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PAPERS

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PEABODY MUSEUM OF AMERICAN ARCHAEOLOGY AND
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Vol. V.

THE ARCHAEOLOGY OF THE DELAWARE VALLEY

BY

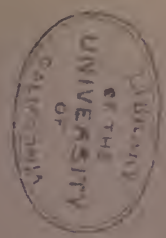
ERNEST VOLK

WITH TWO MAPS, ONE HUNDRED AND TWENTY-FIVE PLATES
AND TWENTY-SIX ILLUSTRATIONS IN THE TEXT

CAMBRIDGE, MASS.

PUBLISHED BY THE MUSEUM

AUGUST, 1911



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EDITORIAL NOTE.

FOR twenty-two years Mr. Ernest Volk, working under my general direction, has been engaged in archaeological researches in the Delaware valley at Trenton and vicinity. The geological features of this region have made it a Mecca for students of glacial geology, for many years, and it has been the site of many controversies. To this day no perfect accord has been reached as to the age of the clays, sands and gravels which were deposited there during the glacial period and at its close.

It has not been the purpose of Mr. Volk to enter into any controversy as to the age of the Trenton gravel and sand, nor to make special geological researches, but simply to ascertain if there are unquestionable evidences of man's occupation at the time contemporary with the deposits during any portion of the glacial period and its immediate close. To this end, my directions to Mr. Volk have been to examine every exposure of the sand and gravel; to watch for stones that had even the slightest appearance of being in any way artificial and possibly the handiwork of man; and to look for any bones of man or animals. In complying with these instructions, Mr. Volk has examined many thousand square yards of exposures and has sliced away, with a trowel, several thousand cubic feet of the sand and gravel. That this work has been done faithfully and conscientiously, no one can doubt after reading the following pages.

That the reader, not familiar with the glacial geology of the region, may have a general conception of it, Mr. Volk has begun his report with a brief summary of the geological conditions as he interprets them.

In order to understand the whole archaeology of the region, several old Indian sites and others of comparatively recent date, have been explored, and a large amount of material has been gathered for comparison with that of an earlier time. Many

skeletons of Indians have also been secured. This part of Mr. Volk's report is largely embodied under the title of "The Evidences of Man in the Black Soil," and in the "Journals" which follow the summary of his researches from 1889 to 1905.

It is to the section of his report which he designates "The Evidence of Man in the Yellow Soil or Drift," and to that part called "The Evidences of Man in the Gravel," with notices here and there in his "Journals," that the evidence is presented showing that man was living in the Delaware Valley at the time the Trenton gravels were laid down, whatever that time may have been.

The bone of the musk-ox and the portion of the elk's antler, found in the gravel, give evidence that human bones could also have been preserved under the same conditions, and this is proved by the discovery of the portion of a human femur in the same gravel, with the fragment of a human parietal near by.

That man's artifacts are also found *in situ* in these deposits, the numerous photographs taken by Mr. Volk, of which only a portion are here reproduced, are sufficient proof that they are as old as the yellow drift deposit. The chipped pieces of quartz and a few other chipped stones found in the gravel, if really showing the work of man as they seem to do, are confirmatory facts, while the occurrence of the two human bones in the gravel deposit shows that man was somewhere in the valley when the gravel was being laid down.

It is almost needless to state that the following pages contain only Mr. Volk's personal researches, with no reference to any other persons or their work, with the exception of that of the several gentlemen who visited the Lalor Field excavations and made personal examinations, as recorded on pages 90 and 91. From the first it was understood that the work he undertook was to be his individual research, and as such it is here recorded.

In order that any archaeologist interested may know what others have done in the vicinity of Trenton, and what they have written, a bibliography is printed at the end of the volume, which, while it may not be complete, is sufficient to cover all the points that have been brought out during the past third of a century in relation to the Trenton gravel and its bearing upon the antiquity of Man in the Delaware Valley.

In the Appendix to the volume a few special papers on the geology of the vicinity of Trenton are printed as coming from geologists who have made examinations at my request. A description is also given of the human femur and parietal by Dr. Hrdlička, into whose hands I placed the bones for the purpose.

In presenting this volume to archaeologists, it is with pleasure that I acknowledge in behalf of the Peabody Museum, our indebtedness to Dr. Charles Peabody, Assistant in European Archaeology in the Peabody Museum, and Director of the Museum of Archaeology, at Phillips Academy, Andover. Dr. Peabody's untiring interest in the work of Mr. Volk led him not only to prepare Mr. Volk's reports for publication and personally to make the photographs of the specimens figured, but also to furnish the means for the publication of these reports as volume V of the Museum Papers.

F. W. PUTNAM.

PEABODY MUSEUM, HARVARD UNIVERSITY,
June 30, 1911

PREFACE.

My attention was called to the archaeology of the Delaware Valley as far back as 1875, commencing thus a fitting apprenticeship for the more important work to follow; but it was not until the fall of 1889 that actual systematic work began, under the direction of Professor F. W. Putnam of Harvard University for the Peabody Museum of Archaeology and Ethnology and it has been continued under his direction to the present time.

The following year until July was spent in exploring the Valley above Trenton, and in examining caves and rock-shelters; then I was one of a party sent to explore the earthworks in the Little Miami Valley, Ohio; I returned in the fall to continue my work along the Delaware.

In the spring of 1891, a special arrangement was made to explore for the World's Columbian Exposition in Chicago, where, in 1893 the results of the two years' work were exhibited and are now in the Field Museum of Natural History. The Peabody Museum then continued the work until 1895.

In 1895 the Duke of Loubat generously contributed funds to continue the work for two years for the American Museum of Natural History, New York; after this until 1903 the necessary means were supplied through the generosity of Dr. F. E. Hyde for the same Museum. The collections made during these years are in the American Museum of Natural History. Since 1903 the work has been continued for the Peabody Museum.

The result of the systematic explorations of the past twenty-two years has to my mind settled the question of the antiquity of man in the Delaware Valley.

While this is intended to be a purely archaeological report, the special significance of the geological conditions in connection with the archaeological has made necessary a close study of the deposits, and a description of them as they appeared during the progress of the work will begin the volume.

ERNEST VOLK.

TRENTON, NEW JERSEY.
December 31, 1910.

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est near the river, thinning out to the eastward where it abuts against the elevations of the Columbian. The whole is stratified showing by the size of the material the strength of the different currents; gravel changes to sand and vice versa, but throughout are found large boulders, both angular and water-worn. They vary in size from two by three feet to six feet by ten or more; they represent all the outcrops of rock in the Valley above and may even be seen on the present surface (Plates II and III).

So much for the character of the Trenton gravels and glacial deposits; it appears that there were two different streams of transportation for the Trenton gravel, one coming from the northeast and the other from the northwest; the elevated land between them called Hillcrest upon which the northern or upper part of Trenton is built, had evidently not been washed much by the flood that transported the Trenton gravel, at any rate the Columbian is the surface on this elevation. At the base of Hillcrest the two streams united.

The falls at Trenton between the two bridges about in line with the State Capitol or a little above show the remnants of a strong barrier of bed-rock across the valley that once raised the level of water above the barrier to a considerable height, the traces of which can be seen to-day in the deposit of Trenton gravel at Cadwallader Park, nearly thirty feet above the present level of the Delaware (also on the Pennsylvania side at Edge Hill); this is the old northwest stream. The gravel here is much broken and bruised (Plates IV and V).

The other stream on the east of Hillcrest flowing through a broad plain, not a narrow bed such as that just described, had a more quiet current and transported finer material. The shallow valley of the Stony Brook and others is the old bed of this stream and shows the Trenton gravel as far as Penn's Neck and beyond. This stream transported not only finer material, but also a gravel the pebbles of which show scarcely any fracture, and which is abundantly mixed with white quartz pebbles of the overwashed Columbian. The shores of Assanpink Creek at Trenton show this (Plate VI).

When the stream reached the open valley at Trenton two

terraces were formed of which the upper begins at the rocky barrier, runs southeast through the city of Trenton, then east and finally south again, and is lost at the crossing of Hancock Avenue and Lalor Street; it is from fifteen to twenty feet above the lower terrace.

The wider lower terrace begins at the Delaware River in the Riverview Cemetery, runs at right angles with the stream eastward, then bends at the Lalor farm to the south in a graceful bow, continuing for several miles and finally turns southeast. The elevation of this terrace above that of the lowlands or meadows (the level of the Delaware River) varies from forty to fifty feet; the surface is laid out in farms and beginning at the River at the cemetery includes Pennsylvania Railroad land, the suburb of Deutzville, the Wayman, Bilbee, Lalor, and Wright farms, Broad Street Park, and the Andrew K. Rowan, Dr. Abbott's and other farms.

Running parallel with the upper terrace on its western side and near its end is a noticeable depression nearly half a mile long which shows yellow loam mixed with pebbles at the surface, duplicating the top deposit at Penn's Manor on the Pennsylvania side (Plate VII).

Both terraces are cut through by the Assanpink Creek at Trenton, and the lower terrace is cut twice besides, once by Crow Creek at Deutzville and again by the brook at Dr. Abbott's farm, where the banks form the extreme eastern limit of the Trenton gravels; all the cuts are within three miles of Trenton.

The Pennsylvania side of the Delaware Valley, opposite and below Trenton shows quite a different surface. Above the Falls the old original bed-rock is still protruding at the elevation Edge Hill and shows the same surface material as that on Hillcrest. The low and level land south of Morrisville is called Penn's Manor and the composition of the drift there as far as can be judged from extensive excavations is coarse gravel of two varieties; the bottom deposit from twenty feet down, up to within four or five feet of the surface is identical with that on the New Jersey side, while the deposit within these four or five feet is a medium gravel mixed with a yellow clayey material. The whole is covered with a black soil. The long bars that show

clear gravel and that run in a southeasterly direction are evidence that the bed of the stream was here long before the Delaware found its present channel.

From these lowlands on the Pennsylvania side a single elevation called Turkey Hill rises about seventy-five feet high; of considerable length, it tapers from the densely forested north end (the higher), to a mere ridge at the south; the north end is covered with Trenton gravel. The flora in the forested part differs entirely from that in the surrounding forests and on neighboring elevations, but it is identical with that on the New Jersey side three miles southeast of Trenton. Several visits to Turkey Hill in June and later in the summer showed the following flora:

Trees:

- Beech,
- Oak (several varieties),
- Chestnut,
- Ash,
- Maple (several varieties).

Plants:

- Moccasin flower, *Cypripedium acaule*,
- Goat's rue, *Tephrosia virginiana*,
- White topped aster, *Sericocarpus bifoliatus*,
- False indigo, *Baptisia tinctoria*,
- Crowfoot or bird's foot violet, *Viola pedata*, *Viola palmata*,
- Pipsissewa, two species, *Chimaphila umbellata*, *Chimaphila maculata*,
- Bracken or Eagle fern, *Pteris aquilina*.

The following plants common to the elevations on both sides were missing:

- Blood-root, *Sanguinaria canadensis*,
- Liverwort, *Hepatica triloba*,
- Dutchman's breeches, *Dicentra cucullaria*,
- Saxifrage, *Saxifraga virginensis*,
- Dog-tooth violet, *Erythronium americanum*.

Another singular and interesting elevation is Morris Island in the Delaware about three quarters of a mile below Trenton; it is almost in line with some of the high gravel bars of Penn's

Manor, but strange to say it is covered with a yellow loam two to three and one half feet thick, and strongly resembling that covering the large terrace on the New Jersey side. Of the four hundred acres of the island two hundred and twenty-five are on the upper part raised from twenty to twenty-five feet above the common summer level of the river; a cross-section here presents a black soil, six to twelve inches thick, covering the yellow loam (molding sand) itself two to three and one half feet in thickness; this covers eight feet of stratified sand resting on a heavy boulder bed (Plate VIII).

The remaining one hundred and seventy-five acres upon the lower end are quite different; below the black soil forming the top layers of black mud the deposit alternates with layers of sand from six to fourteen inches thick, and the mud layers are mixed with decayed wood and leaves commonly found in river-drifts. This is repeated all the way down to the boulders.¹

Centre, Second and a few other streets near the river, running parallel to it, show precisely the same grade of gravel as is found on the surface at Morrisville and to the southward; it occurs too at about the same level.

At the very end of the upper terrace, where it finally unites with the lower a very interesting feature occurs in the stratification of the upper deposits of the Trenton gravel and was observed in the numerous sand pits in the southern part of Trenton in the neighborhood of Hancock Avenue, Smith Street, and other places. It appears first like a pit dug from the surface down, but a closer examination shows a cut-off at the mouth or entrance, evidently the result of a current that left a six-inch stratum of small pebbles and coarse sand, and an irregular stratification composed of fine material such as sand of a pale

¹ Mr. Lacy, the owner of the island told me that it was bought of the Lenape Indians by a man named Billy Biles about 1630 and was owned by a succession of his descendants bearing the same name. Mr. Lacy's oldest deed was signed "Billy Biles" and the branch of the Delaware that separates the island from the Pennsylvania shore is called Biles Creek to the present day. There is in existence a parchment chart showing two hundred and twenty-five acres of land with the territory outside marked as bars and swamps. Mr. Lacy informs me that he has now four hundred acres of good land. Thus in two hundred and seventy years the one hundred and seventy-five acres represent the growth of the land formation (chiefly on the lower end).

grey color alternating with the characteristic reddish clay of the pits. The pits themselves appear to have been filled from the southwest side and the layers are very thin, sometimes hardly one quarter of an inch thick. The material in the filling appears to be the same as in the overlying stratum, except the fine yellowish material: this dries very hard in the sun or when exposed to the air. A similar material is also found in the deposit shown in the "Rail-road cut" a quarter of a mile to the south, at a depth of twelve feet. These pits have an irregular shape with a mouth or top ranging from three to six and even ten feet in diameter, and are equally cut off and topped by the fine gravel deposit (Plates IX, X, XI, XII, XIII). I have found, close together, in a space of three hundred feet in diameter forty such curious pits, all on the southern end of the upper terrace; several show water-worn boulders five to twenty inches in diameter (Plates XIV and XV). Further north (about one quarter of a mile away) and considerably deeper I found several of these pits in a cellar excavation showing interesting and differing forms of deposit. Another pit in a Jennie Street excavation for a cellar (the locality is on the very edge of the upper terrace or western shore of it) is shown in Plate XVI. Here the top deposit is thicker and the clayey deposit lower; still another was found in the deep depression following the upper terrace near its southern end (Plate XVII). I found several of these interesting pits a half mile east of the southern end of the high terrace and still another of gigantic size on White Horse Road in a cut in Columbia gravel coming within two feet of the present surface. They differ in size and shape, but are alike in the way they were filled.

A close study of these deposits reveals many facts that will warrant a theory as to their origin. The Trenton gravel at Hancock Avenue shows at a depth of fourteen feet below the present surface a heavy bed of round, water-worn pebbles and boulders of all the different materials found in the valley above; they lie in a compact mass, comparatively level and without any intermixture of loam. The current was apparently from the northeast. Covering this is a very fine sand and fine gravel in alternate layers, also free from loam and from eight to ten

feet thick. The sharp division between the coarse boulders and the fine sand shows a sudden change of current from one so powerful as not to allow the deposition of a single grain of sand to one so quiet that fine sand was deposited in even layers. The strong current had evidently found an outlet to the west very suddenly and left a quiet stream. It appears that at certain stages of the flood, masses of ice were stranded over the area now occupied by the delta terrace and buried beneath finer sediment, while later other floods brought coarse material over the same area. Upon the melting of the ice-masses the material drifted or washed in and filled the cavities (or ice-pits as they may properly be called), while subsequently yellow loam was spread over all by the gentler currents which moved over the higher elevation of the nearly finished terrace.

On the great terrace and for miles north and east of Trenton the gravel is covered by a loam yellow in color and varying in thickness from one to five feet or more, being thickest in depressions. Proceeding northeastward, about two or three miles from the river it seems gradually to become mixed with fine gravel. A ridge of this yellow loam runs south southwest from St. Mary's Cemetery, a Columbian elevation, for two miles; the thickness reaches five feet. The upper terrace at Jennie Street shows six feet of loam and underneath are found several beautiful ice-pits and peculiar clay deposits. In South Trenton near Bridge Street, in close proximity to the river there is a yellow deposit eight feet or more thick; on examination it proves to be much darker than that of the terrace from intermixture with a darker material not unlike the sediment from an overflow of the Delaware of today. This is of course of a much later date and at a much lower level. The color and mixture are undoubtedly due to some recent overflow, as the locality is not much above the present level of the Delaware.

The loam of the terrace is crossed by a series of red bands, composed of red clay, iron, sand, and minute water-worn pebbles of red shale; they are from fourteen inches to six feet down, and deeper, throughout the sand; in the loam they are usually from four to six inches apart, with extremes of one quarter of an inch and ten inches. The thinnest band is usually nearest the

surface, but once I found this condition reversed. I also found them in sand where the yellow loam is absent. (Plates XVIII to XXV show the Trenton gravel and the position of the red bands, and figures 1-4 show the red bands in the yellow soil.)

The sand-pits on Hancock Avenue facing west and the Bilbee sand-pit show the red bands ten to twelve feet below the surface; here the bands have been subjected by the current to a peculiar twisting process; the same phenomenon is seen at Lalor field near the western line of the farm on the terrace, five feet down. The regularity of the bands in the yellow loam is a very telling factor in determining its origin; as far as three miles from the Delaware at Dr. Abbott's brook the yellow loam shows the bands in the same order and composition as before.

An analysis of the material of the bands made by Professor George Frederick Wright shows from twenty-seven to thirty-seven per cent. of clay, six per cent. of iron, and the remainder sand and pebbles; the lower bands only show four per cent. of iron and much clay is found in the sand between the bands; evidence of the existence of clay in the whole deposit is seen in the fact that when exposed to the sun it becomes so hard that a pick is necessary to dislodge the face; in some instances the clayey bands are shown in indistinct layers (fig. 2). The red bands, or rather the substance that forms them, may be detected in the deposit nearer the city and to the eastward, in the gravel and sand — not in distinct bands, but in a stratum that shows washed-out margins.

Another interesting feature of the yellow loam is that it carries pebbles from the size of a walnut to boulders of three or four feet in diameter. Some boulders are round and water-worn showing no fracture and some are angular. I have found them at all depths from far down in the sand all the way up to the surface; many are of large size and still to be seen, for instance near St. John's Cemetery, in the rear of a house on Hancock Avenue, south of Crow Creek, Lalor Street near Crow Creek, in the lane leading to the Lalor farm, etc. (Plates XXIV and XXV). In general these stones are loose or isolated but on the Wayman property near Deutzville I found in a strip

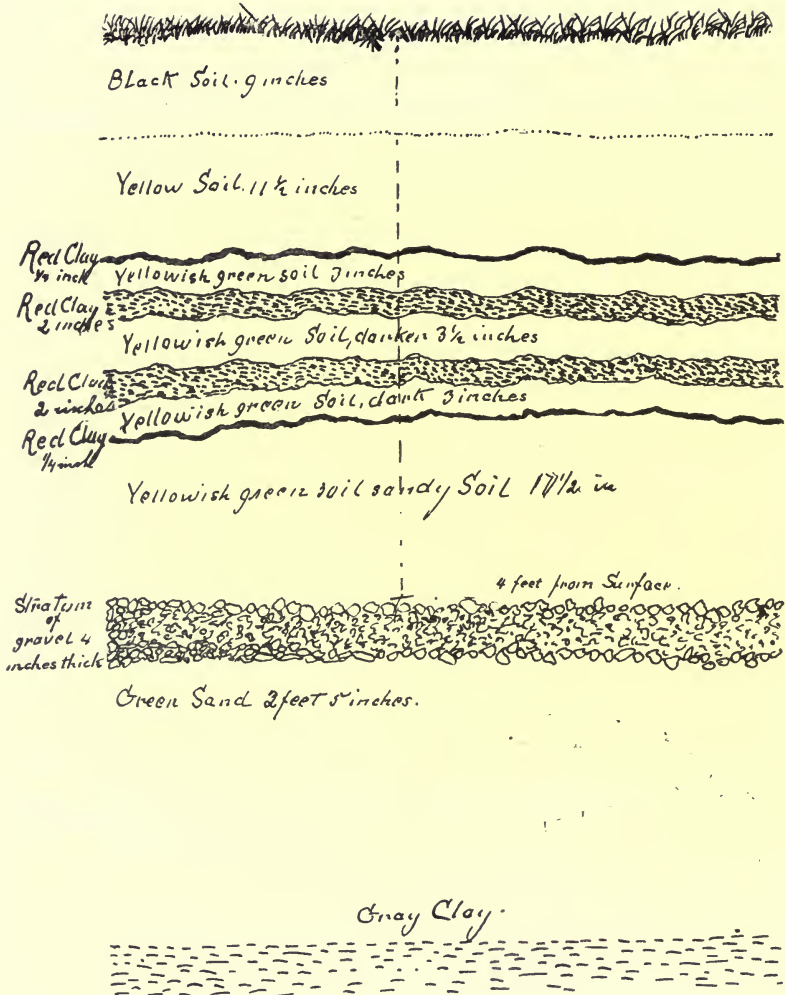


FIG. 1.

Illustrating the Red Bands in the Yellow Soil. Lalor Field.

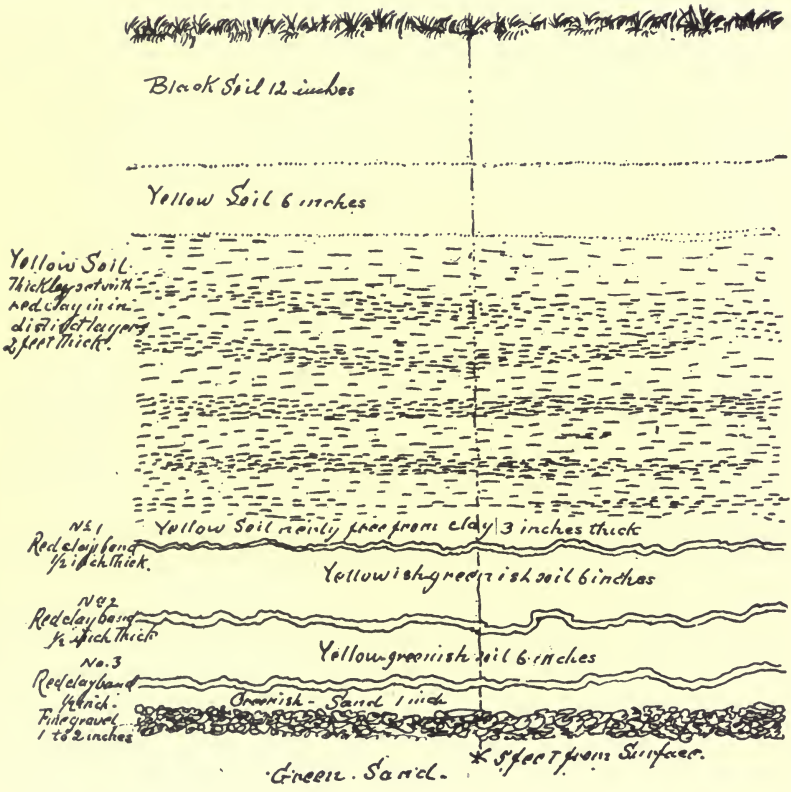


FIG. 2.

Illustrating the Red Bands in the Yellow Soil. Lalor Field.

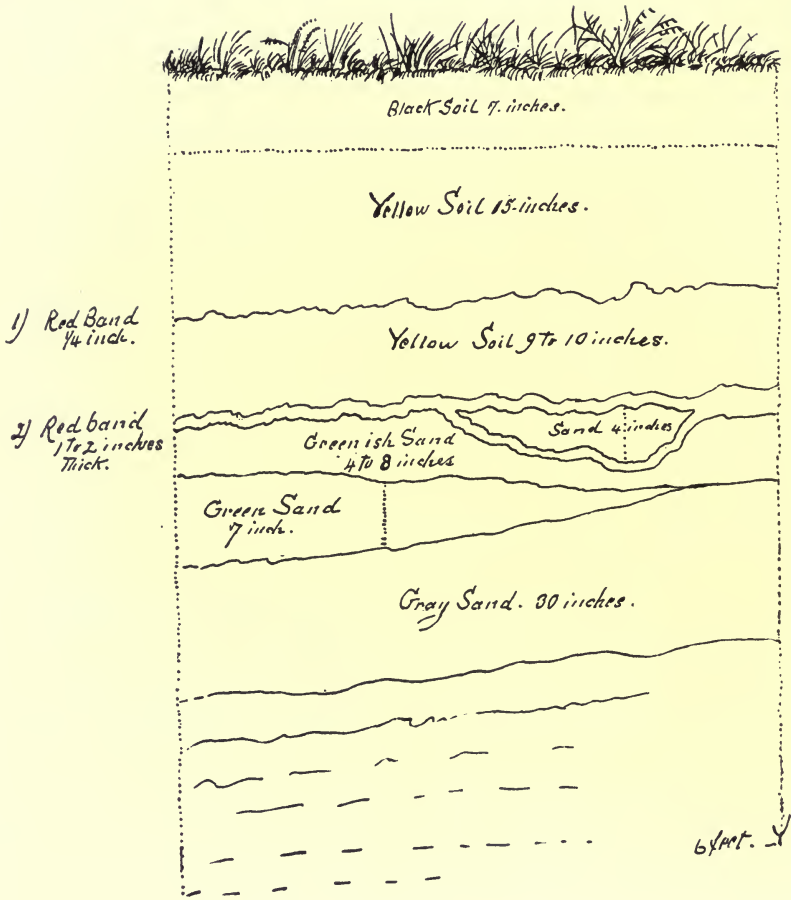


FIG. 3.

Illustrating the Red Bands in the Yellow Soil. Lalor Field.

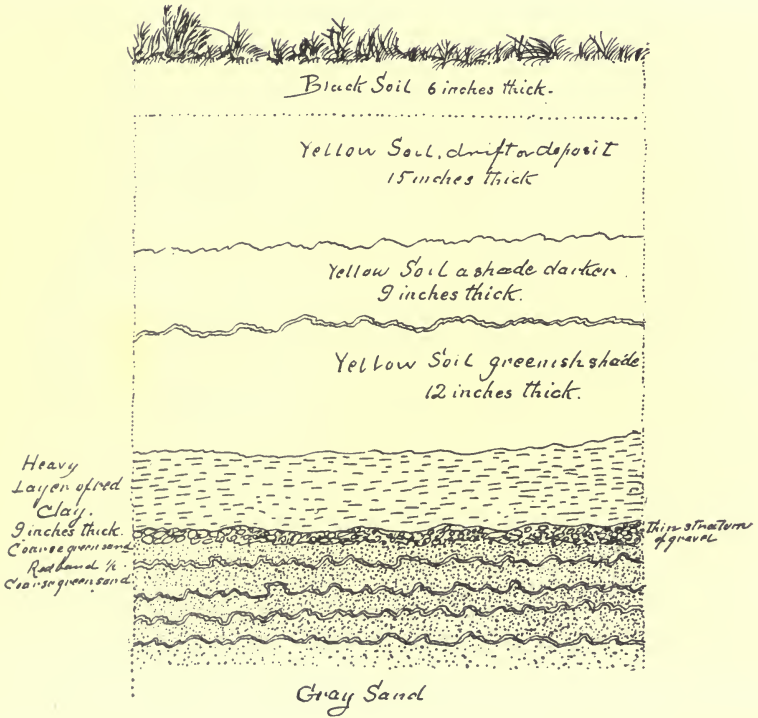


FIG. 4.

Illustrating the Red Bands in the Yellow Soil. Lalor Field.

of yellow drift six by twenty-five feet in area at least a bushel of them varying in size from that of a baseball to that of a football; in three places on the terrace the pebbles form a stratum.

On the present surface over all is a black humus discolored by decayed organic matter. This is several feet thick in some places, in others again only a few inches, all depending on the conditions favoring plant growth.

I have noticed on the highest part of the lower terrace on the Lalor estate in a dry locality over two feet of black soil, indicating that at one time a luxuriant plant life existed there. Again near a stream in a lowland a humus has accumulated to a thickness of three feet in about eighty years, and it is still increasing. At another place in a gravel-pit twelve feet deep where there is abundant moisture from springs, trees of considerable size have grown in fifty years, yet here, supporting the most luxuriant crop of wild strawberries I have ever seen, is a humus not over two inches thick.

In a recently excavated gravel-pit, twenty acres in extent, and eighteen to twenty feet deep on the Comfort farm south of Morrisville, Pennsylvania, a single season of exposure has almost covered the bottom of the pit with fifteen different kinds of plants. Generation after generation thus dies and new life springs from the decay; so the accumulation is kept up. Plant life begins as soon as it is allowed to, and keeps on under the promotion of moisture as long as conditions are suitable.

These are the main geological features of the deposits in and around Trenton that have come to my knowledge during my long and laborious explorations, and they will be constantly referred to during the archaeological portion of this report.

II. ARCHAEOLOGY.

TRACES OF MAN IN THE BLACK SOIL.

THE TERRACE.

(Maps A and B.)

The surface on the terrace and the vicinity is black soil and on it the Indians were found dwelling by the first Europeans who came here. Here are found Indian relics, such as broken stone of all the varieties that the river and gravels produce, arrow-heads, spear-points, scrapers, grooved axes, celts, potsherds, and many other articles.

The surface of land during the course of two hundred years' tilling, having been turned over and over again by the plough, affords a ready field for the collector. Thousands and thousands of specimens have been picked up here and along the length of the terrace to fill the many treasure-boxes of the farmer boys, and the museums of universities and professional archaeologists. The collections furnish much information about the people, their tools and weapons; and the thousands of chips and flakes show the materials used, while a systematic exploration unfolds the story in remarkably clear detail, affording a fair inside view of Indian life.

In the explorations, trenches were cut on the terrace, several miles in extent, and along the lowlands, and the creek. Day after day for months and years, the earth was sliced down with a trowel to a depth of from four to six feet or more, in order that not a specimen, nor a pebble be overlooked and its position unrecorded. Burial places and Village sites have been examined. Thus explorations were carried on at various times for twenty-two years and thousands of specimens have been collected. In recording the explorations I will speak of them in chronological order.



FIG. 5.
Showing portions of Wright's Field and Lolor Farm. Explorations of 1890-92.

In the seasons of 1890, 1891 and 1892 I opened numerous trenches in the Lalor and Wright fields on the terrace (fig. 5); I found the black soil penetrated and the underlying yellow soil disturbed and intruded upon by the Indians through the digging of graves, pits, hearths, caches, ash-beds, post-holes, etc. The first trenches were at the extreme east end of the Lalor farm near a row of sassafras trees, known as Sassafras Lane; here fourteen graves were found (Plate xxvi). These could be divided as regards the burials into two kinds, the shallow and the deep. The latter are from two to two and one half feet deep, and in digging them a limit or level seems to have been found in the third red band found in the yellow drift; the two upper were broken through while the third was left as the bottom of the grave. The skeletons lay on the side, knees drawn up, arms bent with the hands near the face; the heads pointed in every direction. The bones were mostly in a bad state of preservation, the skulls generally best resisting decay (Plates xxvii and xxviii). The skeletons were all of adults except one, that of a child of about six years of age (Plate xxix). Nothing at all was found with the skeletons except in one instance to be referred to later.

The shallow graves were of interest inasmuch as they were on the very surface. Sometimes only the outlines of the skeleton can be traced; these showed the position of burial to have been at full length, limbs straightened, arms to the side (not unlike the burials of the white man). The method of procedure was evidently to lay the body on the ground and then to heap the earth in a low mound above. Traces of six such graves were found not very far from one another. Undoubtedly the plough has destroyed many others during nearly two hundred years of cultivation. I had, in the years previous to the explorations picked up many a fragment of human bone.

The most remarkable deep grave is No. 6, Trench 1, Lalor Field, 1891 (Plate xxx). The skeleton was found in the posture of one sitting in a reclining chair. It was exhibited at the World's Columbian Exposition in 1893. Its condition was excellent; under the skull was found the jaw of a deer, and the whole burial was covered with two feet of wood ashes,



FIG. 6. Pit 12. Trench 1, Lalor Field, October, 1891. Diameter, 4 feet 8 inches, depth, 2 feet, 9 inches.

The pit contained stone implements, broken quartzite pebbles, pottery, bones, and charcoal.

a. Ploughed soil. b, Yellow sandy soil. c. Red band 2 to 3 ft. below black soil.

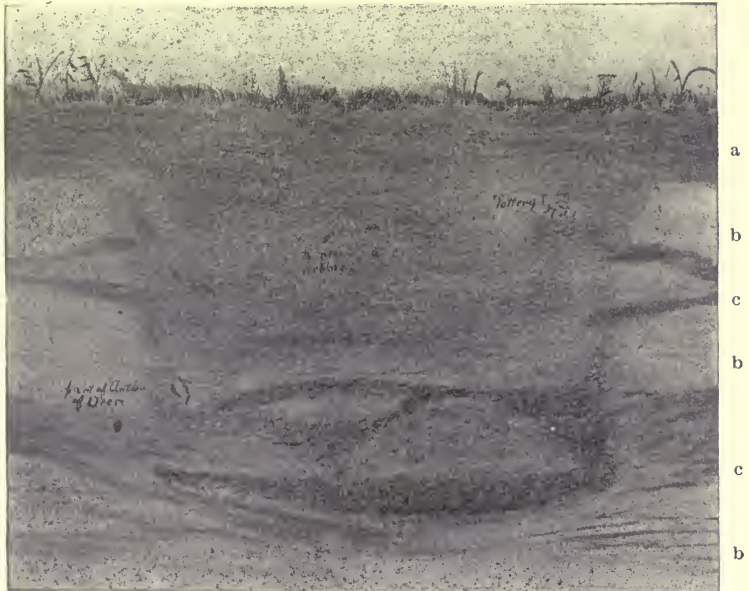


FIG. 7. Pit 18. Trench 6, Lalor Field, October, 1891. Diameter, 6 feet.

a. Ploughed black soil. b, Yellow sandy soil. c. Red bands.

mixed with little lumps of charcoal and sand; some of the charcoal had been in contact with the skeleton and had left a stain upon it. The ashes were filled with objects of various kinds, such as stone and bone implements, whole and broken sinew-dressers, rubbing stones, fragments of pottery and one bone tube, unio shells, fragments of mammal and bird bones; there were a number of small river pebbles about the size of a silver quarter; the unios are identical with those living in the creeks at the present day.

Besides the graves there were many pits (figs. 6-11); they are excavations made in the earth from the surface downwards, nearly circular and becoming narrower downward, ending in a blunt round bottom, indicating that they were made by scraping out the earth. The difference between the surface soil and the clean, light, yellow loam underneath shows distinctly any disturbance made from the black above, like black ink on white paper. I have explored about two hundred and fifty of these pits on the terrace and found them to be of three different sizes; large, medium and small. Those found here were of medium size and varied from twenty to thirty-six inches in diameter and depth. The smaller pits can be termed fire- or charcoal-pits as they never contain anything but charcoal.

The medium pits generally contain broken quartzite pebbles fractured either by fire or by battering, fragments of pottery, animal bones, etc. In one trench were thirty-eight pits and the specimens in them were as follows:

fragments of animal bones in	30 pits
fragments of pottery in	26 "
charcoal in	19 "
broken quartzite pebbles in	18 "
bone implements and fragments in	11 "
red and yellow jasper chips and flakes in	11 "
argillite chips and flakes in	10 "
burnt bone fragments in	9 "
unio shells and fragments in	8 "
broken argillite in	7 "
nut shells in	6 "
stone implements of various materials in	5 "

chipped argillite in	4 pits
whole pebbles in	4 "
fragments of turtle shells in	3 "
fragments of clay pipes in	3 "
chipped pebbles in	3 "
notched pebbles or net-sinkers in	2 "
nuts, whole and charred in	2 "
animal teeth in	1 pit
bird bone in	1 "
white quartz in	1 "
dermal scale of sturgeon in	1 "
bone of human finger in	1 "

The soil in the pits varies from a light brown to a black, and from a sandy substance to one of a very greasy nature. Some contained more pottery fragments than others; No. 35 yielded a whole peck basket of fragments, some evidently belonging to a large vessel; nearly the same quantity of broken quartz pebbles were mixed with the pottery. Pit 36 had only a thin argillite chip, a worked flake and a few fragments of rude pottery. The pits that contained the black greasy soil generally showed more remains, such as stone and bone implements, fire-broken quartzite pebbles, fragments of pottery and of animal bones. In extending the trench northward four more pits were found with their contents:

very black soil in	4 pits
fragments of pottery in	4 "
fragments of burned animal bones in	3 "
burned nut shells in	3 "
fragments of animal bones in	2 "
fire-broken quartzite pebbles in	2 "
chipped pebbles in	2 "
greasy soil in	2 "

Of all the terrace pits these show the best preserved specimens; this fact together with the finding in one of them of a European gun-flint proves that they belong to the very latest occupation on the terrace. The pottery fragments are of the very late Indian design and are beautifully decorated with

incised lines and dots. These specimens from the Lalor field were exhibited at the World's Fair and are now in the Field Museum, Chicago.

The contents of the medium pits are quite dissimilar, for instance, pit No. 2 had a large quartzite pebble of the size of a football lying in a greasy matter in the bottom part of a large pot; between the stone and the pot was the shell of a turtle, while pit No. 4 showed not a round bottom like other pits, but a taper-pointed end; in this pit nothing save an argillite chip was found.

Here were found a few hearths, composed of a single layer of quartzite pebbles, of which some are fire-broken. These are identical with the fire-broken quartzite pebbles found in pits, but here are placed in the shape of a hearth. Scarcely ever is anything found in or on the hearths except fragments of charcoal. The diameter of the hearths varies from eighteen to thirty inches and more, and this position is from just below the black soil to near enough the surface to have been disturbed by the plough.

But one ash-bed was found here; of small dimensions, it showed specimens identical with those found in pits; in fact this could be called a very shallow pit.

Charcoal- or fire-pits are small, running from six to ten, rarely to twelve inches in diameter; they may have a depth of a foot or more, and they contain nothing but charcoal.

