quarries were Indians were necessary, the discovery of this object would seem to be satisfactory. Finds on the sites of ancient soapstone quarries in Maryland include many of these grooved axes. In most cases they have been more or less completely remodeled by flaking to fit them more fully for use as picks.

Correlation with Bowlder Quarries

The question arises as to what correlations can be made out between the steatite quarries and the quartzite-bowlder quarries of the District of Columbia. Are they all probably of one age and the work of one people, or are they separated by long periods of time and by marked differences in art characters? It is observed that the two classes of quarries are located in the same valley and only a mile and a half apart; that they correspond as closely in extent and in appearances as could be expected if worked at one time and by one people; that modern neolithic implements are found in the steatite quarries, and that the products of the steatite quarries are found on many modern village-sites.

It appears that the steatite was not quarried to a depth equal to that of the quartzite bowlders, but it will be seen at a glance that the difficulties attending the working of the former are much the greater. With increasing depth the steatite becomes firmer and more massive, and the difficulty of detaching the necessary masses with primitive tools increases. With the bowlders the difficulty does not increase with the depth in the same degree, and greater depths could be reached with comparative ease.

It is true that the bowlder quarries exhibit more decided evidence of great age than do the steatite quarries in that the pits are much more completely filled up and obliterated. This fact may, however, lead to erroneous conclusions if the conditions under which the two classes of pits existed are not considered. The deepest steatite pits were not over 5 or 6 feet in depth, but they were excavated in solid rock and on the crests of hills where there was little or no material to fall into them save the leaves from the trees. Such of the pits as were not on the summits were entirely or almost entirely filled up. The cobble pits on

Piny branch were in all cases situated on the slope of the hills, and were therefore directly beneath overhanging masses of loosely compacted sands and gravels and may have been more completely filled up in one year than the steatite pits in a century.

The character of the two sites corresponds very closely in the respect that both are in hills so steep as to be quite unsuited for camping or dwelling. Both are therefore naturally free from village refuse, and the tools found, for the most part if not exclusively, consist of those actually used in the work of quarrying and roughing-out the articles produced.

In the cobble quarries no tools of a durable material were needed save the natural bowlders found by thousands in the quarries. Carefully shaped hammerstones, polished celts, and grooved axes had no place in the industries carried on in these localities. A grooved ax, such as that found in the Connecticut avenue quarry, would be an effective tool in the work of quarrying steatite, and could be used without the least danger of breakage. The chisels were especially adapted to, and no doubt made for, the cutting out and carving of the steatite.

The nature and range of the work of shaping carried on in both classes of quarries has a close correspondence. No finished pieces of work of the classes made there were found in either class. In the cobble quarries the blade was roughed-out to a convenient shape for transportation and subsequent elaboration; in the steatite quarries the pots were roughed-out and carried away to be finished elsewhere. It is significant also that on many village-sites in the vicinity the shaped objects of both materials are found freely and intimately associated.

Review of the evidence thus shows many significant correspondences in the work of the two classes of quarries, and no differences that require the assumption of wide distinction either in time, people, or culture. The historical aborigines are probably responsible for all the phenomena observed.

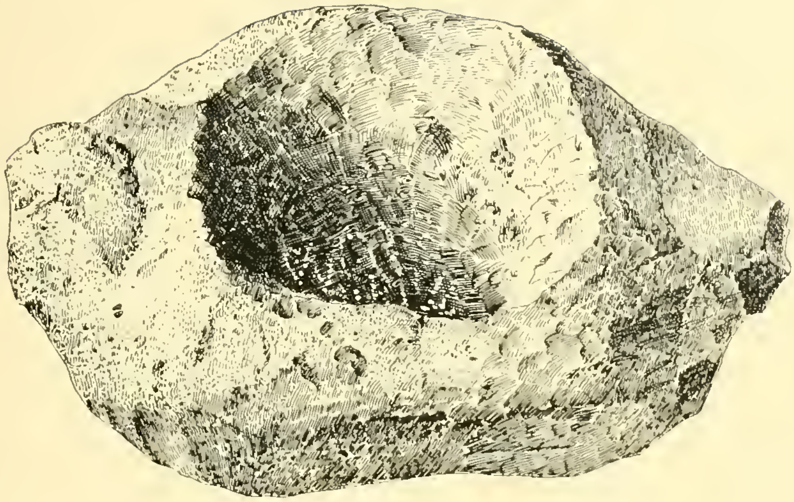
THE SHOEMAKER QUARRY

About 2 miles southwest of the Rose hill quarries, and not far from the grounds of the American University, there are several obscure outcrops of steatite. Numerous partially worked vessels have been found, but if quarries ever existed they are now entirely obliterated by the plow.

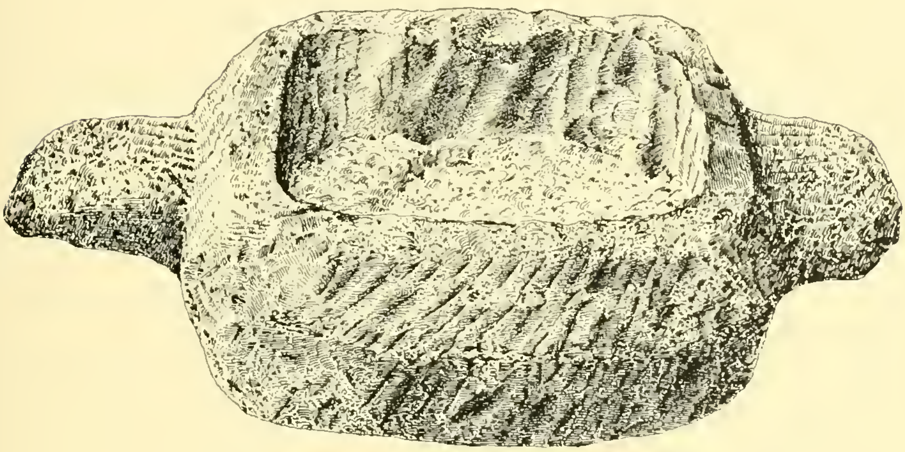
THE LITTLE FALLS SITES

A slight outcrop of steatite occurs in the creek bank at the Virginia end of Chain bridge over the Potomac, just below Little falls and at the head of tidewater; but no traces of ancient work have been observed. That the work of quarrying and cutting this rock was prosecuted in the vicinity is indicated by the discovery of steatite picks and chisels, and many articles made of steatite, finished and unfinished, on the village-

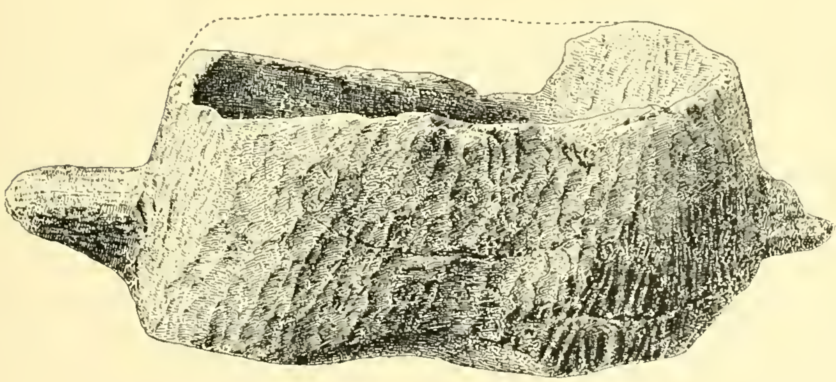
QUARRY-SHOP REJECTS SHOWING EARLY STAGES OF THE STEATITE SHAPING WORK AND SHOWING THE CHISEL OR PICK MARKS WITH PERFECT CLEARNESS. FROM THE CONNECTICUT AVENUE QUARRIES; ABOUT ONE-HALF ACTUAL SIZE



a



b



c

EXAMPLES OF UNFINISHED STEATITE VESSELS

a and *b* (11 inches and 8 inches, respectively, in length) are from the Clifton quarry, and *c* (11¼ inches in length) is from a village-site at College Station, Maryland

sites in the vicinity. These are well represented in the collections of Thomas Dowling, junior, and F. W. von Dachenhausen, of Washington. Typical mining and cutting tools are rarely found at any considerable distance from the quarries. Several small chisels of the usual type, shown in plate XC, were obtained from a village-site between Chain bridge and Eades mill, on the northeastern side of the river; and two sinker-like objects of soapstone from this locality, one discoidal with a peripheral groove and the other oblong with a groove passing along the sides and across the ends, are shown in *a* and *b*, plate XCIX. A small, partially finished ring or bead is represented in *c* on the same plate.

THE BRYANT QUARRY

Following the trend of the soapstone belt northeastward from the Tenley quarries, the first observed occurrence of a primitive quarry is at Four Corners, on the estate of Mr Bryant. Near this gentleman's mansion are two clusters of trees, each less than an acre in area, in which the steatite outcrops, and on account of which the land has not been utilized for agricultural purposes. Considerable work has been done on this site. In the first cluster of trees, 100 yards south of the house, a number of shallow depressions are seen marking the sites of ancient pits and trenches. Numerous worked pieces and partially shaped pots are scattered about, and a few tools have been found, mostly by Mr W. H. Phillips, who kindly directed my notice to this site. The material, the nature of the work, and the tools used correspond very closely with the same features of neighboring sites.

QUARRIES OF THE PATUXENT VALLEY

Numerous steatite quarries have been discovered in Montgomery and Howard counties, Maryland, within the limits of the Patuxent valley. Our knowledge of them is due chiefly to the enterprise of two resident archeologists, Mr J. D. McGuire, of Ellicott, and the late Thomas Bentley, of Sandyspring. The former gentleman has an extensive series of the quarry utensils and products, and has published a valuable paper concerning them.[1] I have been permitted to make illustrations of several specimens from the Bentley collection by Mrs E. P. Thomas, the collector's daughter, and additional illustrations have been obtained from the local collections of Mrs Charles Kirk and Miss Frances D. Stabler, of Olney.

Schooley's mill site—At Schooley's mill, on the eastern side of the Patuxent and about half a mile below Snells bridge, steatite of excellent quality outcrops in a number of places. These outcrops have recently been worked to some extent by the residents of the vicinity, but traces of ancient quarrying have not been entirely obliterated. It is difficult in most cases to distinguish the modern from the ancient

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[1] Transactions of the Anthropological Society, vol. II, 1882, p. 39.

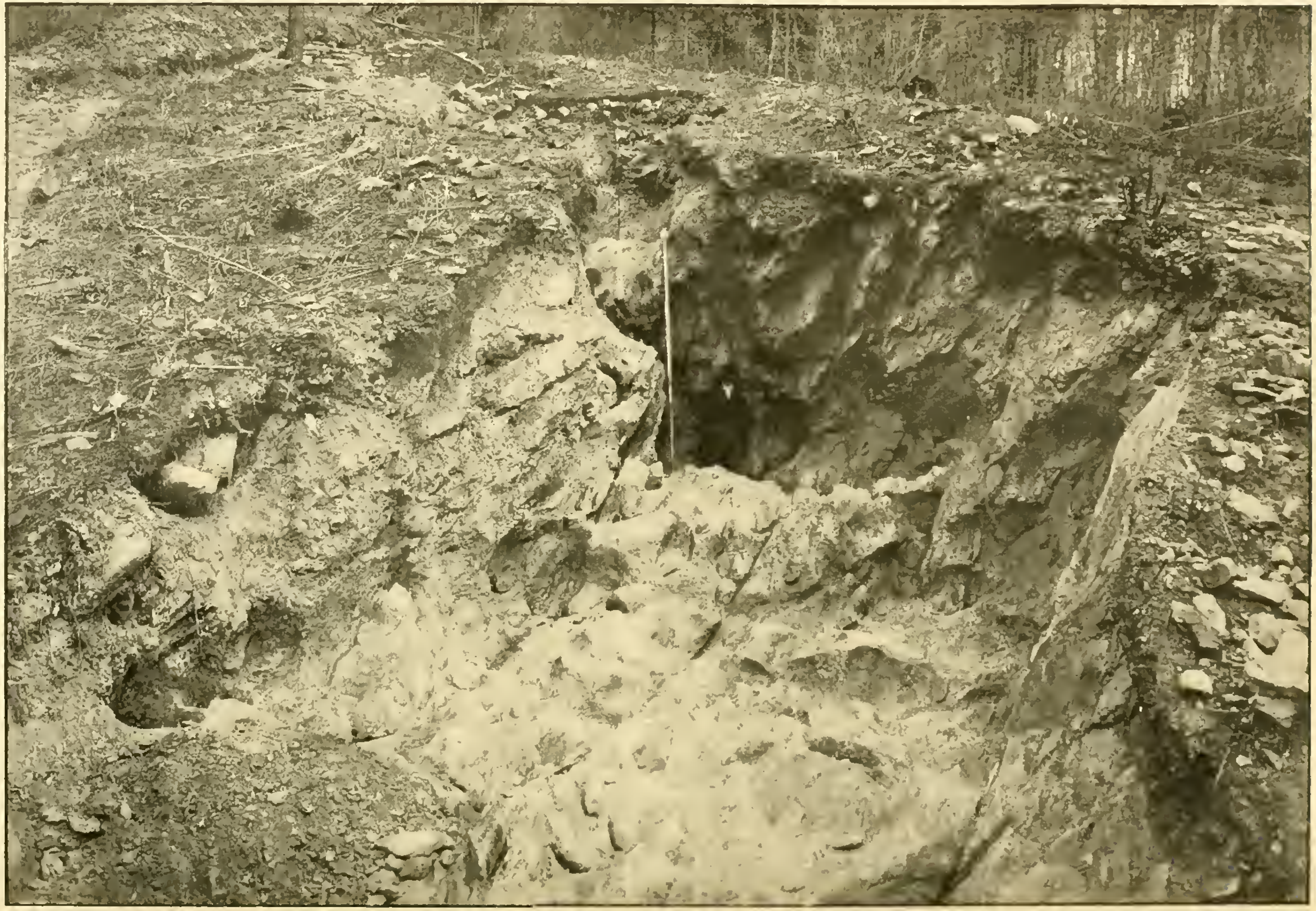
pits, but there are a number of irregular depressions in a grove on the hillside just above the mill that may be regarded as of aboriginal origin. Masses of steatite appear at many points, and some of these bear evidence of the use of stone picks in detaching masses of the rock. A number of broken pots were observed, including several varieties of form. One is a flat-bottom basin or pan of circular outline and vertical periphery, about 13 inches in diameter and from 3 to 4 inches deep, the bowl being roughed out to about half that depth. The entire surface retains the marks of the roughing-out pick, which has been boldly handled. Another specimen, half of which was found, represents an oblong shallow basin with projections for handles at the ends. Another appeared to be part of a deep, almost hemispherical bowl, neatly worked but retaining no traces of handles.

In an hour's search two fragmentary tools were found. They are ordinary chisel picks, one showing the point and the other the head or rounded end. The surfaces have the appearance and feel of ordinary sandstone, but on examination the material is found to be a very fine-grained argillite. Part of the surface of the larger specimen has been shaped by pecking, the remainder having been flaked.

Thompson quarry—The region about Browns bridge over the Patuxent abounds in deposits of steatite, and the ancient workings are extensive. The first outcrop encountered after leaving the Laurel and Sandyspring pike is on the farm of Mr Benjamin Thompson, midway between the tollgate at Ednor and the bridge. A grove of trees with much undergrowth borders the road on the right, covering an area of 2 or 3 acres. In the grove the soapstone outcrops at many points; numerous large masses protrude from the beds of leaves and mold, and present the deeply excoriated surfaces characteristic of weathered steatite. At the roadside and in the lanes, as well as in the neighboring fields, fragments and protruding masses of the rock are seen. A careful search revealed no very definite traces of ancient pitting, but an interesting feature was encountered near the entrance to the wood at the right. An angular mass of the rock rises about 2 feet above the ground, and the highest corner of this has been partially encircled by a deep, wide groove, which still shows the pick marks as seen in plate XCI. It seems remarkable that pick marks exposed to the weather should have been preserved for so long a period, yet the work must undoubtedly be attributed to the aborigines who disappeared from this region a century and a half ago.

The fragments of pots observed here are of ordinary types. A fine medium-size chisel (*b*, plate XCIV) was found in a field adjoining the grove, and other fragments were picked up at different points in the vicinity. A boy living near by had found two fine picks, made by remodeling grooved axes, illustrated in *b* and *c*, plate XCII.

Brown quarry—On the farm of Mr T. E. Brown, within about half a mile of the last-mentioned bridge over the Patuxent, steatite is quite



VIEW OF THE CLIFTON QUARRY AFTER CLEARING OUT, AS IT APPEARED FROM A PLATFORM ERECTED IN THE STREAM BED AT THE FOOT OF THE EXCAVATION plentiful. In the fields near the house masses project from the ground and fragments are scattered about in great profusion. A number of worked places were seen, and a grooved pick made from a grooved ax and the point of an ungrooved pick of medium size were collected.

Wilson quarry—The site most productive of implements for working steatite is located within 50 yards of the Patuxent, half a mile below Brown's bridge, on the farm of Mr W. F. Wilson. The quarry sites have been cultivated to such an extent that but slight indications of the ancient pits are seen. A few small outcrops of the steatite are found, and within a radius of 60 feet about one of these over thirty

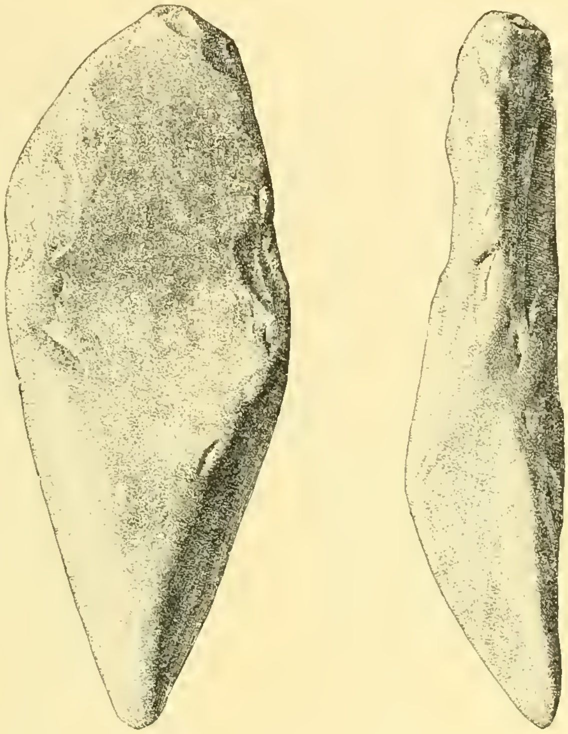


FIG. 23—Implement used in cutting steatite; from quarry in Howard County, Maryland.

tools were picked up. This series includes chisels of ordinary varieties (*c*, plate XCIV) and rude grooved picks of the extemporized variety, one of the latter appearing in plate XCIII.

Fragments of unfinished vessels of various forms were observed on the land of Mr Wilson on the northern side of the river within the limits of Howard county. Several acres of forest land are covered by rough-looking masses of dark steatite. In some places it has been worked and indistinct pits can be traced, and rudely shaped pieces of the material, together with specimens of the tools, were encountered. Beyond this spot, on the farm of Mr Henry Kruhm, another quarry is located. The outcrops are limited, but characteristic fragments of worked steatite and three rather rude chisels were found, two of which are shown in figures 23 and 24.

QUARRIES NEAR OLNEY

During a short stay at "Fair Hill," the residence of Mr Richard Kirk, at Olney, Maryland, my attention was called to a number of rude soapstone dishes that lay strewn about the grounds, and Mrs Charles

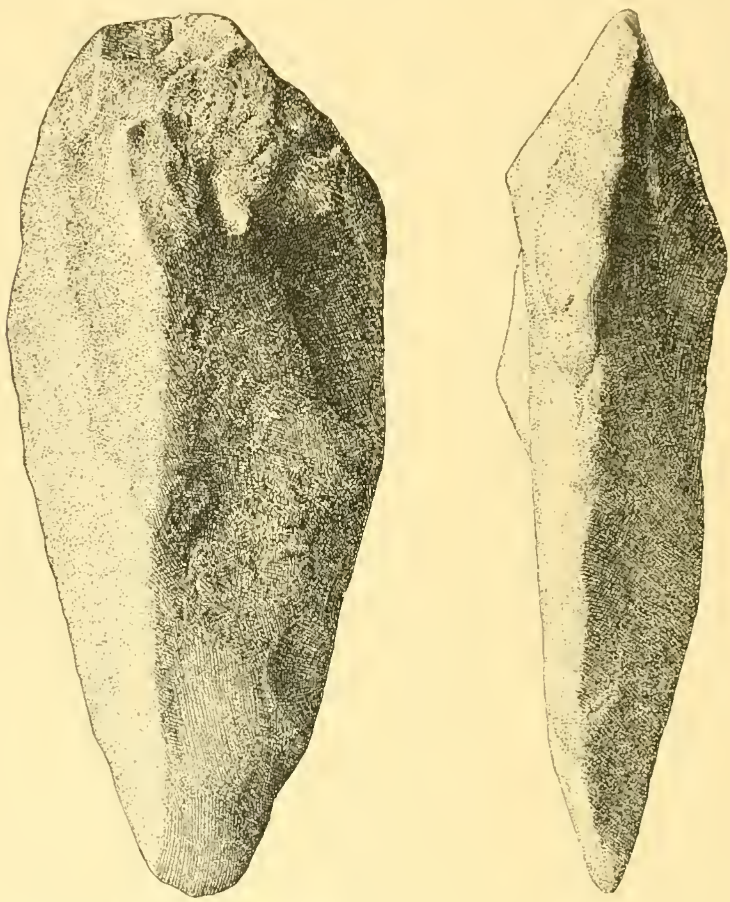
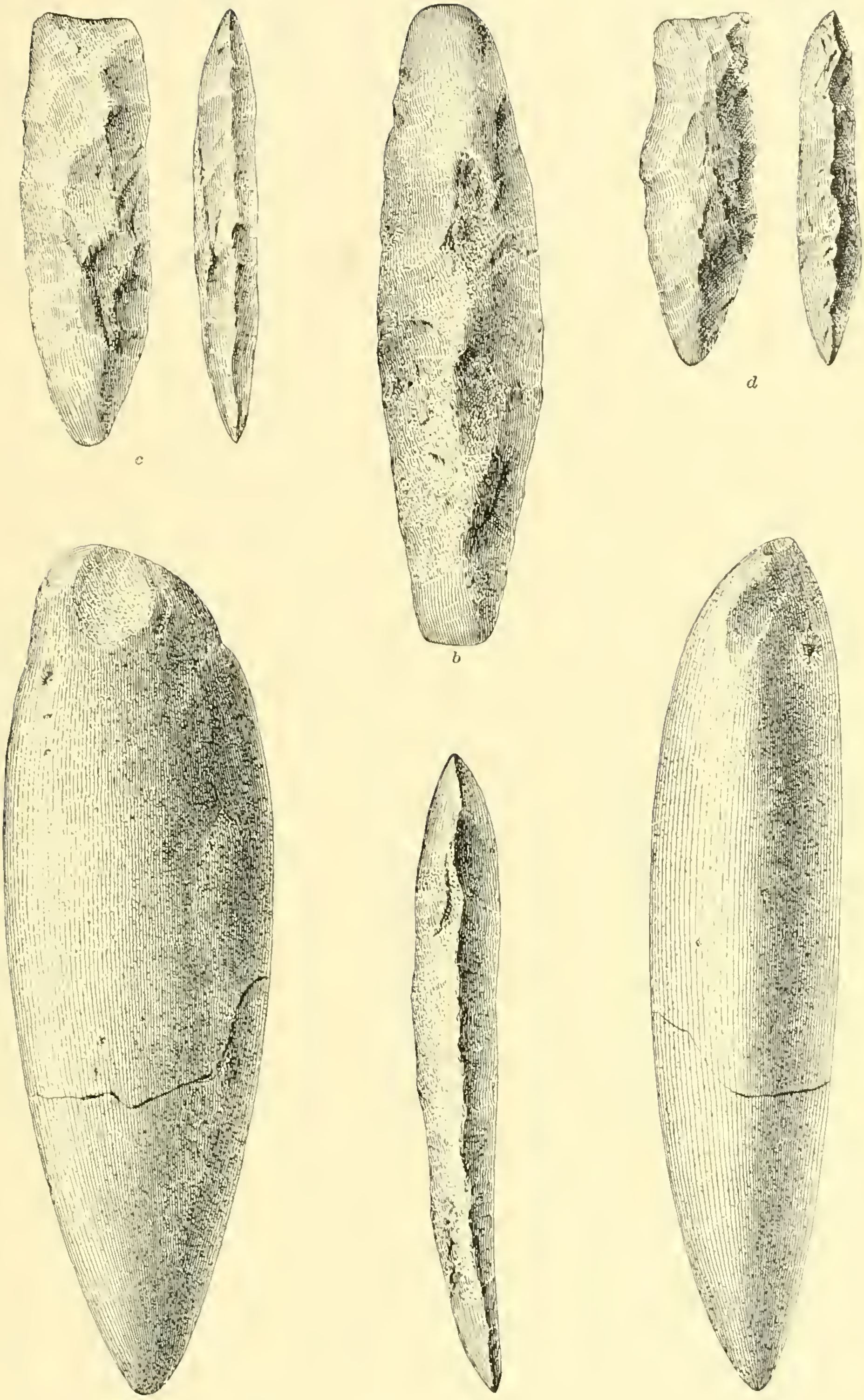


FIG. 24—Implement used in cutting steatite; from quarry in Howard County, Maryland.

Kirk had in her possession an excellent specimen of the two-point chisel-pick (shown in figure 25). Ancient quarries are located in the meadows below the house and in the adjoining woods on Brooke grove farm; they are now almost obliterated by recent quarrying and by farming over the sites. Worked pieces of steatite and specimens of the tools used are still occasionally picked up in the vicinity. The rude vessels are all of usual types, and no example was seen that approaches at all near a finish.



IMPLEMENTS USED IN CUTTING STEATITE; FROM THE CLIFTON QUARRY

a two-thirds actual size, *b c, d* actual size

The chisel pick mentioned above was found by Mr Charles Kirk on the quarry site. It is made of iron-impregnated sandstone, which appears and rings like metal. It has been worked rudely into shape

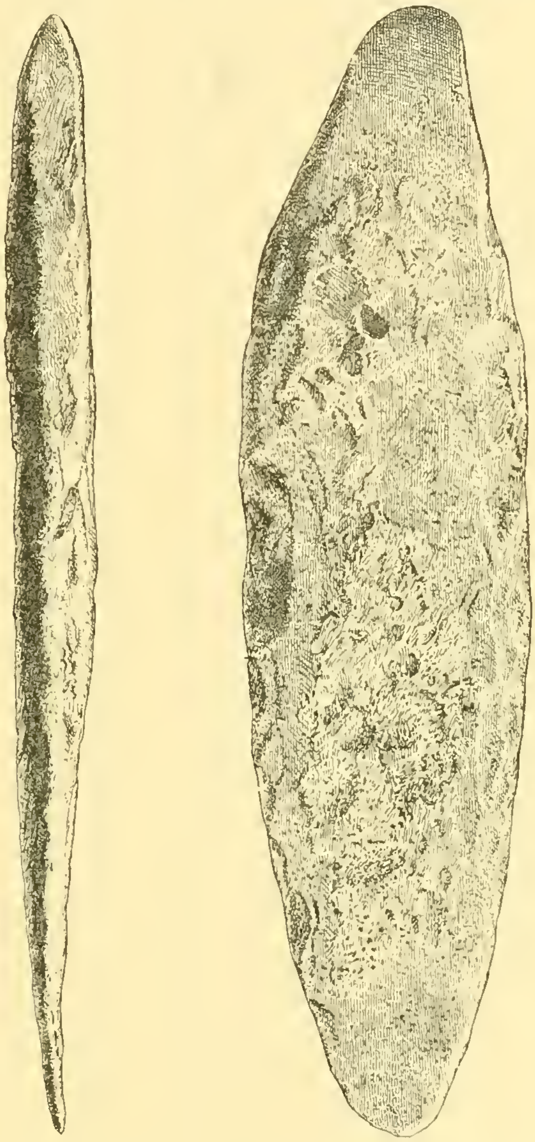


FIG. 25—Implement used in cutting steatite; from the Olney quarry.

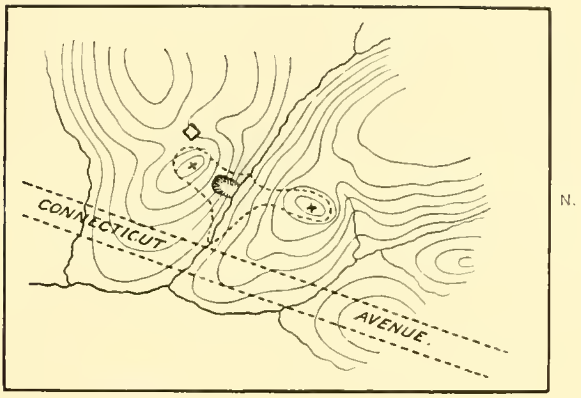
by flaking, and then finished apparently by grinding. It is 8 inches long, 3 inches wide, and half an inch thick, and would appear to be one of the most effective tools of its class yet found. I was so fortunate as to find on this site the small chisel shown in *a*, plate XCIV, which is almost identical in size, appearance, and material with one found in the Rose hill quarry in the District of Columbia. The point is well shaped, and shows the effects of use. The head terminates in a sharp edge, which is not worn, and must have been protected by a haft when in use. The material appears to be a fine-grain greenish-gray argillite. A second chisel of small size (*a*, plate XCV) was subsequently picked up in the field near the Kirk residence. Half a dozen fine soapstone tools were obtained from this vicinity by Miss Frances D. Stabler, who resides at Sharon, a neighboring estate.

FIG. 26—Implement used in cutting steatite; from Sandyspring quarry.

About a mile south of Olney, on the farm of Mr Mackall, the location of an ancient quarry was noted, and the usual refuse of aboriginal operations was observed. A chisel made of blue-gray porphyry and a very rudely grooved or notched fragment of quartz, once hafted as a pick, were picked up. This quarry is said to extend to the farm of Dr Kirk, which lies south of Mr Mackall's place.

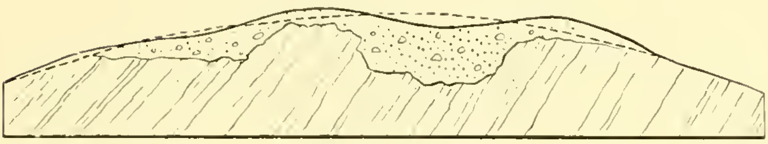
Another site formerly occupied by the aboriginal soapstone worker is situated about 4 miles west of Olney, on the premises of Mr Holland. This place did not yield any form of tool, but the unfinished vessels occur as usual. Other sites are reported in this vicinity.