Post-holes are numerous and interesting. The clean yellow soil underlying the black shows plainly every intrusion, and preserves the exact size and shape of the posts that have stood here and decayed; the minutest details are shown, even to the sharp or dull point of the posts as the case may be. They are generally found near the pits or graves but nothing is found in them except black earth; they vary in size from two to four inches in diameter, and from fourteen to eighteen inches in depth.

Numerous trenches were dug on the field adjoining the Lalor farm on the east, the property of Mr. Frank Wright. Here too I found graves, pits and one cache. Of the graves, there were six deep, one large and shallow and one medium. The contents of the deep graves were in such a bad state of preserva-

tion that a great difference in age may be allowed between them and those of the Lalor field (Plates XXXI, XXXII, XXXIII, XXXIV). The deep graves were three feet below the surface and the skeletons were badly decayed except one, that of a female who had evidently attained great age in life (Plate XXXV). The skeleton lay on the left side and the body had apparently been buried with great care; the others were also on the side. The shallow grave resembled those in Lalor field but in this one there were found the skeletons of eight individuals, lying on their backs in such a manner that the head of one touched the feet of another side by side. Only the occipital part of the crania and some of the long bones remained, the rest as elsewhere having been removed by the plough. A fragment of a soapstone pipe was found near a skull.

The medium grave was scarcely two feet below the surface and the skeleton was lying in a heap, the long bones on top of the ribs and the skull underneath them all; the soil was not disturbed beyond the measure of a common pit (Plate XXXVI). This was probably an instance of secondary burial.

Another grave east of the sassafras trees resembled the deep graves in the Lalor field about fifty yards away; the skeleton lay on the left side with the head to the south and the knees drawn up toward the body. Touching the skull was nearly a whole pot and nearby on the other side a quantity of pottery with broken turtle shells (Plate XXXVII).

The pits were here of the medium grade and were thirty in number; the specimens were few and poorly preserved despite the fact that the soil is of a very light color and nearly all sand. They consisted principally of animal bones so badly decayed as to be almost valueless, and pottery, rude, frail and plain, without a trace of the thin decorated kind occurring in the adjacent field.

A cache containing seventeen chipped argillites was found thirteen inches below the surface in the yellow drift, the specimens lying together in a heap.¹

The fire-pits, nine in all, were not different from those in the adjoining fields on the west, the charcoal occurring however

¹ See Ernest Volk, "Cache-finds from Ancient Village Sites in New Jersey," *Memoirs of the International Congress of Anthropology*, p. 140. Chicago, 1894.

in more solid lumps. The general digging showed the following: (from the black soil) arrow-heads, net-sinkers, "slick" or polishing pebbles, the fragment of a tube, flakes and chips of argillite, jasper, and chert, chipped quartzite pebbles, round quartzite pebbles with small depressions or pits, an occasional large argillite chip, and fragments of animal bone. An extraordinary feature was the finding of several little heaps of animal bones and also of pottery in the black soil near the yellow, somewhat like the cache of chipped argillite; the intrusions penetrated from the black into the yellow soil.

The results of these explorations were exhibited at the World's Columbian Exposition at Chicago in 1893 and are now in the Field Museum.

The locality known as the Indian Burying Ground one mile south of the Riverview Cemetery and below it was investigated in the spring of 1894. After excavation and a careful search it proved to be only a sand-heap due to the action of the river; the material has been so frequently altered and mixed that very little could be gathered from the several weeks of systematic exploring. Several pits were found with a few very small fragments of pottery and some chips of jasper and chert, but no bones of men or animals, and the work was finally abandoned.

A new trench was then opened in the Lalor field east of the Homestead, near a large solitary buttonwood tree. There were two graves but no skeletons. No. 1 was $2\frac{1}{2}$ feet deep, two red bands having been disturbed by excavation; a fragment of a bone two inches long with a few black lines indicating the position of some decayed body and some whole quartzite pebbles were all that were found in the disturbed soil. Grave No. 2 showed the soil disturbed down to a distance of three feet, the top bands of red clay were destroyed and the disturbance had the size and appearance of a grave, but no bone or traces could be found. Six ordinary pits were found of from two to three feet in depth and diameter, but very few specimens; in one was there nothing but broken quartzite pebbles, another contained six broken quartzite pebbles, several chips, one broken argillite implement, four fragments of pottery including a rim carefully

decorated with impressions, another pit contained small chips of black chert and charcoal, another held chips of chert, a fragment of pottery, the usual charcoal and charred nuts; all but one (that second mentioned) contained black soil; in the exception the soil was reddish.

There were six fire-pits in this trench of the same size as those mentioned above, containing nothing but charcoal.

The time allowed for excavation being but six days, the trench was abandoned to make room for planting; another space was then assigned me in the vegetable garden west of the Homestead where I had long wished for permission to explore. The black soil was found to be twelve inches thick, and had evidently been enriched by artificial fertilizing. In this were found the usual objects of the locality already described, such as: broken stone implements, flakes of argillite, jasper, chert, quartz, and quartzite, quartzite pebbles broken by fire and by hand, a large fragment of very rudely made pottery and several smaller pieces. Ten trenches were opened in this neighborhood. I will describe them in order. Their location is shown on the plans. Trenches 1-6 in fig. 10, and 7-10 in fig. 9.

TRENCHES ONE AND TWO.

They were 74 feet and 39 feet long north and south and 38 feet and 15 feet broad respectively.

Ten pits were found of which the description follows;

- 5 pits, diameter 2 to $2\frac{1}{2}$ feet, depth 2 to $2\frac{1}{2}$ feet,
- 1 pit, diameter 1 foot, depth, 1 foot,
- 1 pit, diameter $3\frac{1}{2}$ feet, depth, 2 to $2\frac{1}{2}$ feet,
- 1 pit, diameter $4\frac{1}{2}$ feet, depth 2 to $2\frac{1}{2}$ feet,
- 1 pit, diameter $3\frac{1}{2}$ feet, depth $3\frac{1}{2}$ feet,
- 1 pit, diameter $4\frac{1}{2}$ feet, depth $4\frac{1}{2}$ feet.

Nothing other than what has already been described from the pits was found. Pits 1 and 2 contained several large animal vertebrae apparently belonging to the same individual. Pit 5 contained 23 notched pebbles or net-sinkers, 20 of them together; in this pit a complete layer of greasy material and of small fragments of bone lay near the middle in a thin stratum, indi-

1. Paved place on the surface of the yellow drift.
2. Argillite workshop, 10 inches in the yellow drift.
3. Black spot on surface of the yellow drift.
4. Argillite implement, 3 inches in yellow drift.
5. Argillite workshop, 4 inches in yellow drift.
6. Argillite to workshop, 14 inches in the yellow drift.
7. Charcoal pit, 6 inches in the yellow surface.
8. Heap of burnt stone on the surface of the yellow drift.
9. Disturbed soil, no bones.
10. Yellow soil burnt red.
11. Heap of broken pebbles.
12. Workshop of argillite.



Fig. 8. Trenches west of house Exploration of 1895. Lalor Field.

- 13. Argillite implement.
- 14. Black streak, 16 inches in the yellow drift.
- 15. White Quartz heap.
- 16. Workshop, 4 inches in the yellow drift.
- 17. Argillite implement and rude flakes, 4 inches in the yellow drift.
- 18. Traces of a large tree.
- 19. Argillite slabs, 1 foot in the yellow drift
- 20. Grave II.
- 21. Workshop, 12 inches in the yellow drift
- 22. Grave III.
- 23. Hearths, 6 inches in the yellow drift
- 24. Little heap of broken pottery.
- 30. Disturbed Soil.

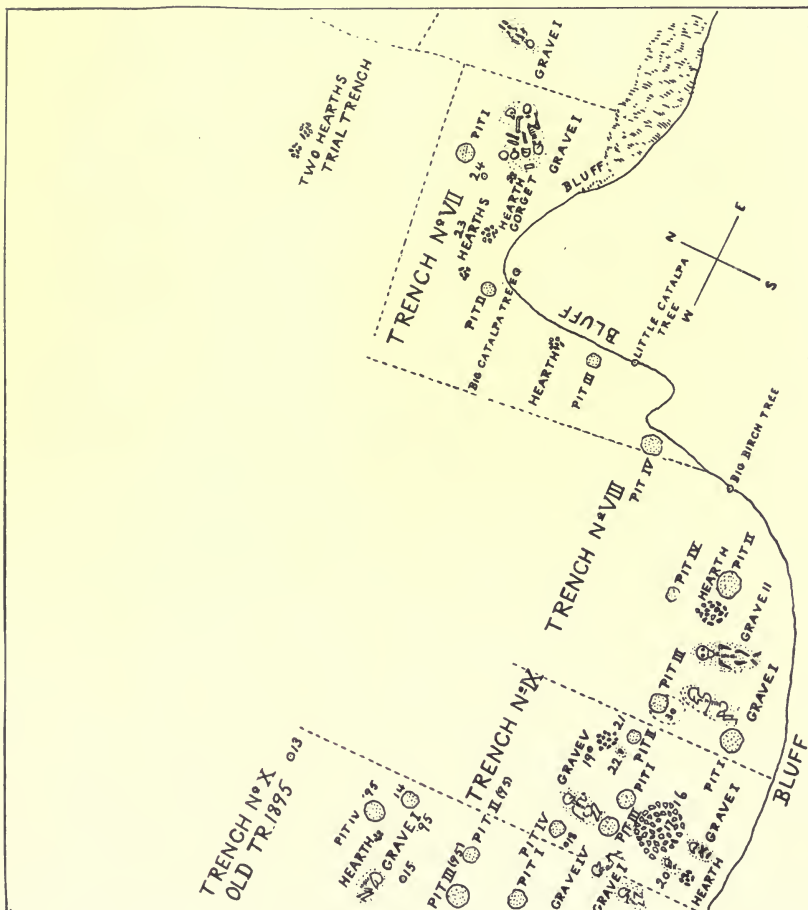


FIG. 9.
Continuation of plan from Fig. 8. Explorations of 1894 and 1895.

cating the deposition of the whole at one and the same time. The pits showing the greasiest soil contained the most specimens.

Two hearths, but no fire-pits were found. Hearth 1, 12 inches down, 3 feet in diameter, contained a single layer of burnt pebbles one half of them fractured by the fire, and hearth 2, 6 inches down, 1½ feet in diameter, presented a similar double layer; both hearths were in connection with the black soil and contained nothing but the stones.

Two caches were found in connection with the black soil and penetrating several inches into the yellow; they were somewhat smaller than the cache of Wright's field and they contained seven and eleven pieces of chipped argillite respectively.

TRENCH THREE.

This trench lines the bluff on the south; it was 50 feet long and averaged 25 feet broad.

7 pits were found; 6 were 2 to 2½ feet in diameter and 2 to 2½ feet in depth; pit 2 was 5 feet in diameter and 3 feet deep. The soil resembled the top soil in the medium black color.

The contents are summarized as follows:

chert chips in	5 pits
argillite chips in	5 "
jasper chips in	5 "
charcoal in	5 "
charred nuts in	5 "
animal bones in	5 "
quartzite pebbles broken by battering in	4 "
small fragments of pottery in	4 "
implements of chert in	3 "
implements of chert (unfinished) in	2 "
stone mortars in	2 "
chips of quartzite in	2 "
quartzite pebbles fractured by fire in	2 "
fragments of pipes of clay in	2 "
implements of jasper in	1 pit
implements of argillite in	1 "

pitted pebbles in	1 pit
whole pebbles in	1 "
also charred animal bones.	

Pit 2 contained fragments of thin pottery, pit 5 only a few flakes and pit 6 one half of a peck of pebbles broken by battering.

The two hearths uncovered were 12 inches deep and 3 feet in diameter, and 18 inches deep and 2 feet in diameter, respectively; like those found before, they contained nothing but the stones and in one case a few fragments of charcoal.

TRENCH FOUR.

This measured 50 feet by 50 feet and showed only 3 pits, one of the usual size and contents, and the other containing only a hammer-stone and a few large worn pebbles, pestle-like. A hearth and a single grave were found in the trench.

TRENCH FIVE.

Owing to lack of funds the excavation of this trench was not continuous, being discontinued from August 27 to September 21, 1894. It was $56\frac{1}{2}$ feet east and west and 52 feet north and south.

One grave was found in this trench, 22 inches down containing a human skeleton; this was 22 inches long and 22 inches broad, lying on the left side, head to the northwest and with the knees drawn up towards the body; it was very badly decomposed and but little of it could be saved. The skeleton of an animal was also found with a pink quartz arrow-point in the skull.

Six pits were explored; pit 1 showed black soil above and light at the bottom, otherwise the color was that of the ploughed ground; they were of the medium diameter and depth, except in the one instance of a diameter of 1 foot. The contents:

small fragments of pottery in	6 pits
broken quartzite pebbles in	5 "
argillite flakes and chips in	4 "
chips of chert in	4 "

charcoal in	4 pits
animal bones in	4 "
chips of jasper in	3 "
implements of chert in	2 "
implements of argillite in	1 pit
implements of quartzite in	1 "
whole quartzite pebbles in	1 "
large fragments of pottery in	1 "

besides one mortar which was a rude stone with a cavity worked in the centre.

The 5 hearths in trench five lay some in the black soil and some on the border; they varied from $2\frac{1}{2}$ to $3\frac{1}{2}$ feet in diameter; hearth 5 contained 200 pebbles broken by battering of which a dozen were much burned.

The general digging showed 2 boulders of soap-stone, and several small flat stones into the centre of which a small cavity had been worked.

A cache of net-sinkers was found 15 inches down and penetrating 3 inches into the yellow soil but still in contact with the black.

TRENCH SIX.

One grave was found near the brow of the hill 2 feet 6 inches down. The body had evidently been buried differently from the others, placed on the back, with the limbs extended and the head towards the west. The skeleton measured from the skull to the lower end of the tibia just 6 feet. It was badly decomposed, the ribs, hands, feet and parts of the arms all gone; only a few of the long bones and the skull could be saved; the fact that the face lay upward hastened the decay as the bones of the face are more easily crushed by the weight of the superimposed earth. The soil of the grave contained a beautiful argillite spear-head, flakes of quartzite and chert, and pottery in small fragments; the thicker stratum of red clay formed, here too, the bottom of the grave.

One of the largest pits on record occurred in this trench; it was 18 feet from the grave, 6 feet in diameter and $5\frac{1}{2}$ feet in

depth, with a medium black soil, somewhat stratified. The contents were:

1 three-cornered arrow-head,
1 small chipped argillite disk,
1 argillite implement,
long, pestle-like, water-worn pebbles,
several unfinished implements of black chert,
chips of yellow jasper (deep down in the yellow soil),
large chips of quartzite,
a few of argillite,
2 pecks of whole and broken quartzite pebbles,
small chips of chert,
a broken clay pipe with beautiful incised decoration,
small fragments of pottery of the medium kind,
much charcoal in very small fragments,
fragments of animal bones.

The hearths (termed hearths, though I have as yet been unable to discover their use) lay on the junction of the black and yellow soil and below, were two and three feet in diameter, and had only a single layer of stones.

They showed no ashes, charcoal nor burnt stones — nothing but pebbles broken by battering.

The general digging produced nothing different from what has already been described.

TRENCH SEVEN.

In this trench 50 feet east and west, to the west of trench six, lay a large grave 18 inches down and 5 feet broad. It contained 6 human skeletons in fair condition, close together; 2 of the skulls pointed to the east and 4 of them to the west (Plate xxxviii). They lay so close that the bodies must have been placed side by side, and possibly partly one on top of another. The vertebrae were badly decayed. The skulls were numbered as they lay: No. 1, face downward, No. 2 with its base upward, No. 3 with the face toward the north and with the lower jaw

dropped four inches out of place, No. 4 looking south, and the jaw also out of place, No. 5, on the east end of the grave, facing south, with the jaw firmly closed, and No. 6 looking south. Except No. 6 they were in fair preservation. The skeletons were lying straight, except No. 4, where the legs were drawn up toward the body. Between the skulls of No. 3 and No. 4 was a beautifully polished gorget with one hole drilled through the middle, an exquisite piece of workmanship. The soil of the grave contained numerous quartzite flakes, a few argillite flakes, one net-sinker, many broken quartzite pebbles, several fragments of medium pottery and some small pieces of charcoal, occasionally in contact with the bones and staining them. Among the tibiae on the east end I found the lower jaw of a jaguar or puma with two large teeth; one side of the jaw was rounded and smoothed.

Four pits were found, of which the individual description follows:

- No. 1 was $2\frac{1}{2}$ feet deep and 3 feet in diameter; the contents:
 one net-sinker,
 broken implements of jasper,
 white quartz,
 argillite flakes and chipped argillite,
 $1\frac{1}{2}$ pecks of broken quartzite pebbles,
 pottery,
 fragments of animal bones and
 soil of a medium quality.
- No. 2 was $3\frac{1}{2}$ feet deep by $2\frac{1}{2}$ feet in diameter; the contents:
 stone implements,
 flakes of chert and of jasper,
 broken quartzite pebbles,
 a few small fragments of pottery,
 charcoal, and
 a few charred nuts.
- No. 3 was 2 feet in depth and diameter; the contents:
 broken implements of argillite,
 flakes of argillite,
 some chert,
 broken quartzite pebbles,

charcoal and
very black soil.

- No. 4 was 3 feet in depth and diameter; the contents:
flakes and chips of argillite,
very large fragments of quartzite pebbles,
large and small fragments of pottery,
animal teeth,
small fragments of burnt animal bones and
a black stratum, 3 inches thick, 2 feet down,
evidently decayed organic matter.

There was a difference in the contents of these 4 pits, as can be readily seen, 2 of them containing no bone fragments at all.

In trench seven were 4 hearths from 12 to 16 inches down:

- No. 1, $1\frac{1}{2}$ feet in diameter with pebbles broken by fire, and charcoal.
No. 2, 1 foot in diameter, without pebbles broken by fire.
No. 3, 2 feet in diameter with pebbles broken by battering but not by fire.
No. 4, $2\frac{1}{2}$ feet in diameter with chips of argillite and chipped argillite, pebbles broken by both battering and fire, fragments of pottery and charcoal; this one is an exception to the rule and was probably a true hearth.

TRENCH EIGHT.

This trench, 85 feet long, joined the preceding on the south and I worked it from north to south to avoid breaking in the bank. In it were 2 graves with 2 skeletons, 5 pits and 2 large hearths.

Grave 1 was only 9 feet from the bluff and 2 feet down; the skeleton was of an adult, lying on the right side facing west with the knees drawn up towards the body, the right leg farther than the left; its length as it lay was 3 feet, $3\frac{1}{4}$ inches and the breadth 16 inches; the soil of the grave was burnt red and mixed thoroughly with charcoal in very small particles.

Grave 2 was about 18 inches down; the skeleton was also of an adult, but it lay on the back with the head towards the north with the arms by the sides, the legs straight, one over the other. It was in a very bad state of preservation, the frontal and temporal bones were broken, the lower jaw had dropped, and with the exception of a few of the lumbar, the vertebrae had disappeared.

The soil of the grave showed one perfect stone implement, flakes of black chert and chipped argillite and very small fragments of charcoal. The specimens found in the grave soil probably became mixed in by accident.

Of the five pits Nos. 1 and 2 were as those described, but No. 3 was a very curious one and unlike others; the ground was disturbed for 5 feet and a wheelbarrow-load of artificially broken quartzite pebbles was found in it; lower, the pit suddenly showed a further disturbance and I dug 3 feet deeper where I found a curiously shaped pot, conical in shape, broken and resting bottom upwards in a greasy soil filled with very small particles of bone not larger than coarse sand. Six inches below this a lot of artificially broken quartzite pebbles was found; charcoal in small particles and flakes of jasper were found among the pebbles, the latter having apparently been exposed to fire.

Pits 3 and 4 were not unusual.

The two hearths did not differ from those already described.

TRENCH NINE.

This trench was 25 feet broad and joined trench eight on the west; the length of the trenches inland depended on the findings. Here were found 5 graves, 4 pits, and 1 hearth.

Grave 1 was 2 feet down and only 6 feet from the edge of the bluff, the nearest I have ever found. It contained the skeleton of a child, lying on the right side, head pointing north and facing west, the knees drawn slightly up towards the body; it measured 2 feet from skull to heel; the bones were nearly

all gone, being badly decayed; the skull had parted, the fragments being as thin as paper, consequently little of it could be saved.

The soil contained one three-cornered arrow-head of chert, very small, flakes of argillite, many broken quartzite pebbles, and one fragment of pottery.

Grave 2, only 18 inches below the surface, also contained the skeleton of a child and from the slight discoloration of the soil the head seems to have pointed south; very little was left, merely a small fragment of the cranium from the parietal and occipital parts, the lower jaw and a few small teeth.

Grave 3, only 15 inches below the surface and penetrating the yellow soil but 4 inches, also contained the skeleton of a child. The discolored soil indicated the position of the body when buried; it had been placed on its side, head to the east, with the knees partly drawn up, as in the previous grave. All the bones had disappeared except a portion of the skull.

Grave 4 was but 18 inches below the surface; the skeleton was of an adult, lying on the left side, the knees drawn up and the head pointing west. There was very little left of the bones, the skull, a femur and a tibia being all that could be taken up. The grave was of an intense red color due to fire, and much more soil than was necessary had been disturbed in making the grave. The disturbed soil contained one unfinished argillite implement, flakes of argillite and of chert, one flake of yellow jasper, many broken quartzite pebbles, of which one large one was under the neck of the skeleton, and one small fragment of pottery.

Grave 5, 18 inches deep, contained the skeleton of an adult, lying on the left side, hands up to the face, the knees drawn up towards the body, and the head pointing to the north. The hands were gone, also humeri and one radius; but the femora and tibiae were partly preserved and the skull and pelvis were in a fair condition. The skeleton measured 3 feet, 3 inches from skull to toe, 2 feet, 6 inches from shoulder to shoulder, and $22\frac{1}{2}$ inches from knee to pelvis. The grave soil contained one red slate spear-point, flakes of chert, argillite and quartzite and small fragments of a smooth pot of a medium variety; the soil was very red and full of minute fragments of charcoal.

The pits were as follows.

Pit 1 was 3 feet in depth and 3 feet in diameter; the soil was black showing a stratum of greasy matter 8 inches thick; the contents:

several chipped black cherts,
flakes of jasper,
argillite and quartzite,
fragments of pottery of the medium kind,
one vertebra of an animal,
several small fragments of animal bones,
burnt animal bone,
and charcoal.

Pit 2 was $2\frac{1}{2}$ feet in depth and 3 feet in diameter and contained black soil, the contents:

a beautiful three-cornered arrowhead of light colored quartz,
chips of argillite,
broken quartzite pebbles,
fragments of pottery,
fragments of the antler of deer,
and charcoal.

Pit 3 was $2\frac{1}{2}$ feet in depth and 3 feet in diameter, and stratified, the greasy substance being from 3 to 6 inches thick. The contents:

flakes of chert,
argillite and quartzite,
fragments of pottery of the medium kind.

Between this pit and grave 5 (8 feet away) I found many disturbances made by the roots of trees; a large hole in the yellow soil showed where the tree had been, and I found traces of the roots both in this pit and in grave 5, shown by black lines; some of the roots had had a diameter of 10 inches running down through the black soil and breaking all the red lines or bands.

Pit 4 was $1\frac{1}{2}$ feet in depth and $1\frac{1}{2}$ feet in diameter; the soil was very greasy but not in layers; nothing unusual was found in it.

The one hearth found was 15 inches down and 4 feet in diameter. The pebbles were nearly all broken, many by fire, and had much charcoal among them in small fragments; the stones were scattered, not touching one another (an exception to the general rule). This hearth was near the grave of the child (No. 3) and contained nothing different from what has been already described.

TRENCH TEN.

Trench ten adjoined trench nine on the west and like the preceding was 25 feet broad; in it were 1 grave, 2 pits, and 2 fire or charcoal pits.

The grave was 18 inches deep and 17 feet from the brow of the hill, and contained the skeleton of an adult in a bad state of preservation; it lay on the left side with the head pointing north, face to the east, and the knees drawn up towards the body; it measured 36 inches from head to heel and 2 feet from knees to pelvis. Only a part of the skull and of the tibiae and femora could be saved; nothing was found with the skeleton.

The black soil is deeper or thicker along the bluff for from 20 to 30 feet inland; this is due partly to the practical ploughing near the bluff to prevent the washing away of the bluff during heavy rains, and partly to the heavy forest-growth still flourishing on the hillside and carefully preserved by the owners. Farther inwards, away from the influence of the trees the black soil is chiefly due to the original heavy forest-growth and the soil ceased to accumulate as soon as the forest was removed for purposes of cultivation.

Of the pits, pit 1 was $3\frac{1}{2}$ feet deep and $4\frac{1}{2}$ feet in diameter; the stratified filling resembled that of others already described and the very dark layers alternate with a much lighter-colored soil or an organic matter that had changed to soil. The outer line where it joined the yellow soil was densely strewn with charcoal in minute particles. The contents:

one three-cornered arrow-head of black chert,

many small flakes of chert,

several flakes of argillite,

many quartzite pebbles broken by fire and by battering,

fragments of medium pottery, showing cord-marking, animal bones in fragments, apparently of deer (broken but in excellent preservation), bird bone.

A little heap of fire-broken quartzite pebbles lay just outside of this pit. This pit appeared to be one of the most modern, and seems to have belonged to the very Indians living here when the white man came. In all 80 such pits were found near Sassafras Lane in 1890, 1891 and 1892, most of which have been described; the contents of this last one were the same in firmness and appearance as those before described.

Pit 2 was also a large pit, $3\frac{1}{2}$ feet in depth and 6 feet in diameter; both 1 and 2 were near the bluff, in fact the nearest as yet found. The soil was not stratified but was dark and contained fragments of pottery, all of them small and apparently of the same design as those in pit 1. The other contents: many flakes of black chert and quartzite, several flakes of yellow jasper, chipped argillite, a large lot of broken quartzite pebbles, of which those broken by fire mixed with charcoal occurred through the whole pit, the rude bowl of a pipe of clay, several fragments of animal bones, but none burnt. A very interesting discovery was a piece of parched leather, or the skin of some animal. This was the first time that such leather was found in these explorations, and it was found but once afterwards.

Fire-pit 1 was found 10 feet west of the grave and was $1\frac{1}{2}$ feet in depth and 1 foot in diameter; nothing was found in it but the usual charcoal. Between this pit and fire-pit 2 were found several pieces of parched leather in a small disturbance, like a smaller pit.

In the spring of 1895, work was resumed in Lalor field and a new trench laid out.

TRENCH ONE.

The new trench (fig. 8) ran along the bluff and was 75 feet in length, and from 12 feet in width at the east end to 22 feet at the west. In this were 8 pits as follows:—

Pits 1 and 2 were common as heretofore described.

Pit 3 was 3 feet deep and 2 feet 10 inches in diameter, the

soil was stratified, a very light stratum alternating with a dark brown one which was full of fragments and small particles of charcoal; the pit had many roots of neighboring trees. The other contents:

- one small arrow-head,
- one net-sinker,
- one flake of a light-colored stone (hornstone), very rare here,
- broken quartzite pebbles,
- flakes of argillite,
- many fragments of pottery,
- one small fragment of animal bone,
- burnt nuts,
- little lumps of charcoal the size of a hazelnut.

Pit 4 was a common one.

Pit 5 was 4 feet in depth and 4 feet in diameter and contained very black soil mixed with small particles of charcoal; the other contents:

- one chipped pebble,
- several whole pebbles,
- some pebbles broken by battering,
- quartzite pebbles broken by fire,
- small fragments of pottery, well baked,
- fragments of animal bone, fairly well preserved, but often burnt,
- the fin bone of a fish,
- burnt turtle-shell,
- burnt nuts, whole and in fragments (walnut and hickory).

Pit 6 was 2 feet in depth and 2 feet in diameter, 6 feet from the bluff, with a medium black soil. The contents:

- one arrow-head,
- a few flakes of chert and quartz,
- several small fragments of pottery.

Pits 7 and 8 were common and contained nothing new.

There was a place near pit 6 that could not rightly be called a pit, being very shallow, and penetrated the yellow soil but

four inches; here were found several traces of tree roots; it was 3 feet in diameter; the contents:

several chips of black chert and quartzite,
a few flakes of argillite,
broken quartzite pebbles,
a very few small fragments of animal bones,
burnt soil and charcoal.

Besides the pits there were 2 hearths in the narrow trench, but they were not of much importance.

This ended for a time the explorations west of the house, for the crops were in and I was compelled to go to the east of the house and there near the Sassafras Lane, trial trenches were opened close to the place explored in 1891.

The trenches were 50 feet long from the hill inland, and 3 feet wide; in them I found three fire-pits exactly four feet apart, forming a perfect triangle. These pits were 1 foot in both depth and diameter and contained nothing but charcoal. More of the fire-pits and several of the medium pits were found in these trial trenches, but they were identical with those found to the west of the house; occasionally I found a little heap of pottery in the black soil near the junction with the yellow.

Trench 1, 44 by 25 feet was then laid out in a place west of the village-site explored in 1891, near the Sassafras Lane. Here the soil to a depth of nine inches is looser than usual and of an intense black color, then it becomes very hard and firm, packed solid, not unlike a wagon-road. A further investigation showed that the firmly packed soil contained broken implements of jasper, small flakes of chert, and minute fragments of pottery.

Trench 1 contained 2 pits.

Pit 1 was $3\frac{1}{2}$ feet in depth and 5 feet in diameter; the soil was inky black; the contents:

very small flakes of black chert,
quartzite pebbles broken by fire,
fragments of pottery which showed that mica had been
used in the composition of the clay,
a little heap of calcined bones.

Pit 2 was smaller, being 2 feet in depth and 2 feet in diameter; the contents:

a few very small flakes of black chert,
 one whole pebble,
 quartzite pebbles broken by fire,
 but no yellow jasper, this stone being found on the surface and very rarely in pits.

The general digging in the hard packed soil revealed an interesting feature in the form of an immense bed of charcoal beneath a foot of black soil (fig. 11). The charcoal was in

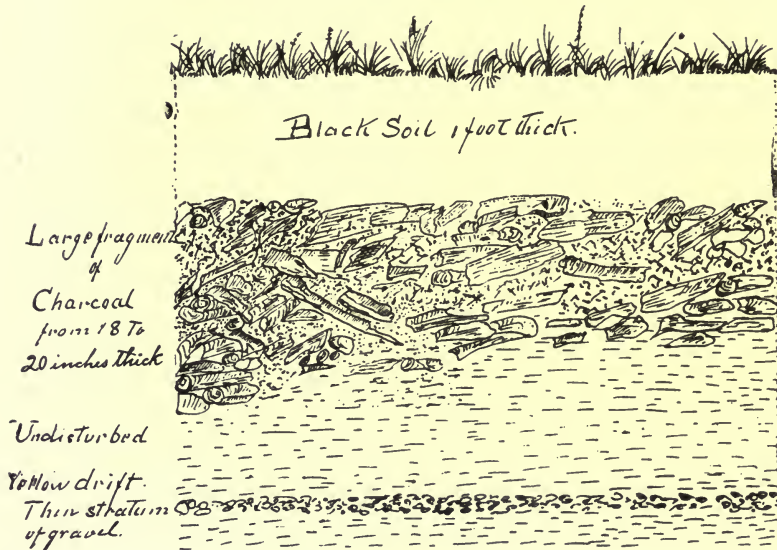


FIG. 11. Illustrating the bed of charcoal.

large pieces, some measuring nearly a foot in length and several inches in breadth and thickness, arranged in a circular shape. At first the deposit appeared like a large pit, but on investigation it proved to be bow-shaped, about 20 feet in outside measurement, from 8 inches to 2 feet in thickness, and from 2 to 5 feet in breadth. Around the curve of the larger pieces smaller particles of charcoal were found distributed in a black streak

or layer in a space of 50 or more feet and to a depth of 5 or 6 inches.

Trench 2, also 44 by 25 feet, parallel with trench 1, showed several pits, of which one was large, 5 feet in diameter, but contained only a few quartzite pebbles broken by fire and no charcoal; the soil was very light in color, almost yellow. The small pits were of little importance and contained nothing unusual.

To the south and towards the inside of the charcoal deposit there was a space 8 feet in diameter and 9 inches down thickly filled with flakes or chips of red argillite and also of red slate or shale. Leaving this deposit and moving towards the hill, one encountered a deeper black soil at the top; although considerably above the lower level, this soil attained a thickness of 18 inches; an investigation showed that the yellow soil underneath this rich loam was penetrated to a depth of 8 inches by black veins and by perforations, undoubtedly caused by a thicket of underbrush, or some other luxuriant plant growth that had once flourished here. Although over one half of the trench on the south was in this part of the field nothing was found in it.

Trench 3 contained three pits of little importance.

Trench 4 was only partly explored as the specimens were scarce, and, showing the usual features, of little importance.

After finishing the trenches I measured and found the black streak and the hard, compact soil to be about 200 feet in diameter, and that the large charcoal deposit was a little to the northeast of the centre of this, further, that all this came to an end on the south near where the ground rises. When I took all these features into consideration, I concluded that the large charcoal deposit in the half-circle was probably the remains of one of the stockaded dwellings of the last Indians of the place, that the hard ground packed so tightly was the inside of the dwelling and that the pits were the storage and cooking places of the occupants. The rise in the south was covered by an impenetrable thicket, hence the lack of traces of village refuse, and the pits and the graves of the spot near Sassafras Lane explored in 1891 were probably the pits used by these Indians and the graves of their people.

The next place of exploration was west of the Lalor house, alongside of the old trench abandoned in the spring.

TRENCH TWO.

This trench (fig. 8) was laid out on July 27, 1895. It contained 1 grave, 6 pits, 3 hearths, and 2 fire-pits.

The grave (apparently not dug and prepared as usual, but merely a round hole into which the body had been dropped) was that of a child; the skeleton, the bones of which were much broken, was 2 feet, 8 inches long, with the head pointing south. The head and feet had been nearer to the surface than the rest of the body, consequently the plough had in the course of time taken away some parts of these. After removing the bones I found 6 inches of yellow loam, and below this a large pit (No. 4) described below.

The pits were as follows:—

Pit 1 was 2 feet in depth and 2 feet in diameter, with medium black soil; the contents:

an implement like a celt,
flakes of argillite, quartzite and black chert,
quartzite pebbles broken by both fire and battering,
much burnt pottery in fragments,
animal bone in fragments, and small particles of charcoal.

Pit 2 was 2 feet in depth and 2 feet in diameter, with medium soil; the contents:

several chips of yellow jasper,
2 fragments of pottery,
the skull and antler of a deer.

Pit 3 was $2\frac{1}{2}$ feet in depth and $2\frac{1}{2}$ feet in diameter with medium brown soil; the contents:

a few chips of yellow jasper, chert and argillite,
small quartzite pebbles broken by fire,
fragments of pottery from the top and bottom, apparently
belonging to the same pot, besides other fragments,
small particles of charcoal.

Pit 4, underneath the skeleton was $2\frac{1}{2}$ feet in depth and 2 feet 10 inches in diameter; in it was a thick layer of black soil, 8 inches deep containing objects similar to those usually found in pits, viz.:

a few flakes of white quartz, flakes of yellow jasper,
broken quartzite pebbles,
other pebbles whole and burnt,
fragments of pottery with cord markings,
animal bones,
charcoal mixed with the black soil.

In the pit, above the layer of black soil and below the 6 inches of yellow loam underlying the skeleton was nearly a whole pot standing upright.

An interesting feature was that in the yellow loam were a few argillite flakes, identical with those commonly found in the yellow soil, just outside the disturbance made by the grave; it is probable that the yellow soil caved in on the half-filled pit.

Pit 5 was $2\frac{1}{2}$ feet in depth and 2 feet in diameter with medium soil; the contents:

one flake each of yellow jasper and chert, a few of argillite,
a large slab of argillite partly chipped, at the top of the pit,
numerous fragments of pottery with cord markings,
a part of the antler of a deer,
charred nuts.

Pit 6 was 2 feet in depth and 2 feet in diameter with medium soil; the contents:

one net-sinker,
chips of yellow jasper, chert, and quartzite,
flakes of argillite, quartzite pebbles broken by fire and
battering,
very small fragments of pottery,
one large fragment of animal bone,
the jaws of a deer with teeth,
charcoal.

The hearths.

Hearth 1 was 14 inches down and 2 feet in diameter and

contained a single layer of quartzite pebbles broken by fire and fine particles of charcoal.

Hearth 2 was 1 foot down and 3 feet in diameter and contained a single layer of quartzite pebbles on the junction; near by were a few fragments of animal bone.

Hearth 3 was 14 inches down and 2 inches in the yellow soil, and $2\frac{1}{2}$ feet in diameter; it contained a single layer of pebbles all whole and unburnt, without charcoal; one broken argillite point was found.

Besides these stone piles or hearths I found several individual little heaps of pottery, and occasionally a little heap of much broken and badly decayed animal bones.

The old trench east of the Homestead was reopened and showed one grave, 4 pits and one hearth.

The grave was very small and shallow, being only 10 inches below the surface; on investigation the soil was found to have been disturbed for a foot below the enclosed skeleton, the whole resembling a pit rather than a grave. The skeleton, as well as could be judged, was that of a young person; it had been lying on the left side with the knees drawn up, and the head towards the east; the body had evidently been buried on top of broken quartzite pebbles, and was also partly covered with them. The bones being badly decayed, only portions of the skull and a part of the femur could be saved. Accompanying the skeleton was a net-sinker near the front of the skull.

Pits 1 and 2 were as those heretofore described.

Pit 3 was 2 feet in depth and diameter, and showed many interesting features and specimens. The soil, was light-colored on top of the contents of the pit, but black below them. There was a layer of chestnut shells 8 inches in thickness, also acorns, hickory-nut shells, and a large lot of nut shells not identified, charcoal in large and small fragments, little sticks not larger than a match, all charred and black, showing that the fire had been smothered out before it had had time to burn the contents to ashes. The layer of charred material was in all 2 feet in diameter and reached down to the bottom of the pit.