The collection of Mrs Mary Bentley Thomas, of Sandyspring, was made from the quarries of the vicinity, several of which are mentioned above. There are many specimens of the partially shaped vessels illustrating all phases of the work. The picks comprised in this collection are very fine. Some are modified grooved axes, others are fragments of rock roughed out by flaking just enough to make them available, with the addition of a haft, for working the soft stone. One of the former is shown in plate XCVI, while the latter type is illustrated in figure 26. One of the most striking implements found in this collection, and of wider interest than the other quarry tools, is a gouge of the New England type, which has been roughly grooved by the steatite worker in order that a haft might be attached (figure 27). This specimen serves to add to the force of the remark, suggested by the remodeling of



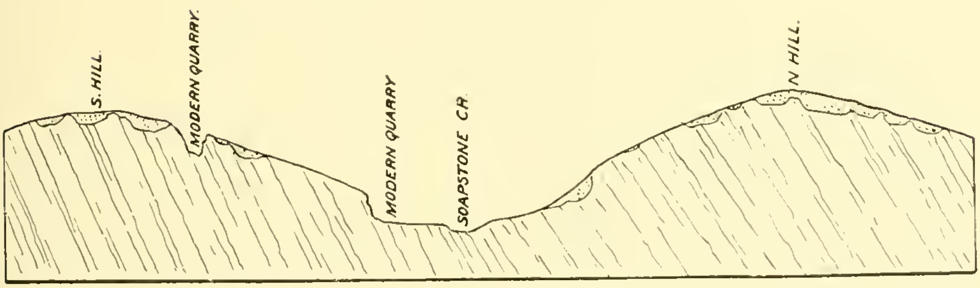
a

Sketch map of the Connecticut avenue quarries The area of the soapstone outcrop is inclosed by a dotted line and the tops of the two hills are marked by crosses



b

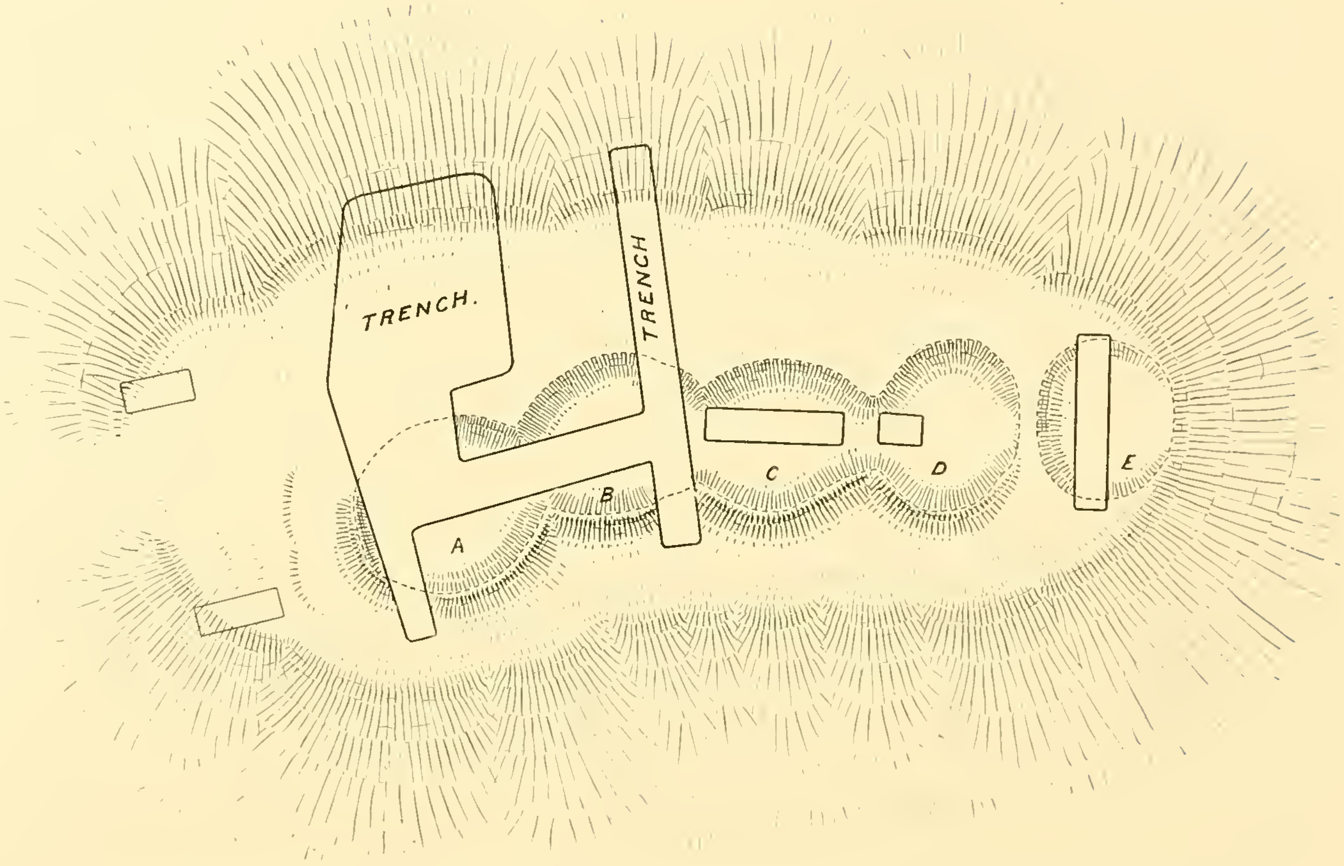
Section of the pittings on the northern hill. The dotted line indicates the original profile



c

Section through the two hills, Connecticut avenue quarries

MAP AND SECTIONS OF THE CONNECTICUT AVENUE STEATITE QUARRIES



MAP SHOWING TRENCHING OF THE ANCIENT STEATITE QUARRIES ON THE NORTHERN HILL; SCALE ABOUT 20 FEET TO THE INCH grooved axes for the rough work of the quarries, that the date of this work is comparatively recent. It would seem that older tools from all sources were pressed into service for carrying on a new art.

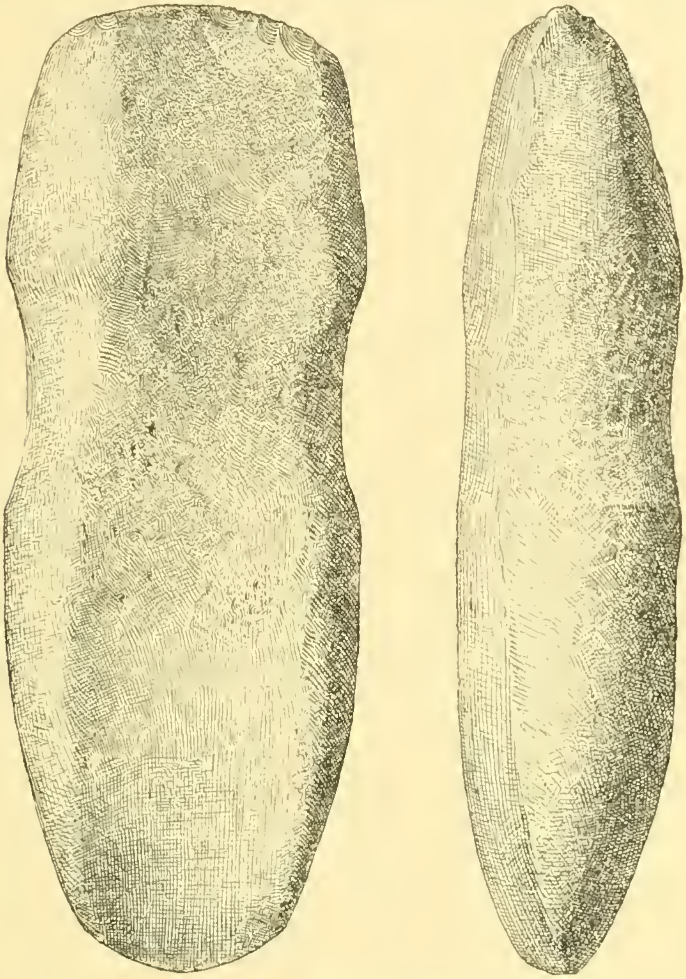


FIG. 27—Gouge-like implement grooved for hafting and used in a steatite quarry near Sandyspring, Maryland.

FALLS CHURCH AND HOLMES RUN QUARRIES

Near Falls Church, and some 3½ miles southwest of Little falls, Virginia, steatite has been found, and some traces of ancient work have been reported. Similar reports come from several other localities in Alexandria and Fairfax counties.

In 1891 a soapstone mine was opened on what was then the Bassett place, on Holmes run, 7 miles from Alexandria and the same distance from Georgetown. As the work advanced a few shallow depressions marking the sites of ancient pits were observed, and in cutting through them several rudimentary vessels and numerous mining and cutting tools, broken and entire, were encountered. The ancient work had extended to the depth in one place of 7 or 8 feet. Several specimens from this site are illustrated in the accompanying plates. An ordinary grooved ax, broken in use, is illustrated in plate XCVII, and two other axes modified by flaking to give them sharper cutting edges (plate XCVIII) are of special interest as further illustrating the subordination of general to special function among the tools of the aboriginal quarrymen.

AMELIA COUNTY QUARRIES

On the southern side of James river, in Amelia county, Virginia, a very interesting site was studied by Mr F. H. Cushing, who conducted extended excavations and made a model of an ancient pit illustrating the manner in which the masses of partially shaped steatite were cut out and removed. The tools recovered and the quarry rejects were identical with those from the more northern sites.

MADISON COUNTY QUARRIES

Between 5 and 6 miles from Orange, on the road to Madison courthouse, Virginia, is a negro church, at which a road turns off northward. At a point about 200 yards from the church the latter road strikes an outcrop of steatite, along which it runs for 500 or 600 yards. Most of the deposit has been so much worked by residents that it is now impossible to determine whether there is any trace of aboriginal work except at the extreme northern end of the outcrop. Here there are a few small pits that seem due to ancient work.

CULPEPER COUNTY QUARRIES

There is a very extensive quarry of steatite near Waylands mills, on the Orange road, 9 or 10 miles west of Culpeper court-house. At the top of a hill, something over 100 feet high, the steatite outcrops and the pits begin at once. They are all to the right of the road, and vary from a foot to 4 feet in depth, with the exception of one, which is fully 150 feet in diameter, the bottom being filled over an area of 50 or 60 feet across with muck, so that its depth can not be determined. Almost the entire surface has been dug over for half a mile in extent.

On the farm of H. I. Aylor, about 2½ miles from the mill, is another steatite quarry, in which it is reported that aboriginal digging was extensive, and that fragments of pots and the like were plentiful. Specimens may be found at neighboring houses, especially at the negro cabins, where they are used for "chicken troughs."

BRUNSWICK COUNTY QUARRIES

On the farm of Bassett B. Wilkes, at Charlie Hope station, 6 miles west of Lawrenceville, Virginia, there are several pits, extending over an acre in area, where steatite has been quarried by the Indians. The

VIEW IN EXCAVATION ON THE NORTHERN HILL, SHOWING SURFACE OF MASSIVE STEATITE ONLY SLIGHTLY MARKED BY THE QUARRY IMPLEMENTS

stone crops out near the top of a narrow ridge on which considerable manufacturing seems to have been carried on, as fragments of vessels are numerous.

RELATION OF CLAY AND STEATITE POTTERY

It might appear that peoples employing earthenware would hardly resort to the difficult task of quarrying and working steatite for vessel making, since the uses to which both classes of utensils were devoted must have been nearly identical; but that the historical tribes made pottery and at the same time employed soapstone vessels is known through colonial records, and also from the frequent occurrence together on village-sites and in shell banks of vessels made of both materials. It has also been observed that pulverized steatite was often used in tempering ordinary pottery, and that the vessels so tempered are occasionally modeled in the form of steatite vessels, having the heavy projections or handles at the sides.

The occurrence of grooved axes and celts in the quarries, and the adaptation of these tools by slight modification to use as picks and chisels, indicates with sufficient clearness that the quarrying of steatite was a comparatively recent industry, practiced after all forms of polished implements had been perfected, and in all probability by the Algonquian peoples.

VARIOUS ARTICLES OF STEATITE

The number of miscellaneous carvings of steatite found in the tidewater districts is very limited, and the execution is usually inferior. They are in striking contrast with the work in neighboring districts in North Carolina and Tennessee, which furnish pipes and ornaments of remarkable beauty.

The fragment of a neatly carved platform pipe shown in *a*, plate XCIX, was found on an Anacostia village-site, near the Pennsylvania avenue bridge. The rudely shaped, channeled, sinker-like objects, *b*, *c*, *d*, are from village-sites near Little falls of the Potomac, and the bit of pipestem *e* is from a dwelling site near the Clifton quarry, Virginia.

The specimens illustrated in plate C are from village-sites in Virginia, and represent several stages of the shaping operations—*a* was roughed-out by breaking and sawing; *b* was reduced to approximate shape by cutting and abrasion, but the bowl is not yet excavated; and *c* appears to be a finished specimen, though quite rude in appearance. The object shown in *d* has been carefully trimmed, but the work is not sufficiently advanced to show whether a pipe or an ornament was to be made.

That such a very limited number of miscellaneous steatite carvings should be found in the tidewater country is a matter of some surprise.

Chapter VI

DISTRIBUTION OF STONE IMPLEMENTS

THE AREA INVESTIGATED

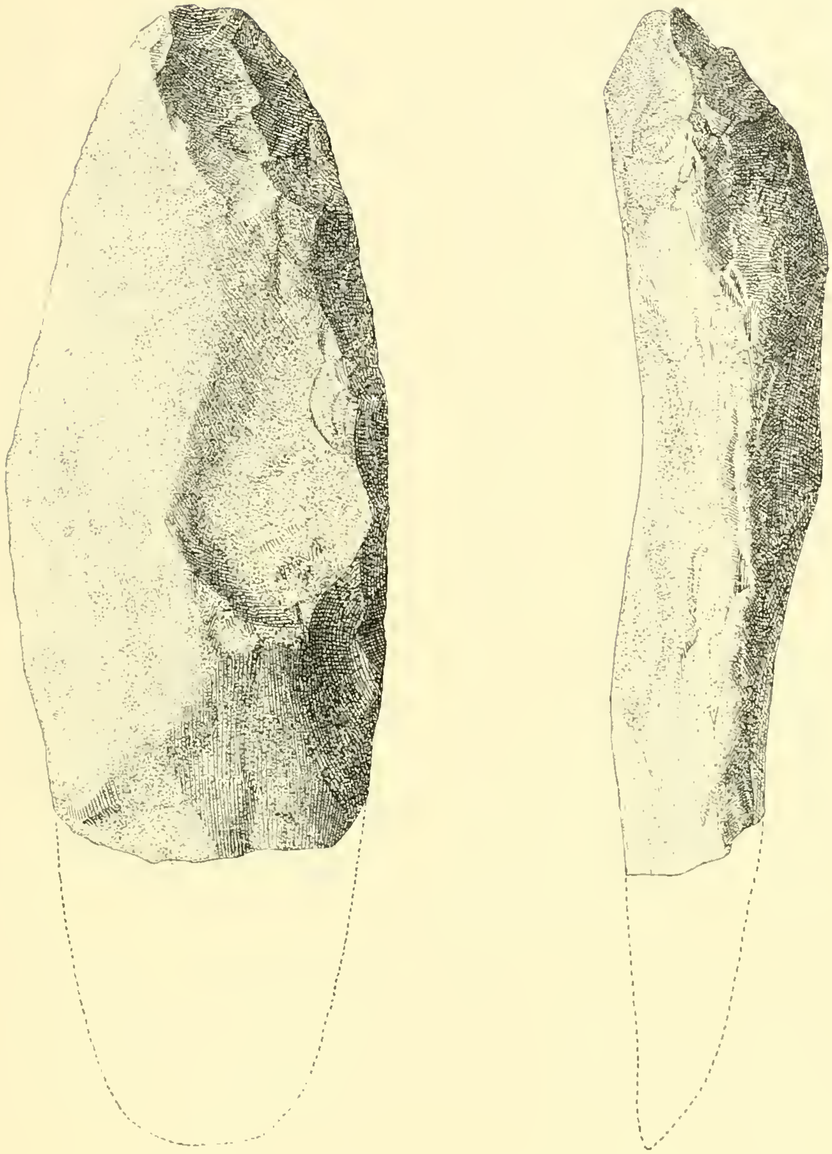
The tidewater portions of Maryland and Virginia have an area nearly equal to that of the state of Maryland. About one-fourth of the area is occupied by broad arms of the sea, chiefly Chesapeake bay and its tributaries, and the land is a much diversified plain, broken by erosion into hills and terraced valleys. It extends inland from the Atlantic seaboard to the base of the highland or Piedmont plateau, which rises on the west to the Appalachian mountains. The curved line separating the two topographic divisions—the lowland and the highland—is marked by falls in all the rivers, and by the location of town and cities through which pass the great highways of travel connecting the north with the south. On this line are located Philadelphia, Havre de Grace, Baltimore, Laurel, Washington, Fredericksburg, Richmond, and Petersburg (see plate I). This was the shore-line of the Atlantic when the formations constituting the lowlands were laid down.

The separation of the lowland from the highland is not a topographic separation only; there are pronounced biologic and geologic distinctions, and these combined in archaic times to produce marked anthropologic distinctions. The tidewater region furnished a plentiful supply of game and fish, and in the brackish and salt water areas an abundance of oysters. The natives lived much on the water, and were perhaps more nearly a maritime people than any other group of tribes in the east. Their peculiar biologic environment had a marked influence on their art, giving it unique forms and exceptional distribution; while their unusual geologic surroundings had a still more pronounced effect on their implements, utensils, and weapons, limiting the forms and sizes and determining to a considerable extent the kinds employed in the various districts, independently of biologic and other conditions.