Further contents were:

one three-cornered arrow-head,
 several flakes of quartzite,
 a few quartzite pebbles,
 a water-worn pebble the size of a foot-ball,
 broken pebbles of white quartz,
 many fragments of a pot.

Pit 4 was 3 feet in depth and $2\frac{1}{2}$ feet in diameter, the contents:

one implement of red slate,
 some chips of red slate,
 chipped argillite,
 chips of yellow jasper, chert and argillite,
 a great deal of pottery in larger fragments than usual,
 several fragments of a clay pipe,
 animal bones, one of them a large fragment,
 animal teeth,
 calcined animal bones,
 charcoal.

Most of the pottery was in the bottom of the pit, only a few fragments at the top.

The hearth was on the surface of the yellow drift, was one foot in diameter, and showed a double layer of quartzite pebbles broken by fire mixed with charcoal; the yellow soil underneath was burnt red.

TRENCH THREE.

Trench 3 (fig. 8) was 75 feet long by 25 feet broad; it contained no graves, but there were 6 pits, 1 hearth and 1 charcoal pit.

Pit 1 was $2\frac{1}{2}$ feet in depth and 2 feet in diameter with very black soil, the contents:

one peculiar implement of stone,
 one chip of yellow jasper,
 several chips of quartzite,
 chipped stone,
 quartzite pebbles broken by fire and battering,
 fragments of pottery,
 animal bones of remarkable firmness,

charred animal bones,
fish bones,
unio shells,
charcoal and ashes,
small fragments of burnt nut-shells,
a burnt fragment of unidentified fruit.

Pit 2 was not deep, only penetrating the yellow soil by 3 inches; it was 2 feet in diameter with a medium black soil; the contents:

a broken implement of stone,
chips and flakes of chert, argillite and quartzite,
broken quartzite pebbles,
a beautiful implement of bone,
a few fragments of animal bones,

Pit 3 was 9 inches deep from the surface of the yellow soil and 12 inches in diameter; it contained nothing important.

Pit 4 was 15 inches deep, 6 inches below the yellow soil, and 12 inches in diameter, the contents:

fragment of pottery,
the rib of an animal.

Pit 5 was $2\frac{1}{2}$ feet in depth and 2 feet in diameter, with a soil stratified but very little discolored, just enough to show that it had been mixed with the top soil; a dark stratum in this pit showed a little flake of yellow jasper and a few fragments of pottery; the other contents:

a few whole pebbles,
a few broken quartzite pebbles,
a large fragment of a pot, the rim missing (found on top of the dark stratum),
a few fragments of charcoal.

Pit 6 was 3 feet in depth and 3 feet in diameter, with stratified soil; the top soil was here 9 inches thick and on the yellow soil's surface the outlines of the pit were plainly marked; in the pit itself there were 18 inches of yellow slightly discolored soil on top, showing that the pit had been refilled with the clean soil

taken out when the pit was made, below this was a blacker layer 15 inches thick and this in turn rested on a light yellow soil slightly discolored; in the black layer were the following contents:

- a large flat water-worn stone with a slight cavity worn into one smooth side of it, this was 8 inches long 7 inches wide and 2 inches thick,
- a long water-worn, pestle-like pebble, neither bruised nor burnt,
- a flake of yellow jasper,
- several flakes of black chert,
- quartzite pebbles, whole and broken,
- a few fragments of pottery,
- a few whole nuts,
- charred nuts in fragments,
- a few large lumps of charcoal,
- small pieces of charcoal (showing the smothering of the fire by the material, now black, being thrown upon it).

The yellow soil on the north side of the pit was burnt a salmon red color; in the burnt soil at the bottom of the pit a chipped piece of yellow jasper was found.

The hearth was 2 feet in diameter and composed of a single layer of pebbles broken by fire and battering, some of them badly burned into small fragments; there were no ashes, charcoal, nor black soil; there were found a slender spear-head of argillite, some argillite chips and a few whole pebbles among the broken ones.

A charcoal pit was also found 20 inches down, 8 inches thick and 12 inches in diameter; there were no specimens.

TRENCH FOUR.

Trench 4 (fig. 8) was started on the west of trench 3 and running parallel with it; like the latter it was 75 feet long and 25 feet wide; it contained 1 grave and several pits.

The grave was 2 feet below the surface and was that of a

child; the skeleton was only 2 feet long and lay on the right side with the knees drawn up and the skull pointing north. It was nearly entirely decomposed and but little could be saved; the soil was burned red about and also below the little skeleton and contained four chips of chert and several of yellow jasper, etc., as is usual in the general digging.

Pit 1 was $1\frac{1}{2}$ feet in depth and $1\frac{1}{2}$ feet in diameter with a disturbed but only slightly discolored soil, the contents:

a few flakes of chert,
quartzite pebbles broken by fire and battering,
small particles of charcoal.

Pit 2 was 3 feet in depth and $2\frac{1}{2}$ feet in diameter, the contents:

chipped white quartz,
chips of black chert,
broken quartzite pebbles,
a considerable quantity of broken pottery, seemingly
from the same pot,
2 fragments of animal bone, animal teeth.

TRENCH FIVE.

Trench 5 (fig. 8) was contiguous to the north line of trench 1 begun in the spring of 1894. There was little found in it; a heap of about 20 stones was found at the junction of the yellow soil, chiefly whole quartzite pebbles but a few were broken.

What was apparently a hearth or paved place 5 feet in diameter consisted of a double layer of quartzite pebbles burnt and broken by fire, but with no trace of ashes nor of charcoal. The soil was burned red; I have tested the effect of fire on the yellow soil and find that it takes very little fire to turn it red.

In 1898 a trench was opened near the northwestern line of Dr. Abbott's farm; it was on a high part of the terrace, the last rise to the eastward of the Trenton gravel. The trench was 10 feet long and 2 feet wide with the black soil here 15 inches thick, resting on the yellow loam as usual; there were one pit and several fire-pits, the latter from 8 to 12 inches in depth and in diameter.

The pit was $4\frac{1}{2}$ feet in depth and $3\frac{1}{2}$ feet in diameter with medium black soil not stratified; the contents:

one chipped argillite implement nearly finished,
 fragments of black chert,
 chips of argillite,
 quartzite pebbles broken by fire and by battering,
 several fragments of thin pottery apparently from the
 same vessel.

This pit, though large, produced little and was evidently not used for cooking, as it contained no traces of fire.

In April, 1899, a trench (Trench 1) was opened on the Abbott farm on the western bank of the little stream called in these notes "Abbott's Brook" which flows through a gully about 30 feet below this trench; the chief object of digging this trench was to get at the exact depth at this point of the drift (Trenton gravel), the eastern bank being the elevation noted of the Columbian gravel.

The trench was laid out 5 feet wide and about 75 feet long, the depth depending on the conditions, and at the opening which was at the bluff the black soil was 15 inches thick over 2 or 3 feet of yellow soil. (I shall refer later to the further exploration of this trench when speaking of the archaeology of the yellow loam.) This trench produced in and in connection with the black soil 2 graves and 3 pits.

Grave 1 was 18 inches below the junction of the yellow soil and was in connection with the pit first found or pit 1, apparently having been dug either at the same time or shortly after the pit. The skeleton had apparently been lying on the side with the feet drawn up towards the body and the head pointing south; there were left only a few fragments of the skull.

Grave 2 was 28 inches below the surface and the skeleton was nearly all gone, leaving it possible to preserve only a few fragments of the skull. The body appeared to have been buried in a kneeling posture with the face downwards. Near the skull on the northwest I found the following objects:

1 arrow-head of black chert,
 1 blade of black chert,

1 broken spear-point,
 1 broken implement of argillite,
 2 blades of argillite,
 3 flat pieces of limonite,
 a flake of yellow jasper,
 a long flake of argillite,
 a small pot badly burned and broken,
 an object of bone,
 several teeth of the beaver.
 a shell of a turtle, probably used as a cup, inside of the pot.

Not very often are objects found with skeletons. A few of the finger bones were found under the face.

Pit 1 penetrated 8 inches below the junction of the yellow soil and was 2 feet in diameter with medium black soil; the contents:

chips of argillite,
 quartzite pebbles broken by fire and by battering,
 a few fragments of mica, pottery and charcoal.

Pit 2 was 1 foot deep and 2 feet in diameter; the contents:
 a few chips of jasper and argillite,
 a few small fragments of pottery.

Pit 3 was 2 feet in depth and 3 feet in diameter; the contents:
 a large stone partly chipped and burned,
 chipped argillite,
 flakes and chips of jasper and argillite,
 a few fragments of mica,
 a few fragments of pottery.

The black soil of the general digging showed the usual formation on the terrace.

Later in the season (in August, 1899) trench 2 was dug running at right angles with trench 1 and parallel with the brow of the hill (east and west), both trenches (Nos. 1 and 2) started at the same point; the black soil varied here from 12 to 15 inches in depth and offered the same results as trench 1, viz. chips of chert, jasper, argillite and quartzite, etc., and fragments of

pottery. Several pits were found, all of small size except one; this was 5 feet in depth and 5 feet in diameter with soil discolored by having been burned red and strewn with fragments of charcoal but it could hardly be called mixed. The dimensions were remarkable and reminded one of some of the larger pits in the Lalor field; the contents:

a thin layer of fine particles of charcoal mixed with about
one half of a peck of broken quartzite pebbles,
several of the latter scattered in the pit,
2 thin flakes of argillite lying among the pebbles at the
bottom.

The disturbance made by the pit could clearly be distinguished after the black soil had been removed.¹ It is evident that this pit had not been used for cooking, nor as a refuse-pit.

Pit 2 was also a large one and presented nearly the same features as that just described, and they were evidently of the same date; in neither was there any undisturbed soil between the pit and the black soil.

These two pits are unique and the firmly packed soil in them unlike that of other pits, is very interesting. This will be referred to later.

These are the main features of the terrace excavations as far as the black soil and its traces of human occupation are concerned. Many other explorations were made upon the terrace in the working out of other problems of which the following pages will treat; several skeletons, pits and specimens were found, but as the important matters connected with them have already been set forth in relating similar discoveries I shall not further enumerate them nor describe them.

A few concluding remarks will close this part of the report.

In reviewing the evidence of the foregoing explorations I would call attention to the special significance of the chief facts as they were brought to my notice.

¹ See the chart in the American Museum Natural History, New York.

THE GRAVES.

The graves varied as to mode of burial and the position of the body and the burials differed in depth from only a few inches to three feet below the present surface.

The burials may be divided into classes, depending on depth, disposition of the skeleton and the accompanying objects.

First: the shallow graves or "Surface burials" as they may be called were apparently produced by placing the body on the ground and then heaping the earth around and over the body, so as to form a low mound; later the plough often removed this and destroyed many of the bones. The posture of the bodies was exceedingly various, the most common arrangement seemingly having been that the body should lie on the side with the knees drawn up toward the body, the arms bent and the hands near the breast or face. The direction in which the heads pointed apparently had no significance, as they were found pointing towards all the points of the compass. Burials at full length on the back were not common and may not always have been due to intention; the fact that a body is rigid soon after death may be the cause of some of the few burials in this manner.

Second: what seems perhaps to deserve the title of "Burial with Distinction" was exemplified in one case, grave No. 6 in the Lalor field, found in 1891; here the body had been placed in a sitting posture (Plate xxx).¹ The skeleton was covered with the remains of a feast, showing that ceremonies had been held at the time of burial; traces of fire were also in evidence.

The two large graves found in the Wright and Lalor fields possibly indicate what may be called "Emergency Burial." The first contained eight individuals all lying on the back and arranged in such a manner that the head of one touched the feet of another; this points undoubtedly to a case of great haste, the number of bodies perhaps indicating an epidemic. The second, nearly a mile further west contained six individuals lying so close together that they seemed to have been packed into one grave and partly over one another. Five of the skele-

¹ The skeleton is in the Field Museum of Natural History, Chicago.

tons were in the same posture as the eight of the preceding large grave, and the heads of two of these lay so that the base of the skull was upward; the sixth skeleton was put at the end of the grave in the common posture with the knees drawn up towards the body (Plate XXXVIII). One skull was separated from the body and the base was uppermost. In one grave in Wright's field the body was evidently thrown into the excavation head first; the femora and tibiae were on top of the ribs, the skull underneath all; the excavation appeared no larger than an ordinary pit; such a burial may well be given the title of "Secondary Burial" (Plate XXXVI).

Accompanying objects with the skeletons are rare on the terrace; besides the two large graves described as Emergency Burials in one of which was part of a soapstone pipe and in the other a beautiful gorget and the lower jaw of a puma, I can refer to only two others, one found on Wright's land and the other on the farm of Dr. Abbott. The former showed a large fragment of a pot touching the face of the skeleton, and a turtle shell cup with fragments of pottery on the other side of the skull (Plate XXXVII); in the other grave were found several stone implements, pottery and animal bones and teeth near the skull.

THE PROBABLE AGE OF THE GRAVES.

The human bones on the terrace were generally badly decayed in spite of the fact that some of them lay under conditions rather favorable to their preservation; it would be too speculative to attempt to decide upon the exact length of time elapsed since the bodies were buried, but that it is over two hundred years is a matter of certainty; the land was purchased from the Lenni Lenape in 1680 and after the sale the Indians moved away and no more burials were made; there is a stone house on the terrace still standing bearing the date of 1708, and previous to the building of this the man "Watson" lived in a log house at the same place for a number of years. Judging from the condition of the bones I conclude that the graves may be arranged according to their antiquity as follows: the six deep single graves in Wright's

field are the oldest, and the bones were the most decayed. The deep graves in the Lalor field, east of the house, near the Sassafras Lane are the second in age. The other graves in the Lalor field west of the house (not "surface" burials) are the third in age. The "surface" burials are the most recent and the best preserved; in spite of the fact that the bones are badly broken, possibly by the plough in many cases, the fragments are remarkably firm.

That the burials, either before or after, were accompanied by fire is established in every instance except one, that of the "secondary" burial. The charcoal found in contact with the bones and in the filling of the graves, also the burnt walls of the excavations, give unmistakable evidence of the use of fire at interments.

THE PITS.

THE PROBABLE AGE OF THE PITS.

The pits may be regarded as a sort of record of the daily life of the inhabitants of the terrace, and from them was gathered a great amount of interesting and suggestive material justifying the following conclusions. I find that in relation to the graves just mentioned, the pits and their contents were generally similar to the graves found in the same locality; where the deepest and oldest graves with the skeletons most decomposed were found, there the contents and the condition of the pits were of a like character; this was particularly striking where the bones of animals were present.

The pits found among the graves and deep skeletons of Wright's field are apparently the oldest of all and of a very ancient date; like the contents of the graves found there, what the pits held was in the most advanced stage of decay; a much lower order of culture was suggested by the rudeness of the stone implements and the plainness of the pottery and by the absence of decorated pottery and of bone implements.

The pits found at the extreme east end of Wright's field and along the terrace next in place to those just mentioned were of a

different order; while there was no marked improvement in the stone implements or the pottery, the former being of the same types and materials (chert, jasper, argillite and quartz) as prevailed in the oldest pits, yet the specimens were much rarer than in the most recent pits and on the other hand the animal bones much better preserved than in the older pits.

The pits found in 1891 and 1892 in the Lalor field, together with three more found later (one half of a mile to the west near the bluff, where the leather was found) seem to be of the most recent date. They contained Indian implements of a finer pattern and finish and later type, some being of bone, and the finest decorated pottery was present; the animal bones were firmer and better preserved. During these explorations no object of European or white man's origin was found, save one gun flint in a pit of the most recent date.

THE SIZE AND PROBABLE USES OF THE PITS.

The pits were large, medium and small.

The Large Pits.

The large pits were usually 3 to 4 feet in depth and 4 to 6 feet in diameter. They may roughly be divided as regards their contents into two classes. The contents furnish the only available evidence for what purposes may be assumed for their existence.

The first class contained a few flakes or chips of the different materials employed in manufacturing implements, charcoal and light colored soil chiefly burnt red.

The few flakes or chips hardly warrant the assumption that the pits were used for rejected workshop material, nor do the few fragments of burnt pebbles force on one the conclusion that cooking was done in them.

They may have served as storage pits, for drying fruit, for keeping grain or for many other purposes incidental to Indian village life; where found the chips and pebbles probably occurred by accident.

The second class contained the remains of what were probably feasts partaken of by a large number of people and may well be designated cooking-pits. The pebbles broken by fire and the charcoal indicate this, and the fragments of pottery show the type of pot used, its shape and decoration; the animal bones exemplify the animals used for food, and the intentional breaking of such bones only as contained marrow, point clearly to the purpose of the fracture.

Various other articles of food were represented in the ashes and charcoal, such as fish, turtle, and acorns and various nuts. The greasy nature of the soil was undoubtedly due to the decayed organic matter.

The Medium Pits.

The medium pits were in the greater number and were of two classes: the stratified and the unstratified, or ordinary pits.

(a) THE STRATIFIED PITS.

The stratified pits were evidently filled gradually, thus giving an excellent record of the doings of these people; four examples will be given.

(1) The lowest stratum was composed of a layer of charcoal with pebbles broken by fire and battering; these were sufficient to make possible the cooking of meat; the next stratum contained the bones of animals; the bones here were broken into pieces among which was one broken bone point, or so-called "marrow-fork"; above and covering all this was a stratum of thin jasper chips with battered hammerstones, a few broken implements and failures of the same materials; the last stratum showed that the pit was not used for cooking purposes only, but also as a refuse-pit after the meal was over, also as a receptacle for the useless chips remaining after the making of implements.

(2) The first stratum at the bottom was charcoal with a layer of pebbles broken by fire; second, above this a thick stratum of acorn and chestnut shells mixed with thin sticks of charcoal not thicker than a match; these were apparently small twigs which had been smothered out before they were burned

to ashes; last and at the top was a medium soil full of chips and flakes of various minerals, and of fragments of pottery, probably the scrapings or the results of brushing up from the surface around the pit.

(3) The first stratum at the bottom was composed of numerous rude chips of quartzite and quartzite pebbles broken by battering; the absence of the implement of whose manufacture the chips were an evidence suggests that the artisan's work was a success; second, above this was a stratum of charcoal mixed with burnt pebbles fractured by heat; the absence of animal bones suggests that what was evidently cooked here was either not meat at all, or meat without bone; third, over this was a layer of potsherds, apparently belonging to one vessel, and last at the top was the stratum of black soil and the usual rubbish; the pot, probably accidentally broken was accompanied by burnt pebbles and a greasy substance or soil.

(4) Above the usual traces of cooking was a layer of thin flakes of jasper and chert with the fragment of a round, somewhat bow-shaped bone; this was part of a bone tool commonly used in detaching small flakes in the making of implements, and in their more artistic finishing; then at the top was the surface soil containing no specimens, the pit having probably been leveled up.

It will thus be seen that each stratified pit tells its own story and while other descriptions and conclusions could be presented, these are deemed representative and sufficient.

(b) THE UNSTRATIFIED OR ORDINARY PITS.

The unstratified pits were the more numerous, and were also somewhat more complicated than the stratified; they presented many varieties of which nine may be mentioned.

(1) They contained medium black soil, broken implements of various minerals, chips and flakes, broken quartzite pebbles, broken pottery of differing kinds and shapes, and fragments of animal bone; at the same time, no charcoal nor other signs of fire were visible. These may be classed as rubbish- or refuse pits having probably served previously as storage-pits, or for some purpose other than cooking.

(2) They contained nothing but the chips and flakes of the various materials used in the manufacture of implements and weapons. As in many cases post-holes were found within a foot or two of their outlines it is not impossible that the pits represented the sites of sheltered work-shops.

(3) They contained nothing but small fragments of various kinds of pottery with traces of fire; these were not so much charcoal but mainly ashes; here the pits may have served as places for burning pottery.

(4) They contained broken quartzite pebbles, a few scattered fragments of pottery, animal bones, and charcoal and ashes; this type was the best represented. They may have been simple cooking-pits, in spite of the comparative scarcity of the charcoal and of the fact that the refuse such as bones, nut-shells, etc., may have been thrown in.

(5) They contained fragments of burned animal bones; this suggests a possibility that the fire was still burning when the bones were thrown in.

(6) They contained only pebbles burnt and unburnt, whole and broken by battering; perhaps these were for the storage of these pebbles saved for further use.

(7) They contained the soil and all the specimens appropriate to the large cooking-pits already mentioned, but on a smaller scale.

(8) They contained, besides a few accidental specimens, long water-worn, pestle-like pebbles, together with flat, water-worn stones with a cavity worn in the middle of one side; these had apparently served as mortar-stones for grinding corn.

(9) They contained as characteristic of the type, large fragments and sometimes nearly whole vessels of pottery; invariably these were near graves; they also contained broken stone and bone implements, small fragments of mica, broken clay pipes, broken animal bones (the remains of meals) and charcoal in large lumps, indicating a hot fire; all these were near the bottom of the pit. These pits, associated with graves as they were, strongly impressed me as possibly being identified with burial ceremonies and the accompanying destruction of the property of the dead.

The Small Pits.

The small pits, termed charcoal or fire pits in my notes, had a depth of from 10 to 15 or 18 inches and a diameter of from 8 to 12 inches, rarely more than that; their top was always within a few inches of the present surface and they always contained common or light soil, mixed with charcoal in small lumps. They were of a different order from the other pits and cannot be associated with them; probably of a very late date, they may have originated with the last roving bands of Indians who dwelt in this locality; their purpose is not clear.

THE HEARTHES.

The numerous hearths found at varying depths were from $1\frac{1}{2}$ to 3, and even 5 feet in diameter; they contained each from 50 to 300 whole or broken quartzite pebbles, when broken, fire was often the cause of the fracture; they lay in single layers, but in the case of the largest hearth there was a double layer.

A distinct feature of the hearths is that traces of cooking or the remains of meals were never found; the few chips and single fragments of pottery occasionally found were of no significance; their occurrence was probably accidental.

Occasionally in the black soil near the surface there were found little heaps of stone, pottery or bone possessing no apparent significance.

THE EXPLORATION OF THE LOWLANDS.

The Meadows, or so-called Lowlands, extend from the southern edge of the terrace and from immediately below it on to the southward for about six miles; their breadth is from two to three miles, except at the village of Crosswicks, in the valley of Crosswicks Creek, where it is but a few hundred feet. They are from 30 to 40 feet lower than the terrace, and low enough to

be flooded by the regular rises (non-tidal) of the Delaware River; some small elevations in the Lowlands escape. The floods enter the meadows through two small streams that normally empty into the river; except for these the lowlands are separated from the Delaware on the west by the Camden and Amboy Division of the Pennsylvania Railroad and the Delaware and Raritan Canal.

The upper and more northern of the streams winds through a dense growth of bushes and trees "a thing of beauty" and "a joy forever"; it has changed at both extremities from its former condition; probably originally a branch of the Delaware, it is now fed only by the drainage of numerous springs, and, whereas at one time it had a free access to the river at its own mouth, it has now, since the building of the railroad and the canal, become more stagnant, though still tidal. This has caused it to become a paradise for plant growth which has gone on increasing till there has been formed a vegetable mould several feet thick in the old creek bed; this is now called Watson's Creek, formerly Achpoachquissings Creek (Plates XXXIX, XLI, XLII). This creek flows for about one mile and a half with the bluff or terrace as its eastern bank, then takes a bend towards the west leaving the higher bank and is bounded on the east by a shore which rises only about seven feet above the high tide level of the present day; this bank forms a ridge, highest at the creek and gradually sinking eastward. The ridge follows the creek as it leaves the terrace and runs for about one half of a mile; its composition is as follows: at the surface is a black soil varying in depth from 12 to 24 inches; this is evidently the result of a long continued, luxuriant plant-growth; under this is a dull yellow sand, and this in turn overlies a bluish, pre-glacial clay, which is itself the bed of the creek. The terrace to the north covers this clay with forty feet of gravel, sand and loam, but, at the northern end of the city of Trenton the pre-glacial clay rises to the surface again, but at a height of more than one hundred feet above the level of the Delaware. A little brook draining one of the swampy places to the east, near the terrace, cuts the eastern bank of Watson's Creek at about its middle point and flows there into the larger creek.

The southern or lower half of the ridge on the east of the old creek was explored in 1892 for the World's Columbian Exposition in Chicago; the upper half to the north of the little brook bisecting the ridge was investigated in 1895 for the Peabody Museum of Harvard University and later (in 1898) for the American Museum of Natural History in New York.

I. THE SOUTHERN SECTIONS (1892).

The whole area explored was about 500 feet in length roughly north and south, following the creek and from 30 to 90 feet in breadth east and west; the trenches extended from the creek eastward and were eleven in number; they will be considered together.

The original front of the ridge on the creek was higher than at present; the white settlers in damming the creek and in erecting flood-gates took much of the soil away for their construction and in doing so probably disturbed and carried away much of the village-site.

The top soil showed no traces of man whatever, having accumulated since the Indian departed; after removing from 15 to 24 inches of this I found the original surface of habitation marked by a black streak or stratum two feet in thickness darker at the top and, becoming lighter downwards, fading away altogether (Plates XL, XLIII).

In the eleven trenches were discovered: 6 graves, 190 pits, 3 ash beds, several hearths, fire-pits.

THE GRAVES.

The six graves were all near the little ridge overlooking the picturesque creek with its tangled mass of plants and the gorgeously colored flowers (Plates XLI and XLIII).

As to interment, three graves contained each a single skeleton, two graves contained two skeletons each, and one grave, the southernmost, contained five skeletons. One of the single skeletons was without a skull. Of the double interments one

presented the two skeletons side by side, the other, one above and one below with a separation of six inches of earth; these four lay on the side with the knees drawn up towards the body. The five skeletons together lay side by side on the back, but not touching; they were badly decomposed, the skulls and nearly all the bones having disappeared.

As to soil, Nos. 4 and 6 showed black soil, while the others resembled those on the terrace; here it was burnt red, mixed with small fragments of pottery, and filled with particles of charcoal, evidence that fire accompanied the burials (Plate XLIV).

Particular interest attached to No. 4. The surrounding soil was here of a pale yellow color all the way down to the clay, $5\frac{1}{2}$ feet below the surface; in this yellow soil, throughout its depth and lying in a semicircular area of 12 feet radius from the grave I found a great many thin argillite flakes such as are detached in finishing implements; here had evidently stood a workshop of earlier date; into this site a pit had been dug 2 feet in depth and 2 feet in diameter, containing darker soil than that surrounding, small fragments of rude pottery and decayed pieces of deer bone; into this in turn the grave had been dug, cutting off a section of both pit and work-site. The skeleton lay like the others with the knees drawn up towards the body, and was in a similar state of preservation; it was surrounded by very rich black soil wholly made up of decayed vegetable matter.

Apparently the work-site was the oldest of the three disturbances; next, the pit, corresponding with those found at the northern end of the excavations, and last the grave of like age with the rest in these trenches.

THE PITS.

Here too as on the terrace I found the large, the medium and the small or charcoal pits. (Figures 12-17 show sections of several of the pits in the Lowlands.)

They furnish some interesting evidence of a long-continued occupancy of the village-site, many of them having apparently been dug before the completion of the black stratum underlying

the one or two feet of top soil; this streak may be considered an indicator of the duration of the stay from the beginning at the line of demarkation on the clean yellow to the termination shown by the thickest accumulation; some of the later pits do not even penetrate the yellow, so thick had the black become.

It is plain to me that as the pits were dug and the clean soil thrown out that the dump soon became dark like the rest of the surface and thus contributed itself to the depth of the accumu-

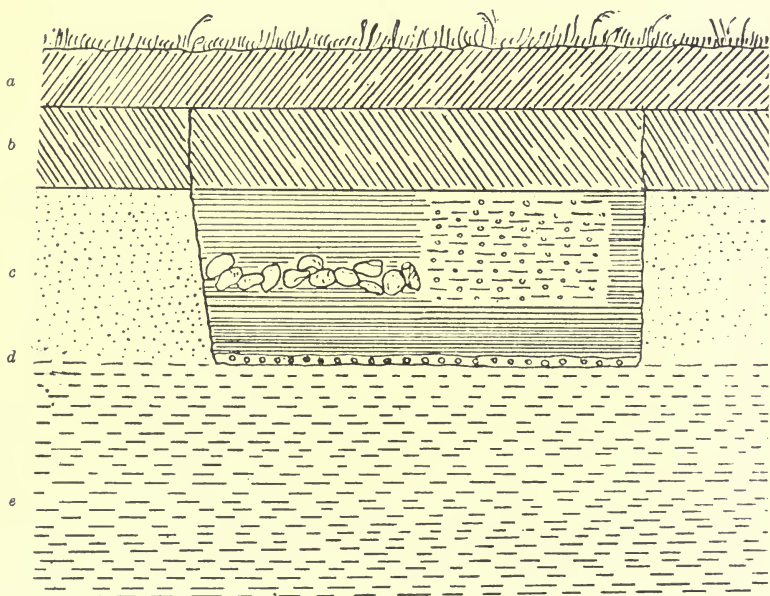


FIG. 12. Pit 24, Trench 9. Village Site, Lowlands, 1892. Diameter, 5 feet, depth 3 feet, 3 inches.

a, ploughed soil, 9 inches; *b*, black soil, 10 inches; *c*, virgin soil, 14 inches; *d*, burnt clay, bottom of pit; *e*, clay. Contents:— burnt bones, some of fishes; part of pottery vessel; on the left side half a circle of stones, some broken by fire.

lation; the pits meanwhile were gradually filled with outside material, stone implements and pottery, natural stones, animal bones, refuse of animal and vegetable matter, ashes and charcoal. The largest and deepest of the pits were on the southern end, the medium pits and the charcoal pits at the upper or northern end of the section excavated.

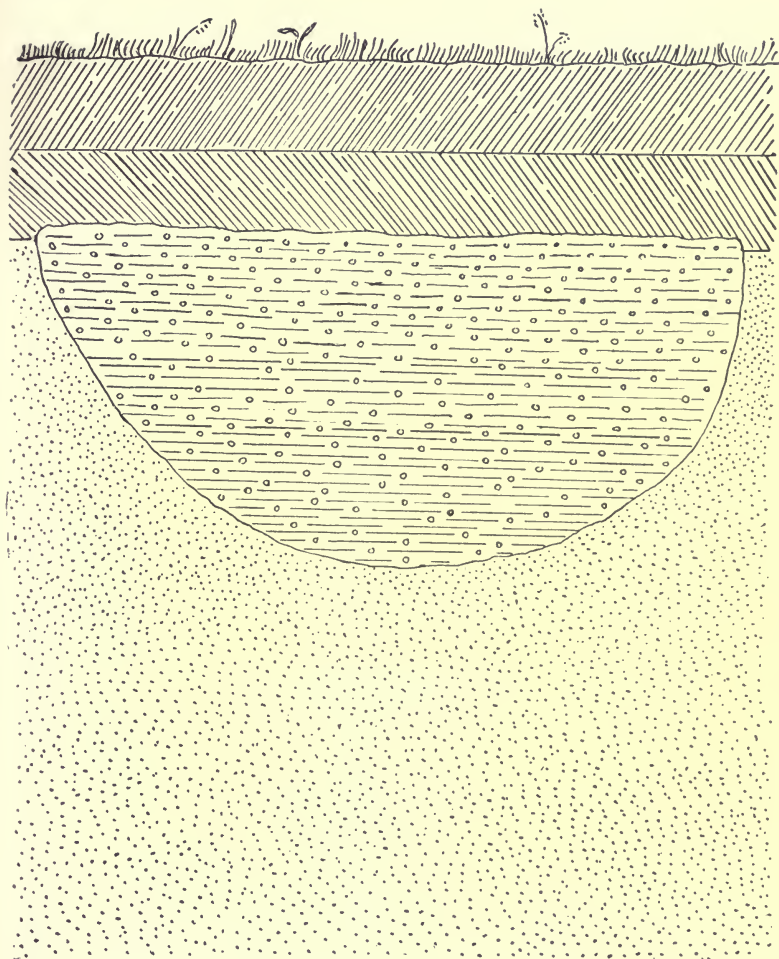


FIG. 13. Pit 10, Trench 6. Lowlands, 1896. $7\frac{1}{2}$ feet in diameter, $3\frac{1}{2}$ feet deep. It contained stone and bone implements, broken stone, pottery, animal bones in fragments and charcoal.

At the top is a stratum of "plough soil" about 1 foot thick; beneath this black soil 1 foot thick, and beneath this the undisturbed glacial sand; the pit is almost entirely contained in the sand.

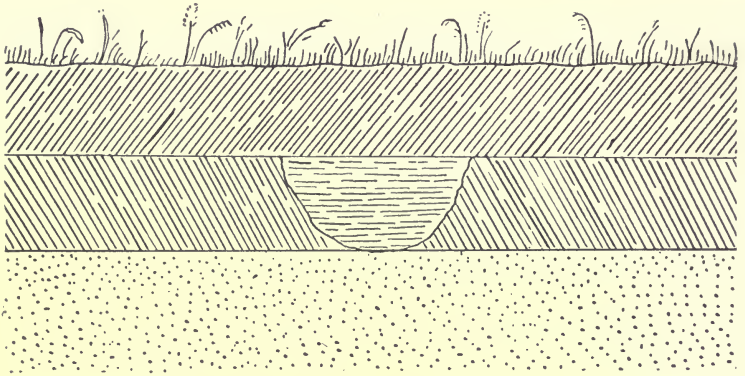


FIG. 14. Pit 15, Trench 6, Lowlands, 1896.
Diameter, 18 inches, depth, 1 foot.

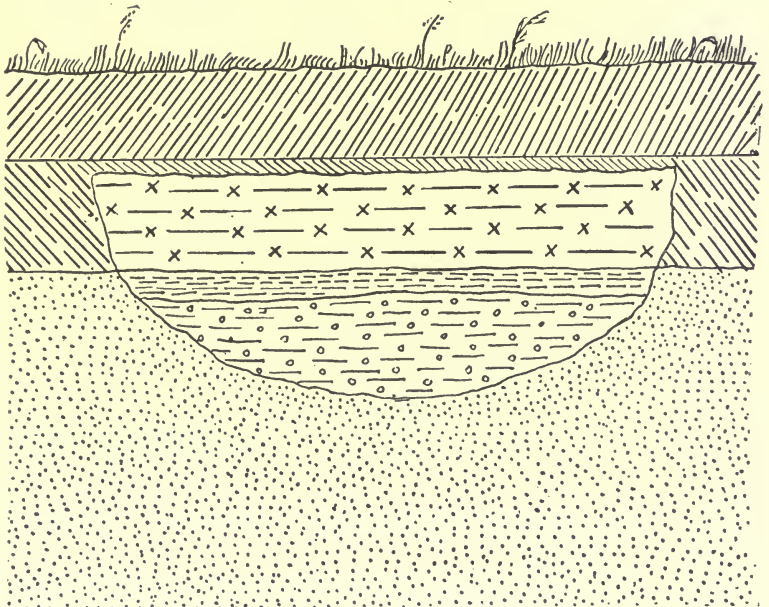


FIG. 15. Pit 27, Trench 6, Lowlands, 1896. Diameter, 4½ feet, depth, 2 feet. At the top is the "plough soil," beneath this, the black soil and lowest is the glacial sand.

The pit contained a stratum with pottery and bones, next lower a stratum with charcoal, and at the bottom calcined bones and charcoal.

The contents; nine tenths of the pits contained fragments of pottery; the pots had been of various sizes, shapes and decorations. The pottery here on the lowlands presents two kinds, the rude, fabric-marked, and a cord-marked variety in common with the pottery of the terrace; otherwise it differs both in shape and decoration; I have found here the most beautiful patterns of fine lines that I have ever seen east of the Alleghanies. (The sherds and the restored pots are in the Field Museum in Chicago).

The large pits differed from the large pits on the terrace in that they all contained mica near the bottom; it was found perforated or cut in a straight line.

The large pits at the southern end differed from what large ones there were at the northern in that the stone implements and pottery in the former were ruder, and that of the remains of animal food only the remnants of large game such as deer, bear and beaver and the bones and scales of the sturgeon were prominent.

Three pits at the northern end of the tract near the surface probably of later date, corresponded exactly with the later pits, of Lalor field, near the Sassafras Lane in regard to specimens and condition.

The medium pits and the small or charcoal pits are, except for the pottery, similar to those on the terrace.

In the medium pits were found:

whole and broken implements of chert, quartz, quartzite, and argillite, with very little jasper; these are arrow-heads, spear-heads, scrapers, knives and perforators, chipped pebbles of the various materials, chips and flakes of the various materials, quartzite pebbles broken by fire and battering, large and small fragments of pottery, ashes and charcoal generally, the bones of animals, such as the Virginia deer, beaver, opossum, and some unidentified mammals, the bones of birds, such as the wild turkey, goose and duck, the bones of the land turtle and snapping turtle, catfish and shad;

shells of three species of unios still existing locally;
 shells of the hickory-nut and walnut;
 charred remains of the root of the water arum and Solomon's seal.

The following pits are worthy of special mention.

Pit 3 (trench 1) contained nothing but a half of a bushel of broken quartzite pebbles;

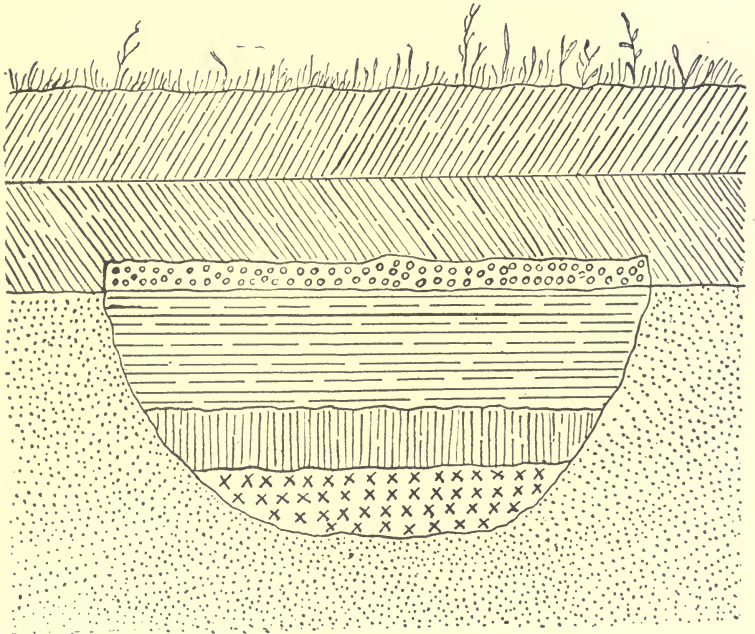


FIG. 16. Pit 18. Trenches 6 and 7. Lowlands, 1896. Diameter, 4 feet, depth, 2 feet. At the top is the "plough soil," below this the black soil, below this the glacial yellow sand.

The pit contained at the top a stratum of animal bones, some of them calcined, with charcoal, below this, a barren stratum, next lower a stratum of pottery and charcoal, and at the bottom a stratum containing pottery and fragments of bone and charcoal.

Pit 4 (trench 3) contained nothing but a few chips of white quartz, and a great amount of rude, thick pottery;
 Pit 7 was very large and near several post-holes 2 feet in depth and 4 inches in diameter; nothing was found in

it other than that it was paved with a stone floor made up of a slab in three sections (Plate XLV). Pit 22 contained a lump of burnt clay, but no greasy soil. Pit 23 contained a part of a flat stone showing by a worn

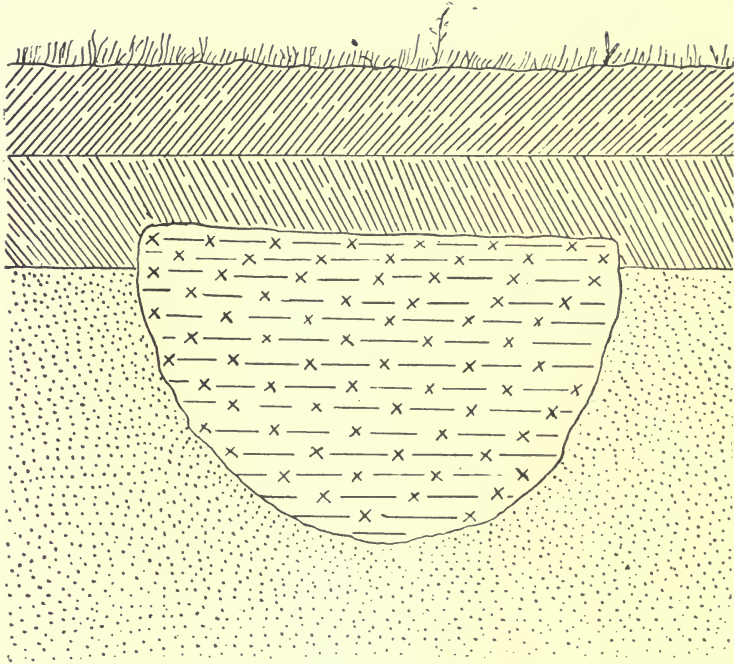


FIG. 17. Pit 2, Trench 7. Lowlands, 1896. Diameter, 4 feet, depth, $2\frac{1}{4}$ feet. At the top is the "plough soil," beneath this the black soil and lowest is the glacial sand. The pit contained fragments of bones, pottery and charcoal.

cavity that it had been used as a mortar or mill; the other part was found in a near-by pit.

Pit 24 contained a burnt clay bottom one half of an inch thick, and in two other pits traces of clay near the bottom were evident.

Among the fragments of pottery were the remains of medium-sized pots in shape resembling a cocoa-nut. The fragments

showed various materials used in tempering; crushed unio-shells, mica and pounded stone, apparently granite, had been used.

One medium pit at the upper end of the area contained fragments of pottery identical with those from the terrace.

THE HEARTHES.

Several hearths were found varying in depth as did the pits; one penetrated below the black soil or "stratum of habitation," many lay within it and many at the top. Near the upper end of the area excavated, 10 inches below the surface or less, a fragment of a celt was obtained from one of the hearths.

THE CHARCOAL PITS.

The charcoal- or fire-pits were identical with those of the terrace and only contained charcoal; they were nearest the surface and, like those of the terrace, evidently of late date.

There were three ash-beds, all lying in the black layer, the contents:

whole and broken implements of argillite,
chips of chert,
broken quartzite pebbles,
fragments of pottery,
the bone implements called "marrow-forks,"
a great number of bone fragments, chiefly deer, partly
burned,
charcoal in large quantities.

THE GENERAL DIGGING.

In trench 8 three finished argillite implements were found. Numerous mortars came from the trenches or the pits; they were rude, flat, water-worn pebbles with the slight cavity worn in the middle, the only mark of man's handiwork; equally rude were the pestles, simply long, water-worn pebbles. One celt and one pestle that I found here were the rudest ever found in

this vicinity; the common Indian implements, such as the polished celt, the grooved axe, and the long, carefully worked pestle were lacking.

In trench 7 a little heap of unfinished argillite implements was found; they resembled those of the caches already described, but a trifle smaller than those of Wright's field on the terrace.

Flakes and chips of argillite were not associated with the pottery found near the surface, but they occurred about a foot deeper in the black streak together with white quartz and jasper. Near the northern end of the site, not deep, occurred fragments of a red, brittle, rude pottery, very lightly burned and marked with some coarse fabric; in trench 9 four little heaps of the red, brittle pottery and in trench 10 several more were found; it is possible that the sand (in this case used as tempering) was too abundant in proportion and was the cause of the brittleness. In trench 1, 6 inches deep, was found a little heap of the points of antler.

The remarkable feature of the archaeology of these village-sites is the continuous improvement noted in the specimens, from the cruder in the lowest pits to the finer in the pits nearest to the surface.

The large game which was abundant when the hunters arrived gradually became scarce and the smaller animals, with birds and fish, furnished a substitute; so we see the bones of the large animals in the large, deep pits and the corresponding bones of smaller animals in the medium pits.

This necessitated improved implements of different materials and a finer form; large rude pottery vessels were abandoned for less capacious ones and the art of decoration began to develop at first in rude, straight lines, it is true, but later on arranged in an artistic manner that would be a credit to even a modern potter of today.¹ The polishing of the stone implements seems to have come later; one polished broken gorget, and two broken celts of granite with the cutting edge polished were found near the surface.

The black deposit, as before stated, was largely composed of

¹The various decorations on the pottery found during the explorations about Trenton are shown on Plates cix, cx, cxI, cxII, cxVIII, cxIV, cxv.

village refuse and throughout this the fragments of pottery were scattered, the most numerous of the specimens; the improvement in technique was so great as to demand a long occupancy for its realization, necessarily also peaceful; this assumption is strengthened by the depth of the deposit, 2 to 3 feet.

The drawing of a cross-section of the village-site is in the Field Museum in Chicago, and shows it plainly from the beginning of occupancy at the bottom on, or in the yellow soil to the leaving of the inhabitants; after this, plant-life again took possession and continued to augment the deposit until the site was buried under two or three feet of humus and sediment from the periodical overflows; then came the white man and his plough.

II. THE NORTHERN SECTIONS.

As mentioned above, in August, 1895, explorations were continued north of the little stream that cuts the ridge in two. The terrace and the creek separate where the northern end of the ridge begins; the terrace trends directly east for several hundred feet away from the creek and then turns south and southeast; it thus leaves a little plain between the hill and the creek; the ridge, however, on its west slope follows the creek and forms its eastern bank (Plate XLVI).

The composition of the soil was similar to that below, with some variations. The original deposit at the upper end was found to be covered by a gravelly stratum three feet or more in thickness; it runs out from the hill or terrace towards the creek and the meadow for a distance of over two hundred feet. The old inhabitants tell of a cloud-burst that occurred here about sixty years ago and they credit the gravelly deposit to it (Plate XLVII).

Under this the series of strata is as follows: first, the original surface immediately underlying the results of the cloud-burst, of a light medium brown color and covering the black stratum with about one foot of soil; next this black stratum, itself three feet in thickness near the Creek, but becoming thinner

as one leaves the Creek, until near the hill it fades away, becoming mingled with the clay which lies here immediately underneath; this is the pre-glacial clay, which rises near the hill nearly to the surface; the mixing is due to the plough of the white man; next in order, nearer the Creek, below the black stratum, lies a layer of dull yellow sand three to five feet thick, resting on the pre-glacial clay. The dull yellow sand is identical with that below and, like it, containing not a single pebble of any kind, nor any red bands.

This locality forms a natural cross-ways for the routes and trails connecting the villages of the deep forested interior, of the river and of the sea eastward and southeast, and a natural meeting-place of land and water routes as well; hence there was probably more traffic here within these few hundreds of square feet in Indian times than anywhere else in the neighborhood, a supposition strengthened by the southern exposure and the shelter from the north winds afforded by the terrace (Plate XLVIII).

Near here on the hill overlooking the meadows and the Creek stands the old massive stone house, before referred to, built in 1708 by Isaac Watson (Plate XLIX).

In the course of the exploration of this upper section ten trenches were opened (Plate LI). The trenches all ran eastward from the Creek, except one; this followed the course of an old wagon road running south from the terrace and parallel with the Creek; the trenches were each 50 feet broad and 90 feet in length eastward; in all they yielded: 19 graves, human bones found in pits and in the general diggings, hundreds of pits, large, medium and small, hearths, ash-beds, caches, and stray deposits.

THE GRAVES AND SKELETONS.

- Grave 1; 22 inches down; one adult skeleton, lying on the back, badly decomposed; the skull of this skeleton was later found in trench 10 which ran at right angles along the head of the other trenches; there were no accompanying objects.
- Grave 2; 20 inches below the junction of the surface soil with the black stratum; an adult skeleton; lying on the right

side with the knees drawn up toward the body, skull pointing east; also badly decomposed.

Grave 3; 15 inches down in the black stratum; an adult skeleton with the long bones in a heap; the skull was found to the south of the long bones; no vertebrae, ribs, pelvis, or sacrum were present. The position of the bones could only have resulted from burying the body in a kneeling posture with the face downward; against this theory, however, is the absence of the other bones; the bones were badly decomposed and it is likely that such as were found were brought here after interment and partial decay somewhere else.

Grave 4; 15 inches down in the black stratum; an adult skeleton with the long bones in a similar heap to that of grave 3 with the exception that here they lay parallel with the major axis of the skull, whereas in grave 3 they were crosswise; the skull was here to the west of the heap; the bones were even more decomposed than those of the preceding grave, crumbling on being handled.

Grave 5; 15 inches down in the black stratum; an adult skeleton lying on the left side with the knees drawn up toward the body and the skull pointing towards the northeast.

Grave 6; 21 inches down in the black stratum; an adult skeleton, lying on the left side, with the knees drawn up towards the body, and the skull pointing towards the north; very little could be saved.

Grave 7; the skeleton of a very young person; it had nearly all disappeared, the skull crumbling; the position of the body could not be determined, as part of the skeleton had been destroyed by an intrusive pit.

Grave 8; 19 inches down in the black stratum; an adult skeleton lying on the left side with the knees drawn up towards the body and the skull pointing towards the east; it was badly decomposed.

Grave 9; 18 inches below the beginning of the black stratum; an adult skeleton lying on the left side, with the knees drawn up towards the body and the skull pointing towards the west; near the neck of the skeleton lay a celt of argillite

and above this a long thin pebble; near by was a pipe of clay broken into three fragments, the breakage apparently of long standing. The pieces lay several inches apart.

Grave 10; 18 inches down in the black stratum; an adult skeleton lying on the right side, with the knees drawn up towards the body and the skull pointing towards the west; the bones were as brittle as in the case of grave 7 but the skull was firmer and the teeth were fairly well preserved.

Grave 11; 18 inches down in the black stratum; an adult skeleton lying on the right side with the knees drawn up towards the body and the skull pointing towards the south-west; the bones were very brittle.

Grave 12; from 2 to 3 feet down in the black stratum, higher at the skull; an adult skeleton lying on the back in a half reclining posture, with the knees partly drawn up towards the body and the skull pointing towards the south; badly decomposed.

Grave 13; 20 inches down in the black stratum; an adult skeleton lying on the left side with the knees drawn up towards the body and the skull pointing towards the west; badly decomposed.

Grave 14; 16 inches down in the black stratum; an adult skeleton lying on the right side with the knees partly drawn up towards the body and the skull pointing towards the north; the bones were very delicate in structure; the skull was best preserved with the teeth good; it was evidently a very careful interment (Plate LII).

Grave 15; an adult skeleton whose position could not be accurately determined as it was very deep down and an intrusive pit had been dug directly into the grave carrying away a part of the skeleton; apparently it was a very old interment.

Grave 16; 20 inches down in the black stratum; an adult skeleton lying on the left side with the knees drawn up towards the body and the skull pointing towards the west; nearly all disappeared.

Grave 17; below the black stratum and with a part of the grave and the skeleton destroyed by an intrusive pit; this burial

- was not unlike grave 15; a few small fragments of tibiae and femora and of the cranium were all that could be saved.
- Grave 18; an adult skeleton lying at the bottom of the black stratum; the original position could not be determined; the skull pointed towards the west, and this with the long bones were all that were left, all in poor preservation; one radius was found to the west of the skull; the whole appeared more like a deposit of dry bones than the burial of a body; a few stone implements accompanied the skull on the east (Plate LIII).
- Grave 19; one foot down in the black stratum; a skeleton of a child lying on the right side with the knees drawn up towards the body and the skull pointing towards the south; it was almost entirely decomposed.

NOTES ON THE BURIALS.

Among the nineteen burials, thirteen could be classified as "regular"; of these six lay on the left side, five on the right and two on the back, all with the knees drawn up towards the body which was apparently the most common posture.

A new feature is presented by the deep burials penetrating below the black stratum; they were apparently the first interments of the villagers, shortly after their arrival, and at the beginning of the accumulation of the black stratum.

Graves 3 and 4 were interesting, as only bones disconnected and bare of flesh could have been placed in the positions observed; the absence of the ribs, vertebrae, sacrum and pelvis, all goes to indicate secondary burial, the bones having been brought from some other place.

The original surface of these trenches was so disturbed as to render the exploring and classifying of the graves exceedingly difficult, and had it not been for the experience gained in the lower part of the field it would have been almost impossible; this particular part of the ridge, especially right under the hill, was evidently the most frequented.

Fragments of a human jaw, of a cranium, and several finger-bones, were found in pits and others in the general digging;

the fracture of the bones was natural and showed no signs of artificial breaking or of burning as did the animal bones.

THE PITS.

Over 300 pits were found in the trenches and explored during the several seasons of work.

I shall divide them into the large and the medium.

The Large Pits.

These were 4 to 5 feet in depth and of a corresponding diameter and they extended down to the blue, pre-glacial clay. They resembled the large pits of the lower village-site and the specimens were also similar, even to the rude fragments of pottery and pieces of mica found in them. Noteworthy were the following:

Pit 4 was 12 feet long, 7 feet broad and 5 feet deep (probably two large pits together); it contained antlers of deer and beaver teeth, besides the usual specimens.

Pit 17 in trench 7 was 4 feet in depth and 7 feet in diameter, and contained, besides a few fire broken pebbles in a medium black soil a great deal of pottery in large and small fragments; newspapers were laid on the ground for a distance of eight feet and were then completely covered by the fragments of pottery taken out of this pit alone; no refuse of meals was found, but on the bottom below the pottery lay a black stratum which proved on examination to be composed of burnt grass and charcoal of small twigs.

Pit 20, trench 7, was about 4 feet in depth and 7 feet in diameter, and contained, besides the remains of cooking, large fragments of pottery, apparently from the same vessel.

Pit 14 in trench 8 was 4 feet in diameter and extended down to the blue clay; it was stratified, a black layer alternating twice with a brown one; very little was found in the strata until the bottom was reached where small fragments of rude pottery and mica lay in the wet clay.

Pit 7 in trench 9 had disturbed an ancient grave by its excavation; it contained besides the usual specimens some large fragments of a pot, above a large lump of clay; this clay broke apart and liberated several fragments of the parietal bone of a human cranium very badly decomposed; fragments of the long bones were found on the side of the same pit.

Another unusual pit was found in trench 10; in this, 5 feet below the black stratum in the water and clay I found large fragments of rude pottery and among them three argillite blades of an excellent finish.

The large pits are undoubtedly the oldest on the ridge.

The Medium Pits.

These were more numerous; and may themselves be divided into an older and a later kind.

The Older Medium Pits — The dimensions of these which resembled those of the lower village-site may be gauged by their extending into the yellow sand below the black stratum; the contents were similar to those found before; the following deserve special mention.

Pit 1, trench 3, contained a celt or perhaps a wedge made of the bone of a whale; this is in the American Museum of Natural History in New York.

Pit 4, trench 3, was close to a grave, and very rich, the contents:
 the usual specimens,
 three celts of granite,
 one celt of argillite,
 implements of argillite, whole and broken.
 a large flat stone,
 mica,
 antlers of deer,
 beaver teeth.

Pit 14, trench 3, was stratified, strata of a light sandy soil alternating with a black soil; the alternations were four in number; in the former were charcoal and fragments of

pottery, in the latter a number of argillite chips and animal bones.

Pit 15, trench 3, had many argillite chips and flakes in layers forming a compact mass; nothing else was found.

Pit 18, trench 3, also had many chips and flakes but they occurred in layers alternating with the black soil.

Pit 32, trench 3, contained besides the usual specimens the lower part of a funnel-shaped pot; this presents a very odd pattern; only one other similar specimen has been found in this vicinity, namely, on the terrace several years ago.

Pit 35, trench 3, contained a little heap of bluish clay; it apparently originated elsewhere than in the space occupied by the pit.

Pit 3, trench 7, contained a medium black soil, a large stone at the bottom and the usual specimens.

Pit 6, trench 7, contained a fragment of a large animal vertebra, a bone, apparently a large animal tibia, and beaver teeth.

Pit 11, trench 7, was large in diameter, and contained fragments of marine shell such as the clam and the conch, unio shells of two varieties still extant in this region, and the usual specimens.

Pit 20, trench 7, contained strata as follows: at the bottom a layer 7 inches thick of charcoal lumps as large as walnuts cemented together with ashes; next, above this, a stratum of animal bones all in small fragments, then came fire broken quartzite pebbles, several grooved pebbles, and fragments of a very thick and coarse pottery.

Pit 21, trench 7, contained several flakes of beautiful green jasper; this mineral is very rare and it is only occasionally that a flake or an implement made of it is found.

Pit 27, trench 7, was 2 feet 7 inches in depth and 4 feet 6 inches in diameter; it contained two distinct strata, one black, one red, with the red under the black (the inverse of the usual condition); the black was inky in appearance, much darker than the black stratum outside; the red was 9 inches thick and was apparently burnt earth; it had burnt animal bones, and a bone implement, a perforator, unique save for one other example in these excavations, but commonly found in the "Mound-builder" region in Ohio.

- Pit 2, trench 8, contained a solidly massed layer of unio shells thickly interspersed with the shells of a small land snail, of a species still to be found here.
- Pit 3, trench 8, contained a layer of shells similar to the preceding; and three fragments of a yellow, hard-baked pottery heretofore unknown in the excavations and in this neighborhood; the clay used turns buff or yellow, like that used in the buff brick of the present day.
- Pit 5, trench 9, contained the usual specimens and 125 quartzite pebbles broken by fire; this is thrice the ordinary quantity; they were of the size of a base-ball.
- Pit 6, trench 9, contained the bowl of a large clay pipe; it was decorated with curious and interesting markings (fig. 18). Another pipe bowl of a different shape found in the ploughed soil of Lalor Field is shown in Fig. 19.



Fig. 18.

FIG. 18. Bowl of Pipe $\frac{1}{2}$. From Pit 6. A. M. 11955.



Fig. 19.

FIG. 19. Clay pipe $\frac{1}{2}$. Lalor Field, Ploughed soil. A. M. 11325.

Another excavation, more like a cache than a pit, contained a few implements of stone and a stone axe, the first to be found in the lowlands.

The Later Medium Pits.—These pits penetrated the black soil only and may be considered characteristic; so frequently had the pits been dug that the soil became uniform in color, an intense black that prevented the determination of the individual dimensions and caused the whole accumulation to appear

like one immense pit. An approximation to their location could be made when an unusual amount of fire-broken quartzite pebbles, bone fragments and very greasy soil was found in close connection; the same kind of specimens was always present, and the soil was never stratified, showing that the pits had served but the one purpose of cooking. It is evident that no more time was spent here than was necessary for eating and resting. Apparently these pits were dug by the occasional bands of roving Indians who followed the earlier permanent villagers and who while following the main trail to the forest, found this spot convenient and favorable for a break in the journey.

HEARTHES.

About 50 hearths in all were found; they lay at all depths in the black stratum and seem to date from the beginning of its accumulation to its completion; they are generally round and may have a single or a double layer of quartzite pebbles; the diameter from 1 foot 6 inches to 4 feet. Most of the pebbles had been broken by fire, though those broken by battering are not absent; the spaces in between are usually filled with charcoal, but some are entirely lacking in both charcoal and ashes. The pebbles are similar to the quartzite found throughout the sites of human occupation, pits, graves, etc.; one might as well look for a meadow without grass as to seek for an Indian village-site without broken quartzite pebbles.

As for the hearths themselves, no specimens are usually found in them, but I have occasionally found a chip of argillite or jasper or a few fragments of pottery; the absence of refuse and of animal bones precludes any necessary connection with cooking; as a whole the use of the hearths is a problem unsolved; as there is no stone in the lowlands the materials of the hearths had to be brought from the river banks or from some place on the terrace where the gravel comes to the surface, and it is clear that, whatever their use, the hearths required much time and labor in their construction.

About 100 yards south of the beginning of the ridge I discov-

ered that formerly a ditch or trench had been in existence; its appearance was more that of an artificial ditch than of one made by nature, as the sides were in no way slanting. It was about 15 feet long east and west, by 12 feet broad north and south and 4 feet 6 inches to 5 feet deep. The soil in it resembled very much that of a dried out swamp and yielded many specimens such as chips of argillite, fragments of pottery (these in the majority) and animal bones; they were like those found generally in the black soil, but they were generally found standing erect in the soil, instead of lying flat as elsewhere; it was as if they had fallen into a soft, but firm mud and remained upright.

POCKETS.

Several small pits or pockets not over 8 inches in depth and one foot in diameter were found, resembling type 2 of the unstratified pits on the terrace which were evidently dug by the latest comers. They contained in one case a small, highly polished celt of the latest type; otherwise only chips and flakes of jasper and chert.

ASH-BEDS.

One large ash-bed was found 16 feet long north and south and 8 feet east and west. The difference between a so-called ash-bed and the black stratum proper, is that the former is thicker and reaches down below the latter, and the specimens are more numerous in the ash-bed lying even closer together than in the pits.

This particular ash-bed had been dug into and a part taken away by an intrusive pit and hearth. It contained jet black soil, quartzite pebbles broken by fire and by battering, bone implements, a scanty amount of pottery, an unusual amount of charcoal and the bones of various animals, those of the deer predominating; these bones seem to have been subjected to great heat leaving them dry and with a rattling sound when shaken together; the fractures are sharp.

CACHES.

Six caches were found as follows: (10 to 16 inches down in the black stratum).

In one were four polished celts and in another six; the longest was $9\frac{1}{2}$ inches by 3 inches. In one were 32 rudely chipped argillites, in another 18, and in another 10, the coarsest of all; here were also two implements, one finished, one incomplete.

The polished implements were similar to those from the terrace, while the rude chipped argillites were apparently unfinished implements cached to be finished at leisure; this was perhaps the custom exemplified in the pits where the small chips and flakes had been left as the remains of technical workings.

MISCELLANEOUS.

Several animal skeletons were found in the different trenches, probably those of dogs or foxes; they were not mutilated. Besides the specimens similar to those from the cooking-pits, the following were found in the black stratum:

several gorgets, whole and broken,
 a fragment of soapstone (exceedingly rare),
 mica,
 little heaps of coarse, rude pottery of a very brittle kind,
 fragments of a white clay pipe of European origin,
 teeth and jaws of the deer,
 teeth of the beaver.

In reviewing all these traces of Indian life in the black soil in the lowlands, the exploration of many years, and comparing the many facts gathered, it becomes evident that this little plain presents traces both of the earliest and of the latest Indian occupation; this was a place so favored by nature as to satisfy all the requirements of these early people.¹

¹ Cf. "Observations on the use of argillite by Prehistoric People in the Delaware Valley" by Ernest Volk. Proceedings of the American Association for the Advancement of Science, Madison Meeting, 1893. p. 312 (abstract).

TRACES OF MAN IN THE YELLOW DEPOSIT OR DRIFT.

This part of the report will treat of the geology and the archaeology of the "yellow deposit or drift" laid down during the closing epoch of the glacial period, that deposit which underlies the black soil on the terrace.

The order of description will be largely chronological.

All traces of the recent Indian occupation cease with the black soil except the intrusions made from the black surface into the yellow soil, and these are plainly marked.

The method of exploring the deposit was very plain and simple: A trench was staked out, usually 50 by 25 feet or so and a ditch dug across the narrow end at the beginning; the black soil from this was thrown back and the process of digging and dumping continued in such a way that a straight, perpendicular wall, bank, or "breast" was constantly kept in advance of the work; this, according to the depth of the ditch could be of any chosen height; all disturbances, whether natural or artificial, whether made from the black soil above, or from some lower level, could thus be detected, traced, and accounted for in the bank.

By slicing down the bank with a trowel, every pebble, "relic," artifact, or object of interest could be discovered and noted in situ and recorded; this is a slow process, it is true, but it is the only one to be depended upon in the investigation of a matter of such importance as that in hand. It is like reading a book carefully, page after page.

It is the yellow deposit that presents the red clay bands, mentioned in the geological section of this report; as there have been different views among geologists as to the origin of this deposit, and as the investigations were conducted with that point in view, it will be well to describe the geological conditions and specimens as well as the archaeological, of which they were the accompaniment.

The systematic explorations began on the terrace, under the

direction of Professor F. W. Putnam, in the fall of 1890. A trench was laid out in Lalor field to the west of the sassafras trees in a locality already described.¹ Here numerous chips of argillite and chipped argillite boulders chiefly of angular form were found in the undisturbed yellow drift from 6 to 18 inches below the plane of contact of the yellow drift with the black soil above; they were all lying flat and many have a heavy coat of patina.

In 1891-1892 comparatively few specimens were found in the yellow deposit as most of the explorations took place in the lowlands and along both shores of the Delaware River both above and below Trenton. However in the spring of 1891 large chips of argillite were found in the undisturbed yellow deposit from 5 to 20 inches below the plane of contact of the yellow with the black above. This was in Wright's field on the terrace.

The year 1893 was spent in the preparations for the World's Columbian Exposition and the trip there.

In 1894 the explorations were again begun on the terrace to the south of Trenton.

April 17, 1894, Lalor field, trench 1; I found rude implements of argillite in the undisturbed yellow drift.

April 25, 1894, Lalor field, trench 1; a number of argillite chips were found 3 to 5 inches down in the undisturbed yellow drift, without any connection with the black soil.

April 26, 1894, Lalor field, trench 1; a disturbance was noted in the yellow soil which proved to be in the form of a pit; it was 16 inches in depth and 18 inches in diameter and its top lay about 10 inches below the plane of contact with the black soil above; it contained rude chips of argillite and quartzite pebbles, whole and broken; the disturbance was not made from the black soil above as the line of junction showed no trace of any intrusion, and there was no black soil from the surface to be found within the pit.

April 28, 1894, Lalor field, trench 1; many implements of argillite were found scattered about, 4 inches below the plane of contact.

¹ See p. 17.

- May 1, 1894, Lalor field, trench 1; many argillite implements and chips were found from 4 to 6 inches below the black soil; they were of the same type as those found before and no other stones were found with them except the broken quartzite pebbles.
- May 2, 1894, Lalor field, trench 1; a large quantity of chips of argillite was found 6 inches down in the undisturbed yellow drift.
- May 3, 1894, Lalor field, trench 1; the same as for May 2.
- May 5, 1894, Lalor field, trench 1; several argillite implements were found in the yellow drift.
- Aug. 18, 1894, Lalor field trenches 4 and 5; I found several very large argillite chips, 6 inches below the plane of contact.
- Aug. 22, 1894, Lalor field, trenches 4 and 5; the same as for August 18.
- Aug. 23, 1894, Lalor field, trenches 4 and 5; a number of argillite chips and implements were found 8 inches below the plane of contact, in every instance in the undisturbed yellow drift.
- (It may be remarked in passing that none of the large argillite blades nor even their fragments, have been found here in the yellow soil; neither were there any rejects or failures to suggest the making of these blades.)
- Aug. 24 and 25, 1894, Lalor field, trench 5; some chips of argillite were found 5 to 6 inches down in the yellow drift.
- Sept. 22, 1894, Lalor field, trench 6, argillite chips were found several inches down in the yellow drift.
- Sept. 25, 1894, Lalor field, trench 6; a chipped argillite boulder was found, also in the yellow drift.
- Oct. 1, 1894, Lalor field, trench 6; a number of argillite chips were found, 8 inches down in the yellow drift.
- Oct. 8, 1894, Lalor field, trench 8; argillite artificially fractured was found 8 inches below the plane of contact.
- Oct. 12, 1894, Lalor field; argillite flakes and a chipped implement of the same material were found eight inches down.
- Oct. 15, 1894, Lalor field; argillite chips were found 12 inches down.

- Oct. 16, 1894, Lalor field, trench 8; argillite chips and a long argillite spear-head were found 8 inches down.
- Oct. 17, 1894, Lalor field, trench 9; a large workshop of argillite was found 8 inches down.
The black soil was here from 16 to 18 inches thick, which places the workshop 2 feet below the present surface; it contained, under a flat slab of argillite, a beautiful slender argillite spear-head; also several chipped argillite boulders, argillite chips, and a number of quartzite pebbles broken by fracturing. No charcoal, burnt stone nor traces of fire were found. The yellow soil was not disturbed below the workshop, nor was there any connection between the workshop and the black soil.
- Oct. 18, 1894, Lalor field, trench 9; pieces of argillite, artificially broken were found from 4 to 10 inches below the plane of contact, in a space about 10 feet in diameter. It was of an inferior quality, the fracturing not being such as to suggest a preconceived idea of special shaping.
- Oct. 23, 1894, Lalor field, trench 9; some rude chips of argillite were found scattered about in the yellow soil 12 inches down; also chipped argillite pieces.
- Oct. 24, 1894, Lalor field, trench 9; a large space of the yellow soil was found burnt and thickly strewn with argillite chips and broken quartzite pebbles, but there was no black soil whatever mixed in. The yellow soil was disturbed two feet down but the line of contact with the black was intact.
- Oct. 27, 1894, Lalor field, trench 9; argillite chips and quartzite pebbles broken by fracturing were found 8 inches below the intact line of contact with the black soil, here about 12 inches thick and evenly distributed; there was none of it mixed with the specimens in the disturbance.
- Nov. 1, 1894, Lalor field, trench 9; two large argillite slabs were found, partly chipped 12 inches down in undisturbed yellow drift.

On May 9, 1895, explorations began again in Lalor field west of the house.

May 20, 1895, Lalor field; an argillite workshop was found 5 feet in diameter from 4 to 6 inches down in the yellow drift, the line of contact was not disturbed and no black soil was in the workshop. It contained two finished argillite implements, argillite chips and flakes and quartzite pebbles broken by fracturing. During the day numerous argillite chips were found from 6 to 10 inches down in the undisturbed yellow drift, also a finished implement of argillite. It was very interesting to dig down through the yellow deposit a foot and more and find in the solid, hard-packed drift that showed no signs of having been disturbed since the mighty waters laid down the immense bank, an artificially fractured, chipped argillite rock which could not possibly have come down from the surface.

May 23, 1895, Lalor field; another argillite workshop was found, three feet in diameter, and 10 inches below the line of contact. It contained many argillite chips and flakes, also quartzite pebbles broken by fracturing. Besides the workshop, a finished point of argillite and several chips of argillite were found scattered about in the yellow drift down to 12 inches below the line of contact with the black soil.

Another similar workshop was found 12 feet south of the last mentioned. It was 4 feet in diameter and 14 inches below the line of contact. In this the argillite flakes were large and there were also broken pebbles of quartzite.

For a large space in this neighborhood there were no specimens found in the overlying black soil, while at other localities the black soil was filled with Indian remains.

June 8, 1895, on the terrace 100 feet inland from the bluff, near the Sassafras Lane, an angular boulder was found 14 inches down in the undisturbed yellow drift; it was 2 feet 6 inches long, 2 feet wide and 10 inches thick; it bore no traces of human workmanship.

June 15 and 18, 1895, on the Lalor farm east of the homestead, argillite chip implements were found in the yellow drift, 6 to 12 inches below the line of contact.

- July 29, 1895, to the west of the homestead, in trench 1, two beautiful argillite implements and chips were found 6 to 12 inches below the line of contact in the undisturbed yellow drift.
- July 30, 1895, Lalor field in the old trench of last November; were found: a fragment of an argillite implement, 12 inches down and 6 feet towards the west at the same depth a complete one, and near by another workshop, 2 feet in diameter, and 1 foot down in the yellow drift; it contained chips and flakes of argillite and chipped argillites, no other material.
- July 31, 1895, Lalor field, trench 2 (new trench); a large, chipped argillite slab was found, also some argillite pebbles water-worn, but not chipped, 1 foot below the contact in the undisturbed yellow drift.
- Aug. 3, 1895, Lalor field, in the old trench and trench 2; coarse chips of argillite were found 4 to 6 inches below the contact-line.
- Aug. 6, 1895, a space covering about 6 feet in diameter was found about 3 feet thick and reaching nearly up to the black soil; it looked like a grave, but no trace of bone was found, only disturbed yellow soil; the line of contact was intact and no connection with the black soil could be traced.
- Aug. 6 and 7, 1895, Lalor field, old trench and trench 2; rude argillite implements and chips were found from 4 to 8 inches below the line of contact.
- Aug. 8, 1895, Lalor field, in trench 2 and old trench; many rude argillite chips were found 10 inches down in the yellow deposit.
- Aug. 9, 1895, trenches 2 and 3 and in the old trench; a rudely chipped piece of argillite of interesting shape was found 12 inches down in the yellow soil.
- Aug. 13, 1895, Lalor field, trenches 2 and 3; several rude argillite chips were found at a depth of 12 inches.
- Aug. 14, 1895, Lalor field, old trench (this is the trench from last year); a chipped argillite was found 12 inches down and a second, a few feet to the west 10 inches down and

numerous argillite chips were found from 4 to 12 inches below the contact.

- Aug. 15, 1895, Lalor field, trench 4; three beautiful slender argillite implements were found in the yellow soil, 9, 8 and 10 inches below the line of contact.
- Aug. 19, 1895, Lalor field, trench 6; argillite chips were found frequently, scattered about from 4 to 14 inches down in the undisturbed yellow soil.
- Aug. 26, 1895, Lalor field, trench 4; an argillite implement was found 12 inches down, and one foot away to the north, another at the same depth.
- August 28, 1895, Lalor field, trench 5; a number of chips were found about 1 foot down.

The result of the special exploration of the yellow soil on the Lalor farm west of the homestead showed 26 specimens found at various depths; a colored chart was made showing each specimen, as well in the black as in the yellow soil in place, and the specimens and the chart are in the American Museum of Natural History in New York.

April 29, 1897, explorations were again resumed in Lalor field, and a plot (Plate LI) was staked out near the western end of the farm, 40 feet long and $5\frac{1}{2}$ feet wide. The black soil near the bluff was 18 inches deep, thinning out to 6 inches 30 feet north of the bluff. This soil contained many Indian artifacts. I continued exploring in this trench until May 18, during which time 82 specimens of argillite pebbles, chips and implements, and broken quartzite pebbles were found in the yellow soil; their position, depth and material were noted, and several of them were photographed in situ (Plates LIV, LV and CXVI, fig. 4, LVI and CXVI, fig. 3). On Plates CXVI, CXVII, CXVIII, several flakes, chipped pieces of argillite and argillite points are shown which were found in the yellow soil from 1 to 15 inches below the bottom of the black soil.

June 25 to June 28, 1897, a number of scientific men came to the place where I was exploring in Lalor field to see for themselves some of the specimens in situ, which I had so often reported; they were:

Professor George Frederick Wright of Oberlin College, Ohio,
 Professor Arthur Hollick of Columbia College, New York,
 Mr. Henry C. Mercer of Doylestown, Pennsylvania,
 Professor William Libbey of Princeton University, New
 Jersey, and
 Dr. Charles C. Abbott of Trenton, New Jersey.

With the object of examining the deposit, they selected the spot where they wished to explore; trenches were opened and the search was continued by them alone (Plate LVII). Numerous Indian remains were found in the black soil. In the yellow soil they found chipped argillite and broken quartzite pebbles and one piece of chipped chert. Two of the specimens found were photographed in situ in the presence of all. Plate LVIII, chipped piece of black chert, A. M. $\frac{20}{13012}$ (Plate CXVI, fig. 5), 1 foot down in yellow soil. The upper dark line marks the separation of the black soil from the yellow, the other scratched lines are on the red clay bands; two of the bands are above the specimen. Plate LIX, chipped argillite, A. M. $\frac{20}{13011}$ (Plate CXVI, fig. 2), 22 inches down in yellow soil. These specimens with others from the yellow soil are on exhibition in the American Museum in New York.

July 25, Professors Salisbury and Holmes, Mr. Culin, Mr. Cushing and Mr. Kümmel visited the trenches. On the next day Professors Salisbury and Holmes and Mr. T. Wilson were at the trenches.

June 28, 1897. Mr. H. B. Kümmel of the State Geological Survey joined the party to-day and the exploration was continued in new trenches dug under the direction of the gentlemen. I was taken sick and went home leaving the party at work for the day when they left. At the request of Mr. Kümmel the trenches were left open several days that they might be examined by members of the State Geological Survey.

June 29. Received from Mr. Kümmel a chipped piece of argillite found by Professors Smoch and Knapp and himself, 16 inches below the surface and 4 to 5 below contact of yellow soil, A. M. $\frac{20}{13013}$ (Plate CXVII, fig. 1).