In early historic times the tidewater country was inhabited by numerous tribes of Indians, mainly of Algonquian stock, subject to the renowned Powhatan. A few other nations were located about the headwaters of Chesapeake bay and others appeared at times along the western and southern borders. The period covered by this occupancy practically closed about the middle of the last century. Its beginning is not determined, but it probably does not date back very many centuries. Of antecedent or prehistoric peoples, if such there were, we have no

THREE CHISEL-LIKE IMPLEMENTS OF DARK ERUPTIVE ROCK FROM THE CONNECTICUT AVENUE QUARRIES; ROUGHED OUT BY FLAKING AND SHARPENED BY GRINDING; ACTUAL SIZE

STEATITE-CUTTING IMPLEMENTS OF ERUPTIVE ROCK FROM THE CONNECTICUT AVENUE QUARRIES; ACTUAL SIZE



FRAGMENT OF A STEATITE QUARRY IMPLEMENT OF GREENISH-GRAY ERUPTIVE ROCK, EXPOSED BY GRADING OF CONNECTICUT AVENUE ; THREE-FOURTHS ACTUAL SIZE

information, for the art remains are simple and homogeneous, giving no hint of the presence in this region of any other than the historic tribes. The region is nearly identical with that explored by that intrepid and illustrious adventurer and colonist, John Smith, whose accounts of the natives are among our most valuable contributions to the aboriginal history of the Atlantic states.

DISTRIBUTION OF MATERIALS

GEOLOGIC DISTRIBUTION OF STONE

The geology of the tidewater country is wholly unlike that of the highland, and the rocks available to the aborigines in the two regions were not only different in distribution but peculiar in the shapes they took and in other features that affect the character of the utensils made and employed. In the highland, west of the dotted line on the map forming plate I, the varieties of rock occur in massive forms and with definite independent distribution. The workable varieties, such as quartz, quartzite, rhyolite, jasper, and flint, were much sought by the aborigines of the lowland. Fragmental material was to be obtained almost everywhere on the surface, but choice varieties were confined to limited areas and often to distant regions, and where the surface exposures were not sufficient to supply the demand, quarrying was resorted to and the work of extracting, transporting, and trading or exchanging the stone must have become an important factor in the lives of the people. The masses of rock were uncovered, broken up, and tested; the choice pieces were selected and reduced to forms approximating the implements to be made, and in this shape they were carried to the lowland.

In the lowland all varieties of hard stones are fragmental, and the species are intermingled in varied ways. These fragments of rock are not merely broken, angular pieces, such as characterize the surface of the highland, but are rounded masses and bits known as bowlders or cobbles and pebbles, and comprise chiefly such tough, flinty, homogeneous stones as are available in the arts of primitive man. Nature, in her own way, selected from the highland along the stream courses the very choicest bits of the crumbled rocks, reduced them in hundreds of cataract mills and in the breakers of the seashore to rounded forms, and deposited them in what are now the lowlands, in great heaps and beds, ready to the hand of primitive man.

At first it would seem to even the keenest observer that a cobble or ovoid bowlder or pebble would be a difficult form of stone to utilize in making knives, spearheads, arrowpoints, drills, and scrapers. The smooth, rounded mass had to be transformed into a thin blade, every contour of which is incisive or angular. So far apart are the two classes of forms that few people have thought of the bowlder as a prominent source of these objects. But when we look into the matter more carefully we find that nature has not provided any other form of the several tough varieties of stone so perfectly suited to the purposes of the stone-implement flaker as the bowlder or pebble.

Each river brought down from the highland only such varieties of stone as belonged to the drainage of that river, so that in one valley one set of materials prevails and in another a different set of materials appears, varying with the geologic formations of the region drained. Rivers having identical formations have nearly identical bowlders; long rivers crossing numerous formations have many varieties; short rivers crossing but few formations have but a limited number.

There is also a selection as to size by each drainage way. Near the base of the highland, where the force of the current is reduced by meeting tidewater, the larger bowlders are dropped, the smaller ones are deposited farther down, and the pebbles and sand are carried far seaward. Small and weak streams transport fewer pieces and drop them sooner. This selection does not hold good with ice transportation, which agency has carried irregular masses of stone to many widely distributed points. Notwithstanding the fact that all water-transported stones are more or less rounded, there is a selection with respect to degree of roundness. If dropped early in the progress of transportation, the bowlder is imperfectly rounded; if carried far, it is fully rounded. Near the margin of the highland, therefore, there is a large percentage of imperfectly rounded stones, and farther out there is a small percentage of decidedly irregular forms. These conditions are probably considerably modified by the action of the waves along the ancient seashore which skirted the base of the highland. Such fragments as were subjected to wave action became fully rounded and were deposited in beds along the ancient beach-lines. It is not easy to distinguish the beach-rolled material from that rounded by the flow of streams, both agencies having no doubt frequently acted in turn on the same material.

Again, we observe that on river banks near the base of the highland many varieties of rock are present, but with each mile as we descend the number is diminished—the softer species are reduced to sand as they move toward the sea and one after another disappears. Quartz, being the hardest, is last to yield to the erosive agents, and at various points along the ocean beach well-polished quartz pebbles are found.

A comparison of the Potomac and Patuxent rivers with respect to these points is instructive. In ancient times both streams, as they descended from the mountains, gathered fragments of rock and carried them downward until the soft and friable ones were reduced to sand and the tough, flinty varieties became bowlders and pebbles. The latter consisted chiefly of quartz and quartzite. The Potomac was a long stream, heading far in the west and cutting through many ranges of mountains and hills. It crossed heavy beds of quartzite in the region of the Blue ridge. This rock is tough and massive, and breaks

IMPLEMENTS USED IN CUTTING STEATITE; FROM A CACHE OF FOUR FOUND NEAR THE SURFACE ON THE SOUTHERN HILL

a, two thirds actual size; b, actual size up into rather large fragments; thus it is that we have many large quartzite bowlders deposited in the valley about Washington and below, the sizes diminishing toward the sea. Between the Blue ridge and tidewater the river crosses a belt of gneiss rocks intersected by many veins of quartz. This latter rock is hard and brittle, and breaks up into small fragments, which, when rounded, are usually of the size denominated pebbles. These were taken up by the waters in countless numbers and distributed with the quartzite bowlders from Washington to the sea. But the quartz is harder than the quartzite and resisted the erosive agents more successfully, so that after the quartzite disappears there are still quartz pebbles in plenty.

The other stream, the Patuxent, has a limited drainage and does not cross the quartzite belt but drains the quartz-bearing zone. Below the point of its entrance into the tidewater country at Laurel, we find, of the flakable stones, chiefly quartz in small fragments; lower down all are well rounded, forming pebbly gravels. It is thus seen that nature has selected the rocks used by the tidewater peoples and has distributed them in groups varying with original location, with hardness, with toughness, with shape, and with size.

GEOLOGY AND ART

The effect of the natural conditions of distribution on the stone art of the various districts was necessarily pronounced. One community located conveniently to deposits of large bowlders used large stones, and the tools shaped from them average large. Another community located in a pebble-bearing district utilized pebbles, so far as they are capable of utilization, and this people had few large tools and many small ones, the average size being small. Dwellers in quartzite-bearing districts had quartzite tools, those having quartz deposits had quartz tools, and those residing near the base of the highland had many varieties of stone and hence used a much greater diversity of stone tools, since the working qualities or capacities of each stone vary from the rest.

As a result of these conditions the tidewater Potomac is rich in chipped tools, both of quartzite and of quartz, of home production. The Patuxent yields a large percentage of quartz tools, most of which are native. The Potomac yields to the collector a large percentage of large tools, the Patuxent a large percentage of small ones. These remarks relate to the native varieties of material and implements made from them. Exotic materials had their own peculiar distribution, which will be examined further on.

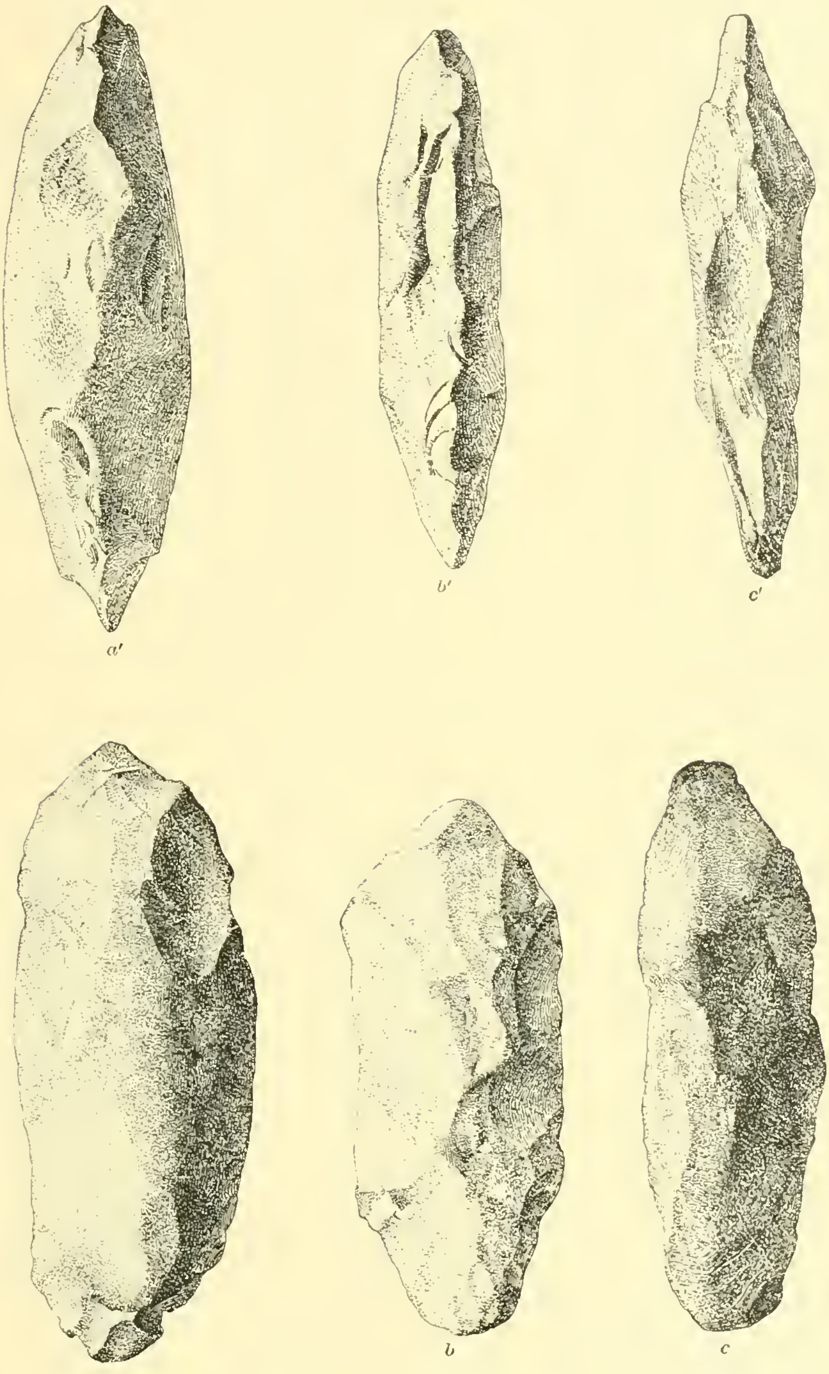
Nearly all rude, bulky implements of chipped stone, and all failures or rejects of manufacture, are, as a matter of course, found on or near the sites from which the raw materials were derived. Rejects are large and clumsy on the upper tidewater Potomac because of the large size of the bowlders available; they are small on the Patuxent because the pebbles utilized were small.

Again, we observe that the percentage of failures—the turtlebacks and other refuse of manufacture—decreases rapidly with the distance from the source of supply of the raw material. This may be illustrated by a suppositious case. In the vicinity of Washington we have a great deposit of quartzite bowlders. In figure 28 the dotted line may be taken as roughly indicating the area yielding workable bowlders, and the angular markings show the distribution of rejects of manufacture. The successful blades and the finished tools produced radiate much more widely, but also diminish with distance from the source of supply, as indicated by the smaller strokes in figure 19, a generalized case also. Favorite routes of travel would receive the fuller supply of these

FIG. 28—Distribution of rejects of manufacture, confined largely to the area yielding the raw material.

objects, and dwelling and important hunting and fishing sites would have large supplies, as indicated by "village-sites" in figure 29. On the source of supply of the raw material, failures and unfinished implements or rejects exceed finished implements in numbers, but beyond this the latter are almost wholly prevalent. So-called paleolithic forms, the rejects of manufacture, are thus confined to certain areas—the areas producing the raw material—and it is easy to see how, in various sections of the country before the true nature of these forms was known, certain localities were thought to have been especially favored by the hypothetic paleolithic man.

It would appear from what has been said that the artificial distribution of materials is limited by, and is indeed a modification of,



IMPLEMENTS USED IN CUTTING STEATITE; FROM VILLAGE-SITES AT LITTLE FALLS OF THE POTOMAC; ACTUAL SIZE

MASS OF STEATITE PARTIALLY CUT OUT BY MEANS OF STONE CHISELS AND NOW EXPOSED ON THE SITE OF THE THOMPSON QUARRY

a *b* *c*

GROOVED AXES USED IN SOAPSTONE QUARRIES

The fine specimen *a* is from the Connecticut avenue quarry, north hill, three-fourths actual size, *b* and *c* are from the Thompson quarry, about one-half actual size the natural distribution, and that each class of artificial objects is scattered in a way peculiar to itself. But the human agent is an important factor. Other things being equal, human distribution of small things is far, of large objects near; implements of war and the chase travel far, domestic utensils remain near; improvised articles or devices are near, highly elaborated and valuable objects go far; along thoroughfares distribution is far, across thoroughfares it is near. Again, much-occupied sites are richly stocked with utensils, while slightly occupied spots have but few; sites near the source or sources of supply have a wealth of art, very distant ones have almost nothing; and sites convenient to a plentiful supply of one material have many tools of that material; sites remote from any of the sources

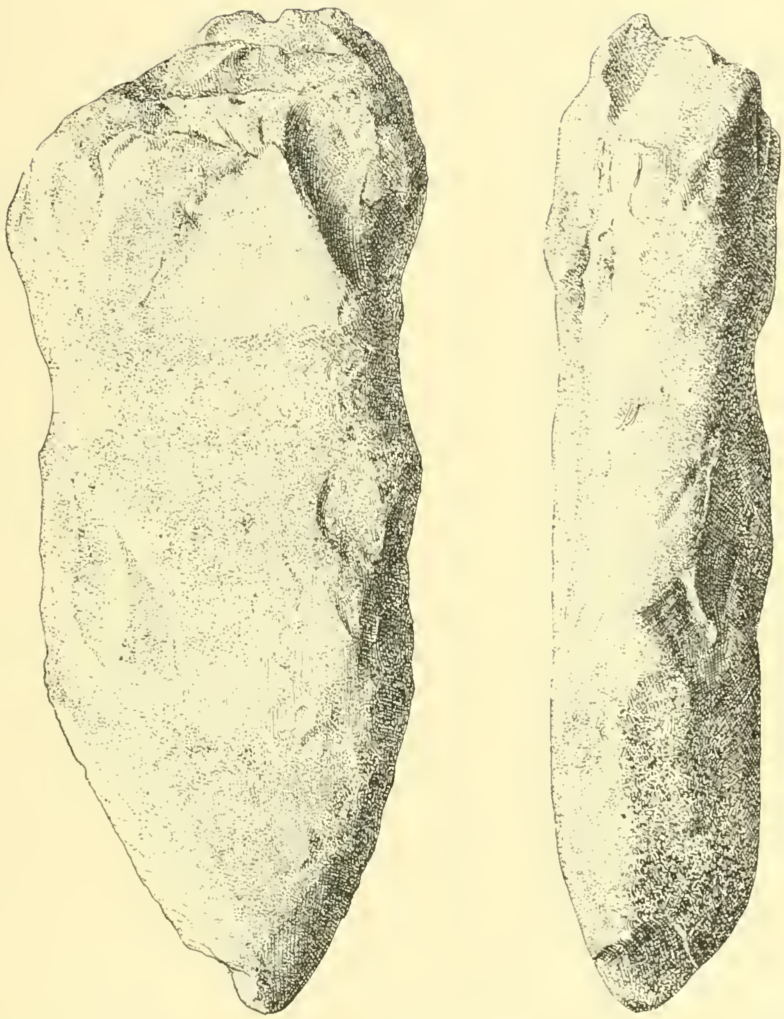
FIG. 29—Distribution of implements, much more general and extensive than the distribution of rejects.

have a limited supply from many sources. So, too, a sedentary people will not distribute widely, while wandering or semisedentary tribes will transport their possessions to many distant places; and sites occupied by numerous tribes in turn will have diversified art remains. It may be further noted that on sites devoted to single or simple industries the range of tools will be small, while on sites where occupations were varied the range will be large; and that where peoples were varied, occupations varied, materials varied, and time was long, we will have the widest range.