- Aug. 2, 1897, Lalor field, trench B; a straight wall cut in this trench showed six specimens at once (Plate LX); they were argillite chips and water-worn pebbles illustrating the deposit (No. $\frac{20}{11546}$ in the American Museum of Natural History).
- Aug. 10, 1897, Lalor field, in the long trench; there were found in the yellow drift 13 specimens, being water-worn pebbles of varying sizes and at various depths; nos. 4 and 6 were photographed in situ (Plates LXI and LXII).
- Aug. 16, 1897, in the long trench; another quantity of water-worn pebbles of different sizes and at different depths was found.
- Aug. 17, 1897, Lalor field, in the long trench; a number of water-worn pebbles of different sizes and at different depths were found in the yellow drift; two of the largest were photographed in situ: no. 1 was 5 by $3\frac{1}{2}$ by 3 inches; no. 2 was larger than would appear from the photograph as the thickest part lay in the bank; it was 10 by $8\frac{1}{2}$ by $5\frac{1}{2}$ inches, a two-foot rule is standing on specimen 2 in the photograph, other smaller pebbles are also in sight; a red clay band (scratched to show in the photograph) which was overlying these boulders was firm and whole and in no wise broken or disturbed. [Many of the photographs mentioned are not reproduced.]
- Aug. 20, 1897; for a few days preceding this date, numerous water-worn pebbles occurred of all sizes from that of a pea to that of a foot-ball; on this day eight more were found of which one, no. 7, was of argillite and lay 3 feet 7 inches below the line of contact; it was lying flat, like all the others.
- Aug. 23, 1897, Lalor field, in the long trench; 5 specimens were found, No. 1 an argillite flake, 6 inches below contact, no. 2, an argillite chip, 1 foot below the contact, no. 3, a broken argillite implement 8 inches below the contact, no. 4, an argillite implement 5 inches below the contact A. M. $\frac{20}{11335}$ (Plate CXVIII, fig. 7), no. 5, a water-worn pebble $7\frac{1}{2}$ by 6 by $2\frac{1}{2}$ inches lying 2 feet 2 inches below the contact.

- Aug. 26, 1897, Lalor field, in the long trench; specimens were found in the yellow drift, as follows: no. 1, an implement of argillite, 5 inches below the line of contact; no. 2 was an argillite chip similarly $5\frac{1}{2}$ inches down; no. 3 was an argillite chip 3 inches down; no. 4 was an argillite chip 4 inches down; no. 5 a water-worn pebble 10 inches down; no. 6 a round water-worn pebble 8 inches down; no. 7 was a very small argillite flake one foot down; no. 8 an artificially broken pebble, 2 feet 2 inches down (Plate LXIV). It lay flat in the third band of red clay which was $3\frac{1}{2}$ inches thick; the band next above this was $1\frac{1}{2}$ inches thick, and that nearest the surface was $\frac{1}{4}$ inch thick; they were both of them unbroken; the band next below the specimen was 12 inches thick and solid clay. No. 12 was an argillite chip, 6 inches down. Nos. 14 and 15 were argillite chips, 10 and 7 inches down.
- Aug. 27, 1897, Lalor field, in long trench; three specimens were found: no. 1, an artificially chipped argillite A. M. $\frac{20}{11362}$ (Plate CXVIII, fig. 5), lay under the first band of red clay reckoning from the top 20 inches below the contact with the black; it was photographed in situ (Plate LXV); no. 2 was an argillite flake, 5 inches down; no. 3 was a rude argillite implement (Plate CXVI, fig. 9) with the natural surface exposed to view, 2 feet 10 inches down; two red clay bands lay above this specimen, the upper was $\frac{1}{4}$ inch thick and the lower 10 inches resting on a stratum of light colored sand in which the specimen was found; none of the bands was destroyed or broken; the specimen was photographed in situ before being removed (Plate LXVI).
- Aug. 31, 1897, Lalor field, the long trench. A large water-worn pebble was found 2 feet down, like all the others in the undisturbed yellow drift; it was $8\frac{1}{2}$ by $7\frac{1}{2}$ by 3 inches and it lay between two strata of clay; the boulder lay flat and was photographed in situ with the two-foot rule resting upon it (Plate XXV).
- Sept. 2, 1897; many water-worn pebbles were found of various sizes and at various depths.

A green sand which lay 5 feet below the line of contact of the yellow drift and the black soil above, also presented the red bands, the same wavy lines being visible as in the yellow drift (fig. 3).

Sept. 3, 1897, in the extension north of the long trench; 6 specimens (pebbles) were in view at one time in the straight wall (Plate LXVII). An argillite pebble was found 21 inches below the line of contact; it was resting on the third red band from the top and was 4 inches below the red band next above (Plate LXVIII). The photograph also shows a second pebble in place just below the red band second from the top.

Sept. 7, 1897, a new trench was laid out on the terrace at the very highest part where it had been still higher before much of the soil was carried away by erosion and cultivation; this was trench 2. The line of contact of the black and of the yellow soil was found intact and below it from 7 to 12 inches deep in the yellow were numerous argillite chips and water-worn pebbles of various sizes.

Sept. 10, 1897, trench 2; a large stone fragment without water wearing was found in undisturbed yellow soil $25\frac{1}{2}$ inches below the contact. From this date until September 13, in trench 2, numerous specimens were found in the yellow drift similar to those described.

On September 13 a second visit was made to the site by Professor George Frederick Wright, Professor A. Hollick, Professor W. Libbey, Mr. Henry C. Mercer, and Dr. C. C. Abbott, and two more trenches were opened for them on the terrace, one on a height and one in a depression. Professor Hollick found an argillite implement in the yellow drift, 2 feet, 8 inches below the line of contact. The specimen, A. M. $\frac{20}{11415}$ (Plate CXVIII, fig. 4), lay below two of the red bands; it fell out and was placed upon the trowel which was stuck into the bank at the exact spot where the implement had been; a photograph was then taken (Plate LXIX). A water-worn pebble of black chert was found in the yellow soil near where a rude implement was found on August 27 (no. 3, 2 feet

- 10 inches down); this too fell out and was photographed on the trowel (Plate LXX).
- Sept. 14, 1897, Lalor field, trench D; another implement of argillite, A. M. $\frac{20}{11418}$ (Plate CXVII, fig. 3), was found by Mr. Mercer in the undisturbed yellow drift 2 feet 5 inches below contact; above were two unbroken bands of red clay, the specimen resting on the third from the top; it was photographed in situ. Two inches higher a round water-worn pebble, about the size of an egg, was found (Plate LXXI).
- Sept. 17, 1897, Lalor field, in trench A (No. 1) two chipped argillites, A. M. $\frac{20}{11426}$ and $\frac{20}{11429}$ (Plate CXVII, figs. 4, 5), were found in the sand $4\frac{1}{2}$ feet below the contact with the black soil; they had been dislodged by the spade but were replaced on the trowel which was stuck in the bank where the specimens had fallen out and the photograph was thus taken (Plate LXXII). A pebble of argillite naturally fractured, was found in undisturbed yellow soil similarly $3\frac{1}{2}$ feet down.
- Sept. 20, 1897, Lalor field, in trench no. 1 (A); numerous chips of argillite were found in the yellow deposit from 8 to 12 inches below the contact, also many water-worn pebbles of all sizes, from that of a nut to that of a foot-ball, and at all depths.
- Sept. 25, 1897, Lalor field, in trench D; a chipped quartzite flake, A. M. $\frac{20}{11440}$ (Plate CXVII, fig. 6), was found 21 inches below the contact in undisturbed yellow soil.
- Oct. 1, 1897, Lalor field, in trench D; a stratum of gravel was found $2\frac{1}{2}$ feet below the line of contact with the black soil on what was nearly the highest part of the terrace; none of the pebbles of this stratum showed any traces of wearing by wind or sand.
- Oct. 4, 1897, Lalor field, trench D; many water-worn pebbles could be seen in the straight wall or breast in advance of the digging, varying in size from that of a base-ball to that of a foot-ball (Plate LXXIII). Numerous chips of argillite and a chipped piece of argillite, A. M. $\frac{20}{11473}$ (Plate CXVI, fig. 7), were also to be seen in the yellow drift from 6 to 21 inches below the contact.

- Oct. 8, 1897, Lalor field; nine argillite chips were found in the undisturbed yellow drift from 5 to 20 inches below the contact. One of these is figured on Plate CXVI, fig. 6.
- Oct. 11, 1897, Lalor field, trench B; in a heavy stratum of red clay 21 inches below the contact of the yellow and the black a large water-worn pebble was found; the yellow drift was undisturbed as usual (Plate LXXIV).
- Oct. 13, 1897, Lalor field, trench B; further work presented the stratum of gravel referred to above always intact. Of all the gravel on the terrace it was nearest the surface; the yellow soil was undisturbed above and below it (Plate LXXV).

A number of fragments of a reddish, shale-like sandstone were occasionally found in the yellow drift; the fracture was natural but sharp and not at all worn; the stone is soft, of a variety of which an outcrop appears on the surface up the valley about 6 miles from Trenton. (One specimen of this was found in undisturbed yellow soil 21 inches below the line of contact with the black and numerous specimens of it occurred in Bilbee's sand-pit on the terrace about 150 yards to the northwest of Lalor field.)

In this trench B, besides the usual traces of plant growth from the surface which are always present, there were those of a large tree whose roots had caused a disturbance which reached down vertically to a depth of four feet and was then plainly visible horizontally through a clay stratum for several feet into the green sand. Another similar disturbance from a tree in the trial trench showed like features. I simply relate these instances to show that the least disturbance made by man or by nature from the surface can be readily detected.

- Oct. 14, 1897, Lalor field, trench B, an artificially broken quartzite pebble was found 2 feet, 2 inches below the contact; the trowel was put under it to keep it from falling out; the red clay band overlying the specimen was filled with minute particles of red shale, giving the band a very dark appearance (Plate LXXVI).

Oct. 19, 1897, Lalor field, in trench B; several specimens of interest were found; among numerous argillite chips from the yellow drift was an argillite implement, A. M. $\frac{20}{11517}$, lying flat 21 inches below the contact and just 6 inches above the uppermost band of red clay (Plate CXVIII, fig. 3).

Several disturbances caused by the roots of large trees were found in the drift, similar to those already described.

Oct. 28, 1897, Lalor field, trench B; a chipped piece of quartzite, A. M. $\frac{20}{11532}$ (Plate CXVI, fig. 8), was found in the undisturbed yellow drift 2 feet 3 inches below the contact lying flat in the second clay band from the top; this band was here nearly 4 inches thick (Plate LXXVII).

Nov. 4, 1897, Lalor field, Trench B; found an argillite implement, A. M. $\frac{20}{11537}$, 4 inches below line of junction of black and yellow soil (Plate CXVIII, fig. 1).

In May, 1898, explorations were resumed on the terrace and several trenches were opened in a field to the west of the Lalor farm near to where the tracks of the Camden and Amboy Division of the Pennsylvania Railroad cut through (Plate LXXVIII). This is within the limits of Deutzville as it is called. The composition of the deposits is similar to that in Lalor field and the specimens found tell the same story as those of the other trenches.

There is a conspicuous depression near Bunting Avenue at this place fully 10 to 12 feet lower than nearer the railroad track; trenches were opened at both the higher and the lower places. Nothing new came to notice except that the clay bands in the trench in the depression were thicker near the top and thinner near the bottom; it was also observed here that the argillite found deep down in the sand had a fresher appearance than that found near the surface in the yellow drift; no doubt the atmosphere causes more disintegration in argillite than moisture and any specimen within the reach of freezing and thawing, with soil adhering to it will go to pieces sooner than those out of the reach of frost. A specimen when exposed to air and water at the surface no matter how completely patinated will soon adopt a weathered appearance; the softer particles disappear

while the harder resist; the surface thus becomes rough and finally of a sort of honey-combed texture.

May 18, 1898, Lalor field; trench C was opened the first of this season in the field and the usual objects were found, such as water-worn pebbles, boulders, argillite chips and implements.

June 3, 1898, a specimen of argillite was found 4 feet 9 inches below the line of contact of the yellow with the black soil, in the green sand; it was a water-worn chip. A pebble artificially broken was also found in the undisturbed yellow drift 14 inches below the contact with the black soil.

During June and July, 1898, in Lalor field the specimens were in general similar to those described.

There were three trenches in operation with the wall or breast facing south. As the season was very dry the yellow soil with its large proportion of clay was baked as hard as a brick and a pick was necessary to scale it off.

July 25, 1898, Lalor field, trench C; an interesting discovery was made. A pit was found 4 feet in diameter and 3 feet from top to bottom, in the yellow soil; it was not connected with the black soil above; the line of contact of the yellow with the black was not disturbed and there were from 24 to 28 inches of undisturbed yellow soil between the top or mouth of the pit and the line of contact; the upper two of the red bands of clay were broken by the digging of the pit (fig. 20). Broken quartzite pebbles lay throughout the disturbed yellow soil filling the pit; they were large and small, some broken by fire; there were also chips of argillite and chipped argillite; at the bottom of the pit lay a stratum darker in color composed of yellow soil and small particles of charcoal. About 18 inches below the contact and directly over the pit lay an argillite implement in the undisturbed yellow soil. No black soil was found in or in connection with the pit. Other similar pits were found, but this was the most distinct.

The specimens from this pit are on exhibition in the American Museum of Natural History, New York.

I have noticed during the course of these explorations that the upper part of the yellow drift, at the contact and downwards for from four to six inches, presents a peculiar discoloration which is due to disturbances caused by little roots reaching from the surface to not more than six inches in the yellow soil; below

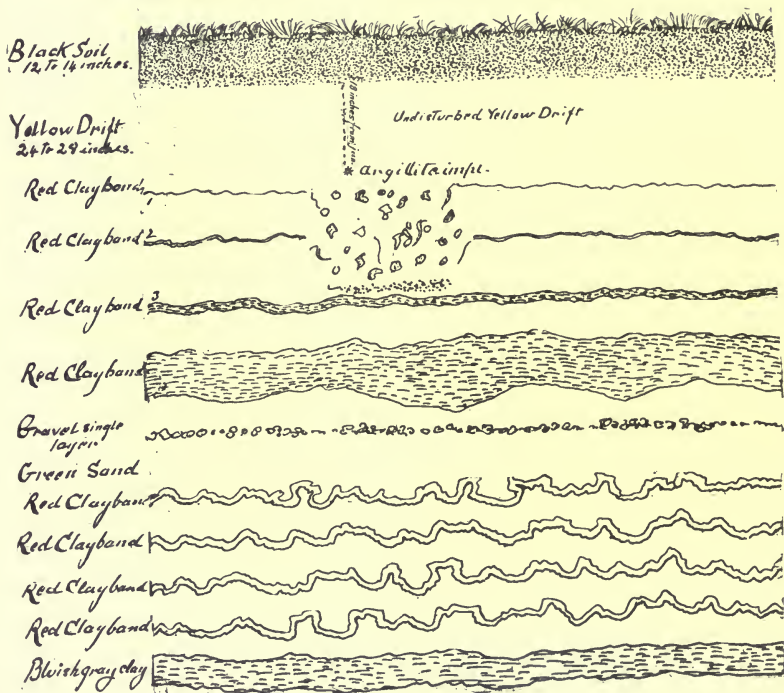


FIG. 20. Pit 1. In the yellow soil. Trench C, Lalor Field, June 25, 1898.

this comes a very light shade of the yellow soil extending down to the first red band; this shade deepens as the respective bands are passed; when the band lowest in order is reached it is often found mixed with a thin stratum of small pebbles; these in turn generally divide the yellow drift from the sand; the clay bands are again met with in the sand below (fig. 20).

Aug. 15, 1898, Lalor field, trench C; it was found that in one place in this trench the bands became more numerous and many of them lay closer together than was usual and that a number of them approached nearer to the surface; the uppermost of the bands lay within six inches of the line of contact with the black soil; many water-worn pebbles were found in the spaces between the bands.

About 800 feet north of trench B on Bunting Avenue is a sand-pit, where in a cutting made for the grading of a street, a thin stratum of gravel 4 inches in thickness was visible barely two feet below the original surface; the gravel carried pebbles the size of an egg or larger and the site is as high as any point on the terrace. There were no red bands between this stratum of gravel and the line of contact of the yellow and the black.

Sept. 26, 1898, Lalor field, trench C; numerous specimens of water-worn pebbles were found of various sizes and at all depths; also chips of argillite occurred in undisturbed yellow drift.

Oct. 27, 1898, photographs were taken of a fine exposure of deposits of the terrace 12 feet in depth, at Broad Street Park; three red bands were visible in the yellow soil below its contact with the black; below these three was a heavy band three inches in thickness showing the results of a peculiar twisting current of water. The distance between the line of contact and the uppermost red band measured here did not vary by more than three inches from the same measurement taken in the trenches in Lalor field a mile and a half away (Plates xx and xxi, already referred to).

Nov. 4, 1898; a chipped argillite was found in an excavation made for sand in Deutzville; it lay 20 inches below the line of contact in the undisturbed yellow drift.

Nov. 16, 1898, a trench was dug on the terrace on the extreme west end of Dr. Abbott's farm. The composition of the drift was found to be similar to that of the Lalor field even to the number of red bands. An argillite chip was found here 14 inches below the contact in the undisturbed yellow drift.

A trial trench in the same field, 500 feet further east, within 25 feet of the ravine and on a much lower level presented the following cross-section: at the top 10 inches of black soil (just the contrary to what one would conjecture from the position and the slope); below this lay the yellow soil, at this place, however, only ten inches thick; under the yellow was a sharp, clean, green sand several feet thick with some admixture of yellow soil; I found two argillite chips in this place, 10 and 12 inches below the line of contact of black soil, respectively; one was in the green sand and one in the yellow loam.

April, 1899. Explorations were again opened on the terrace and a trench was staked out on Dr. Abbott's farm near the ravine and running from the bluff inland parallel with the ravine.¹

The object of digging the trench here was to ascertain how thick the Trenton gravel was at this point and the depth of its contact with the Columbian.

At a depth of 6 feet, 3 inches a solid bed of boulders was found, which was composed of a mixture of both the Trenton and Columbian gravels; a section shows:

At the top, $1\frac{1}{2}$ to 2 feet of black soil resting upon yellow loam; the yellow loam became, as one descended, of a greenish yellow color and it was mixed strongly with sand; this was underlain by a 4 inch deposit of lighter colored sand and loam; again under this, coarse, green sand and yellowish-white sand was found down to the boulder stratum; the work went on as before by slicing down the bank in front and the same depth was adhered to.

April 21, 1899; two distinct heaps of human bones (fig. 21, c, f) were found; they were 6 feet below the present surface, and rested upon a stratum of whitish sand, coarse, clean and sharp, 6 inches thick; this sand lay over the boulder bed containing here much broken limonite, the typical Columbia gravel. (This coarse, whitish sand was similar

¹ This trench has been referred to before during the description of the "Traces of man in the black soil" and of the pits and graves then found (p. 50); the small stream "Abbott's Brook" has also been mentioned as forming the eastern boundary of the Trenton gravel as it runs through a cut in the terrace.

to that found overlying the boulder stratum in various places about Trenton).

A thin red stratum partly covered the bones; the overlying deposit proved on examination to be undisturbed, as was the light colored stratum and the line of contact between the black and the yellow soil. The human bones were badly decomposed, and the crania were in fragments. The heaps of bones measured three feet by two feet; in the heap further towards the south was found an argillite implement; and an object which proved to be a fragment of pigment was found one foot northeast of the bones in the undisturbed red band and sand.

In the course of the excavation of the trench the whitish coarse sand was found to disappear and a stratum of manganese to take its place, and this continued in the trench as far as it was carried; the sand was undisturbed as were the deposits overlying the pigment and the heap of bones. The pebbles found in the yellow drift and down to the boulder stratum were small, smooth and water-worn.

April 24, 1899; an object similar to the pigment was found in the same trench 6 feet 6 inches below the present surface and one inch above the boulder bed in the whitish, coarse sand.

April 28, 1899; another collection of human bones was found lying, like the others, in two heaps but a trifle higher and one foot apart (fig. 21, *d*). They rested upon a stratum of fine gravel, the particles of which were the size of peas and smaller; this was 6 inches thick and was cemented with black manganese; the manganese partly covered the bones and had colored them. The crania, ribs, a pelvis and a sacrum were represented in fragments, and the long bones lay on top of all; this was a condition quite different from anything I had observed before. The individual bones were of large size. The deposit over the bones was undisturbed and packed hard as the yellow soil always is on the terrace, when undisturbed. As I have said before, all the disturbances in the yellow soil made from

the black soil down could be clearly recognized, and there were no such traces over these bones (Plates LXXXIX, LXXX, LXXXI, LXXXII, show the ravine; LXXXIII, LXXXIV, show the trench; LXXXV, shows the depth at which the skeletons were found; a rule 2 feet long rests upon the trowel marking one of the skeletons).¹

Trench 1 was later extended for 75 feet (fig. 21) and was worked for some time; during this part of the work it was found that the Columbian gravel came nearer to the surface, and the results of the current which overwashed the Columbian on the northeast were plainly demonstrated by the intermixture of the Trenton and the Columbian; after this trench 1 was abandoned.

Another trench (trench 2) was staked out beginning at the bluff, but running parallel with it and at right angles to trench 1. The boulder bed was retained as a bottom or base for the trench as before and the exploring went on in like manner.

It was found that the deposit over the boulder bed increased in thickness, as the distance from the ravine increased, at a rate of from $1\frac{1}{2}$ to 2 feet in every 20.

The numerous specimens in this trench, the order of the deposits, the bands in the yellow soil, etc., were identical with those of Lalor field.

In this trench there was nothing further of interest found except a large pit, 5 feet in diameter and 5 feet in depth counting from its beginning at the surface of the yellow soil; a few broken quartzite pebbles, a thin stratum of small fragments of charcoal, and yellow soil were all that were found in it; it quite resembled some of the Lalor field pits and was evidently dug down from the surface of the yellow drift.

I have now enumerated some of the facts and finds that came to my notice during the many years of exploration in the yellow soil; in reviewing them the evidence bearing on the deposit itself will first be considered.

- (a) The stratification, known as the red bands, is everywhere found in the drift.

¹ The specimens from the trench are all on exhibition in the American Museum of Natural History, New York.

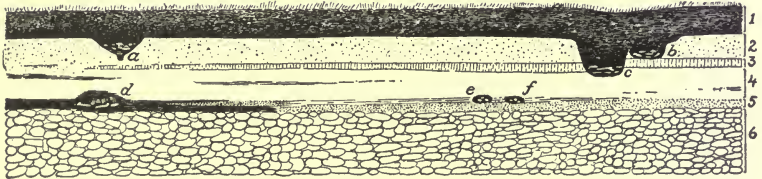


Fig. 21. A PORTION OF THE SEVENTY-FIVE FOOT TRENCH 1.

1. Black soil, $1\frac{1}{2}$ to 2 feet.
 2. Yellow soil, 2 feet.
 3. Light yellow soil, 3 to 4 inches.
 4. Green sand, 2 feet.
 5. Yellowish-white sand and fine gravel, 6 inches.
 6. Boulder-bed of the Columbia gravel.
- a. Artificial Pit, see p. 50.
 b. " " " " "
 c. " " " " "
 d. Portions of two Human skeletons, see p. 102.
 e. " " a Human Skeleton, " " 101.
 f. " " " " " " " "

- (b) The red bands extend for miles holding a constant distance between themselves.
- (c) The red bands are found nearer to the surface on the elevations on the terrace, while in the depressions a heavier deposit is found.
- (d) The red bands contain water-worn minute pebbles of red shale, a material the mother rock of which can be found up the valley, north of Trenton.
- (e) The red bands, as well as the yellow soil outside contain water-worn pebbles of all sizes.
- (f) Some recent deposits made by freshets in the Delaware River are similar to the yellow drift.
- (g) The waving lines of the red bands are duplicated by thin bands of clay in the stratified sand and gravel twelve feet below the surface (the large percentage of clay carried by this deposit is attested by the large demand for it in foundries, where, under the designation "moulding sand" it is used in making moulds for casting).
- (h) Numerous boulders of larger size than those commonly found in the gravel strata occur at all depths, from the very surface down.
- (i) Peculiar "ice-pits" are found on the upper terrace some of which contain boulders.

It can safely be deduced then from the foregoing points that the yellow drift or deposit is the sediment of a current of slowly running, muddy water (at any rate to a very large extent). The proportionate influence of the wind in its deposition is a matter on which there may be a difference of opinion. The boulders point to their deportation from above by, or in the presence of floating ice, and the current thus was a glacial stream; the fact that no later water deposit covers the yellow drift is a proof that it was laid down during, or at the close of the last glacial epoch.

The direction of the current can be plainly traced by observations on the surface; it was from the northeast towards the southwest; thus the elevation of Columbian gravel known as St. Mary's Cemetery holds on its southern border a sediment five feet thick formed in an eddy of the stream; this occurs in the form of a ridge of yellow loam that spreads to the south

and southwest (and finally east and west) over Lalor and Wright fields.

The traces of man in the yellow drift may be considered as to their material, their types and their occurrence.

MATERIAL.

The artifacts found in the yellow soil were either quartzite pebbles broken by fire or by fracturing, or of argillite, and one chipped piece of chert. This argillite is a metamorphic rock, originally a slate, altered by heat, giving a conchoidal fracture; this condition is probably due to contact with a hot trap, as the two are found side by side at an outcrop twenty-three miles above Trenton, there extending across the valley.

The argillite is found in the Trenton gravel below the outcrop, occurring mostly in angular forms.

TYPES.

The worked argillite is found in chipped pieces, in detached chips and flakes and in implements, whole and broken. The implements represent two classes only, namely, implements for penetrating (projectile points), and implements for cutting or scraping possessing a jagged cutting edge. No other forms were apparently used or manufactured (Plates CXVI, CXVII, CXVIII).

OCCURRENCE.

The artifacts were found scattered over an area of several square miles in the yellow drift from the Delaware River eastward. Under this heading they may again be divided into two classes: the specimens found scattered or isolated, and the specimens found in groups. The former were the chips, flakes and implements scattered over the whole area and found from near the surface of the yellow soil down to a depth of four or five feet within it.

The red bands above them in the drift were never disturbed by the deposition of the specimens; both were a part of the drift and the specimens were given their scattered positions while the drift was in process of being laid down. The latter class of specimens, those found in groups, occurred in pits and workshops while the isolated were found in undisturbed soil.

The pits were of two kinds; those at or near the surface (of the line of contact with the black) of the yellow soil, and these were apparently excavated from this level; second, the pits at a deeper level showing undisturbed yellow soil between themselves and the line of contact. The terrace was thus again overflowed after the pits had been in use; the stratification of the fine bands near the surface of the yellow and the strata in the old creek bed of Abbott's Brook serve to substantiate this. In both kinds of pits I have found broken quartzite pebbles, chips and implements of argillite and traces of fire.

The workshops containing quartzite pebbles, broken by fracturing, and but few traces of fire were at or near the surface of the yellow soil; the pebbles had evidently been the hammerstones used in chipping the argillite; the pits at or near the surface of the yellow soil were probably begun when the terrace was permanently dry and before plant life had begun to take possession. (That this vegetation was not slow in gaining a foothold after the recession of the waters is forcibly illustrated in the steepness of the banks of the terrace; in the places where the original forest has not been destroyed by civilization the grade is such that only vegetation could have preserved it.)

The pits and workshops may therefore be considered as marking the final occupation of this deposit by man.

The manner in which the first class of specimens, the isolated, came to be in the deposit is not clear; two views may be considered, of which either or both may be possible or even probable; first that they were originally part of the workshop material of the neighborhood and

were afterwards washed out of place. The water-worn condition of some of the specimens supports this supposition; but, on the other hand, many of the chips and flakes possess sharp edges with a minimum of wearing. The other view is that they were dropped and scattered by men during the dry periods; this is perhaps the more probable, particularly in the case of the perfect implements.

In general the traces of man in the yellow soil must be regarded as pre-Indian for two reasons; first, because the characteristic traces of regular Indian occupancy found in the black soil, except the intrusions made from that level, cease to appear below the black, and second, because the traces of man's work in the yellow soil were limited to quartzite pebbles broken by fracturing and fire, and to implements made of argillite.

The evidence of man's presence at the time of the accumulation of the yellow soil might, from the unquestionable traces just described, be considered conclusive; but very important additional proof is presented by the finding of the deep skeletons in trench 1 on Dr. Abbott's farm at the extreme eastern limit of the Trenton gravel.

The conditions under which the human bones were found accentuate three points: first, the stratified sand overlying them was packed as hard as that of the terrace in general and shows that water must have flowed over them after their deposition; second, the bones were close to the edge of the brook, and this brook now flows at a level 20 feet lower than that at which the bones were found; now it is clear that the water flowing over them flowing similarly and in like manner with the water flowing over the rest of the terrace, could have continued this steady flow only so long as the level of the water on the lowlands was the same as that of the bluff; as soon then as that level became lower the brook began to deepen its bed into the fine material overlying the boulder bed; this continued until the brook reached its present level; third, it naturally follows that the burial, or deposit of these bones, was contemporaneous with the deposit of the argillite chips and flakes in the yellow soil of the terrace. As to the manner in which the bones came to be

where they were found, whether from regular burial of the bodies or brought there by natural forces, is uncertain; considering the arrangement and the position in which they were found and the facts that in the one case they were partly covered by the red stratum and in the other by the black manganese, one would rather conclude in favor of natural causes. The pieces of pigment found in the undisturbed, coarse, whitish sand stratum were, beyond a doubt, deposited with the sand by the same agent, water.

This concludes the evidence dealing with the traces of man in the yellow deposit of the terrace during and up to the ending of the processes of its deposition, previous to any plant growth there and to the accumulation of the black soil on top.

TRACES OF MAN AND OF ANIMALS IN THE
STRATIFIED GRAVEL AND SAND OLDER
THAN THE YELLOW DRIFT.

In my search for the traces of man older than those described or in older deposits, the first point which impressed me was the poor chance of survival that artifacts would have among the debris of the various rocks from above during the forced journey down the valley to their present resting place; therefore the gravel claimed my attention in a search for that work of man on stone which would be most likely to resist the transportation down the valley from the higher land and also that I might learn more of the nature, the composition and the deposition of the gravel itself.

A study of the fractures of the various rocks native to or found in this locality was also necessary in order that I might be able to distinguish the natural fracture from the artificial; also to allow for the wear and tear incident to an artificially shaped (or chipped) stone at the time of its travels.

That "practice makes perfect" is proven by the skill the human eye acquires by constant vigilance, which soon enables one to detect the slightest deviation from the natural appearance of a pebble, no matter how water-worn or broken it may be. With these points in view the search went on.

For over twenty-five years I have made use of every excavation available for observation in the study of deposits, and of these opportunities the finest perhaps lay in the excavations made for sand in various parts of the city of Trenton by the building contractors and others. Observation of these pits has the advantage over that resulting from digging in the river bed in that the archaeologist finds employment here at all seasons, in summer and winter, at high or low water, as he watches the different sand-pits in operation.

Gigantic pits dug in search of sand, excavations made in the laying out and the grading of whole streets, sewer excavations,

cellars, etc., water and gas trenches, railroad cuts, all were studied and yielded many specimens of interest and importance.

Besides all this in 1891 and 1892 much time was spent in observing both shores of the Delaware River, up and down from Trenton, and sometimes at the seasons of low water the stream bed itself was examined; then when the Pennsylvania Railroad was preparing the construction of the new bridge across the Delaware at Trenton, excavations were necessarily made and these were carefully watched for specimens; this includes the eighteen excavations made under the river for piers.

These river studies pursued within a radius of fifty miles brought numerous specimens to light but justified no safe conclusions regarding them; the action of the stream makes the classification of the specimens exceedingly difficult; therefore a report on this branch of the work, with the incomplete material at hand is not possible. The cases of the finding of the traces of man or animals in excavations away from the present influence of the river are now set forth.

March 14, 1899. James Stryker, a man who was digging sand on Hancock Avenue near the outskirts of Trenton on the south, showed me the fragment of a bone that he had found the day before (March 13) in the undisturbed gravel of the sand pit in which he was working. Another man, John Phillips, corroborated James Stryker as to the finding of the bone in the bank ten feet below the present surface. The two men were taken to a Justice of the Peace where their affidavit was taken and the bone, acknowledged by them as the bone they had found was sealed by the Justice and packed and sent to Professor Putnam at Cambridge, Massachusetts. This bone, A. M. $\frac{20}{12269}$, (Plate LXXXVII, fig. 1) was later identified at the American Museum of Natural History and at the National Museum by Professor Putnam and others¹ as a part of the scapula of a Musk Ox, *Bos moschatus*. Mr. Stryker was photographed by myself as he pointed to the place whence he had taken the bone; after this photograph was printed Mr. Stryker was again taken to the Justice making another affidavit as to the photograph, certifying that said photo-

¹ By Drs. Matthew, Allen, Boas, Lamb, True and Lucas.

graph was taken by the writer and that he was the man shown in the photograph pointing to the place where he had found the bone (Plate LXXXVI). The affidavit was written on the back of one of the prints of the photograph. I examined the bank and took measurements, noting the stratification. The spot where the bone was found was 10 feet and 2 inches below the surface; a section of the deposit is as follows from top to bottom.

Black soil	2 feet, 6 inches
Yellow drift filled with boulders, here more numerous but resembling those found in the yellow drift in Lalor field	3 feet, 6 inches
A thin stratum of gravel	2 inches
Fine gravel	1 inch
Clean green sand	1 foot, 1 inch
Fine sand the color of ashes	6 inches
Coarse green sand	2 feet
The little seam of gravel in which the bone was found lying flat; the red bands showed plainly in the sand and gravel.	

The locality where the bone was found borders on the depression mentioned in the geological part of this report and on the ancient shore of the glacial stream, the highest terrace being the eastern shore of it.

Many interesting specimens were found in the railroad cutting and a gravel pit south of Deutzville and near the shore of Crow Creek. A large amount of gravel had been taken from here leaving a nearly vertical bank 12 feet in height presenting a southern exposure; a photograph was taken to show the method of digging the gravel (Plate LXXXVIII).

Gravel was first taken from this place about twenty years ago when it was the right hand side of the little valley that the creek had cut through the terrace in its efforts to reach the level of the waters of the lowlands at the time of the glacial floods.¹

¹ A photograph of this bank taken by Professor George Frederick Wright appeared in "The Ice Age in North America," p. 521, and also in a later volume by the same author: "Man and the Glacial Period." It was taken about fifteen years ago.

Exactly the same natural processes were in evidence here as in the other cuttings through the terrace made by the streams draining the inland country; one of these, Abbott's Brook, has already been described.

The taking away of the gravel, which has continued steadily up to the present, has caused the recession of the face or bank until it is now at the point whence the gravel is taken, at least 360 feet north of the line of the original valley bank.

Nov. 9, 1899. I found an interesting pebble in an undisturbed stratum of coarse gravel 5 feet 10 inches below the present surface (fig. 22). The specimen was a smooth black pebble with several scratches on one of its flat sides; the polished surface of the pebble drew my attention to it, but the scratchings were not discovered until it was taken from the bank. In the plate (Plate CXIX) these scratches are faintly shown covering a space about an inch long and $\frac{3}{4}$ of an inch wide, $\frac{7}{8}$ of an inch from the right side and $\frac{5}{8}$ of an inch from the bottom of the pebble. It has not yet been determined if these lines are glacial striae or artificial. The specimen is on exhibition in the American Museum of Natural History.

Dec. 1, 1899. Went to the railroad cut this morning, stopping in the sand pits on Hancock Street. The sun, striking the railroad fully had melted the early frost, which had been sufficient to make about one eighth inch ice on the water. The bank was active, that is, the sand was continuously running down. The gravel overlying the stratum of sand did not move, being firmly cemented by oxide of iron and manganese. The stratum of sand underlying the heavy gravel is not cemented but is stratified with thin bands of clay and iron dipping to the east, one eighth of an inch thick and two to three inches apart. The sand between these bands is only held in place by moisture. The slight frost during the night, now melted, had loosened the sand and it was leaving its place between the thin red bands as fast as the sun was drying up the moisture. A week or so previous to Dec. 1 there was a heavy rain from the south, which, having run down the bank (not sufficient in force, however to dislodge the heavy gravel nor the yellow soil above it) but washing a gully deep into the sand

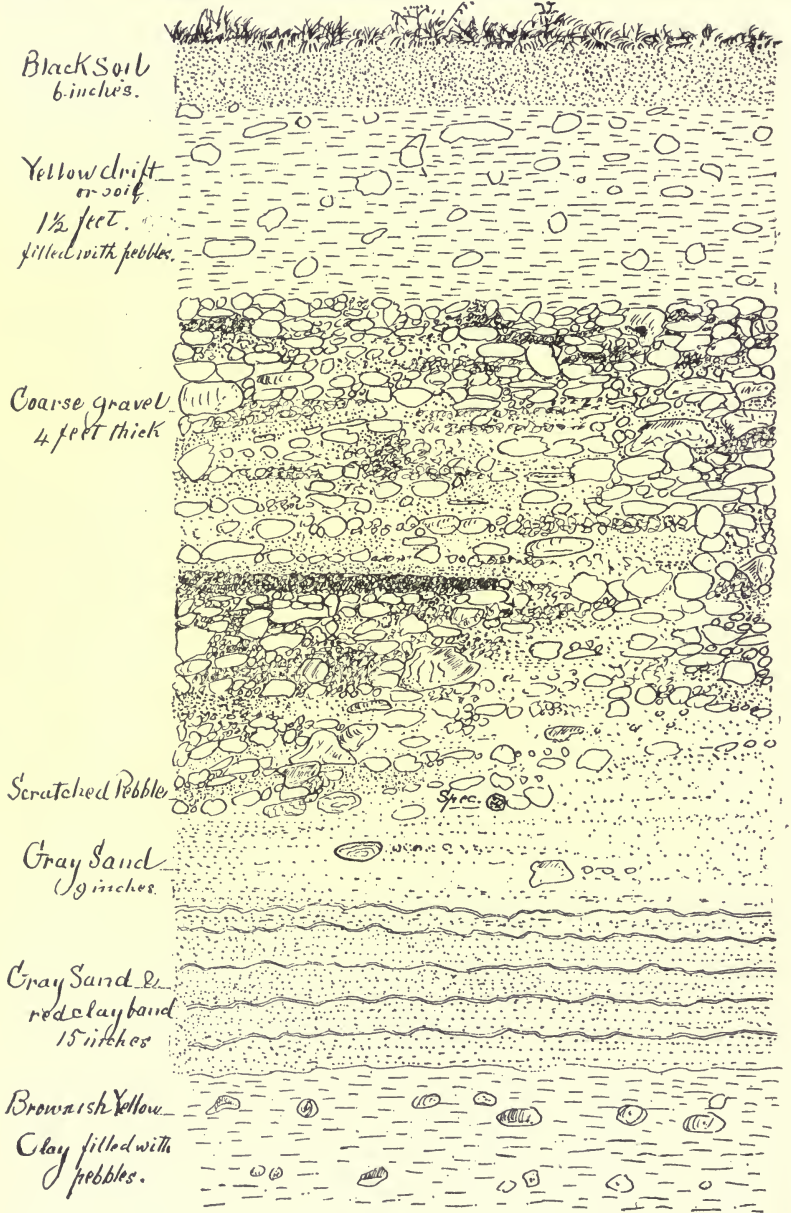


FIG. 22. Section showing the position of the Scratched Pebble.

underlying the heavy gravel. This gully is two feet up and down and five to eight inches broad, and ends on the heavy stratum of yellowish green clay as firm as a rock. This little wash out or as I have called it, gully, was a little over a foot deep in the bank. Now, in this little gully, in a heap of loose sand, probably a coffee-cup full or two, I saw some white object, partly covered by sand, still running down from above and fast covering the white object. The object (a bone as I found it was after picking it up) was one foot inward from the face of the bank, between two little pebbles, one a quartzite (slate color), the other on the right a little darker, of the size of a walnut each. I picked it up, there were two pieces, a large and a smaller one; picked up the larger one first, then the smaller came to view; picked this one up too, the large piece touching the little pebble on the left. Now I took careful measurement and found that this bone was seven feet seven inches below the present surface, in a stratum of sand two feet thick, one foot inward of the present face of the bank, between two little pebbles. The little pebble on the left showed a white mark. I thought that this white mark was from the bone that must have struck this little pebble as the large piece of it was in contact with this very pebble on the left. About four inches over or above the bone, in the little gully, was a place about the length of the bone where it evidently had fallen out of. Realizing the importance of the bone, I took careful measurement, after which I rolled a big stone on the bottom of the bank, marking the place also with the trowel cutting into the clay bank below, wrapped the two pieces of bone in my handkerchief so that they would not touch, and started home for the camera. On my return, after focussing the place, I laid the large piece of bone down at the exact spot where I had picked it up (the smaller one was left at home) and photographed it (see Plates LXXXIX, XC, and XCI). While photographing, the sand continuously kept running down along the whole bank. After photographing I again wrapped the bone in my handkerchief. I searched the little pile of sand in which I had found the two pieces and found two small fragments of bone. Nothing more was found. These apparently belong to

the others. The bone appears water-worn and sand scratched. I handled them very carefully, as carefully as I could, even carried them wrapped in the handkerchief in my hand, not putting them in my pocket, for fear they would rub against each other. At home I laid them into a pasteboard box in cotton and sat down to write to Professor Putnam about my grand find. The bones were not touched any more until I packed them and sent them away to Cambridge. [From field journal.]



FIG. 23. Cross section facing east. Railroad Cut. South of Hancock Avenue.
* Showing position of Human Femur, December 1, 1899.

The following is the cross-section (fig. 23):

Black soil at the top	7 inches
Yellow loam or drift filled with water-worn pebbles the size of a base-ball and smaller	16 to 20 inches
Thick, coarse gravel (apparently cemented together with a reddish, clayey material resembling the red bands in the yellow drift)	44 inches
A stratum of clean sand with red bands lying close together	21 inches
A heavy clay band forming a shelf	3 inches

On to this shelf the sand had trickled down from the overlying stratum, forming a little heap a few inches wide. The sand as it trickled out from the stratum, loosened the bone, so that it dropped out a few inches into this little heap; the sand was still trickling when I discovered the bone. The fractures of the bone were sharp, showing that it had broken in situ.

The bone was in all about a span long, chalky white in color and, owing to the disappearance of all organic matter it was chalky in texture; it was apparently water-worn as the edges were slightly rounded and it had numerous scratchings on its surface; it was immediately packed in cotton and sent to Professor Putnam for identification. It was found to be part of the left femur of a human being, that had been cut off square at one end; the cellular structure had been gouged out to enlarge the opening and it had been perforated in two places; it had apparently been the handle of some implement. The several views of the piece of human femur are shown with other femora for comparison on Plates *III*, *IV*, *CV*, *CVI*, *CVII*.

December 7, 1899. I made my usual visit to the railroad cut; this morning as on the morning (December 1) on which the femur was found a little ice had formed, but the sun had soon melted it and a fresh lot of sand had rolled down over the talus which I had thoroughly examined the day before. On top of

this new sand talus a fragment of a bone was found of a whitish color. A search with the trowel in the new sand talus revealed two more fragments of bone which proved, on examination to fit together and to be parts of the parietal bone of a human cranium; the breaks were fresh or recent but the whole had a water-worn appearance and was white and chalky with a slight stain of yellow (Plate CVIII). The place where the fragment of cranium was found was 24 feet west of that where the femur was found and 10 feet east of that where the polished and scratched stone was found. There was no place on the whole exposure above the stratum four feet thick of gravel that showed a new break or cave-down, the yellow and the black top soil being frozen hard, overhanging the sand stratum, but not broken.

That these human bones did not come from the upper deposits is made more probable by the fact that wherever on the terrace human skeletons have been found they have invariably been stained by the deposit in which they had been lying, but these fragments were nearly white and chalky. The fragments both of the cranium and of the femur are on exhibition in the American Museum of Natural History in New York.

The whole of this sand talus was again worked over with the trowel but no more specimens were found.

Dec. 9, 1899. On the occasion of another visit to this exposure a fractured pebble, A. M. $\frac{20}{12437}$, which has every appearance of having been broken artificially, was found (Plate XCII). It was in the same stratum below which the fragment of femur discovered on December 1 had been found lying. The two-foot rule seen in the photograph, will give an idea of the size of the bank. The stone was removed from the bank before the fracture was observed, so a piece of white paper was placed at the exact spot where the pebble had been and the photograph taken.

Dec. 12, 1899. Several interesting pebbles were found in the same exposure, one of which was of white quartz, and possessed an appearance suggestive of a palaeolithic implement. This specimen is in the American Museum.

Dec. 13, 1899. Another smooth pebble, A. M. $\frac{20}{12438}$, was

found in the same exposure in undisturbed sand seven feet below the surface.

Dec. 15, 1899; this whole day was devoted to taking observations in the railroad cut on the manner, order and rapidity of the scaling processes referred to as of importance in the case of the finding of the human bones. The bank almost seemed to be alive so fast did its features alter. The wind, blowing hard from the west, soon dried the bank. The sand in the stratum where the femur had lain was continually in motion, steadily falling out from between the red bands and rapidly forming a talus below; it is so clean that rubbing it upon the finger scarcely leaves any stain of the sand. The red bands themselves are caused to protrude more and more by the falling out of the intervening sand; they finally break off and fall down; this alternate process of the sand and the red bands goes on constantly repeating itself and specimens are thereby exposed; by watching, for instance, a common pebble, at first a small spot would become visible, but in three hours the whole pebble was to be seen and it actually fell out before nightfall and on to the sand that had formed the talus, the same sand that had been its companion for so many centuries.

It can now be easily understood how the fragment of the femur was exposed and fell; had my visit on December 1 been an hour later I should probably never have seen the specimen.

Of course the wind does not blow every day alike, and the rapidity of the process in the bank when not frozen depends in very large measure on the wind; in cases of freezing and of a sudden thaw the bank is scaled off in sheets of half an inch at once. It should be noted, however, that a thaw which affects the sand may not be strong enough to move the deposit at the top, which requires a much warmer temperature and the rays of the sun striking the bank at a different angle than the surface, on the yellow loam or drift which tops the sand and gravel here.

Dec. 21, 1899; an interesting stone was found near the west end of the bank six feet below the surface at the bottom of the gravel stratum overlying the sand; its interest arises from its showing fractures which in this material are generally only made by fire.

The visits to the railroad cut were continued and during the search in this exposure many specimens were found which presented interesting fractures.

Oct. 3, 1900. An excellent opportunity of studying the deposits was afforded by a sewer excavation in Trenton about four hundred feet north northwest of the passenger station of the Pennsylvania Railroad running parallel with the Assanpink Creek; here the strata belong to the easternmost glacial stream mentioned in the geological section of the report. The specimens found on this date came from a depth of from sixteen to twenty feet and from the lowest stratum of Trenton gravel which overlies the Columbian. On the bottom of the Trenton gravel and at a depth of about twenty-two feet is a heavy deposit of white quartz containing fragments of various sizes and mostly being of natural cleavage, fractured by percussion due to natural forces. Below this again at a depth of twenty-five feet from the surface an orange colored clay was found.

Among the specimens coming from sixteen to twenty feet down was one of white quartz, apparently chipped by man; the chipping occurred on both sides shaping the specimen to a point; the butt was untouched, and the whole bore a resemblance to one of the palaeolithic forms of Europe. It was quite water-worn as if it had come from a distance.

Excavations made in gravel necessitate the boarding up of the deposits at the sides to keep the trench from caving in as the work goes on; this boarding and bracing of the sides preclude the possibility of the specimen's having come from any other than the lowest stratum of Trenton gravel.

March, 1901; numerous visits were made to exposures of the Columbia gravel on Broad Street, Trenton, about three miles to the east of the city; extensive excavations had here been made and a straight bank left on either side of the road. A diligent search was made here and in other exposures of the same deposit in the neighborhood for fractured pebbles and several interesting specimens were thus gathered.

April 16, 1901; on this day began a series of visits to an excavation for a foundry that was to be built to the east of Trenton on the Millham Road and the Assanpink Creek, a mile to the

northward of the sewer trench already referred to. The place chosen for the building was on the east side of an old sand pit ten feet deep, a pit which lay to the east of the Assanpink Creek; the site took in one half of the sand pit and many feet of the land adjoining, nearly up to the tracks of the New York Division of the Pennsylvania Railroad.

The bottom of the foundation in the sand pit proved to be full of springs and in order to drain these springs a deep ditch was dug down to the level of the Assanpink Creek to the west. Several of the springs were first boxed up and in the process deep excavations had to be made through a medium gravel (Trenton gravel) and here in these excavations and later in the drainage trench, the white quartz stratum was met again that had been seen before in the sewer trench; here, however, it occurred in smaller fragments than before.

The composition of the drift was as follows:

Black soil	1 foot or more
Yellow loam	2 feet
Greenish gray sand	12 to 14 feet
Coarse gravel	1 foot or more
White quartz, slightly mixed with pebbles of other materials	1 foot (about)
Coarse white quartz sand; the grains were all of quartz and about the size of rice or larger	2 feet
Clay in layers of various colors changing from gray to slate and from yellow to orange.	

The Columbia gravel contains much white quartz, over one half of it being composed of this material. The quartz sand resembled much that overlying the boulder bed on the terrace; only at the foundry excavation it was coarser and a little deeper. The specimens of white quartz coming from these deposits, with a size varying from that of an egg to that of a pebble five inches in diameter present fractures that make an interesting study. I found here the water-worn pebble, as round and smooth as an egg, the partly worn pebble with rounding on the corners only, and the angular pebble on which the following

points are to be remarked: the natural cleavage of the rock; the fracture of percussion due to natural causes; the glacial striae caused by the passage of ice in which the pebbles were embedded, and, last, the fracture by percussion apparently due to chipping by the hand of man. It is unnecessary to state that all the specimens came from the undisturbed deposit; there is no white quartz on the surface and all the specimens were gathered as they were thrown out by the workmen.

An artesian well was dug at this place near the new building, and I received the specimens from each day's boring; the strata were exactly as described and the quartz stratum lay from fourteen to sixteen feet below the surface; several fragments of white quartz were brought up freshly fractured by the pounder and this added a new variety of fracture for study in addition to those just mentioned. The specimens are in the American Museum.

The specimens from the foundry site in white quartz which seem to have been worked or chipped by man are but little worn, while that one found in the sewer excavation a mile down stream was quite water-worn.

At a depth of 28 feet, after the clay strata had been passed, a bluish disintegrated rock was found which finally became so compact that boring operations were stopped at a depth of 30 feet.

In a sewer excavation at the corner of Lodge and Front Streets in Trenton near the Delaware a very interesting specimen of white quartz was found in the Trenton gravel at a depth of ten feet lying between some very large boulders. Several apparently artificially chipped pieces of white quartz were found in later excavations and are figured on Plates CXXII, CXXIII.

Sept. 11, 1901; a very interesting specimen of white quartz was found in undisturbed Trenton gravel eight feet below the surface; it came from a cellar excavation in Cass Street about one quarter of a mile east of the Delaware and about thirty feet above the level of the water; Cass Street runs directly east and west.

The gravel in this locality is very coarse and compact and is stratified with sand; it contains no great abundance of quartz

apart from the quartz stratum; still it is present and it occurs as often as the jasper; quartzite, however, is the most common stone.

At a depth of four feet from the surface a heavy stratum of sand interrupted the gravel, but it gave way to the stratum of gravel in which the specimen was found.

The whole excavation was fifty by forty feet in area and ten feet deep and the specimen came from a wall on the south of the excavation; this wall was fresh and the specimen was found in situ; it resembled a huge axe though not grooved and very rude; the thin end had evidently been battered.

Dec. 10, 1901; another interesting specimen was found in the railroad cut $5\frac{1}{2}$ to 6 feet below the surface on the bottom of the coarse gravel stratum.

These are all in the American Museum.

April 18, 1902; a bone was found in Cox's sand pit on Hancock Street in the Southern part of Trenton; it was lying flat in a stratum of sand and fine gravel, five and one half feet below the original surface, in the straight bank of undisturbed sand and gravel facing south; an examination of the strata above the specimen showed three distinct layers of gravel, an undisturbed water-deposit.

The bank had been cut down straight the previous day and the wind was blowing hard on the day when the specimen was found, loosening the sand and piling it up in a talus. There were two men digging sand in the pit, neither of whom had noticed the bone; the camera was brought and the specimen was photographed in situ. The men, not having noticed the bone were much surprised when it was shown to them. The wind had evidently removed the sand and exposed the bone after the cutting down of the bank, and the bone would not under the circumstances have remained there long. Finally the specimen was taken out in a solid lump, packed and sent to Professor F. W. Putnam for identification who pronounced it to be a fragment of the antler of an elk and it was deposited in the American Museum. Fig. 24 is a section of the sand pit showing the position of the fragment of antler. On Plates XCIII, XCIV, XCV the antler can be seen in the gravel as a white mark

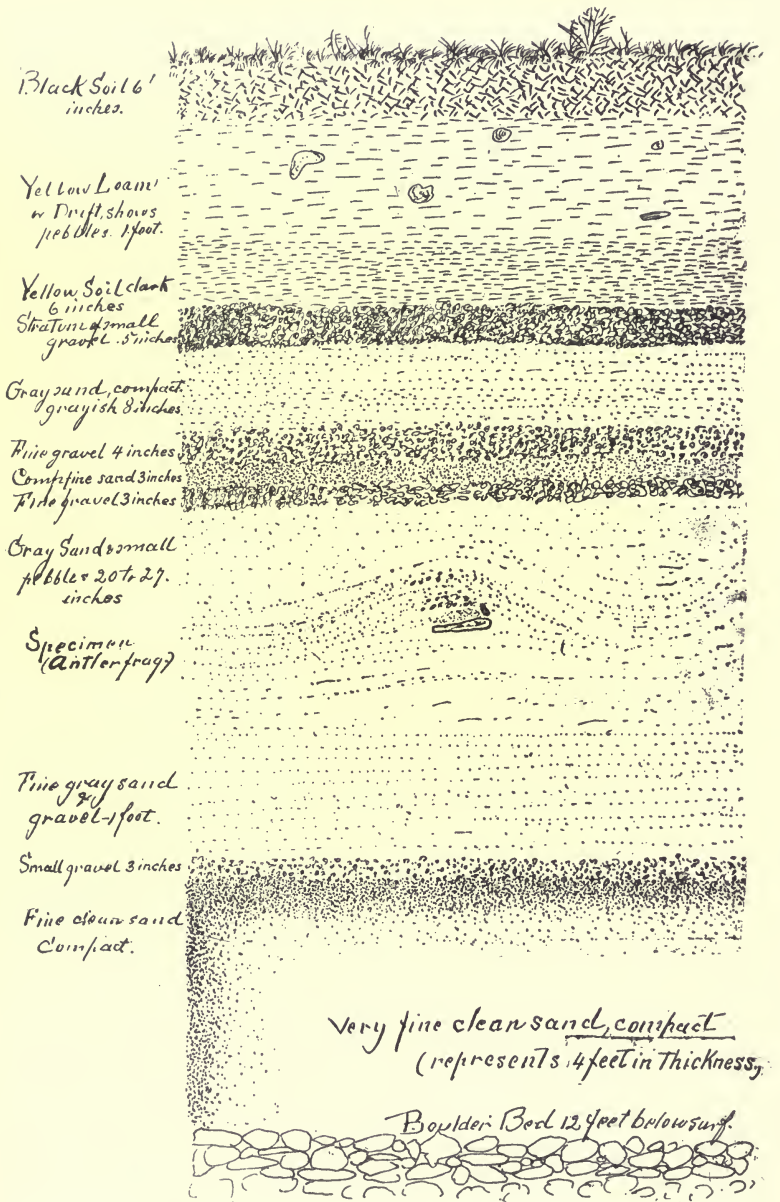


FIG. 24. Section in Cox's sand pit, showing position of fragment of antler.

a quarter of an inch long in the middle of the picture, one third in from the left side.

A continuous watch during several weeks in this particular sand pit also revealed, after the removal of several feet of sand, huge boulders and ice pits, the boulders being embedded in the ice pits.

The fragment of antler was found at a much higher level of the ground than was the fragment of the femur; the former was on or in the highest terrace just before it is finally lost and united with the underlying terrace.

This concludes the description of the gravels and the specimens to the time of this résumé. Further notes are given from the journals on following pages.

CONCLUSIONS.

The evidence in proof of the existence of man in the Delaware Valley from the time of the glacial period to that of the arrival of the white man has now been presented.

We have considered the first arrival of the Indian or Dweller of the Black Soil, his industry and his skill in the manufacture of tools, weapons, pottery, etc., the food he used, the animals that furnished a part of that food, and finally we have noted his departure.

The existence of the Dweller of the Yellow Soil who lived on the drift underlying the black, during its progress of making and after its final drying off, previous to the accumulation of the black soil above by decaying vegetation — has now been firmly established; this is in spite of the fact that the traces of his existence are far less numerous than those of the black soil dweller following him.

The implements of the yellow drift man must, however, have been fairly numerous, judging from the numbers of specimens and from the many chips scattered throughout the drift. These implements were of but two or three distinct types: the spear-head, and possibly the arrow-head, the implements with a jagged, cutting edge, and the drill-like specimen found with

one of the heaps of human bones. The material of these was always argillite.

The pits found at different depths with the charcoal and the pebbles broken by fire indicate that cooking was done.

The finding of the pieces of pigment in the undisturbed stratum of coarse, whitish sand was of more than ordinary interest as such a discovery is thus far unique for this locality.

The skeletons found show that these people were strongly built; the skulls and other bones were so far decomposed as to make it impossible to gather any further information.

The habitation of this Dweller of the Yellow Soil has given him the name of the Man of the Intermediate Period, and his use of argillite in the manufacture of his implements gives him that of the Argillite Man.

The discoveries in the gravels underlying the yellow drift have established the existence of a still earlier Dweller in this region and for the purpose of distinction he may be called the Glacial Man.

In describing the gravel, I think it has not hitherto been noted that the gravel in its wearing down presents two phases, a primary and a secondary; first, the smooth material which actually gives the name of pebble or cobble, according to size, to the once angular fragments that have been rolled and worn; second, the fracturing after the first wearing, these fractures themselves being afterwards partly worn away; had the movement of the material continued long enough these fractures would also have been completely rounded and smoothed away.

In these deposits of gravel and sand, traces of man and of animals have been found as stated.

The latter are the bones of animals contemporaneous with man, the musk-ox and the elk, while the former represent chipped quartz, quartzite pebbles broken by fire and fracturing, fragments of a human cranium, and a part of a human femur which had been cut and worked by man.

All this tends to verify the existence in the Delaware Valley of a man still older than the Indian and the Dweller of the Yellow Drift.

As these remains were found isolated and in stratified gravel

it clearly follows that they were a part of the gravel in which they were found, that they had been in or on some original gravel deposit, had been dislodged with it, and shared its journey down the valley and that they were finally redeposited with it.

In speculating upon the manner in which the remains become incorporated with the gravel it should be borne in mind that the floods which made the deposits were the results of the rapid melting of the ice in the glaciated area of the Delaware Valley, during the last stages of the glacial epoch; the floods would therefore be temporary and recurrent, rising to their maximum about August of each year and diminishing towards the middle and later fall, so that for six months much of the flooded area would be a dry gravelly surface over which man could wander freely. Such artifacts, etc., as might fall would be covered up by the floods of subsequent years; this accounts for the common character of the implements and for the absence of indications of marine life in the deposits.

The traces of man in the heavy, grinding material are naturally very scarce, the osseous remains being necessarily rare.

Numerous observations made during the times of freshet in the Delaware, as to the action of the ice on the shore and in the bed of the stream, as to the depositing of the gravel over the roadways and upon the surface of the cultivated fields, etc., give one the impression that a fragile specimen such as a fragment of a bone or the like, or a bit of clay or of wood, would have very little chance of survival; the few that have been found have probably escaped destruction by the merest accident. The human femur was imbedded in sand between layers of clay and the scapula of the musk-ox was also found in sand; here the sand was probably the means of preservation.

The fragment of elk antler was found in an ice pit which showed large boulders; these ice pits allow of no other explanation than that of natural deposition by the stranding and melting of the ice; the work of the water is everywhere demonstrated in the most comprehensible manner with no trace of artificial disturbance.

In addition to these proofs of man's existence in the gravels and to the bones of animals contemporaneous with him, little

more can be said; there is much more to be learned. The proofs, however, of three distinct occupations by man of the Delaware Valley are indisputable, and the conclusive evidence so eagerly demanded and with so much difficulty secured asserts the antiquity of man on this continent at least as far back as the time of these glacial deposits in the Delaware valley.

III. THE JOURNALS.

[From the beginning of his systematic explorations in the Delaware Valley, under the direction of Professor Putnam, Mr. Volk kept a journal in which he recorded the observations made from day to day. In the foregoing pages Mr. Volk has summarized these observations from 1889 to 1905 under the several headings. In order to record all the important observations made to the end of the year 1910, extracts from his journals of 1906 and 1907 and the journals of 1908, 1909 and 1910 in full are here printed.—EDITOR.]

EXTRACTS FROM JOURNAL OF 1906.

- May 19; A large stone, 4 feet long, 2 feet wide and 18 inches thick, was found today just on top of the sandy loam 2 feet below the original surface; it is apparently a mixture of red shale and argillite, a sedimentary rock, metamorphosed by heat, of an angular form and very little water-worn. Its home or mother-rock was probably the bed-rock that shows an outcrop between Raven Rock and Byram, two railroad stations on the Delaware about 22 miles north of Trenton; as the stone is angular and occurs in a deposit of loam and fine sand there can be no doubt of its having been transported here by ice.
- May 26; I photographed this angular boulder, in Mr. Ahrendt's sand pit in Deutzville (Plate cxxiv).
- June 9; I went to the Rose Street and Southard Street sewer excavations; the latter is very interesting as the yellow clay is filled with boulders, some of which are so large that they could not be removed, but had to be broken by dynamite; most of them seemed to be mica bearing quartz or schist.
- July 7; I visited Deutzville again and all the sand pits there, also the neighboring fields. The last rain had filled

some of the sand pits and washed some of the loam on the surface; the hot sun then dried it fast and thus formed a shell-like covering that cracked into small fragments; the fissures or cracks were from one quarter of an inch to one inch or more in thickness, the little fragments rolling up and thus widening the cracks. I noted a similar action last summer in Ohio near the Turner group of mounds on the Little Miami River; in that case the clay was more abundant and the rolling up more complete, curling the thin clay into tube-like formations.

July 11; I strolled along the terrace and then through De Cou's old homestead down into the meadows towards the old Camden and Amboy Railroad tracks; here I found on a ridge which has been lately ploughed over traces of early habitations; the ridge borders a branch of a creek on the east side and about seven feet above it, not unlike the ridge in the lowlands of A. K. Rowan's farm. The plough had turned up many broken quartzite pebbles on the surface and I also found several specimens of chipped argillite (see No. 71003¹ and the specimens of this date). An exploration here would be perhaps profitable. This was a very hot day and it ended with a thunder storm.

July 18; The sand pits of Mr. Ahrendt presented today some rocks broken by fracturing (71007), in the stratified sand 10 to 12 feet below the surface, also a sand-worn rock (71008).

July 26; I visited Kuser's Woods and the vicinity. This is about three miles north northeast of the terrace bluff and near the woods is an elevation that in a way corresponds with that upon which Dr. Abbott's house is situated. As the town is spreading to the eastward several new roads have been laid out through this region; in the grading of one of these through the Columbian gravel which here succeeds the Trenton gravel towards the east, a large quantity of material was removed; a

¹These numbers refer to the specimens as catalogued in the Peabody Museum of Harvard University where they can be examined by anyone interested.

bank was thus left on each side four or more feet high, which the recent rains had washed and undermined; I made a search here in the freshly exposed bank and found a specimen under the overhang about three feet below the original surface, lying on the washed gravel; apparently it had rolled out with the gravel, which is clear Columbian (71009) No. 1 of this date. On the surface of a freshly ploughed field south of the elevation and about half way to the bluff of the terrace I found (71010) No. 2 of this date; it is interesting because of its resemblance to one I found in the sand pits deep below the surface in undisturbed sand some time ago.¹ There are several specimens in my collection at the American Museum of Natural History in New York from the Columbian gravel at White Horse Road about two miles south of Kuser's Woods. This field is still new (I mean the search for traces of man in the Columbian gravel), and deserves study.

Aug. 3; I examined the gravel thrown out from the sewer trench in Second Street back of the New Jersey Arsenal, and found on top of the heap, newly thrown out, a specimen (71011) much resembling a palaeolith, or the thick end of one. The material is much decomposed and water-worn. The heap of gravel on top of which it was found is five feet high and that part of the trench from which the top of the heap came is eight feet deep; before the sewer trench was made the street had been cut down several feet in changing its grade. Nevertheless I did not see the specimen thrown out.

Aug. 18; In the afternoon I took a party from Trenton, Mr. McCallie, the Principal of the School, Mrs. McCallie, Mr. Lanning, Judge of the Supreme Court and his sons and their friends to the terrace, Lalor Field, and along the bluff to Dr. Abbott's house.

¹The specimens referred to are of a geological character unless specially noted as "artificial". It must be stated however that some of the fractured stones here regarded as probably fractured or chipped by natural causes may possibly have been fractured by man.—EDITOR.

- Aug. 28; In the afternoon I visited the sewer trench on Hermitage Avenue and State Street, examining the large long heap of excavated gravel; I found on top of the heap an apparently chipped chert pebble (71012) No. 1 of this date (Plate LXXXVII, fig. 3). This came from a depth of twenty feet, judging of course from the last material thrown out before the recent rains; the excavations are so deep here that but slow progress is made.
- Sept. 24; I visited a sewer trench on Grant Street twelve feet deep and found a very interesting slab of argillite (71015). It is apparently chipped and came from seemingly undisturbed gravel.
- Oct. 12; I made a trip over the fields in the afternoon and found an unfinished spear-head, chipped quartz and chert, argillite flakes, a fragment of pottery, etc.
- Oct. 16; I visited Deutzville and all the sand pits were examined. In the Morris sand pit I found a very interesting argillite specimen (71022). It was eleven and one half feet below the surface in an undisturbed stratum of gravel on the south side of the pit; it was in situ; I saw the thin end sticking out in the thin stratum of gravel, so I pulled it out; this stratum of gravel was overlaid by stratified sand and clay and that in turn by the regular three feet of yellow loam identical with that of the Lalor field, which is only a couple of hundred yards to the southwards; at the top are eight inches of black soil.
- Nov. 20; I took a stroll out State Street where a new road was made from State Street to the Water Power at right angles to the Delaware. Three feet were cut away and I observed many broken pebbles from Indian hearths; nothing more could be done because the ground is private property and permission to explore could not be obtained so late in the season.
- Nov. 25; The heavy frosts that have set in the last few days and the cold weather have ended for the present these outings.

EXTRACTS FROM JOURNAL OF 1907.

June 6; The beginning; I prepared my tools, note-book, etc.

June 7; I visited all the sand pits at the southern end of Trenton.

I found that Mr. Ahrendt had extended his pits far beyond the former limits; I examined all of the deeper parts and in one of them, that one that ranks second from Bunting Avenue westward, I found, on the bottom, specimen 1 of this date (71027). It was not in situ, but lay among the exposed gravels about twelve feet below the present surface, and I have no idea to what depth it should be attributed; apparently, judging from other gravels in the bank the stratum is from four to twelve feet thick here and four feet below the surface. Specimen No. 2 of this date (71028) was found three and one half feet down in the yellow drift, sticking in the bank in a fresh exposure in Haas' pits opposite Mr. Ahrendt's pits.

June 12; I visited the river shore from the steamboat landing to the Cemetery and the Buttonwoods; I found a chipped argillite (71029) in the water fifty-five feet out from the shore in the bed of the stream.

June 26; I visited all the sand pits at Deutzville and found from ten to fifteen feet down several interesting specimens; No. 1 (71031) was an argillite, apparently chipped, from a stratum of fine sand in Mr. Ahrendt's pit; this sand is of a reddish color and full of pebbles the size of hickory nuts; No. 2 (71032) was a naturally fractured portion of a water-worn pebble, interesting for comparison with those produced artificially; No. 3 was of white quartz with natural cleavages and fractures due to natural percussion; it was fifteen feet below the surface in Mr. Ahrendt's sand pit; No. 4 (71033) was a clay nodule of the kind so often found here.

June 28; I visited Haas' sand pit; here is an exposure nearly twenty feet deep leaving a straight wall facing north; all the different strata are in sight, the black soil, the

yellow drift and the underlying stratified deposits; the boulder bed is here fully twenty feet below the surface. At a depth of from twelve to eighteen feet, strata of gravel appeared with two faces, one older and one newer, apparently reassorted; this I traced through the whole pit now nearly two and one half acres in extent. I found today three specimens: No. 1 (71035) was a fragment of quartzite showing, I believe, artificial fracturing; No. 2 (71036) was a fragment of some variety of granite with interesting fractures; No. 3 (71037) was a stone apparently fractured naturally and presenting a much water-worn surface; on the later surface there are interesting flakings suggesting its subsequent use by man as a tool.

- July 2; I found one very interesting specimen of argillite in a new sand pit on the east of St. John's Cemetery in the Lalor field about one hundred yards south of Lalor Street. I found it in undisturbed sand within one foot of the boulder bed at the bottom and as nearly as I can judge about eighteen feet below the original surface (71038).
- July 3; I visited the sewer excavations in New York Avenue and found several interesting specimens in and on top of the yellowish clay which here reaches to within ten feet of the surface in some places. The layer of white quartz found a few years ago overlying the gray clay at the Laval Turbine Works is also found here; the specimens: No. 1 (71040) was a naturally fractured thin slab, somewhat water-worn; No. 2 (71041) a flake, recently fractured, possibly by the excavators of the trench; No. 3 (71042) presents those short fractures so often found on glacial gravel and already referred to; it was considerably water-worn, having apparently been transported after the fracturing; No. 4 (71043) has been naturally fractured by collision with other rock and other means, but its angular surface suggests that it has not been much rolled or moved; No. 5 (71044) resembled the last but on one side there was a recent fracture which produces a sharp cutting edge; this may also have been done by strokes dealt by the excavators.

July 8; I visited the sewer excavations in New York Avenue and found six specimens of broken white quartz in the yellow and gray clay from ten to fourteen feet below the surface; No. 5 (71049) appears to be artificially fractured and resembles in shape the many argillite specimens found by me as does also No. 6 (71050, Plate CXXII, figs. 3, 4, $\frac{1}{2}$ size). There were some fragments of thin gneiss found here also; this gneiss rock is found some distance up the river and may be traced thence across the state to New York.

July 10; I visited all the sand pits; Cox's, in Lalor field, Wayman's, Malloy's, Haas', and Mr. Ahrendt's. I found in Haas', sixteen feet down an artificially broken quartzite and twenty feet down a slab of argillite Nos. 1 and 2 of this date (71051 and 71052). No. 3 (71053) was a pebble with a sand carved surface and No. 4 (71054) a rude specimen of granite fractured almost like a palaeolith. No. 5 (71055) somewhat resembling the last came from a thin stratum of gravel ten feet below the surface. Nos. 3, 4 and 5 are from Mr. Ahrendt's pits. Under No. 6 (71056) are several specimens of chipped argillite from Wayman's pit; they are from the talus and probably originated in an Indian pit near the surface. The exposures at these sand pits are now a grand sight and I wish that I could take all the schools there and show the children the drift.

July 15; I visited all the sand pits and found in Cox's eighteen feet below the surface two very interesting specimens; No. 1 (71060) was a white quartz with short flaking, a fracture I have noticed on trap rock; a workshop of this material was found several years ago on the farm of Joseph Schwartz in Pennsylvania; today's specimen, however, looks like part of a "turtleback." No. 2 of this date (71061) was a gneiss slab apparently artificially rounded or shaped (Plate CII, fig. 1). I found in Wayman's pit in the talus No. 3 (71062) an argillite that came undoubtedly from the surface.

July 26; I visited all the sand pits at Deutzville; the wind was blowing hard and the banks changed continuously; I

stayed until three o'clock, but could not find any specimens.

- Aug. 3; I visited the sewer excavation in Brunswick Avenue and found the ditch now only eight feet deep running through clay of a yellow color; boulders of white quartz are occasionally found in the clay, ranging in size from that of a walnut to that of a foot-ball; No. 1 of this date (71071) was apparently a portion of a larger piece or specimen with interesting fractures, some older and water-worn, some of more recent date (Plate CXXIII, fig. 5). Another specimen, No. 2 (71069) is probably artificially chipped (Plate CXXII, figs. 5, 6).
- Aug. 8; All the sand pits were visited; I found one specimen in the Ahrendt pit eleven feet below the present surface in a stratum of reassorted gravel. I have often referred to this stratum in my notes as presenting an older and a newer face; the stratum now varies in thickness from four to nine inches while formerly further east where the pit was first begun it was several feet thick. The specimen, No. 1 of this date (71072) was much water-worn and appears to have been exposed to the weather as well before its deposition. I took it right out of the bank eleven feet down the surface. A lad of about eighteen years of age digging sand told me that he had found a bone in Cox's sand pit while digging there; I went there; the boy came and showed me the place where he found the bone; it was nine feet below the present surface in an apparent mixture of sand and loam. "The bone" (71073) proved to be a tooth¹.
- Aug. 10; I visited the sewer excavation which is now right in the rear of McKinley Hospital; it is not deep, only nine feet and entirely in the yellow clay; there are many white quartz fragments in the clay from the size of an apple to that of a horse's head, both angular and water-worn. I examined a lot that had been thrown out and

¹"This is the first right upper molar of either a Bison or an Ox. There is no certain way of distinguishing this tooth between these two species of the genus *Bos*," G. M. Allen. If there was no mistake as to the position of the tooth it must necessarily be the tooth of a Bison.—EDITOR.

also watched the digging of today; the rains of yesterday had washed the clay thrown out before and thus exposed many specimens. No. 1 (71074) presents a large conchoidal fracture undoubtedly caused by percussion, which brought about two protruding points; of these one appears to have been battered. The long narrow place on the back seems due to natural cleavage; all is water-worn although not sufficiently to cause the stone to be classed as a pebble; the wearing seems to have succeeded the fracturing. No. 2 (71075) presents several fractures identically like those produced by artificial chipping (Plate CXXIII, figs. 3, 4). I have found numerous specimens thus shaped on Indian village sites; the fractures show plainly on the specimen and the design of shaping the implement to a point and a cutting edge is apparent; fracture by percussion can of course be produced through the working of natural forces, but these forces shape rudely and without design; the work by the hand of man shows design. No. 3 (71076) presents decidedly artificial chipping and appears to have been broken before completion (Plate CXXIII, figs. 1, 2). All these specimens were from three to ten feet below the surface in reddish yellow and gray clay. The top or surface here is occupied by a black leaf-mould from nine to twelve inches thick, below which I found a yellow loam mixed with fine gravel varying in thickness from 20 to 25 inches.

Aug. 12; I visited the Pennsylvania shore from below the new stone bridge down to the first point nearly opposite the Brewery. The water is very low just now and one can walk nearly half way across the stream. I found five specimens in the river bed from about 60 to 75 feet out from the shore. No. 1 (71080) was an argillite boulder chipped and slightly worn by water; No. 2 (71081) a chipped argillite of palaeolithic form; No. 3 (71082) was a chipped argillite with a cutting edge all the way around; No. 4 (71083) was a chipped argillite with a cutting edge a part of the way around; No. 5 (71084) was a stone with natural fractures, water-worn. The Delaware

is as low now as in 1900 and 1901 when I collected so many specimens here that are in the American Museum of Natural History in New York. It is interesting that after the collecting here for a number of years there are still some to be found. This place is now part of an island of which the top soil has been gradually removed by the stream; the water has been constantly pushed westward to the Pennsylvania side ever since the arrival of the Europeans; the lower strata are freshly laid bare after every season's freshets and new specimens are thus to be found.