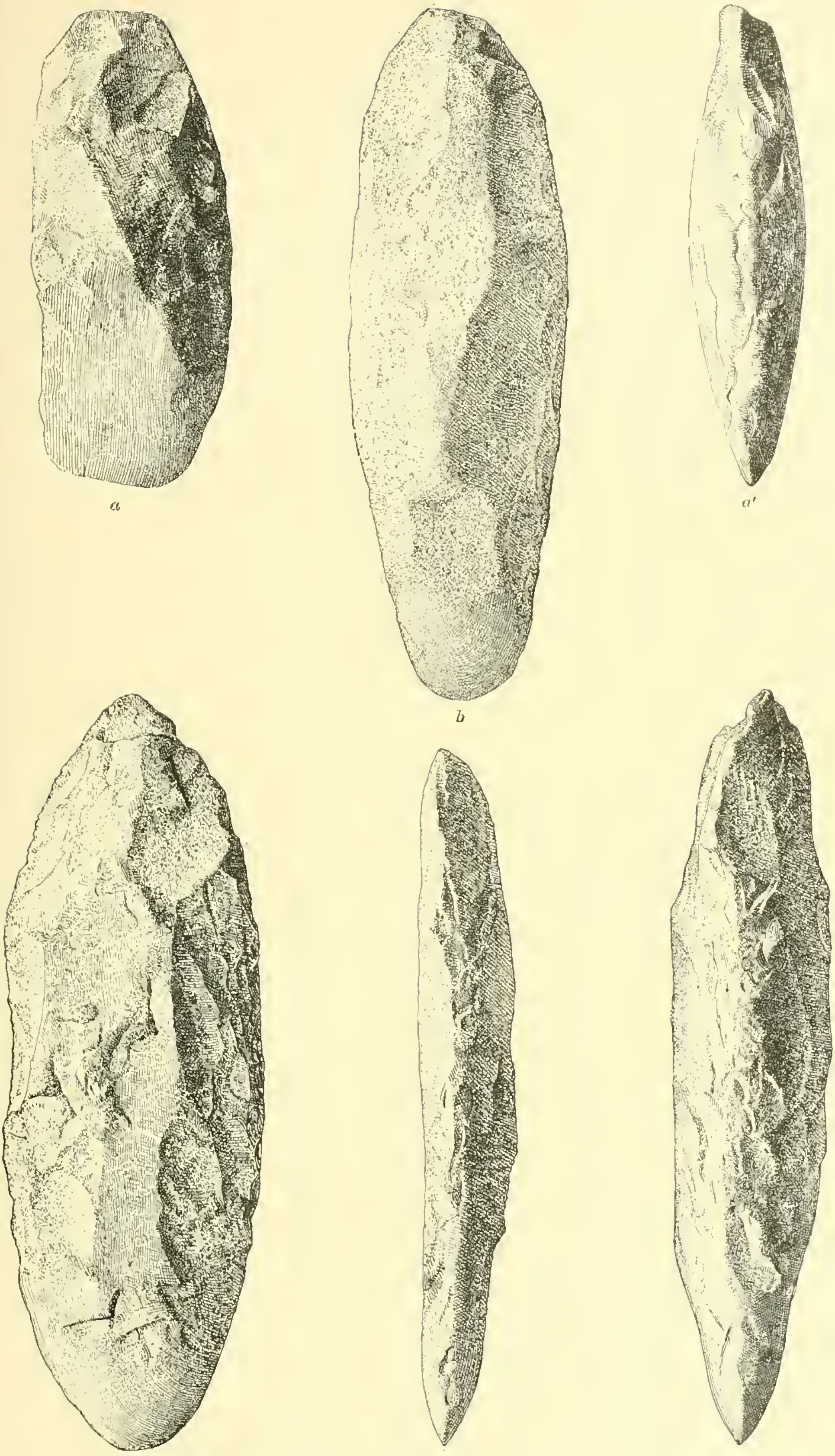
The tidewater peoples were by no means content with the materials supplied by the province in which they lived, although these naturally received first attention. Not being favored by nature in the quality and range of their material, they seem to have searched far and near for those finer-grained, homogeneous varieties so much used in other regions. They sought flint in the mountains of Virginia fully a hundred miles beyond the tidewater limit; they discovered the slaty-looking volcanic porphyry called rhyolite in South mountain 75 miles northwest of Washington, and jasper and argillite were obtained from eastern and northeastern Pennsylvania. It is probable that in some cases the tidewater peoples made long journeys in search of these rocks and spent a considerable season quarrying and roughing out the blank forms and selecting choice bits to be carried home. On the other hand, much of the material from these distant places may have reached the lowland by exchange or trade, and a certain amount, not ascertainable, of the supply of implements of exotic materials was no doubt due to visits and incursions of the peoples occupying the region of the source of supply, as, for example, jasper by the Susquehannocks of the north and flint by the Monacans of the west. It may be that in time, by careful comparison of the forms of implements characterizing various exotic materials, something may be suggested of the presence of neighboring peoples in, or at least of their influence on, the art of the tidewater region. Distribution is really very general, implements made of all of the varieties of stone mentioned being scattered more or less fully over the Chesapeake-Potomac country as far south as James river.

Jasper, the quarries of which have recently been located by Mr H. C. Mercer, of Philadelphia, is most plentiful in the upper Chesapeake and Susquehanna regions. Argillite, which was obtained in the Delaware valley, did not find its way to any great extent into Maryland and Virginia, although several caches of blades have been discovered in the middle Chesapeake region and implements are occasionally found. Rhyolite implements are most plentiful in the Patuxent and Potomac valleys, and especially in those portions of them adjoining South mountain. The quarries of this stone are in Pennsylvania near the head of the Monocacy, and the implements are very numerous on that stream, while fragments of considerable size have been carried far down the Potomac. Transportation was, no doubt, mainly by water. Probably one-fourth of the spearheads and arrowpoints of the Potomac region are made of this rock. Dark or blackish flint was used in making smaller projectile points, and these are rare in the tidewater country, but increase in number toward the west, and prevail in the middle and upper Potomac region.

It should be noted that of these exotic materials we have in the tidewater country very few large or rude implements, and as a matter of course failures of manufacture are rare, save those that result from breakage during such specializing and finishing operations as were conducted subsequently to transportation from the quarry. Of quartz

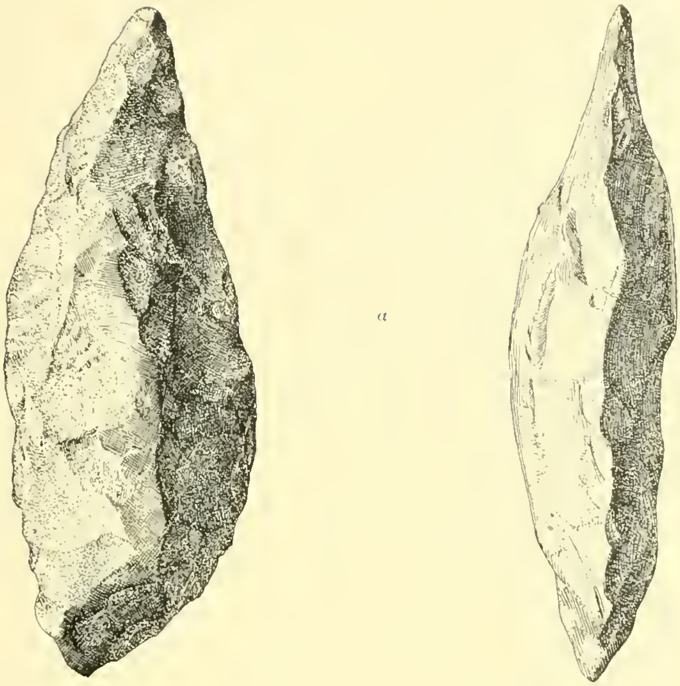


RUDE GROOVED PICK OF DARK ERUPTIVE ROCK FROM THE WILSON QUARRY; THREE-FOURTHS ACTUAL SIZE

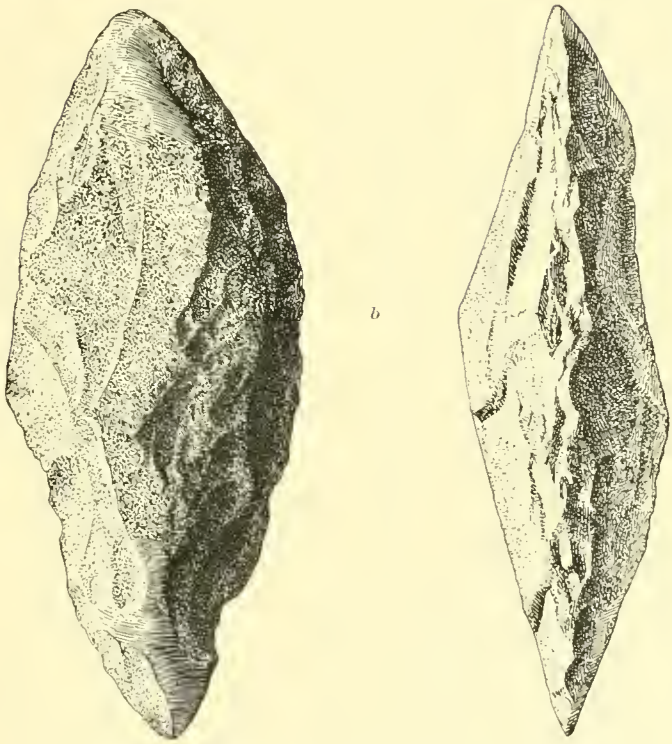


IMPLEMENTS USED IN CUTTING STEATITE; FROM QUARRIES IN THE VICINITY OF SANDYSPRING, MARYLAND

a and *b*, actual size; *c*, two-thirds actual size



a



b

POINTED IMPLEMENTS OF DARK ERUPTIVE ROCK USED IN CUTTING STEATITE

The lower specimen is from the Kirk place, Olney, Maryland; actual size

and quartzite, the native flakable stones, there are countless rejects of manufacture of all grades, as described in the foregoing pages.

It may be said of quartzite and quartz that a portion of these materials, perhaps a large portion, especially of the latter, was gathered from the highland beyond the tidewater limit, and no one can say from the examination of ordinary finished implements of these materials whether or not they were made from a native bowlder or pebble or from a foreign mass or flake; yet the presence of countless numbers of the rejects of manufacture from bowlders and pebbles of these materials within the tidewater area, and the rarity, so far as I have been able to discover, of refuse of manufacture in the highland, seem to make the true conditions clear.

Cut, pecked, ground, and polished implements of usual types are common in this region. Steatite, used in making pots, pipes, sinkers, ceremonial stones, and ornaments, was quarried in hundreds of places along the eastern border of the highland. The unfinished objects are found on and about the quarry sites and on dwelling sites near by. The finished utensils and implements are scattered far and wide over the tidewater province, but grow less plentiful as we approach the Atlantic coast. The picks and chisels used in working the soapstone are confined to the quarries and to shop and dwelling sites in the vicinity. Scores of these objects have been gathered from the Chain bridge sites, within an hour's walk of numerous quarries of the stone they were used in shaping.

Grooved axes and celts were made for the most part of tough bowlders of volcanic and rarely of granitic rocks obtained from the stream beds or about the margins of the highland. Failures resulting from the manufacture of these implements are frequently found on village-sites along the banks of the larger streams but rarely very far beyond the range of the raw material. The implements themselves are of the widest distribution.

COMPARATIVE DISTRIBUTION OF IMPLEMENTS

DISTRIBUTION BY CLASSES

The liability of the various stone implements of the tidewater region to transportation is approximately expressed in the partial list given below. Beginning with those least subject to transportation and ending with those most subject to it we have the following tentative order:

Mortars, generally extemporized from large, flattish or ovoid bowlders having at least one concave surface, which was gradually deepened by use or purposely hollowed out, were probably rarely far removed from the site of their first utilization. Many other improvised tools and utensils—mullers, pestles, hammerstones, etc—were equally home stayers, being merely natural shapes picked up and adapted to the needs of a place or occasion.

Sharpened bowlders, embracing extemporized chopping or bone-breaking tools, occur on all river sites where bowlders were at hand. The edge or point was made by removing one or more flakes, which required but a moment's work. They were not transported far beyond the limits of the bowlder-producing area.

Notched and sharpened bowlders, used as improvised axes and picks or hoes, are closely related to the preceding, but intended to be hafted. Their transportation was but slight, as they are rarely found far beyond the range of deposits of heavy bowlders. Half a dozen blows with a hammerstone were sufficient to fashion one of these objects. They were probably not sufficiently essential or valued to be transported, save in exceptional cases. Blunt-end hammer-like objects notched for hafting are distributed sparsely over corresponding areas.

Picks and chisels, used for working steatite, traveled but little beyond the quarries and the neighboring villages where the finishing was done. These consist of rude, sharp stones, of axes and celts worked over or "upset" to secure good points and edges, and of thick leaf-shape chisels reduced to approximate shape by flaking and then ground to an edge at one or both ends.

Net sinkers are not common. The rude specimens were probably carried back and forth to some extent along the streams, and small well-finished pieces may have been carried everywhere.

Pestles, cylindrical stones symmetrically shaped and well finished by battering, were apparently carried from place to place and perhaps for long distances. Ruder specimens were extemporized and not transported.

Hammerstones—Many of these objects are improvised from bowlders and were quickly cast aside, as already indicated, but others were carried far out into the bowlderless region.

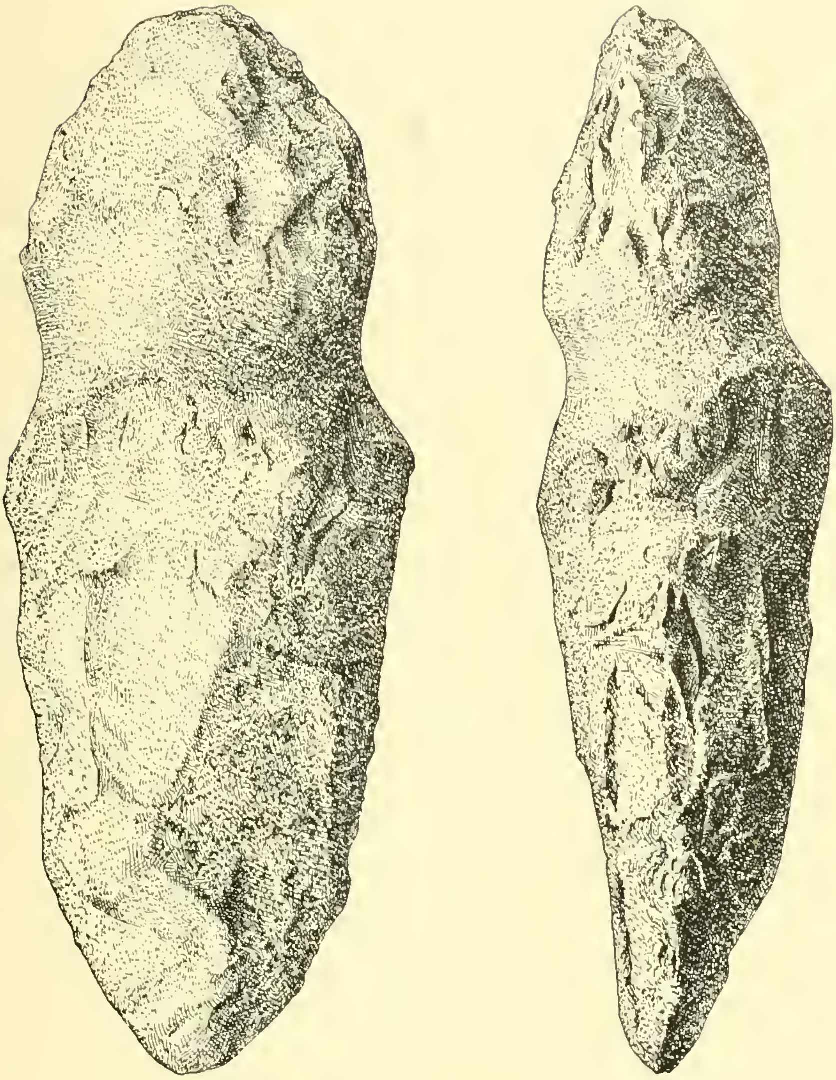
Soapstone vessels are widely distributed, reaching in rather rare cases points 50 miles or more from the highland in which the material was quarried.