Aug. 14; I visited the railroad cutting and found in the bank one of those quartzite pebbles broken by fire that are often found on village sites; I have found these specimens here before; they are part of the four feet of gravel which overlies the cross-bedded sands; they probably formed at one time a part of some fire-place, possibly at some point above this in the valley.

Aug. 22; I took a stroll down the Pennsylvania bank of the river; the water was unusually low at ebb tide at eleven o'clock; I found five specimens in the bed of the stream nearly opposite the rolling mill. The continuous filling in on the New Jersey side has pushed the stream westward towards the Pennsylvania side and thus a large quantity of material has been exposed and washed away on the island, as I have mentioned before. The surface of the Island, that is, what is left of it, contains chipped quartz pebbles and the usual chips found in Indian village sites, but they are all at the top and apparently of recent date; the lower strata, however of this place are composed of clear, closely packed boulders among which are found the argillite specimens; some of them are so water-worn that the flaked faces are almost obliterated; some that I collected some years ago are now in my collection in the American Museum in New York. The specimens found today were two hundred and fifty feet from the present shore and in the real bed of the stream; at low tide they were covered by half an inch of water. No. 1 (71091)

was a partly chipped argillite pebble, much water-worn; No. 2 (71092) was a large argillite flake, water-worn; No. 3 (71093) was a large argillite flake with rechipping; No. 4 (71094) was a chipped quartz pebble of the usual form with a cutting edge on one side and a smooth place on the other; No. 5 (71095) was a notched pebble, much water-worn.

Aug. 23; I visited the sewer excavation in Brunswick Avenue again and found one specimen of white quartz (71096) that had evidently been fractured and water-worn afterwards; it came from a depth of eight feet below the surface.

Aug. 30; I visited all the sand pits; in Ahrendt's pit there is an excellent exposure nearly 200 feet long, I saw one specimen of white quartz in situ (71097); it was of an angular form showing fracturing by percussion, and was nine feet below the surface.

Sept. 6; I hired a boat and started down the river from Captain Clegg's wharf. The dredging and digging planned for some time has now started and the huge machine is at work about half a mile below Periwig Bar; the material is deposited through a long run of pipes perhaps a foot or more in diameter extending from the machine south and then east to the New Jersey shore; the dredgings are apparently carried by or with the water; at present there is nothing but sand and an occasional pebble thrown out, but later when the machine is moved closer to Periwig Bar coarser material will be transported. Another machine is driving piles for the pipes to rest on later on. This work will now continue until stopped by the winter; I made a contract with Captain Clegg so as to be able to get a boat at any time on the river until the end of the season. I also examined the shore on the Pennsylvania side and found one specimen (71098); it was on a heap of gravel that was deposited a few years ago.

Sept. 7; I found today one specimen (71099) in a part of the Brunswick Avenue excavations where clay was found; it apparently has been artificially fractured and came from a depth of eight feet.

- Sept. 9; I visited the sewer excavation on Brunswick Avenue again and found in a deposit of whitish clay which had been thrown out of the trench two specimens, Nos. 1 (71100) and 2 of this date (71101, Plate cxxii, figs. 1, 2). They were six feet below the surface and their fractures are very interesting; the excavation is now ten or twelve feet deep and on an elevated territory, overlooking the town.
- Sept. 17; I started out to go to the excavations in the river and went down along the New Jersey shore but could not get near the place where the material from Periwig Bar is deposited; there is an inland creek, broad and deep, that keeps one off and a boat is necessary; the row from Captain Clegg's wharf down the river to the place of deposit and back is too much for one man to accomplish and the place cannot be reached from the river side even at low water. I stopped at Professor Gill's place at the last lock and inquired how to reach the Long Bar as it is called; he said he had no boat to cross the stream to get to the place, but he advised me to ask Mr. George Mitchell at the lock above who had a boat at Professor's Landing; I did so on my way back, stopping at Mr. Mitchell's, being personally acquainted with him; I made a contract with him so that I could get a boat at any time I should call for it and then pay him at the end of the season; the place where the creek at Professor Gill's Landing enters the river is near the dumping ground from Periwig Bar. The rent of the boat was to be about twenty-five cents for a day.
- Sept. 21; A beautiful day; I started out to visit the gravel deposit at Long Bar; this is an island which is cut into three parts by two creeks; Duck Island is the middle one. It is difficult to get to the dumping ground from the main stream because the water is too shallow to float the boat, and the sand on the bottom is too loose to support a man. There is only one way and that is from the Long Bar itself; one must go down a creek, the same one that flows past Professor Gill's Landing until it strikes the bar at a place

opposite the dumping spot; then one must land, go ashore and cross the bar which is here about one half of a mile wide; these side creeks are the chief cause of the accumulation of so much gravel at the Periwig Bar; they divide the force of the stream and therefore the bar remains; it seems to be the intention to block up the beginning of the creeks with the material taken from the stream. A space possibly two hundred feet in diameter is used to deposit the gravel on. I made an examination of the deposit and found that the remains in the gravel are still modern; these products of civilization are old shoes, rubber shoes, parts of harness, white man's earthenware and porcelain, fragments of sawed boards, glass, coal, brick, cinders, iron bolts etc., with the usual gravel. The brick, coal and wood were found rounded off and looked like the pebbles, except for the brick which made a bright contrast in the deposit. Out of this "machine deposit" as I shall call it I made a collection of "modern gravel," brick, coal, wood, and cinder. I did not find any stones with artificial fractures in the gravel. I found the tibia of some animal, water-soaked like the roots and rootlets found here; it takes so long to get to the place that the days are short for watching the material.

Sept. 23; Rain all day, gently at first until about four in the afternoon when a terrible storm, a gale, blew up which uprooted trees, tore the roofs off of houses and did much damage in the southeastern part of the town.

Sept. 25; I visited the machine deposit on Long Bar and stayed all day; it is strange what a variety of things is thrown into the stream and if prehistoric man had had a source like this modern river gravel what a variety of materials he would have had for the manufacture of implements. The pesky tin can is now in the lead in the gravel and next comes coal, there must have been the wreck of a coal boat here at this spot in the past; the coal is in the form of black pebbles of all sizes. There are railroad spikes, bolts, screws, in short, every imaginable article, all worn with the process of being transported.

- Sept. 26; Another visit to the machine deposit produced the same result; I think that in a few days the work will have passed the newer deposit and will strike the older gravels which will then become more interesting.
- Sept. 27; I visited the sewer trenches on Brunswick Avenue again, and found in the clay specimen No. 1 of this date (71102). It was from a depth of from ten to fifteen feet and resembles the Indian hand-axe and older remains; it has apparently been chipped and water-worn afterwards.
- A sewer excavation on Princeton Avenue now in progress was also examined; there are about eight feet of yellowish clay mixed with gravel covering a gneiss-like rock that has to be dynamited in order to remove it; this is on the elevation that overlooks Trenton, commonly called Hillcrest and belongs to an old deposit called by the geologists Pensauken; the gravel mixed with the clay is of a uniform size, say from that of a base-ball to that of a hickory-nut.
- Oct. 1; I visited the machine deposits again; the material is now coarser but still no artificially fractured specimens could be found. It is interesting what not all is in the river bed below the city; this is really a satisfactory way of deepening the channel, putting the material out of the way and just where it is wanted most.
- Oct. 3; I visited the machine deposit on the river shore now near the head of Duck Island; this place is of easy approach and can be reached without a boat while the other lower down must be reached by way of the back creek and a boat; the gravel here is coarse and old; no modern gravel is in evidence; I found one white quartz pebble, No. 1 of this date (71104) which shows interesting fractures but which had been very much bruised coming through the iron pipes.
- Oct. 5; I visited the same deposit again. There are now three machines working in the river and throwing gravel on the New Jersey side; one at the head of Duck Island, one at Long Bar and one below that. The deposit at the

head of Duck Island has shut off the creek effectually; this place is easily reached through the Buttonwoods and here I made an examination; I found the gravel to be pure with no admixture of other material; the boulders are of a large size, varying from that of a man's head to that of a base-ball and much sand is intermingled. Specimen No. 1 (71105) is an argillite with natural fractures resembling chipping and then water-worn. It shows plainly that all the flaked faces are of the same date, as all are water-worn alike; there are a few new bruises made during its forced journey of half a mile through the iron pipes. The stone is about eight and one half inches long, nearly five inches wide and two and a half inches thick in the middle, tapering each way. Specimen No. 2 (71106) is similar to the "hand-axe"; it shows water wearing to a less degree than the preceding; it is also of argillite. There are many small slabs of argillite in the deposit along with boulders of the same material of various shapes. They show the fractures due to natural cleavage and to accidental percussion; also the marks of frost and of disintegration. I chipped one of these naturally fractured flat slabs in order to show that the apparent "hand-axe" is artificially fractured. This specimen with my chipping is No. 3 of this date (71107). No. 4 (71108) was a naturally fractured argillite slab or flat pebble which had probably been detached originally by frost. No. 5 (71109) was thinner than the preceding, shows disintegration, the action of frost, etc.; it is also of argillite. The day was perfect and I examined the immense amount of gravel that is spread for a mile along the New Jersey shore; many of the pebbles were badly bruised during their transit, through coming in contact with the iron pipes and with each other.

Oct. 9; I visited the machine deposit again and while I was there the machine, the middle one stopped for some repairs and I was enabled to make an examination of the fresh deposit still wet on the shore; I found four specimens, No. 1, 2, 3, and 4 of this date (71110, 71111,

71112 and 71113); they are respectively: a white quartz, possibly artificially shaped before wearing, a pebble with fractures made by percussion whether natural or artificial I have not yet determined, an argillite showing the results of sun-cracking while in the form of clay and last a naturally fractured argillite pebble, water-worn.

The uppermost of the three machines now working in the river is nearly opposite Lacey's Ferry. In digging the channel it strikes the clay, both gray and red that is found of a similar character eight feet or less deep in the rear of McKinley Hospital in the highest part of Trenton, very much higher than the bottom of the river bed now struck by the machine; the clay was struck by steam shovels in the river near this place before; I noted it at the time a few years ago; the suction in the pipes works to such perfection that the clay after having been loosened by the shovel is transported and thrown on the shore with the gravel in great lumps; the specimens found in the clay are mostly white quartz, which I have found in almost all the excavations on shore when they were deep enough to reach the clay.

Oct. 11; The lower end of the machine deposit was visited today. An immense amount of material is thrown out of which I examined the surface, which is all new; there is a great variety of rock, but no specimen of particular interest was found today. A shower came up and reached me before I got far away and I got a thorough drenching.

Oct. 12; A visit to the sand pits was made today, Cox's, Malloy's, Haas' and Ahrendt's; I worked with the trowel in Cox's on the west side where the yellow soil had been disturbed near the surface, finding nothing I made a second attempt later and discovered a cache of argillite implements (71120). There were eleven in all (Plate LXIII) lying lengthwise in contact four pointing west and seven pointing east; nothing else was found with them and the soil was not disturbed underneath; the cache was nineteen inches below the present surface and the disturbance, which was probably due to tree growth was

eleven inches in diameter; there must have been a large tree or more than one tree formerly growing here as in the yellow loam were several traces of roots some three inches in diameter.

Oct. 15; I visited the water-main excavation in Broad Street Park, also cellar excavations; the yellow loam is in many places five feet thick and more and rests on a fine sand and gravel; the red bands are often visible.

I found a large argillite flake, specimen 1 of this date (71115). It lay in the black soil and had apparently been altered or shaped by prehistoric man for an implement; it bore signs of having been struck once or more times by the plough.

Oct. 17; I visited the machine deposit; there is now an immense amount of gravel on the Delaware shore and the inlet to the creek which separated Duck Island from the shore, that is the upper end of it, is now nearly closed up with gravel. The large amount of clay that is dug out of the bottom of the river and mixed with the gravel is now dry and hard; where the water has rolled it the lumps have become round and hard like pebbles in a shorter time than any one would have supposed, only twelve days; now the appearance of the clay nodules in the sand in Ahrendt's and other sand pits does not seem so out of the way, after we have seen how they are produced. Gravels and sand harden and adhere to these lumps of clay and seem to have been there on the river shore for centuries.

I examined the surface of the gravel and found quantities of argillite pebbles with various natural fractures and new ones caused by the transportation through the twenty-inch pipe, but I could not find any artificial specimens. The bar is there still but the middle machine is at the south end of it and will soon strike the foundation of it. I sprained my ankle on the way home; I stepped into a hole in the Buttonwoods and could scarcely walk home.

Oct. 18 to Oct. 21; I was unable to walk.

- Oct. 22; The swelling is down but the ankle is weak; however, I managed to go to the sand pits, but got no specimens.
- Oct. 23; I visited the machine deposits; the creek at the head of Duck Island is now closed and the Island can be reached without a boat, but not the Long Bar. I searched the gravel which is now about five hundred feet long and two hundred feet wide but found nothing of interest.
- Oct. 24; I visited the lower deposit at Long Bar; it is over a mile and a half long and several hundred feet wide; I made a search over a part of the surface of it today and found specimen No. 1 of this date (71116); it was of black chert with apparent chipping, on one side only; there are here a large number of huge argillite boulders, some of them recently fractured by the passage through the different pipes; the gravel is here in general much finer and smaller than above, despite the presence of the huge boulders.
- Oct. 30; I visited the machine deposit on the river shore; the water was very high on account of the recent rains and so I could examine only a small lot of the gravel as the water was up over most of it. I found one specimen (71117); it was a chipped argillite of the "hand-axe" type, but very small, the size of a hen's egg. I also visited the lower gravel but could only examine the upper part of it as the rest was under water; the gravel will be a source of interest all winter if the water does not rise too high and the snow keeps off. The machines are working away every hour day and night.
- Nov. 7; I visited the machine deposits today but found no specimens. The stretch of alluvial deposit called Long Bar has fine sand for its foundation and the river has encroached continuously on this, its left-hand or eastern shore, and washed away hundreds of yards of rich land all planted in horse-radish; now, the middle and lower machines have thrown the gravel here and protected the land from further washing away; there are nearly two miles and a half of this but most of it is under water as the river is higher than at any time since last spring.

- Nov. 11; I was sick and could not go out, but packed specimens; box No. 1 contains specimens from the cache in a cellar excavation in Broad Street Park of which I received notice from a friend; I went there and dug out of the loose soil that was thrown out, the cache and all the specimens yet remaining; the other specimens were in the possession of the contractor from whom I got them; the men said they were all in a pit about two feet in diameter and two feet below the surface; they took them to be broken slate. In the box are all these specimens, jasper knives 71121 (Plate cxxi), nearly all of the same shape, fifty-seven whole ones and pieces of seven others.
- Nov. 12; I visited the river shore although the river is still high. I found one specimen at the head of Duck Island, apparently in old gravel where the wash of the machine had exposed it; it was of argillite on which the artificial chipping was evident and plain, No. 1 of this date.
- Nov. 13; I went to the lower end of Long Bar and had difficulty in crossing as the water is still very high and had been all over the Buttonwoods. There were no specimens today.
- Nov. 16; I visited the upper portion of the machine deposits and proceeded down on the western side of Duck Island. I found one specimen, No. 1 of this date, an argillite, much water-worn.
- Dec. 10; I went to the river shore and found the water very high, running over the Buttonwoods; the gravel cannot be seen at all.
- P. S. The gravels thrown out on the shore and the New Jersey side of the river Delaware during the late summer and the fall of the season of 1907 could not be fully explored on account of the stream rising to a very high level due to the excessive rains. Consequently the results of the study of these gravels, although very gratifying and encouraging in regard to the significance of the finds that had been made, are still meagre and it is hoped that another season be granted to the undersigned so that he may be able fully to investigate all the gravel deposited and dug out of the bed of the stream and Periwig Bar.

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- Jan. 2, 1908; visited some sewer diggings on Liberty Street but found no specimens.
- Jan. 3 and 4; Rain.
- Jan. 5; Sunday.
- Jan. 6; Began to write notes; it got too cold for excavations; the sewer people gave up operations.
- Jan. 7; Rain all day; wrote notes, that is, copied my diary.
- Jan. 8; Visited the gravel on the river shore; the water is very high and not much gravel is visible; found no specimens.
- Jan. 9; Visited the sewer trench on Liberty Street; this is a long trench, but all clear sand; hardly ever a stone is found in the south end of it; no specimens found today.
- Jan. 10; Visited the fields on the bluff from Lalor's to Broad Street Park, while there was no snow on the ground; found nothing of importance.
- Jan. 11; Visited all the sand pits and excavations at Deutzville; in Mr. Ahrendt's pit, the last one to the west, I found a chipped argillite (80589) in the talus, but could not say how deep it had been originally; no other specimen found today.
- Jan. 12; Sunday.
- Jan. 13; Rain; wrote notes today.
- Jan. 14; Went to the river shore; the water is still very high and little of the excavated gravel is visible; the new bank thrown there by the excavators last summer, which connected Duck Island with the Buttonwoods, has been broken through again by the stream and once more Duck Island is island; found no specimens today.
- Jan. 15; Rain.
- Jan. 16; Visited all the sand pits today beginning at Cox's, which is in a bad condition; all the sides and the top have caved in and the yellow loam has fallen over the rest; no specimens here; went to the Wayman pit, to Malloy's, the Haas pit and Mr. Ahrendt's pit, but found no specimens.

- Jan. 17; Stormy.
- Jan. 18; Did not go out today; had an errand in town.
- Jan. 19; Sunday.
- Jan. 20; Visited the sand pits; there was only a little frost during the night, but no sand having been dug for some time the pits had caved in; this was the case at Malloy's; there was nothing of interest found.
- Jan. 21; Could not go out, was sick.
- Jan. 22; Still sick.
- Jan. 23 to 28; Wrote notes; sent them to Professor Putnam on the 28 of this month.
- Jan. 29 to 31; Still sick; could not go out.
- Feb. 1; Visited the river shore again and tried to reach the dump-gravel but the water was too high, even over the Buttonwoods; visited Mr. Ahrendt's pits on my way back, but nothing of interest was found today.
- Feb. 2; Sunday.
- Feb. 3; Snow; unable to go out; I believe I shall get La Grippe.
- Feb. 4 to 17; Sick and could not go out; the weather was very bad anyhow, and had I been well I could not have gone out on account of it.
- Feb. 18; River very high; 9 feet above its usual level in winter; the sand pits badly caved in.
- Feb. 19; Snow storm, but not much of it remained.
- Feb. 20; Had an outing to an excavation near St. Mary's Cemetery; worked with a pick which was left there by the workers, but found no specimens.
- Feb. 21; Visited the same place and made a thorough exploration in the Columbian deposit, but found nothing of interest.
- Feb. 22 and 23; Snow and rain.
- Feb. 24; Rain again; could not go out.
- Feb. 25; Visited all the sand pits at Deutzville, but no specimens were found.
- Feb. 26; Tried to get to the gravel on the river shore, but there was too much water; could not cross the Buttonwoods.
- Feb. 27 to 29; Rain, bad weather.
- March 1; Sunday.

- March 2; Visited the sand pits and the fields on the terrace, but found no specimens.
- March 3; River is still very high and the gravel could not be reached; even the flats and the Buttonwoods are partly submerged.
- March 4; Visited an excavation in East Trenton, also one on Perry Street but found no specimens.
- March 5; Examined the digging at Perry Street Crossing; the Columbia deposit was struck here at a depth of 20 feet and soon after a blue clay was struck; this is the deposit met with at the head of the town, also in the meadows south of the city. I examined the different ditches that were dug here and found the clay uniform as far as the digging went; it is a good chance to study that clay which carries water-worn pebbles; I picked one up which was in the yellow near the blue clay about 15 to 20 feet below the original surface which is here very much disturbed, however, as the canal was dug into this deposit about 80 years ago; the canal bed was made wider here and thus the undisturbed stratum was struck on the west side and afforded an excellent view. The specimen is an interesting one. [80594, argillite, fractured and water-worn.]
- March 6; Snow storm; unfit for out-door work.
- March 7; Was not well and could not go out.
- March 8; Sunday.
- March 9; Weather bad and I could not go out.
- March 10 to 15; Weather still bad but the work at the Perry Street bridge is still going on and so I visited there daily, but found nothing of interest.
- March 16; Visited all the sand pits but found no specimens.
- March 17 to 19; Weather bad, but I visited the river shore; the water was still higher than I expected and I could not see the gravel.
- March 20; Went to New York and stayed with my friend there until the 23d.
- March 25; Visited all the sand pits: Cox's, Malloy's, Wayman's, Haas' old pit; found on the surface in Wayman's field

a chipped pebble (80578) and two knives (80576,77), one finished and complete, the other perhaps a failure; also found a chipped argillite in Haas' pit in the talus: specimen "a" of this date (80575).

March 26; Visited the sewer excavation on Liberty Street and examined the deposit, which is mostly sand; there is a stratum of small sized pebbles about three feet thick nearly four feet below the original surface; below this gravel is sand; found no specimen.

March 27; Another trip to the river was in vain as the water is still too high; watched the excavation in South Trenton in very rough material, but found nothing of interest.

March 28; Several cellar excavations in Broad Street Park were watched today but nothing new was found; it is very hard here to find a pebble in the deposit, nothing but sand.

March 29; Sunday.

March 30; Visited Millham; there were several cellar excavations here of which I examined the deposit; it is that peculiar gravel near the surface that I have called in my former notes the Assanpink Valley gravel. I passed through Wilbur, another new part of the city, which territory lies to the northeast of Trenton and shows gravel on the surface; this is of the same kind as that at the railroad cutting south of the city and in both places about four feet thick. I found no specimens today.

March 31; Rain; did not go out.

April 1; Visited all the sand pits today but found nothing of interest.

April 2 to 5; Could not go out; could not walk.

April 6; Started out again and visited all the sand pits; found several specimens of chipped argillite (80579) in Wayman's pit in the talus.

April 7; Visited the river shore; the water is still very high. I followed the river down to the Buttonwoods; the water had washed away great quantities of rich soil, leaving nothing but gravel; the gravel which was thrown out by the diggers last summer is still under water. (These

excavations removed the deposits of Periwg Bar and were the object of numerous visits in the summer of 1907). I could not examine it as yet. I went across the horse-radish field and over the lock to Deutzville, and examined a cellar excavation there and also one in South Trenton, on Third Street, but found no specimens. Mr. Ahrendt's pit is in operation and a straight wall of sand is in view.

April 8; Rain.

April 9; Rain in the forenoon; in the afternoon I examined a sewer trench in Liberty Street, but found nothing.

April 10 and 11; Rain.

April 12; Sunday.

April 13; Visited all the sand pits, but found no specimens.

April 14; Visited the river shore and Duck Island and made a search of the gravel which was thrown out last fall and which could not be examined before on account of high water. The river is gradually getting lower and has exposed a lot of gravel on Duck Island. The usual specimens showing the water wearing were found (white man's refuse, and the modern gravel) but no artificially fractured rock. I made a clear search of the gravel on Duck Island, but did not go below; however, I hope to do so soon as the water gets lower. The Buttonwoods are getting under cultivation now and as they are entirely an alluvial deposit they show no specimens whatever; I made a search over the fresh ploughed land today but found nothing but white man's material.

April 15; Started out to examine sewer trenches today but a rain storm drove me home at ten o'clock; it rained the rest of the day.

April 16; Visited all the sand pits, beginning with Cox's, then Wayman's, Malloy's, Haas', and finally Ahrendt's; they are all at Deutzville; I found nothing of interest.

April 17; Visited the sewer excavation on Liberty Street; I found now that the deposit has changed as the excavations have advanced towards the northeast; we find here a heavy yellow loam which, however, carries more clay than that on the terrace to the south of the city; it is

from four to six feet deep and instead of the underlying sand we find a gravel resembling the Columbian except for the absence of limonite, which thus far I have failed to find here; the depth of the stratum of gravel cannot be judged as the trench is only about twelve feet deep, penetrating the gravel about six feet. I found one specimen of interest, No. 1 of this date (80548); it is a pebble apparently of sandstone looking as if it had been fractured by fire; it is not unlike those found in the railroad cut some years ago; it came from eight feet down in the gravel.

April 18; Rain.

April 19; Sunday.

April 20; Went to all the sand pits; Cox's has not been operated of late; at Ahrendt's a rain storm came up and stopped all further exploration for the day.

April 21; Visited the gravel on the river shore; Duck Island and Long Bar; the water is still very high, but some gravel is exposed and I examined what I could reach, but found nothing of interest.

April 22; Visited several excavations for water pipe and cellars in South Trenton, also on Princeton Avenue and Gallows Hill, but found nothing of interest.

April 23; Went to Millham where there are several water pipe excavations; the gravel is small and of that kind peculiar to the Assanpink Valley; found nothing today.

April 24; Visited the sewer excavations on Liberty Street again; the trench is still making progress into that strongly oxidized deposit known as the Columbian gravel and its constituents; the white quartz, granite and other material. There are many broken pebbles in the gravel presenting surfaces comparatively fresh; only natural fractures were observed; found a large boulder of yellow jasper, but none artificially fractured; the excavations are continued here.

April 25; Did not go out today; did not feel well.

April 26; Sunday.

April 27; Visited all the sand pits and some cellar excavations in South Trenton.

April 28; Visited the Pennsylvania shore of the Delaware River from above the Calhoun Street Bridge to Yardley, Pennsylvania; when near this place examining a field a storm came up; although I waited under shelter several hours it did not let up and finally I started for home.

April 29; Visited the New Jersey shore of the Delaware River below Riverview Cemetery and along Duck Island and searched the gravel for specimens and away below, two miles below Duck Island, I found five specimens at the very lowest end of the gravel dump; four are white quartz and one is black chert; all are very interesting; one shows glacial striae and all are from the gravel excavated out of the bottom of the river by the machine and dumped here on the New Jersey shore.

No. 1, a very interesting specimen shows age and glacial striae, and is of white quartz; No 2 is much bruised but at least on one side it looks like artificial shaping; it is also of white quartz; No. 3 resembles the butt end of a rude implement, it is of black chert; No. 4 of white quartz presents one side plainly recently artificially fractured, the surface being perhaps of later date than that of the other side; No. 5 shows what are apparently glacial striae, but no traces of artificial fracturing (80557, 8, 9, 60, 61).

April 30; Visited the sewer excavation on Liberty Street; the top deposit here is now a yellow loam five feet thick and similar to that found on the terrace; this rests on a mixture of the Columbian and the later gravels, a combination occasionally found in the sand pits between the strata of sand; especially in Haas' sand pit; it is a gravel that presents different faces, possibly of different epochs; it is very clean and apparently more friable than the other. One specimen of white quartz was found (80549); it looks like the butt end of an implement of rude shape or make; it was found twelve feet below the present surface in a stratum of gravel that runs still deeper, but of which only sixteen feet are excavated; rain stopped further work in the trench; it came down in torrents;

a thorough search of the material thrown out up to the point or end of the trench had already been made.

May 1; Too wet and stormy to go out; thermometer down to 42.

May 2; Rain and storm.

May 3; Sunday.

May 4; Visited all the sand pits, also South Trenton to see a cellar excavation there, also the railroad cut, but found no specimens.

May 5; Visited the river shore on the Pennsylvania side above the Calhoun Street Bridge towards Yardley. I found several old hearths ten to twelve feet below the old shore of the Delaware River that had been exposed by wash-outs. I dug out these hearths with the trowel and found burnt stone, mostly quartzite, together with a few chips of black chert and a fragment of red shale chipped; charcoal was also found, but very fine and dust-like. Specimen A (80608) of this date was found in one of the hearths explored. They were freshly exposed by the high water washing away the bank, the river being constantly pushed away from the New Jersey shore by the numerous factories and the made land resulting from the dumping into the water of the refuse from these establishments.

May 6; Storm again today.

May 7 and 8; Had rain from sundown, May 6 up to this evening; terrible rain, not fit for outing.

May 9; Visited the sand pits again, Cox's first, Wayman's, Malloy's, Haas', and Ahrendt's; made a search with the trowel everywhere where it was possible, but found no specimens.

May 10; Sunday.

May 11; Visited the sand pits again, and then went over the freshly ploughed fields of Deutzville and the vicinity, also on the terrace; found one specimen on the surface (80571).

May 12 and 13; Not well, could not go out.

May 14; Visited the sewer excavation on Liberty Street again; the work has now reached a point on Liberty Street,

near Melrose Street, about three quarters of a mile north of South Clinton Avenue; the yellow loam is here four feet thick underlying nine inches of black soil; it fades on the bottom into a light colored sand resembling that exposed in the deposit in Malloy's sand pit in Deutzville on the terrace; the sand is about two feet thick and presents the red bands in the same manner as on the terrace south of Trenton. This deposit gradually merges into strongly oxidized sand and gravel (the Columbian). Two specimens were found about eight feet down at the bottom of the yellow loam and lighter colored sand, where the Columbian deposit begins. These (80551, 80552) are of granite and white quartz respectively; the former appears to show chipping while the latter presents a very interesting cutting edge.

May 15 and 16; Rain.

May 17; Sunday.

May 18; Visited all the sand pits, Cox's first and there found a peculiar natural specimen (80574). It lay in the talus about 11 feet from the surface and had apparently been dug out and tossed about with the sand; its correct location could not be made out; walked over the freshly ploughed fields on the terrace, but found only a few chips.

May 19; Visited the sewer trenches on Liberty Street and also one on a side street running east and west about half a mile west of Liberty Street which itself runs north and south; the Liberty Street excavation is not in operation on account of the rain; I found one specimen (No. 1 of this date); it was on the top of the heap and from a depth of from ten to twelve feet, as far as could be ascertained. It showed very interesting water-worn fractures. The deposit in the side street is much finer, nearly all sand with iron oxide, pebbles being very scarce; I found nothing today in this sewer trench although it is open for nearly half a mile.

May 20, 21 and 22; Rain.

May 23; Visited all the sewer excavations again, but nothing new turned up.

May 24; Sunday.

May 25; Visited the fields east of St. Mary's Cemetery; here is a large area of new fields, recently ploughed up; made a search over these fields and found them largely composed of Columbian gravel; the surface presents many interesting characteristics in the study of this deposit, but I found no specimens.

May 26; Visited all the sand pits but found no specimens.

May 27; I made a trip up the river on the Pennsylvania side; there is still much water coming down which even covers the grass on the shore and very little gravel is visible. I searched the shore where I formerly found several workshops and an abundance of argillite chips near the Yardleyville railroad bridge and I found some workshops newly exposed from six inches to two feet below the present surface; found several specimens and the hammer stones which had apparently been used here in the manufacture of implements (see the workshop specimens of this date, 80609). One of these, twelve inches below the surface was exposed by digging away a lot of the loam; there were also chips of argillite, quartzite pebbles broken by fire and burnt stone. The hammerstones are similar to those found in a trap workshop at Point Pleasant in 1891. In the same bank and about forty feet to the south I found in a washout a single specimen (80610). The river bank is here about forty feet high and the specimen was sticking in the loam about three feet down. The day was very hot and the walk was long; it was late when I reached the bridge on the way home.

May 28; Visited the sewer digging on Liberty Street and the vicinity, but found no specimens.

May 29; Was not well; did not go out.

May 30; Decoration Day.

May 31; Sunday.

June 1; Visited the New Jersey shore of the River, but found the water still too high below Trenton; came over the Buttonwoods to the lock and went over the terrace to Broad Street Park but found no specimens.

- June 2; Visited all the sand pits; Mr. Ahrendt showed me a stone which he found in the sand pit but it showed no marks of man's work.
- June 3; Went to the sewer excavation on Liberty Street and the neighborhood; in the trench at present three feet down is a stratum ten inches thick of ash colored sand containing very few pebbles; I worked in the sewer excavation with the trowel in a thin stratum of small pebbles, but this soon gave out as the trench proceeded westward.
- June 4; A stroll over the fields near Broad Street Park and White Horse and below was rewarded with several chipped argillites but nothing else.
- June 5; A walk over the fields near Mercerville today; this is Columbia gravel and very interesting; a large area of land has lately been cultivated in this locality and there are numerous broken pebbles which present however only natural fractures; no specimens.
- June 6; Had an errand in town and could not go out.
- June 7; Sunday.
- June 8; Did not go out today.
- June 9; Visited the field near Yardley, Pa., near the river road; on the surface of this field turned up by the plough are large chips of argillite (80611), evidently the remains of a workshop, and numerous broken stones mostly quartzite pebbles broken by fracturing; I picked up several interesting specimens; the field is now in corn; further away from the river the specimens become fewer.
- June 10; Visited the sewer excavations on Liberty Street and the neighborhood but found no specimens.
- June 11; Visited the Pennsylvania shore of the river, but the water is still very high and no gravel could be seen; there were several cellar excavations which I examined; I found the gravel generally of a remarkable size but found no specimens.
- June 12; The sand pits were all visited today; towards the west is a large exposure more gravelly than usual; I made a diligent search here and the sand diggers are throwing all the stones of the size of an egg up to one side in a heap

where they can be carefully examined; the stratifications exposed here are truly magnificent and very instructive showing the actions of the turbulent waters between the plainly marked beds of the large ice deposits. There is here a deposit of gray clay four inches thick, tapering in thickness to the east and west but apparently running further southwards; its outlines are very much curved and twisted; I have often noticed the garland-like shapes of these clay patches and the graceful lines they produce; they are perhaps a prelude to the ice pits I have so often found and noted.

June 13; Sick; could not go out.

June 14; Sunday; still sick, and from the 15 to the 23 I could not walk.

June 24; Started out again, and visited a place in the woods, near the Girls' Industrial Home on the Scotch Road, where I had noticed some broken stone on one of my botanical outings of a Sunday morning last year; I found the place again, and using the trowel discovered a space 25 feet in diameter covered with quartzite pebbles broken by fire and by fracturing; these lay in contact to a depth of eight inches. There was nothing underneath but the virgin soil and though I worked the whole place over with the trowel I found no traces of implements, whole or broken, nor of charcoal.

June 25; I found in Mr. Ahrendt's sand pit, twenty feet down, a water-worn pebble filled with fossils of shells (80593); such specimens are rare here; I have found but one other like it, and that was last summer in the dump on the New Jersey shore. Then I went over a freshly ploughed field on the terrace, and found a chipped argillite (80581) near the buttonwood tree east of the Lalor homestead; several cellar excavations in Broad Street Park were also examined.

June 26; Made a trip to the Pennsylvania shore and began at the falls of the Delaware, where I found two specimens (80612) between the two bridges; the water is now considerably lower.

- June 27; I could not go out as I did not feel well.
- June 28; Sunday.
- June 29; Visited the sand pits, railroad cut and the terrace but found no specimens.
- June 30; Holiday, and the unveiling of the Roebling Monument to which I had a personal invitation.
- July 1; Visited several sewer excavations at Cadwallader Park, Hermitage Avenue, etc., but found nothing of interest.
- July 2; Was called to Court as a witness.
- July 3; Visited an excavation in Spring Lake Park, where sand is dug; I once photographed this site for the World's Fair at Chicago years ago, showing the much discussed red clay bands. Now large quantities of sand are taken out and used in the manufacture of artificial stone of which whole rows of houses are constructed in Broad Street Park. There is here, four feet below the surface in the yellow loam a large quartzite boulder four feet long and two feet thick.
- July 4 and 5; Too hot to go out.
- July 6; Visited all the sand pits today but found no specimens; the weather is still very hot.
- July 7; Visited the gravel bed in the river in the rear of the State-house; I found one specimen (80599) an argillite which was artificially chipped on one side.
- July 8; Went to all the sand pits. While I was working with the trowel in Haas' pit a large quantity of sand caved in and presented an entirely fresh exposure, which I thoroughly examined; there are really beautiful stratifications which should be seen by all who are interested; it is like a picture illustrating the work of the wind upon the shallow water recording every little wave-movement in the sand near the top of the pit; even the direction of the breeze can be noted; it seems like an open book of nature in which every child should be taught to read. No specimens today.
- July 9; Did not go out, having an errand up town which kept me busy all day.
- July 10; Visited Morrisville and several excavations and sewer-

diggings, examining the sand thrown out, but did not find any artificially fractured pebbles.

July 11; Visited sewer excavations on New York Avenue and elsewhere; this was near the MacKinley Hospital. In an old heap of clay thrown out last year of which the weather has washed away the top I found exposed five specimens of white quartz (Nos. 1, 2, 3, 4 and 5 of this date). No. 1 is a naturally fractured slab of white quartz recently broken at one end; nos. 2 and 3 are apparently artificially chipped, the latter much resembling the specimens of the Indian village sites; no. 4 is apparently an implement, water-worn, of which a part had been previously broken off (80553, 4 5, 6).

July 12; Sunday.

July 13; Visited a trench-digging for water pipes on Fair Street where a human bone was found; I will investigate.

July 14; I found the men who laid the pipes; they told me that they had found a human skull and some other bones but that they had buried them again; this was on Fair Street which runs parallel with the river.

July 15; I visited the neighborhood again; I was told by the older residents that in former years, when a certain firm was making excavations for one of their buildings human bones were discovered and were boxed up and again buried; they were found between Fair Street and the river, and were replaced close by. I was shown the place by a man who was a boy at the time. Another told me that time and again during cellar excavations in the vicinity, human bones had been discovered.

It is recorded that the first settlers were warned by the Indians not to settle here (at the Falls), as the water had several times washed away their own attempts at settlement. This place on the east of the Falls is lower than any other on the shore of the river north of the Falls and terrace, probably owing to the fault, the so-called "slip" in the rock. A clear demonstration of this was made when the excavations were made for the foundations of the stone piers of the new bridge built in 1902 by the

Pennsylvania Railroad; on the Pennsylvania side bed-rock was struck at a depth of twelve feet; it sank towards the middle of the stream and on the New Jersey side could not be found at a depth of eighty feet.