Grooved axes, *celts*, *scrapers*, *drills*, *knives*, *spearheads*, *arrowpoints*, as well as *pipes*, *ceremonial stones*, and *ornaments* were freely transported, covering the full range of the peoples employing them, and not infrequently, no doubt, passing from district to district through other hands.

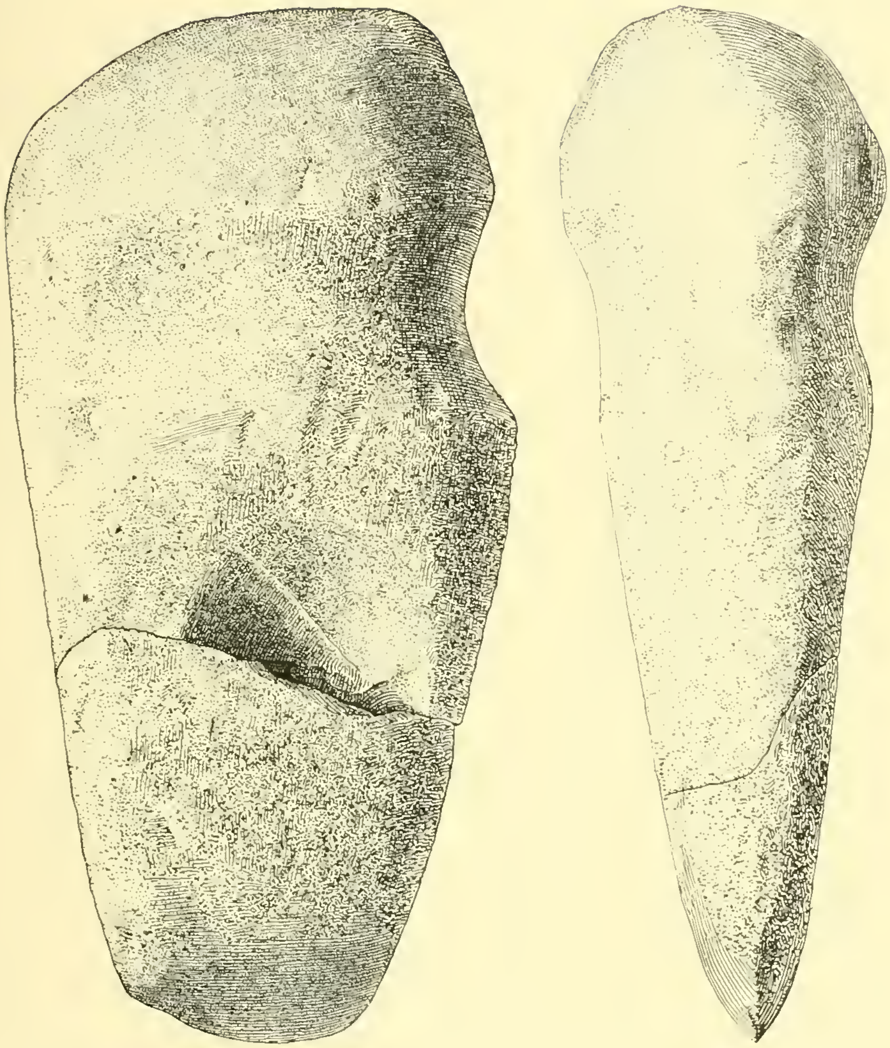
Rejects resulting from failures in specialization of transported forms and of attempts at remodeling of worn or broken tools are to be found everywhere, but rejects of the roughing-out processes are not greatly affected by the transporting agencies, remaining on the shop sites, as has been shown.

DISTRIBUTION BY PARTICULAR SITES

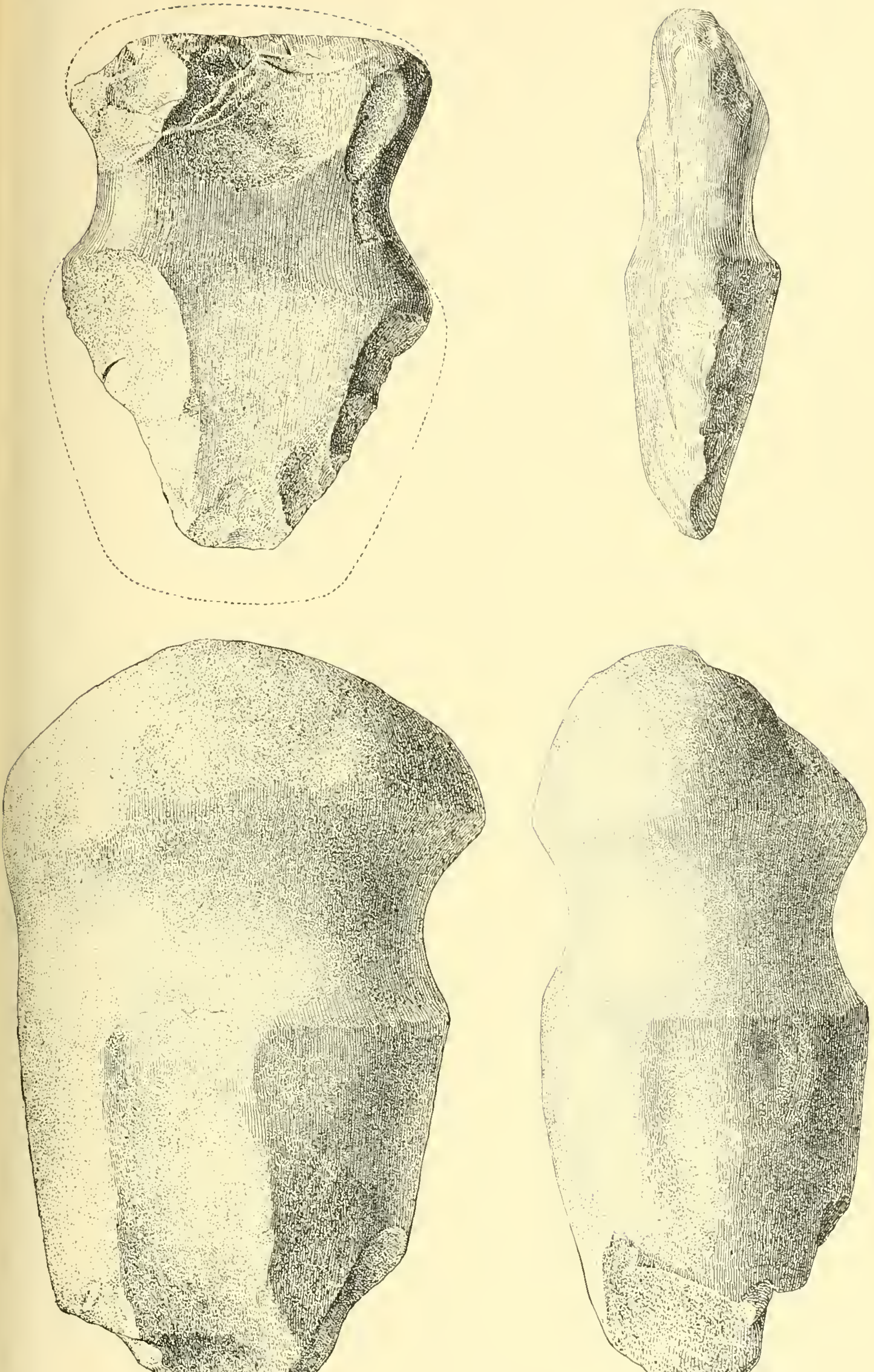
Some of the eccentricities of distribution may be illustrated by an examination of the art contents of sites having varying relations to the deposits of raw material.



STEATITE PICK MADE BY SHARPENING A GROOVED AX, FROM A QUARRY NEAR SANDYSPRING, MARYLAND; ONE-HALF ACTUAL SIZE



GROOVED AX USED AND BROKEN IN A STEATITE QUARRY IN FAIRFAX COUNTY, VIRGINIA; TWO-THIRDS ACTUAL SIZE



GROOVED AXES SHARPENED BY FLAKING FOR USE IN QUARRYING STEATITE, FROM THE HOLMES RUN QUARRIES; TWO-THIRDS ACTUAL SIZE

1. On a site of quarrying and manufacture where dwelling was inconvenient, as on the bluffs of Rock creek, the work was confined mainly to roughing-out leaf-shape blades, and the series of art forms comprises a limited range, including turtlebacks and other kinds of rejects, with refuse and implements of manufacture. On the quarry-shop sites of Rock creek nothing exotic, nothing finished, nothing that might not readily be classed as paleolithic, if shape alone were considered, was found in three months' work.

2. On a site of quarrying and manufacture where dwelling was practicable, and where lodges were actually pitched to a limited extent, we find intermingled with the rude forms some specialized implements and a few tools of exotic origin, such as projectile points of rhyolite, with axes and celts, as at Riggs mill, 8 miles northeast of Washington.

3. On a site of manufacture and at the same time of extensive dwelling, as at Anacostia, in the District of Columbia, where much raw material was at hand, all varieties of refuse and of rude forms are found; likewise well-shaped and wholly finished specimens of flaked tools of local origin prevail. There are also all the cut, pecked, and polished tools, and the ceremonial stones and ornaments common to village-sites. Besides these many exotic materials in varied forms are found.

4. On a village-site where no raw material save small quartz pebbles is found there will be a full range of small quartz rejects and of small quartz implements, with a liberal supply of finished implements of exotic materials, averaging small.

5. On a site remote from all sources of raw material, as on the eastern shore, the objects average small and are much varied in material and style, having come far, through numerous peoples, and from many sources.

Typical illustrations of the two last-mentioned varieties of sites are difficult to find, for the reason that in all sections, even far out toward the present ocean beach, there are occasional ice-borne bowlders and fragments of considerable size, and these were collected by the natives and used for mortars and mullers and for various flaked and battered implements; and such objects destroy the entire simplicity of conditions conceived for the sites described.

DISTRIBUTION BY GENESIS AND FUNCTION

A synoptical statement is made in the accompanying plate (CI), which exhibits many of the most striking features of the flaked-stone archeology of this province, and indicates clearly the points most requiring attention in other regions. The stories of the origin and form of the material, of manufacture, rejection, elaboration, transportation, storage, specialization, and use are all expressed or suggested. Four materials are represented—two native and in the form of bowlders, and two exclusively exotic and derived from mass deposits. Each series indicates the course of development through which most of the finished forms passed between the first stroke given to the shapeless stone and the finished work of art. The size is considerably reduced in the drawing.

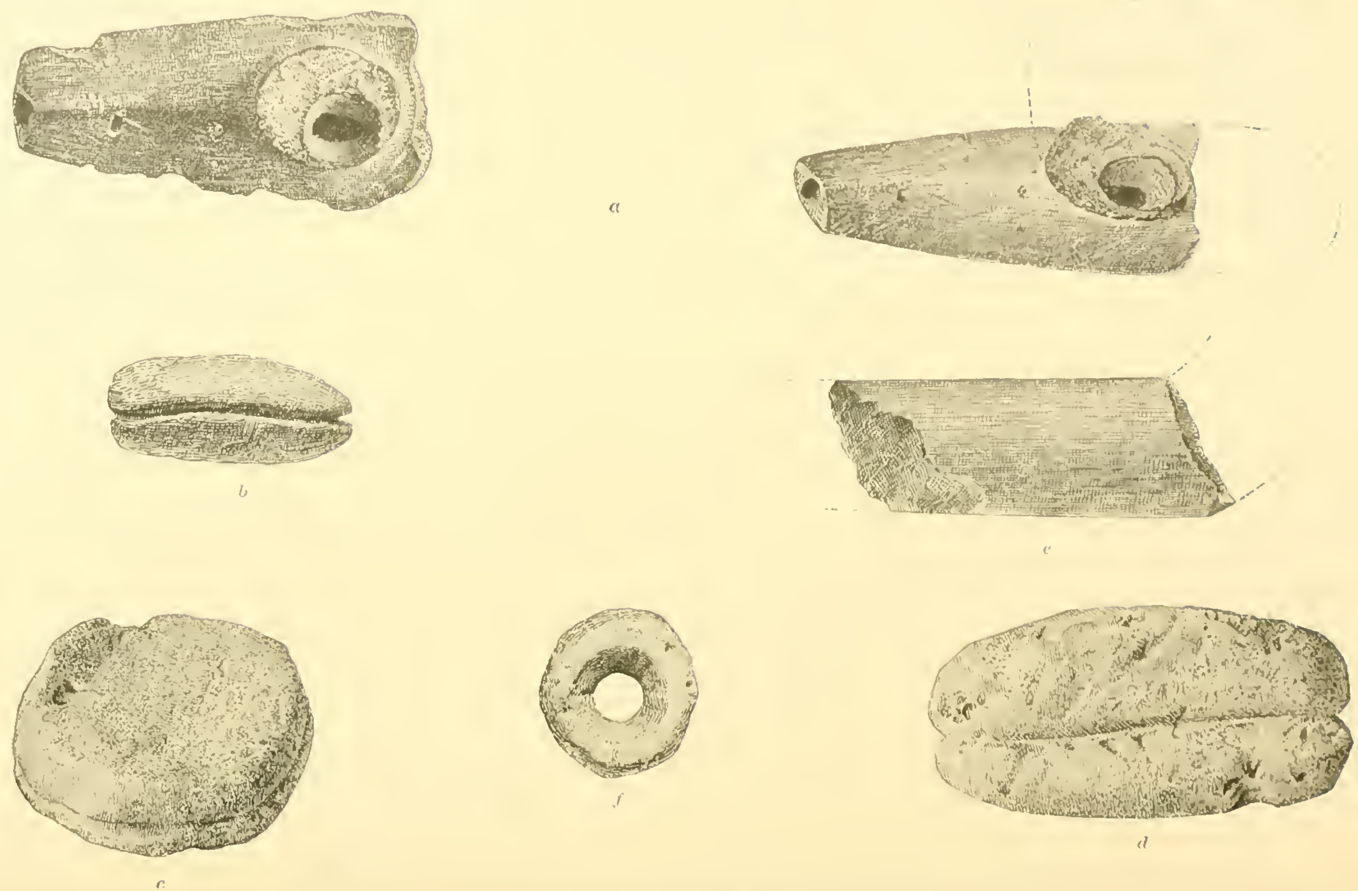
In the first and second series all the forms from the bowlder to the most minute art shapes are represented in solid lines, being exclusively tidewater art. In the first series, numbers 1, 2, 3, 4, 5, and 6 are shop rejects (turtlebacks, etc) and are not implements. Numbers 7, 8, and 9 are roughed-out forms (blanks or blades ready for further specialization) and are not necessarily implements, although they were perhaps available as knives and scrapers. The numbers from 10 to 18 are specialized forms derived mainly, no doubt, from bowlders, and include knives, spearheads, arrowpoints, and perforators or drills.

The second series comprises forms derived mainly from quartz pebbles; naturally they are smaller than the quartzite forms. They are drawn in solid lines, being of native derivation. Numbers 1, 2, 3, 4, 5, 6, and 7 are shop rejects (turtlebacks) and are not implements. Number 8 is a profile showing an ordinary "peak" or hump of the reject. Numbers 9, 10, and 11 are successful blades, which may have been employed as knives or scrapers, though such forms were usually intended for specialization into arrowpoints, spearheads, perforators, etc, as indicated in numbers 12 to 20.

The third series, consisting of objects of rhyolite, is drawn partly in solid lines and partly in dotted outlines. Those in solid lines comprise transported and specialized objects, which were collected in the tidewater country. Those in dotted lines, *a*, *b*, *c*, *d*, *e*, and *f*, are the rejects of manufacture which are not found in the tidewater country, being obtained only on the quarry-shop sites in Adams county, Pennsylvania. The successful blades, illustrated in *g*, *h*, and *i*, were carried away from the quarry to be used as they are or for specialization into the succeeding forms, *j* to *q*, when needed. The tidewater province is abundantly supplied with all the forms from *g* to *q*.

The fourth series, composed of articles of jasper, repeats very closely the conditions of the third or rhyolite series. The sizes average smaller on account of the inferior massiveness and minuter cleavage of the rock. The rejects of manufacture, indicated in dotted lines, are obtained mainly from the recently discovered quarries in eastern Pennsylvania. Other quarries nearer at hand may yet be found, and some of our rivers furnish occasional bits and pebbles of this material. The cache and finished objects, *g* to *q*, are widely scattered over the tidewater region. Three or four other materials of equal interest with those given could be added, but the lesson would not be made clearer than as it stands.

It is of the utmost importance, in taking up the stone implements of a region, that each leading material be traced back to its source, so that from this point of view a study can be made of the full life history of the implements—the work of quarrying, shaping, transporting, finishing,



SMALL ARTICLES—PIPES, SINKERS, AND A BEAD MADE OF STEATITE; ACTUAL SIZE and use. Each form or class of implement will thus be found to have left in its wake a trail of "wasters" or rejects peculiar to itself. Until these are understood, selected, and set apart, there is necessarily much confusion.

It is seen by a study of plate CI, in conjunction with the representations of actual specimens in preceding plates, that a half or more of the range of native flaked forms are actually not implements. The separation is approximately indicated by the upper brackets marked "not implements" and "implements." It will be observed that this division separates the cache forms or blanks of the middle column into two parts. Portions of this class of objects were mere quarry shapes, distributed to be elaborated when needed, but some of them were probably utilized in their blank shape as knives, etc, and some show a slight degree of specialization (as in number 9 of the first series), and thus properly take their place with implements. Nearly all of the specimens shown in this column are actual cache finds, some being depicted on reduced scale in order to get the entire series within the limits of a plate.

The distribution of cut, battered, ground, and polished stone implements, and of the refuse of their manufacture, is governed by laws similar to those governing the distribution of flaked stone.

RÉSUMÉ

Geologic history of the province—The Potomac-Chesapeake tidewater province lies outside or east of what is known as the "fall line"—the base of the highland proper—and is a broad, much broken plateau, nowhere more than a few hundred feet in height. The geologic formations consist in the main of loosely bedded bowlder-gravels and sands derived from the highland at periods when the sea covered the entire area, washing the highland along the fall line. Subsequent elevations of a few hundred feet drove the sea outward beyond its present limit, and erosion carved the exposed land into hills and valleys.

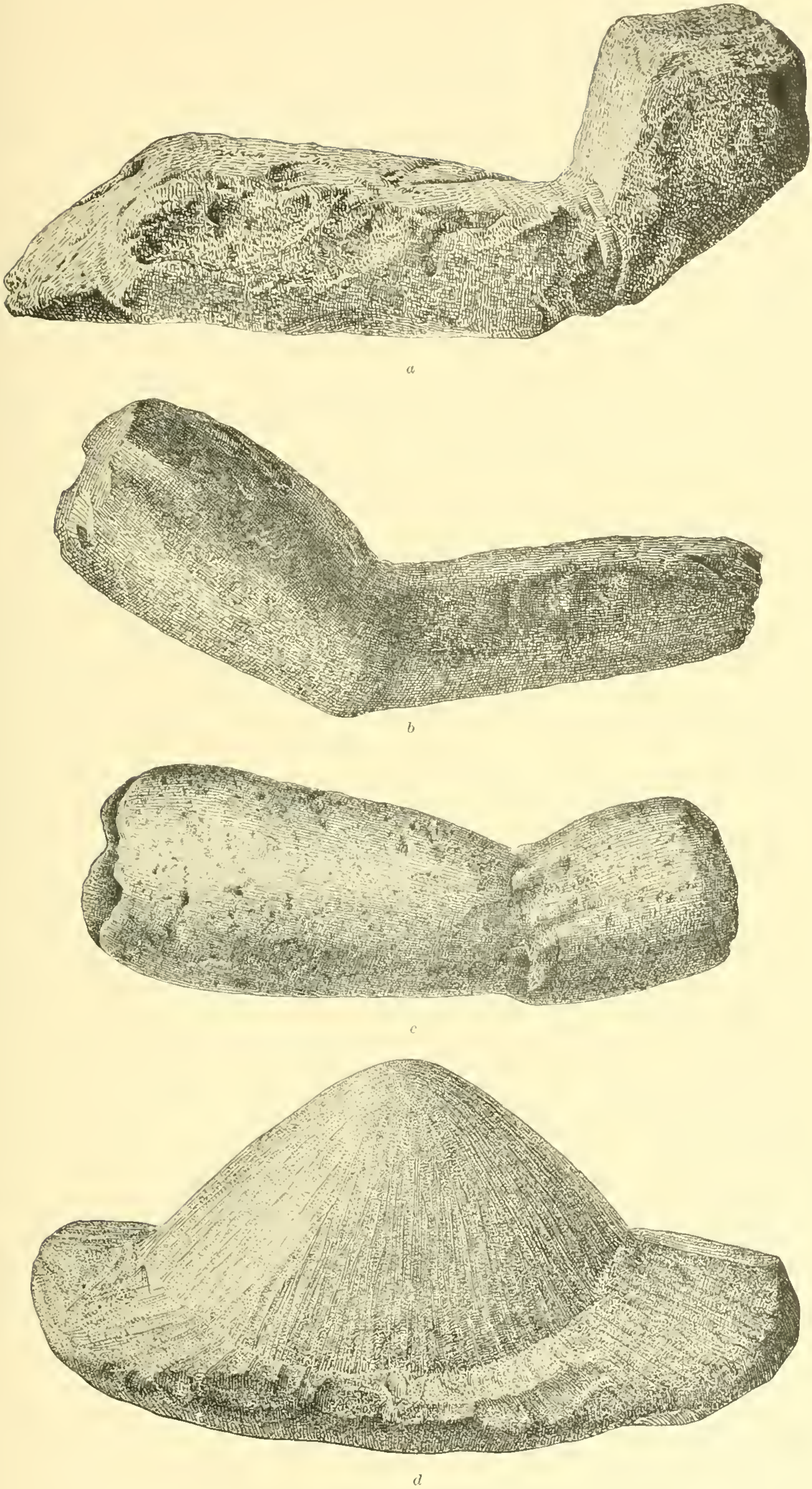
At a later period the land was depressed a hundred feet or more, and the valleys were filled with water from the sea, forming a thousand arms and inlets whose tortuous margins now meander the old hill slopes of the province midway in their height.

Historic peoples—When first visited by the English this district was occupied by numerous Indian tribes, who subsisted largely by hunting and fishing, but engaged to some extent in the cultivation of maize. They were a vigorous, valiant race, but had made but little progress in any of the arts save those of mere subsistence. Today they have entirely disappeared, and students interested in their history gather the scattered remains of their art, seeking thus to supplement the meager records of colonial days.

Art remains—The art remains preserved to our time indicate the prevalence of extremely simple conditions of life throughout the past, and exhibit no features at variance with those characterizing the historic occupancy. While their study throws much light on numerous episodes of the history of the aboriginal tribes, the story they tell of themselves and of the industrial struggles of primitive peoples in general is of profound interest.

Status of art—As indicated by the remains, art in stone—which is the leading art represented—was still almost wholly within the implement-making phase of the stone age, mythology and the esthetic forces not yet having lent their inspiration to the hand of the sculptor.

Utilization of stone—Stone in its various forms was much valued and used by these people and was sought both in the lowland and in the highland beyond. In the lowland it occurred as bowlders and pebbles brought down by the waters and in the highland as original masses and as surface fragments dislodged by natural forces. It was gathered from the surface for various uses, and when the supply was insufficient



SPECIALIZED AND PARTIALLY SPECIALIZED OBJECTS OF STEATITE; ACTUAL SIZE

it was dug from the ground; and thereby the quarrying industry developed.

Shaping processes—The implements made were of many forms and served a multitude of purposes. Their history divides itself naturally into two sections, the period of manufacture being sharply separated from the period of utilization. The first stage, the full analysis of which is of the utmost importance, is studied to best advantage through the shaping processes employed in manufacture. These processes were adapted to the kind of material utilized and the nature of the results desired and are grouped under four heads, as follows: (1) Fracturing processes, (2) battering processes, (3) incising processes, and (4) abrading processes.

Fracture processes—Of the implements made and used in this province perhaps 90 per cent were shaped by fracture processes. These deal with all brittle stone, and the shaping is attended by constant breakage and failure, so that for each completed form several abortive forms are produced more or less closely resembling some of the simpler varieties of finished implements. This work was carried on all over the large area furnishing the raw material, and the articles made and used were everywhere intimately intermingled with the rejectage of manufacture. So confusing were the conditions that no definite line could be drawn between the two classes of objects. The discovery of quarries in the hills, entirely isolated from sites and phenomena of specialization and use, made the separation easy, and led to a correct understanding of what may well be called the morphology of flaked implements.

Lowland quarries—The great quarries of the lowland were located in the bluffs about the head of tidewater on the Potomac and yielded quartzite bowlders in vast numbers. These were obtained and partially elaborated on the local shop sites. The bowlders were cast out of the pits and a few flakes removed to test the material; the best stone was selected and the desired implements roughed-out by free-hand fracture. The form almost universally sought was a leaf-shape blade suitable for further elaboration into any of the specialized forms having their genesis through this general form. The blades made—with perhaps unshaped flakes and fragments—were carried away, and the soil soon closed over the pits and the vast bodies of shop refuse; and these latter, now for the first time systematically examined, tell the story of operations and results with absolute certainty and complete uniformity.

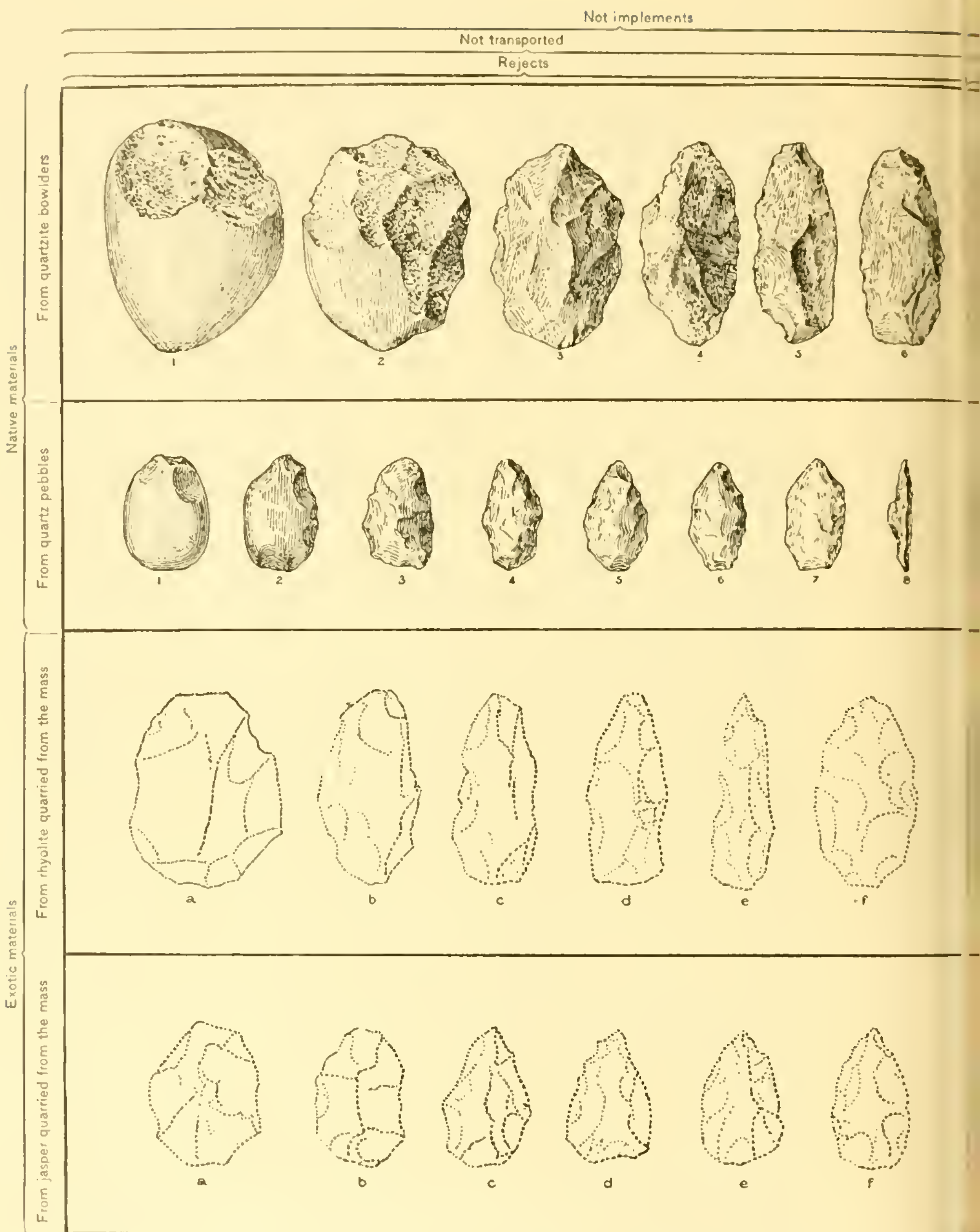
Story of rejectage and refuse—The débris of the quarry-shops consists of (1) tested and shattered bowlders, (2) flakes, and (3) broken and abortive incipient implements, the last necessarily illustrating all the steps of implement development from inception to the end of the quarry work. Thinness was an essential feature of the blades made, and failure resulted in a majority of cases from the development of too great thickness along the middle of the form. It is these thick forms, flaked on one or both sides and exhibiting types of conformation necessarily oft repeated, and scattered over the country wherever shaping from bowlders was attempted, that have puzzled and confused archeologists. It was not the practice here or elsewhere to finish the implements on the quarry site. The form was developed just far enough to make transportation easy and the subsequent work of specialization simple and safe.

Destiny of the quarry product—From the quarry-shops the blades were carried away to be specialized, finished, and used. Some are found in hoards or caches, suggesting transportation from the quarries or from place to place in numbers; some are found on village-sites and scattered over the fields, and many examples still retain the crude edges and points just as they came from the roughing-out shops; others are neatly trimmed, probably for use as knives, scrapers, etc. while the vast majority are sharpened and stemmed, or notched for hafting as projectile points. In these objects we have not only the quarry-shop product but the product of all other shops of the province as well.

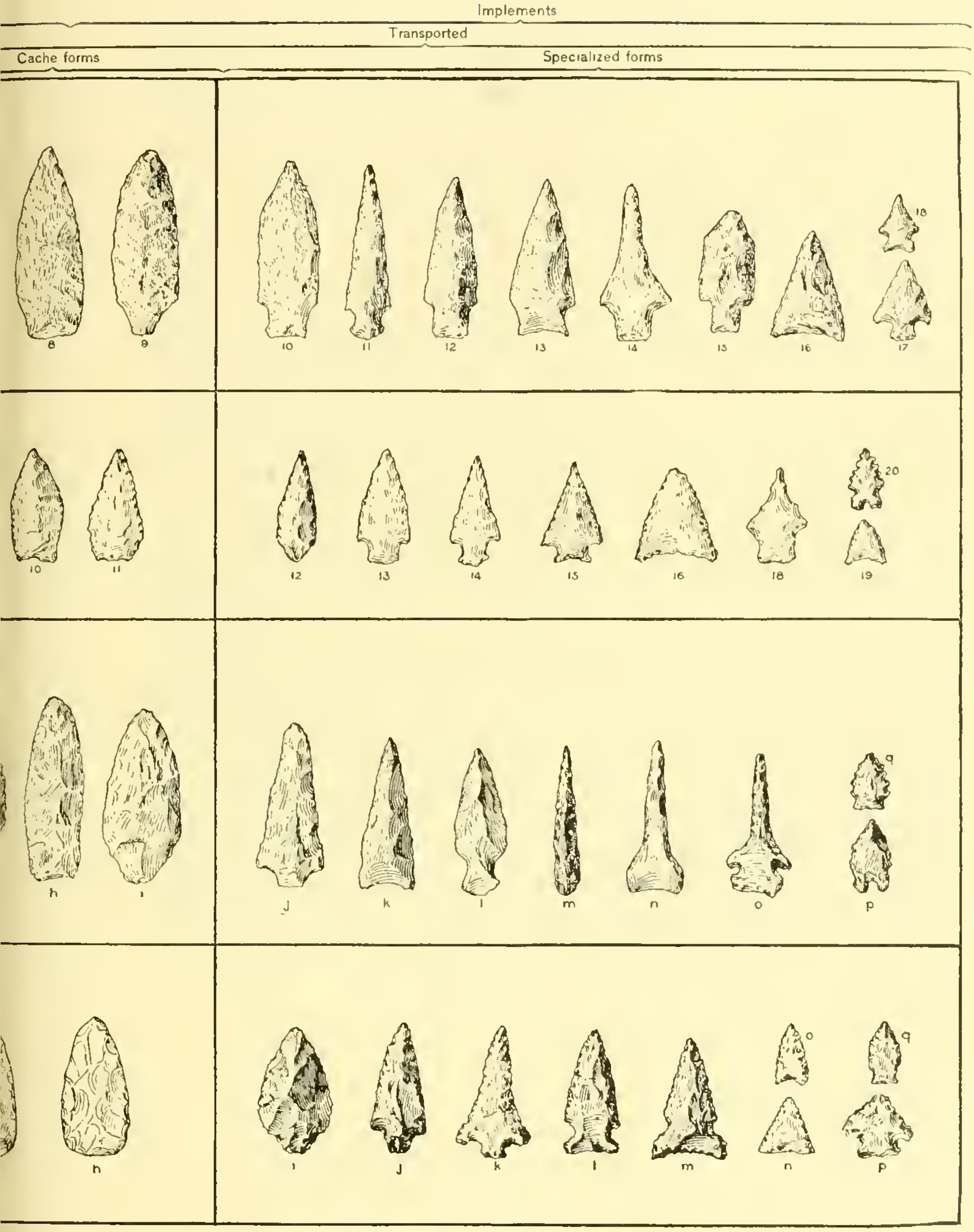
Rude flaked implements—Numerous heavy flaked implements of the region, found on village-sites, in shell banks, and elsewhere, were shaped from bowlders by striking off a few flakes, giving rude edges and points. They are not of quarry origin as the inferior grades of material, found very generally distributed, were utilized. As scattered about they are not easily distinguished from the ordinary rejectage of blade making.

Highland quarries—Quarries beyond the limits of the tidewater region were extensively worked by implement makers. The stone was in the mass, but the processes employed in shaping it and the results reached closely duplicate corresponding features in the lowland quarries. The blades made were transported to all parts of the lowland and worked up into implements duplicating the local varieties. No rejects of this work are found in the lowland, and rude implements of the materials involved are extremely rare outside of the highland.

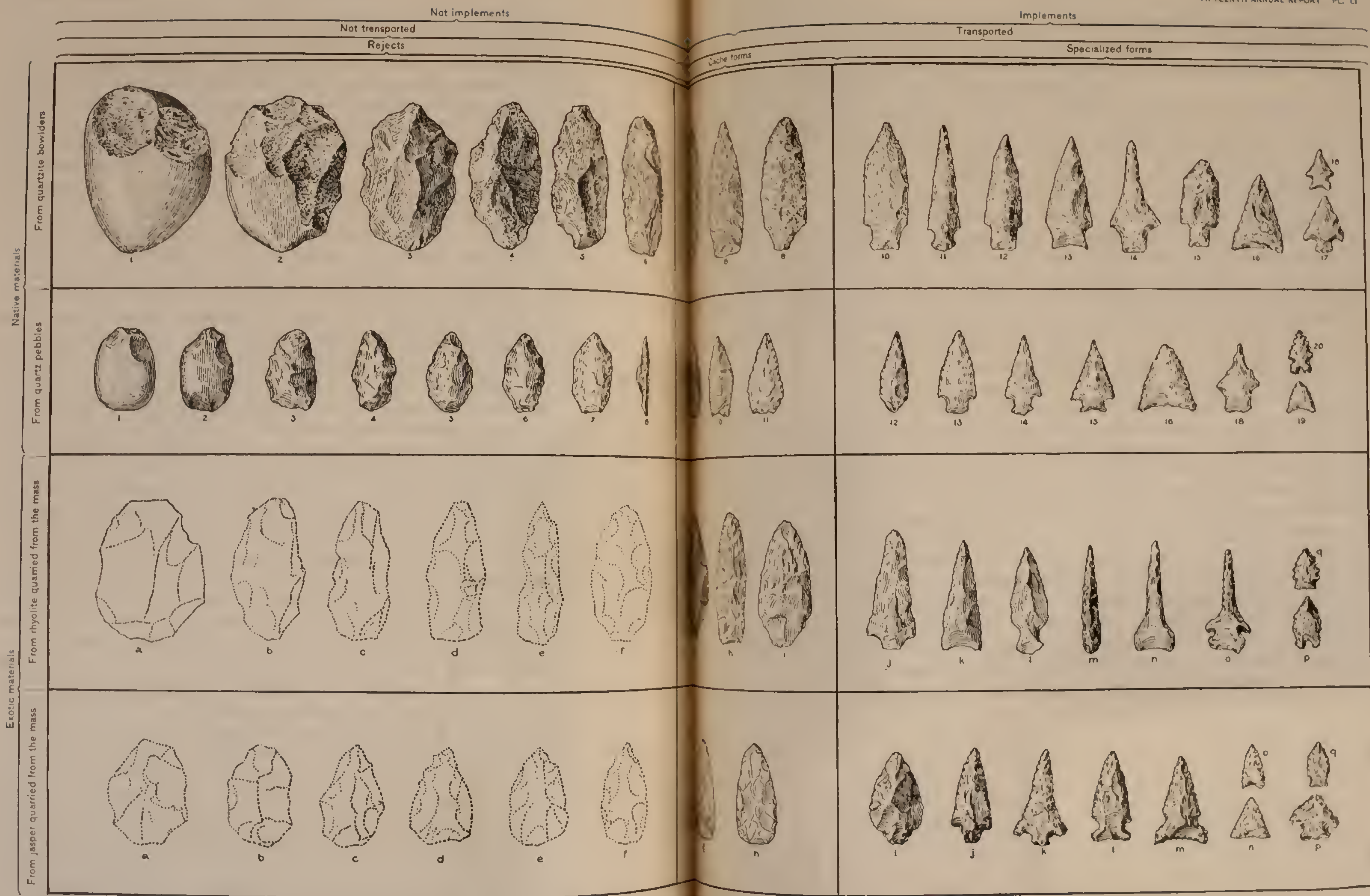
Battering and abrading processes—Implements to be shaped by these processes—celts, axes, and the like—were very often reduced to approximate shape by flaking. Tough, heavy, hard stones were preferred, and disseminated water-worn pieces were often chosen. The fracturing processes employed were the same as those concerned in ordinary flaking, but since the objects to be made were of different classes the rejectage presents distinct types of form. The celt, the most numerous class of pecked-abraded tools, has a wide edge and a roundish body somewhat pointed above. Flaked implements of leaf-blade origin have a point instead of an edge, while the bodies are flat and the upper end is broad. These distinctions were necessarily foreshadowed in the incipient forms, and aborted specimens, found intermingled on sites of manufacture, may be distinguished by tendencies, in the one type, to specialization of a broad end, and in the other by tendencies to defini-



SYNOPTIC GROUPING SHOWING ORIGIN, FORM GENESIS, AND DISTRIBUTION OF THE FLAKED-STONE IM



HE CHESAPEAKE-POTOMAC TIDEWATER REGION. THE SCALE VARIES FROM ONE-THIRD TO ONE-SIXTH



SYNOPTIC GROUPING SHOWING ORIGIN, FORM GENESIS, AND DISTRIBUTION OF THE FLAKED-STONE IMPLEMENTS OF THE CHESAPEAKE-POTOMAC TIDEWATER REGION. THE SCALE VARIES FROM ONE-THIRD TO ONE-SIXTH

tion of a pointed end. The celt forms roughed-out by flaking were specialized by pecking processes and completed by grinding and polishing, the rejectage being unimportant, as the processes were not so violent as to lead to frequent breakage.

Incision processes—Softer varieties of stone were shaped by cutting. The rock, chiefly soapstone, was extensively quarried from massive deposits in the highland and worked into vessels, pipes, and a few less important varieties of objects. As with the other groups, the articles made were only roughed-out in the quarries, specializing and finishing being conducted mainly on sites of use. The implements employed in this work form a distinct class. Many of the quarry forms are rude sledges and picks, while the cutting tool proper is a chisel or pick—according to the manner of hafting—made of hard, tough stone and shaped usually by flaking, pecking, and grinding. Sites of manufacture for these tools have not been observed, and are probably scattered and unimportant.

Distribution of implements—Distribution is found to present a number of points of interest, most of which pertain to the relation of the implements as found to the sources of the raw material. Rejectage of manufacture is little subject to transportation, though raw material in convenient form may have traveled a long way. The smaller implements found their way to very distant parts, while the larger and especially the ruder forms remained on or near the sites of original use. Distribution from the great quarries was doubtless in large numbers, and trade as well as use may have assisted in the dissemination. The general distribution over the country was brought about by many minor agencies connected with use. Each province, each district, and site, here and elsewhere, is supplied with art remains brought together by the various agencies of environment—topographic, geologic, biologic, and ethnic—and the action of these agencies is to a large extent susceptible of analysis, and this analysis, properly conducted, constitutes a very large part of the science of prehistoric archeology.

SUPPLEMENTARY NOTES

I

The quarry group presented in the frontispiece and again in another setting in plate CII was prepared as an exposition exhibit rather than as a necessary feature of the studies recorded in the present paper. It may be further stated that it is intended to exemplify a great art of the race—the shaping of stone by flaking processes—rather than to illustrate a satisfactorily established episode in the history of a particular people. After the return of the group from the World's Columbian Exposition at Chicago, where it formed part of a set of exhibits illustrating the various great quarry-shops of the United States, I conceived the notion that the figures could be taken to Piny branch and placed in the actual quarries, thus more graphically portraying the ancient operations. A site was selected for the purpose on the margin of a gulch near Fourteenth street, where some great oaks grow on the beds of ancient refuse; but before the project could be carried out I was called away from the work permanently. I happened, however, to mention my plans to Messrs Cushing and Dinwiddie, of the Bureau of Ethnology, and these gentlemen very generously took up the work, and the result is indicated in the accompanying view, plate CII, which on its receipt was a great surprise to me, as much more had been done than I had contemplated. It seems that Mr Cushing found traces of dwelling on the site selected, and resolved to restore the scenes of the past in all possible detail without deviating from the theoretic historic models. He established a camp, built the lodge of matting, carried out an antique wooden mortar and other appropriate utensils, laid a hearth of bowlders, and constructed the framework of poles for drying fish and game. The scene is altogether complete and realistic though the picture is somewhat lacking in contrast of light and shade.

It remains only to say in this connection that I desire nothing more than that the group should be taken for what it is worth as an illustration of a most important industry carried on in nearly every part of the country. It will, however, I am sure, assist in conveying a definite impression of the work prosecuted so extensively in the District of Columbia, and as it associates with the quarries the only people that have any claim whatsoever to the occupancy of the region and the site, the chances are greatly in favor of the practical correctness of the impressions conveyed.

Since the completion of this group it has been a source of regret that a fourth figure was not added to illustrate the final steps of the work—the specializing of the blades by pressure processes—though it is true

QUARRY GROUP IN PLASTER SET UP ON THE PINY BRANCH SITE, WITH RESTORATION OF HISTORIC ACCESSORIES BY MR F. H. CUSHING

a *b* *c* *d*

RESULTS OF EXPERIMENTAL FLAKING BY PERCUSSION AND PRESSURE; THREE-FOURTHS ACTUAL SIZE

a, Turtleback with convexity so pronounced as to lead to rejection. *b*, Blade approximating desired form, but so thick as to lead to rejection. *c*, Blade successful, save for slight [illegible] near the wider end. *d*, Point slightly specialized by use of flaking tool impelled by pressure from shoulder that this would be putting together portions of the work not usually associated in the great quarries here and elsewhere. General conditions would have warranted the association, however, for, as has been shown elsewhere, where sites of dwelling or use were closely combined with sites producing the raw material the roughing-out operations were doubtless often followed by the finishing processes in a continuous series.

Copies of the group, as illustrated in the frontispiece, are now set up in the National Museum at Washington and in the Field Columbian Museum at Chicago.

II

While engaged in the work of excavation on the Piny branch quarry site, I took up the matter of the shaping processes employed by the quarrymen, and assuming that bowlders were used for hammerstones, attempted to accomplish by free-hand flaking what had been done by the ancient artisans. For some time I labored at great disadvantage, as I was experimenting as a rule with material already rejected as unfit for use. When the quarry face was reached and the superiority of the bowlders fresh from the bed realized, I took up the work with renewed hope, but an accident to my left arm, resulting from attempts to flake a very large stone held in the left hand, caused the practical discontinuance of the experiments. Although not absolutely sure that I was working as the quarrymen had worked, there can be no doubt that I was not far wrong, for no other known process could take the place of free-hand percussion in fracturing and flaking the firm, smooth, round bowlders. The hammer, even if of other material, would have to be operated in an identical manner.

In taking up the work of flaking stone I fully realized the difficulty of the task. The art is not to be learned in a day any more than are any of the ordinary mechanic arts such as carpentry or the working of metal, yet if savages learned it others can learn it, and no doubt of ultimate success need be felt by any student willing to give liberally of time and labor.

The difficulty of flaking the stone was not great, for a considerable percentage of the bowlders fracture with comparative ease; but the great difficulty was in causing the flakes to carry far enough across the face of the stone to give the necessary low convexity to the surface, and when this result was reached approximately on one side it was extremely uncertain whether it could be repeated on the other side, the requisite form, as indicated in this and all other quarry-shops of the same class, being a thin blade of lens-like profile. The sections shown in figure 29a illustrate phases of successful and unsuccessful flaking.

In the first illustration the left side shows the removal of four flakes and reduction of the surface to nearly the necessary degree of convexity. The work on the other side failed utterly, the flakes did not carry, and a high peak resulted. This is the profile of multitudes of failures.

In the second figure the flaking progressed encouragingly on both sides, but neither was reduced to the requisite flatness. A blade of this degree of convexity was usually rejected. A satisfactory profile was produced in the third case illustrated, and as indicated in the fourth figure a lucky splitting of the bowlder made it possible to produce two successful blades. I found that very often before I had obtained the desired profile some unfortunate blow shattered the stone, but I got very near the desired result in numerous cases, duplicating the best of the rejected forms, but falling a little short of the blade as perfected by the ancient workmen and carried away for use and elaboration.

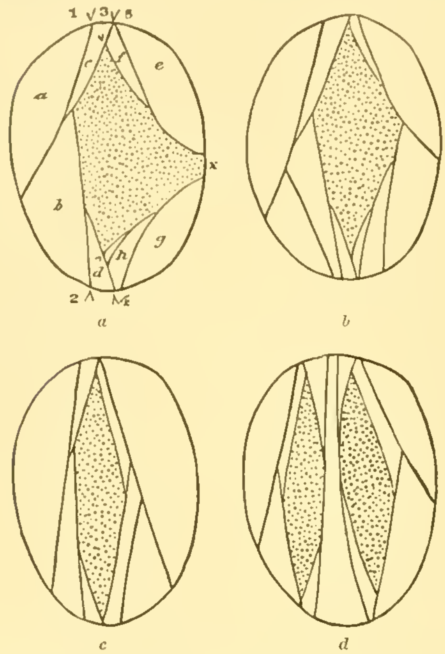


FIG. 29a—Cross sections illustrating successive removal of flakes from bowlders. The dotted space is the section of form produced, *a* and *b* being failures and *c* and *d* successes.

In plate CIII some of the results of my efforts at blade making are presented. I observed that the rejectage of my work, where falling among the freshly uncovered rejectage of the site, was not to be distinguished from it in any way—not even in many cases by the freshness of the fracture.

As to the work of specializing the perfected blade into keen-edged knives, slender drills, and stemmed and notched projectile points, it does not seem to compare in difficulty with the making of the thin blades themselves from the bowlders.