The deposit on top contains about two feet or less of white man's remains; that is, broken bricks, refuse from buildings and mills, etc; all this rests on a yellow loam, darker and apparently of a later date than that of the terrace, but otherwise not unlike it; I have found several of these deposits in South Trenton, always in a depression not much above the high water mark of the river. In the instance under discussion the thickness could not be determined as the excavation was not deep enough.

The yellow drift had apparently been chosen by the Indians as a burial ground, according to the finding of the bones; the men who told me about it said that the bones were found at the bottom of the trench which was four feet six inches deep; this would make the burials a little over two feet in the yellow loam; of course there is no means of knowing how much surface soil there was at the time of interment nor how much may have been taken away or added by the ever recurring washings of the stream.

July 16; Did not go out today as I had an errand in town and was detained until too late to make a trip.

July 17; Visited the river shore at the Buttonwoods finding no specimens; I returned over the lock to Deutzville and looked at the sand pits; a long exposure was visible several hundred feet in extent and fourteen feet deep; owing to a fault in the gravel the stratified sand had slipped down. There is also a fine exposure in Haas' sand pit where the bank is even higher than in Ahrendt's; no specimens were found today.

July 18; A trip to the Columbian gravels on Broad Street did not produce anything of interest.

July 19; Sunday.

July 20; Visited the river shore above the Calhoun Street Bridge on the New Jersey side; I went as far as the rubber mill and searched the gravel all the way down finding several

artificially fractured pieces of red sandstone, but these are evidently from the quarries near by. On the east of the Water Power is a long exposure dug into the gravel when this new part of the town was laid out which I did not examine thoroughly as night came on and time was short.

July 21; Rain.

July 22; Visited several cellar excavations in South Trenton and went to Deutzville, visiting all the sand pits; there is still a fresh exposure in the middle near the western end of Mr. Ahrendt's pit six feet deep; I found nothing.

July 23; Visited the road on the Water Power bank at Cadwallader Place, also a cellar excavation on Parkside Avenue; here a lot of argillite was dug up, four feet below the surface, probably a cache; some of the pieces are artificially fractured; I made a selection but I could not take it with me as a shower came up and I was forced to leave.

July 24; Visited this neighborhood again and picked out a series (80585) from the half-cartload of specimens that there was in all. I also examined the road cutting and the material spread out along the road but found no specimens of interest. I looked at the gravel in the cuttings of all the new roads of the vicinity; it is composed of pebbles from the size of a hickory or hazel nut to that of a man's fist down to a depth of six feet, below which the boulders appear. The cellar excavation on Parkside Avenue where the argillite was found is five feet deep with very large boulders on the bottom; over the gravel there is only a thin layer of top soil. I did not see the argillite in situ; the excavators had thrown it out; they pointed out the exact location, but whether it was in undisturbed soil or not could not be determined; it came from five feet in the gravel (Plate CII, fig. 2).

July 25; I did not go out today; I did not feel well.

July 26; Sunday.

July 27; Visited the cellar excavation again on Parkside Avenue, and the vicinity, but found nothing new.

- July 28; Visited all the sand pits but nothing whatever was found today.
- July 29; In the neighborhood of Cadwallader Park, east and south of it are large excavations, new streets being cut through an elevation of gravel; I made a thorough exploration of all these exposures of gravel, inch by inch, but found nothing new.
- July 30; I made a search in Hillcrest where they were laying water pipes and in the low land (the slope and edge of the elevation at Cadwallader Place), but found nothing.
- Aug. 1; Visited the excavations on the White Horse Road midway between the city and White Horse; the exposures here are in the Columbian gravel in the elevations that can be traced in a series for miles towards the north-east and against which rests the Trenton gravel. The Columbian is conspicuous for its intense rusty orange color and for the immense quantity of limonite (oxide of iron) which it carries; layers of this six to ten inches thick can be seen here broken up in the reddish sand, the whole being very compact. Having formerly found fine specimens of artificially fractured stone here, I made a diligent search, but found none. Another exposure in the sand on Cedar Lane in the rear of St. Mary's Cemetery was visited in the afternoon with the same result.
- Aug. 2; Sunday.
- Aug. 3; Took a trip to Morrisville, Pennsylvania, and visited several excavations but found no specimens.
- Aug. 4; Several excavations in South Trenton were visited today; at one of these I found where a large collection of white quartz pebbles had apparently existed; the whole had fallen and spread out afterwards; this is a strange phenomenon but I could discover no particular disturbance nor any artificial fractures nor any signs of man.
- Aug. 5 to Aug. 9; I was sick and could not go out.
- Aug. 10; Visited Deutzville and all the sand pits; I found in a ploughed field an interesting mortar stone of which apparently the plough had exposed one end; I carried the stone home (80540).
- Aug. 11 and Aug. 12; I was sick again.

- Aug. 13; Deutzville was visited; in one of Mr. Ahrendt's pits I found, twelve feet below the surface an interesting natural specimen (80587) with very fine fractures; the overlying deposits were all undisturbed stratified fine sand and very fine gravel all resting on the boulder bed composed of argillite and various materials from up the valley.
- Aug. 14; I took a trip to Millham to watch the sewer diggings; an interesting condition obtained here; the workmen uncovered a swamp six feet down; it has not been many years since the swamp was at the surface, perhaps not over forty but it is astonishing how quickly all the organic matter has decayed and the deposit changed to a black color; no specimens.
- Aug. 15; A trip to South Trenton brought out nothing new; a depression was struck by the excavators which contained that darker yellow loam of which I have spoken.
- Aug. 16; Sunday.
- Aug. 17; Rain.
- Aug. 18; Visited the gravel from the dump on the river shore and Duck Island; this region is now covered with dirt coming from the sewage of the cities above. I found a peculiar specimen, an argillite (No. 1 of this date 80562). I came back across the lock, visiting the sand pits in Deutzville, finding specimen No. 2 of this date in situ ten feet below the level of the surface; it seems however to present natural fractures only (80588).
- Aug. 19; I took a tramp along the river shore on the Pennsylvania side from the new railroad bridge down to the point; the water was slowly ebbing and was as low as I ever saw it. On the gravel which is now dry I found four interesting specimens; an argillite (80597), apparently chipped, an animal bone,¹ a piece of black chert (80598), apparently chipped, and a naturally fractured stone resembling a spear-head; these were all from the river bed two hundred feet out towards the middle. I visited a stretch of gravel along Morrisville Island, but found no specimens.

¹This is a metapodial of the domestic ox.

- Aug. 20; Visited all the sand pits but found no specimens.
- Aug. 21 and 22; I watched an excavation for a row of houses in South Trenton; the gravel is coarse, with very little sand about it; a large angular slab of argillite was dug out but it presented no artificial fractures.
- Aug. 23; Visited Millham where a trench four feet deep is dug for pipes; no specimens.
- Aug. 24; I took a trip along the Pennsylvania shore above Yardley where freshets have washed away a large quantity of material; what a change has here taken place, as well as lower down opposite the rolling mills where a new channel will soon be established, on account of the pushing west of the stream by the railroads and factories; I found no specimens.
- Aug. 25; Rain.
- Aug. 26; Rain.
- Aug. 27; Visited all the sand pits and took a walk over the terrace, but found no specimens.
- Aug. 28; I took a trip to Duck Island and Long Bar where the gravel was deposited by the dredger last year; it is now covered with a layer of mud from the river; this is probably due to the sewage above; I found no specimens.
- Aug. 29; Not being well this morning I did not go out.
- Aug. 30 and 31, and Sept. 1; Still not able to go out.
- Sept. 2; Feeling somewhat better I went out and visited all the sand pits but found no specimens.
- Sept. 3; I visited the new sand pit of Mr. Walsh, who leased the old farm house of A. K. Rowan and a stretch of land southeast of it for sand; I have the privilege of working there and of watching and of acquiring all the specimens found. I had long wished to explore here but could not get the permission; I had previously worked above and below, but here is a space that has not yet been touched. I found in this pit a few animal bones¹ near the surface and some argillite chips (80580).
- Sept. 4; I took a trip to Lawrence, going between the canal and the Assanpink Creek. I found the gravel the same as

¹ These bones proved to be of the domestic ox.

at Deutzville with decayed fossils similar to those in Mr. Ahrendt's sand pit. I found one specimen (80595) but it is doubtful whether the cavity it shows is artificial. This is the Assanpink Valley on the east side of Hillcrest and shows the course of the Deutzville gravel.

Sept. 5 to 30; I was sick with intermittent fever.

Oct. 1; I took a walk for the first time again going down to the sand pit of John Walsh near the old stone house built in 1708 by Isaac Watson and now two hundred years old. There is now a grand chance to lay out a trench if one had the money to excavate, for several places here have not been touched; no specimens.

Oct. 2 to 5; I was not well enough to go out.

Oct. 6; I tried it again today and visited all the sand pits in Deutzville; there has been much digging since my last visit and one can note the gravel that shows two faces, an older and a newer; the gravel that has once been at the surface somewhere is here four or five feet thick and is buried twelve feet deep. I found pebbles with fractures that resemble the results of fire action; I have found these before and often noted them, all from this neighborhood. (I have found several specimens in the old railroad cut not over 800 feet to the north). Specimens Nos. 1 and 2 of this date were found twelve feet below the surface in the above mentioned stratum (80590, 1).

Oct. 7; I went to the Pennsylvania shore and as the tide was high I went inland where they had been removing a large quantity of gravel to fill up a roadway at a distance; I examined the excavation but found no specimens.

Oct. 8; I felt too weak today to go out; I am not yet up to the mark having not fully recovered.

Oct. 9 to 11; I was unable to go out.

Oct. 12; I visited all the sand pits and several excavations at Broad Street Park and also on the north of Broad Street in the rear of St. Mary's Cemetery, but found no specimens.

Oct. 13; Visited all the sand pits, then went to the Buttonwoods along the river; no specimens.

- Oct. 14; I visited the sand pit of Mr. Walsh near the old stone house and worked there with the trowel; the red bands so much discussed are here visible and numerous. It is a pity that this vast territory now thrown open and not farmed cannot be explored. There is an immense quantity from the later Indian and earlier inhabitants that will all be lost to science if not taken charge of now; after the building of houses once takes place, it will be too late for scientific exploring.
- Oct. 15; I had a slight return of the fever and did not go out.
- Oct. 16; Feeling better; I started out to visit an excavation in South Trenton and also looked at the lot on Centre Street where is the large boulder which is figured in Dr. Abbott's "Primitive Industry." The place has been sold and buildings will be put on it; I am very anxious to see the part of the boulder in the ground and the deposit it rests on. The boulder has the "pot-hole" and is of a granite of a fine grain; it is split and broken, for some years ago a charge of powder was put in it with the result of a breakage on the northeast side and the detachment of five or six fragments; thus the boulder was lost for photographing.
- Oct. 17; I did not go out, not feeling well enough.
- Oct. 18; Sunday.
- Oct. 19; I visited Broad Street Park and the sand pits near the old house; no specimens were found.
- Oct. 20; I had to go to court as a witness in the morning; in the afternoon I visited the sand pits in Deutzville; there is a fine exposure here and as it is so near the railroad cut I am anxiously looking for bones; I found nothing today.
- Oct. 21; I visited the City Hall excavation for the first time as the digging only commenced yesterday; at present they are only taking out black surface soil; but soon deeper digging will be made; there are many teams working with scoops. I visited also the Centre Street lot where the big stone is, but there has been no digging done yet; neither has there been any done at Cass and Second Streets where a large Polish school is to be erected; their church is on Second Street close by.

- Oct. 22; I visited the City Hall excavation again; they have now reached the undisturbed soil; the yellow loam is twenty inches thick; below this a gravel of pebbles the size of a walnut to that of a man's fist and occasionally larger; I do not know how thick the gravel is yet as only four feet have been excavated on the back side.
- Oct. 23; I visited the same excavation again, but found nothing new.
- Oct. 24; I visited all the sand pits at Deutzville and some excavations at South Trenton, but found nothing new.
- Oct. 25; Sunday.
- Oct. 26; Rain all day.
- Oct. 27; It rained in the morning but cleared off in the afternoon. I visited the City Hall excavation but observed only made ground was being thrown out except at the back where they had struck the gravel; I examined this place, but found nothing of interest.
- Oct. 28 and 29; Rain.
- Oct. 30; I visited all the sand pits today, that is in the morning; in the afternoon I went to the City Hall excavation. I found at Mr. Ahrendt's sand pit this morning a fragment of white quartz (80506) which showed what were apparently natural fractures; there may be artificial shaping as two of the edges are apparently battered and afterwards sand-worn. There is here a beautiful exposure of sand in a straight wall nearly three hundred feet long and from twelve to fifteen feet thick; this rests upon the boulder bed from which the white quartz specimen came. Six specimens were here found from eight to ten inches down; as follows: a chipped argillite (80567) possibly rejected, two broken argillite implements, a chip (80568), a broken argillite implement (80569), and a jasper point (80570) showing the action of fire. A careful examination of the whole exposure of the sand and of the boulder bed wherever it could be studied revealed nothing more than the six and the specimen of white quartz.
- Oct. 31; I visited the City Hall excavation; they have now reached the strata of gravel that are usually found below

the yellow loam; here this is sometimes four feet thick and sometimes even six, resting on stratified sand; I have found the gravel at the railroad cut south of Trenton to be four feet thick, whereas east of this place it is only three feet thick and at Broad Street Park only two feet. There were no specimens today.

Nov. 1; Sunday.

Nov. 2; I had private business in town and did not visit any sand pits.

Nov. 3; Election day.

Nov. 4; I visited the City Hall excavation and watched the gravel and searched the dump heaps but found nothing new.

Nov. 5; I watched the City Hall excavation for a while, then went to a sewer-digging in the northeastern part of the town. Here mostly sand is found with once in a while pebbles chiefly of quartzite or white quartz; I found no specimens.

Nov. 6; I went to the sand pits and worked with the trowel until the afternoon, finding nothing of interest; I did some packing of specimens.

Nov. 7; I visited Centre Street and found that the excavations for cellars in the lot with the boulder had begun. The big boulder is five feet high on the northeast and eight feet high on the west; facing Centre Street the boulder measures eight feet long on the bottom; it is only two feet and one and one-half inches in the ground, that is, below the surface; it rests on yellow loam mixed with pebbles the size of a hen's egg or smaller. The yellow loam has here no level upper line of demarcation at all, the unevennesses in this are filled out by the black soil; the excavation exposed this in a line of fifty feet and showed that the black soil had a depth of from eighteen to thirty inches; this is plainly visible. The bottom of the big rock seems to be rounded off and worn; it has not yet been touched, but the intention is to break it with dynamite. I examine the gravel as it is excavated; the largest of the boulders found are of granite, gneiss,

argillite, red shale, triassic rock, mica schist, red sandstone, white quartz, black chert, red argillite, quartzite, etc. The great rock with the "bowl" is of a fine grained granite that is generally found in the case of well rounded large boulders in other excavations, notably a few years ago on Hermitage Avenue. No specimens thus far from here.

Nov. 8; Sunday.

Nov. 9; Further examination of the large boulder showed that on the southeast it was three feet below the surface and that it looks water-worn on one side; there is much heavy gravel mixed with the small and several large boulders under this "erratic block." One of these measures one foot square and nine inches in thickness; the workmen picked out the large boulders and threw them aside thus giving a chance for study. The City Hall excavation is making progress and is pushing into finer gravel than that on Centre Street; no specimens from either place today.

Nov. 10; I visited the big rock again on Centre Street. A blast was fired off last evening which, however, did not destroy the bowl, so another was made ready for today and this time the whole went to pieces; I secured two fragments of the bowl (80541). About fifteen feet to the northwest of the boulder a floor has been laid on the new ground, which is the bottom of the cellar excavation now five feet deep; on this they mix gravel with cement for the purpose of making concrete for the foundations. On the northwest side of this board floor an excavation nine to twelve inches in size was made into a finer gravel underlying the coarser; this they throw on the board floor to mix with the cement. Here in this new excavation I saw while standing there and watching the men, a specimen shoveled out and thrown upon the floor. I recognized its flaked face immediately, and picked it up (80542, argillite with natural fractures). It had evidently been struck by the pick in the hands of the man loosening the gravel before it was shoveled out. It had

lain in situ till I saw it shoveled out, from about five feet six inches to five feet nine inches below the surface in clear gravel, the finer stratum below the heavy boulders.

To go back to the great boulder, it was observed that it had a flat bottom with one corner rounded; the bowl faced west southwest and was not visible from the southeast. The large silver maple tree on Centre Street opposite the rock had sent a root right under the rock to gather nourishment from the yellow loam on which the rock was resting; it was about the diameter of a man's arm, branching out on both sides like a net; the loam being filled with pebbles the root fairly encased them; I took a part of it showing such encasement. The old land-mark is now gone, after marking the site for many a thousand years, an Italian quarry-man lit the fuse and a report like that of a cannon informed the neighborhood that the old erratic block was disturbed in its long rest and literally blown to pieces. Years ago a blast was put into the rock and fired with old-fashioned material (gun powder). Although it split the rock and fragments were thrown from the side to a distance of fifty feet yet the rock as a whole remained intact. Now all is gone; one more blast remained to put in the largest fragment before it all could be utilized in the construction of the cellar walls.

Nov. 11; I visited the site of the big boulder again and watched the diggings; the concrete is made in the middle of the excavation, as it was yesterday, and the work is going deeper; every variety of stone is found there now, but of smaller size than the overlying material which was found just beneath the yellow loam; no specimens today.

Nov. 12; I visited the City Hall excavation; there is still a large proportion of made ground thrown out and the digging goes in general only about six inches into the original deposit; I made a search at the rear of the excavation but no specimens have thus far been found.

Nov. 13; I visited the big stone place again today; the excavation is making deeper and deeper progress as the gravel is used in making concrete for the cellar walls; I watched

the operations all day; but no specimens were found. The weather is very cold and unpleasant now.

Nov. 14; Snow in the afternoon. The forenoon was spent at Deutzville where all the sand pits were visited, but no specimens found.

Nov. 15; Sunday.

Nov. 16 and 17; Too much snow on the ground; did not go out.

Nov. 18; Rain all day; I copied notes when the weather was too bad to go out.

Nov. 19; Snow almost all gone; I visited Deutzville and all the sand pits but found no specimens.

Nov. 20; I watched the excavation on Centre Street; the exact spot where the big boulder lay was dug away today and I found no stone artificially fractured under it; I examined the deposit in the excavation generally today and found two specimens. One of them was an argillite slab with casts of sun-cracks (80544). The other (80543) was a natural quartzite.

Nov. 21; Another visit was made to the big stone place on Centre Street; the gravel at a depth of 6 feet 10 inches now appears of a much finer character; the great stone is now all broken up and is used in making the front wall of the cellar. I watched the digging but found no specimens; there was a large boulder of argillite found nearly six feet below the surface measuring 24 inches long, 22 inches broad and 8 inches thick; it was smoothly water-worn, and covered all over with patina.

Nov. 22; Sunday.

Nov. 23; I visited the same place (the big rock place) again, and found specimens Nos. 1 and 2; they both lay six feet below the surface in undisturbed gravel; one was of argillite (80545) and the other of white quartz (80546). I visited also the City Hall excavation, but the workmen are still in made ground and the cutting seems to go no deeper.

Nov. 24; I visited the big rock excavation again today; I watched it all day, as this will soon be ended and the place built over; I found nothing of interest today.

- Nov. 25; The sand pits at Deutzville and the neighboring excavations were visited today but nothing of interest was found.
- Nov. 26; I was not well today and did not go out.
- Nov. 27 to 30; I was sick and could not walk and did not go out.
- Dec. 1; I visited the Centre Street excavation again today, but there are no new diggings; I also visited a cellar excavation on Landing Street near Centre Street but found no specimens.
- Dec. 2; I visited the sand pits and found no specimens; I had to return on account of pain and my old trouble; I could scarcely walk.
- Dec. 3 to 6; I was unable to go out (sick with the old trouble).
- Dec. 7; Rain.
- Dec. 8; I visited the sand pits in Deutzville but could find nothing of interest.
- Dec. 9; I was sick again with the old trouble and could not walk.
- Dec. 10; I felt somewhat better and started out to visit all the sand pits in Deutzville; no specimens today.
- Dec. 11; I was sick again with the same old trouble, and could not walk.
- Dec. 12 to 14; I was still unable to go to work.
- Dec. 15; I tried today to work again and examined the City Hall excavation, finding a very peculiar deposit on the south side: a stratum of large boulders some very much water-worn and some angular lay under a stratum of fine sand eight inches thick; the same thickness of fine sand lay under the boulders and this again was succeeded downward by a fifteen inch layer of coarser sand with distinct stratification; the yellow loam on top of all this is four feet thick. One boulder two feet long eighteen inches thick and twelve inches broad lay in a stratum of fine sand. I found one specimen today in an undisturbed stratum from six to ten feet below the original surface.
- Dec. 16; I visited all the sand pits in Deutzville, but nothing new was discovered.
- Dec. 17 and 18; Snow and rain; I wrote notes.
- Dec. 19; I visited all the sand pits and the other excavations near by; I found specimen (80564), an argillite with

probably artificial fractures, in the gravel twelve feet below disturbed soil.

Dec. 20; Sunday.

Dec. 21; It froze hard last night and now there is snow on the ground and the City Hall excavation is at a standstill.

Dec. 22 and 23; Colder, more snow.

Dec. 24; Snow and frost.

Dec. 25 to 29; I was out of town over the holidays.

Dec. 29; I visited a place on Broad Street opposite the residence of Mr. Frank Wright. The yellow loam identical with that in Lalor field and originally covering this triangular piece of land had been taken off by the trolley company to fill in with between the ties several years ago, leaving a clear exposure of Trenton gravel. I made a search in the excavation and also in the material thrown out and found it to be the old four feet thick stratum of gravel found lying near the surface in Deutzville; south and southeast of here however, it sinks to a depth of several feet and at the bluff of the bank it is ten to twelve feet beneath the surface; no specimens today.

Dec. 30; I visited the sand pits near Deutzville, but found no specimens.

Dec. 31; Weather better; I visited all the sand pits in Deutzville and surrounding places; Cox's pit has caved in much and by so doing has exposed a beautiful ice pit on the northeast side, similar to those found on Hancock Street in the sand pits there; I also visited South Trenton but no specimens were found today. After returning home I did some packing.

This ends the year 1908 and although I have not found many specimens, yet I have kept in touch with all the excavations around and about Trenton and in the city itself. The most interesting site geologically was that of the Centre Street excavation at the place of the big stone; this gave us additional evidence of the transportation of those great granite rocks on huge ice-rafts down the valley for hundreds of miles at a time when early man was in the Delaware Valley.

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- Jan. 2; I was informed that it was proposed to construct a sewer on Lalor Street from the Cemetery, through Lalor Street, under the Canal past St. John's Cemetery to Liberty Street; the work was to begin in a few days while there was no water in the canal. I was also informed that a sea-wall would be constructed on the New Jersey shore of the Delaware River, beginning at the sea-wall now standing near the pumping station, and extending down stream past the State House, thus making room for a proposed park back of the State House. Both of these will be excellent opportunities for searching for specimens.
- Jan. 3; Wrote my notes from my diary etc. from Jan. 1 to Dec. 31, 1908.
- Jan. 4; Wrote notes all day.
- Jan. 5; Wrote notes all day; terrible rain all day.
- Jan. 6-9; Wrote notes; did not go out as it was too cold.
- Jan. 10; Sunday.
- Jan. 11; Weather beautiful; I took a trip down Centre Street; The river is still very high; I went up Lalor Street, where the work on the sewer has not yet begun; I visited the Railroad cut, here all caved down; I visited all the sand pits but found no specimens today.
- Jan. 12-14; Wrote notes.
- Jan. 15; I visited all the sand pits, but found no specimens to-day.
- Jan. 16; Snow storm; I wrote notes, also on
- Jan. 17; Sunday.
- Jan. 18-23; Wrote notes.
- Jan. 24; Sunday.
- Jan. 25-27; I visited the new diggings at Canal and Lalor Streets. The excavations are still contained in the gravel that had been moved when the canal was dug; it is very interesting to study a historic deposit of gravel; it has been perhaps ninety years since the canal was made; the gravel has still that new mixed appearance which is

readily detected in all deposits recently disturbed. The men are now striking the original surface and will soon be below it. The contractor told me that just on the other side (east) of the canal the depth would average 21 feet for quite a stretch; an excellent chance for a search and a study of the deposit.

- Jan. 28-30; I visited the digging in the morning only; nothing new turned up as the men are still in the disturbed gravel of the railroad bank and the canal bank; the afternoon was spent in writing notes.
- Feb. 1; I visited all the sand pits in Deutzville and the vicinity; Mr. Ahrendt's pit was kept in operation, but the others were badly caved in; I found no new specimens to-day.
- Feb. 2; I visited the sewer trench on Lalor Street and watched the work, all is yet in the disturbed soil.
- Feb. 3; A snow storm sets in.
- Feb. 4-15; I was sick and very weak.
- Feb. 16; Rain storm.
- Feb. 17; Went out and visited the sand pits and sewer digging, staying all day; no specimens.
- Feb. 18-20; Visited the sewer diggings and the sand pits; no specimens. The frost has now stopped the excavations.
- Feb. 21; Sunday.
- Feb. 22; Washington's Birthday.
- Feb. 23 and 24; Rain; I wrote my notes.
- Feb. 25; I visited the sand pits and other diggings today, but found no specimens. A very interesting place in a cellar excavation in South Trenton came to light. It was a gigantic pocket of yellow loam probably even more extensive than is uncovered by this exposure; the color is much darker than that found at Lalor Field; there are some water-worn pebbles the size of a man's fist and larger, mixed with the loam, but not one showed any signs of artificial fracturing.
- Feb. 26 and 27; Too cold to go out; I wrote notes.
- Mar. 1; I visited the excavations at Cadwallader Place, West State Street and along the river road; no specimens.
- Mar. 2; Rain all day; wrote notes.

- Mar. 3; Wrote notes all day and finished them.
- Mar. 4; Snow storm.
- Mar. 5 and 6; Too cold to go 'out, a deep snow on the ground.
- Mar. 7; Sunday.
- Mar. 8; I started out but there was too much snow on the ground for observation.
- Mar. 9 and 10; Rain.
- Mar. 11; I went to all the sand pits and found them badly caved in. I made a search, but found no specimens.
- Mar. 12; I visited South Trenton and found an excavation there; no specimens. Then I went out West State Street and found an excavation in operation; I dug with my trowel a stratum of fine sand but found no specimens. The water is in the canal now.
- Mar. 13; Rain.
- Mar. 14; Sunday.
- Mar. 15; I was sick and could not go out.
- Mar. 16; I visited Broad Street Park and looked over the land. Many farmers are ploughing and the frost is all out of the ground, although there was last night a heavy frost, a white frost. One could open a trench here now; there is plenty of space available now; I walked over the ploughed field west of Broad Street Park but found nothing of interest. I visited numerous cellar excavations in progress in the southern part of the city.
- Mar. 17-19; Too cold and stormy to go out.
- Mar. 20; Rain.
- Mar. 21; Sunday.
- Mar. 22; Cold, but I started out to visit a lot of cellar excavations of which I was told in Millham; I made a search and examined them all but found no specimens.
- Mar. 23; I visited the sewer diggings near Lalor Street; it is interesting how fine and clean the sand and loam are, in the trench just below the so-called yellow loam; large sections contain no stones as large as an egg. A water worn boulder 28 inches by 24 inches and 11 inches thick was found just escaping the plough and 7 inches below the original and the present level of the terrace, this was of quartzite.

- Mar. 24; I visited Deutzville and all the sand pits there including Mr. Ahrendt's, in itself a series of pits. I stayed all day and watched the sand diggers in the different pits; also worked with the trowel; no specimens.
- Mar. 25; Rain all night and all day; I did not go out.
- Mar. 26; I visited the sewer excavation near Lalor Street; the material is still very fine without stone or gravel except that occasionally near the surface a large boulder is found.
- Mar. 27; I visited the sand pits and the surrounding territory on the terrace; the pits are gradually coming into operation again and new surfaces are made. I examined a lot of gravel and boulders thrown out into a heap by the diggers; there were all sizes from that of a base-ball to that of a man's head and the material represented the outcrops all the way up the valley of the Delaware, as far as New York State. I did not find any boulders with artificial fractures.
- Mar. 28; Sunday.
- Mar. 29; I visited the new City Hall site where a lot of gravel was dumped last winter, now in process of being dug down and carted away. I examined the gravel as it was shoveled and found specimen No. 1 of this date (80565); another, an argillite found in the same heap shows interesting fractures; this is No. 2 of this date (80566). This gravel was found very deep down at the excavations of those gigantic trenches for piers in the centre and it was hoisted out by machines.
- Mar. 30; I visited several excavations on West State Street and made a search there; they faced the shore of the Delaware River; there was but little loam and the gravel came to within six inches of the surface; I examined the walls and the floor of the large excavations but found no specimens.
- Mar. 31; I did not go out today as my left knee was badly swollen; I injured it yesterday on a rock in the excavations.
- April 1; Much better; I started out to Deutzville and all the

sand pits but made no finds; I went home early as my knee became painful.

April 2; The sand pits of yesterday were visited again; there are several new ones and I watched them closely, but did not find anything; I informed the sand diggers about the search here for years for bone fragments and chipped stones, and left my address with them.

April 3; I visited all the excavations in Broad Street Park and on its opposite side, on the northeast of the White Horse Road, where quite a village is slowly building up. A rain storm setting in at noon, I went home.

April 4-11; I could not leave the house on account of being sick.

April 12; I started out again and visited all the sand pits and the surrounding territory, but found no specimens.

April 14; Rain.

April 15; Rain in the forenoon; afternoon fine. I visited the sewer excavation on Lalor Street near the river west of Warren Street. The gravel now thrown out is of medium size and is covered with a stratum of sand six feet thick in some places; I found no specimens today.

April 16; I visited the same place again and stayed nearly all day; I watched the throwing out of the gravel, which is done by machinery, by means of a steam derrick. I found one specimen on top of an old heap of gravel thrown out just before the last rain; it showed a fine chipping on the edge (80527); I do not know how deep down it had been, but it lay on top of the heap and the trench was nearly fifteen feet deep in the place the specimen came from. [Probably natural fractures, resembling secondary chipping.]

April 17; I watched the same trench but found no specimen.

April 18; Sunday.

April 19; I visited the sewer excavation again where there is slow progress with the steam shovel; I watched the material and also the filling on the river shore (Lamberton Street) where the gravel is very coarse and contains various kinds of rock. About two hundred feet east of the stream the excavators found a fine sand which when

wet is a regular mud; this sand was not over four feet thick and not a pebble was to be found in it. No specimens today.

April 20 and 21; Continuous rain.

April 22; I visited the sewer trench again and although I watched all day I saw no specimens.

April 23; I visited all the sand pits including the new one which was very interesting as the excavations went so deep; a beautiful cross-bedding appeared on the wall or bank and the thin bands of red are so well illustrated that no one would take them for other than a water deposit; no specimens.

April 25; Sunday.

April 26; I visited a cellar excavation on Academy Street and another on State Street; both show the yellow loam on top of the gravel but it is here full of small pebbles the size varying from that of a man's fist to that of a bird's egg. This alternates with a stratum of coarse sharp sand and then again with coarser gravel; the sand is several feet thick. No specimens.

April 27; I visited all the sand pits, and found in Ahrendt's pit in the sand that was thrown out specimen No. 1 of this date. Of course I could not tell how deep down it had been, but the layer of sand that they were excavating and selling lay six feet below the surface and is coarse with an intermixture of yellow loam and black soil.

April 28; I visited the sewer excavation on Lalor Street; the gravel thrown out was becoming very coarse at a certain depth; a considerable quantity of argillite was found among the pebbles, but, strange to say it is not much worn in comparison; is it possible that it was brought down on ice floes and then that it broke up on arrival? It seemed the only solution. I visited a cellar excavation just south of the schoolhouse in Deutzville, that was only about three feet deep. The gravel is here close to the surface and even at this shallow depth it is struck. A considerable quantity of yellow loam has at some time been removed, probably before the Delaware

River succeeded in cutting its bed to its present level; there is here plainly visible the trace of a surface flow that existed before the little stream called Crow Creek began to cut its bed to its present level just below at the railroad cut. No specimens.

April 29; Rain storm and very cold; I felt bad.

April 30; I could not go out; I was sick with the grip.

May 1-4; I was still unable to go out.

May 5; I took a trip to the excavations now in progress at Second and Cass Streets; the gravel seemed less coarse than that heretofore found in this vicinity. I found an argillite boulder (80528) 6 feet below the surface in undisturbed gravel.

May 6; I visited the sewer-digging on Lalor Street and watched the material thrown out, finding no specimens.

May 7-9; I caught a heavy cold which settled on my lungs and I could not go out.

May 10; I was better and examined the material thrown out by the excavators on Lalor Street, but found no specimens.

May 11; I visited all the sand pits in Deutzville and made a search there, but found no specimens.

May 12; The sewer-digging in Lalor Street did not yield any specimens, neither did the several excavations I visited in the neighborhood.

May 13; I went to Broad Street Park over freshly ploughed fields and also watched the different excavations for cellars but found nothing of interest.

May 14; I heard that a meteorite had been found in his yard by a man digging in his land on Broad Street near Stanton Street; I found it to be a limestone boulder, two and one half feet deep, much decayed on the surface where it had been in contact with the yellow loam; I examined several excavations near Wright's farm but found no specimens.

May 15; I visited all the sand pits in Deutzville, but found no specimens.

May 16; Sunday.

May 17; I visited the sewer excavation and made a search with

the trowel; another sewer near Liberty Street and Lalor Street was also visited; very fine sand was here found with pebbles very rare.

May 18; I went to Millham and Hillcrest and examined several excavations but found nothing of interest.

May 19; Deutzville's sand pits did not show anything today.

May 20; The sewer excavations were visited but yielded nothing of interest.

May 21 and 22; Rain.

May 23; Sunday.

May 24; I visited the terrace, Broad Street Park and Deutzville; no specimens.

May 25 and 26; I spent these days in the sewer excavations working with the trowel wherever I could but finding no specimens.

May 27; I went to the northeast of Broad Street Park over fields and sand pits on Cedar Lane, but found no specimens.

May 28; I went to Morrisville, Pennsylvania, having heard of some excavations there; I examined several of them with the trowel, also some trenches that were made for waterpipes, but found nothing.

May 29; I went to Deutzville and the neighborhood but found no specimens.

May 30; Sunday.

May 31; Decoration Day.

June 1; I went to the sewer diggings and stayed there all day, but found no specimens.

June 2; Rain.

June 3; I visited the old house (A. K. Rowan's) and also asked Mr. Wiley and Mr. Rowan for permission to explore the land. This was given freely. Mr. Rowan told me that he would be eighty-one years old on the twenty-fifth day of August. I made everything ready for exploration.

June 4; Rain all day.

June 5; I bought the things necessary for exploration and got things ready for next week in anticipation of Mr. Merwin's arrival on the sixth of this month, according to Professor Putnam's information; he told me that Mr. Merwin would come to assist me this summer.

- June 6; Sunday. Mr. Merwin came and I conducted him to a boarding house on Broad Street.
- June 7; I began exploring by staking out a trench on the southwest side of the old building (slaughter house), twelve feet broad and twenty feet long. Of this Mr. Merwin took the western half and I the other, both working towards the south. We found the skeleton of a horse, badly decomposed that probably dated back to the former occupancy of the old house. In the general digging were found broken quartzite pebbles, stone implements and fragments of pottery.
- June 8; Worked all day in trench 1 and extended it sixteen feet southwest of the stake. We found pit 1, four feet in diameter and three feet deep, in which were quartzite pebbles broken by fire, flakes of argillite and a small fragment of pottery. In the general digging were quartzite pebbles broken by fire and by fracturing, and implements of argillite; nothing of interest so far. We made a two foot trial trench to the east but found nothing of interest; I have to feel my way here now and take the chances, for a while.
- June 9; Rain; we could not go to work for three days.
- June 12; Clear; we went to work in trench 1 and found pit 2, one and one half feet in diameter and depth, containing only a few quartzite pebbles broken by fire and a few chips of horn stone.
- June 13; Sunday; a visitor from Cambridge was here.
- June 14 and 15; Rain; we could not work.
- June 16 and 17; Found pit 3, a stone pit, two and one half feet in diameter and depth; the contents:
a few chips of argillite,
about one half bushel of quartzite pebbles of which
a few were broken, and all show the action of fire,
a small piece of mica,
a few fragments of pottery,
a few fragments of charcoal.
- The soil in the pit was dark but not black and shows the influence of fire.

Pit 4 was found near the edge of the bluff and was $2\frac{1}{2}$ feet in diameter and one foot deep with medium black soil; the contents:

- one arrow-head,
- one broken quartzite pebble,
- a few chips of jasper, argillite and chert,
- fragments of pottery.

Pit 5 was 6 feet in diameter and $4\frac{1}{2}$ feet deep, the contents:

- one large net-sinker,
- a peck of quartzite pebbles broken by fire and by fracturing,
- chips and flakes of argillite, yellow jasper and black chert,
- fragments of pottery (S0501, Plate CXIV, fig. 3),
- a fragment of animal bone.

Pit 6 was $3\frac{1}{2}$ feet in diameter and 3 feet deep and contained a few pebbles and chips.

Pit 7 was $3\frac{1}{2}$ feet in diameter and 3 feet 2 inches deep. At the bottom was a stratum of fine yellow sand mixed with black soil 12 inches thick and above this a stratum of deep black soil 6 inches thick, the contents: 125 burnt pebbles, mostly broken, a fragment of pottery in the black layer.

June 18; Pit 8 was 3 feet 9 inches in diameter and 2 feet 8 inches deep; the soil is in black layers alternating with lighter colored ones, the contents:

- one spear-head of red argillite,
- a few chips of argillite,
- one half peck of quartzite pebbles broken by fire,
- a small fragment of pottery with a knob, evidently from near the rim,
- a fragment of deer bone.

We found a stone pit 3 feet 3 inches in diameter and $1\frac{1}{2}$ feet in depth; the contents:

- three chips of argillite,
- four pitted pebbles,
- 56 whole pebbles, showing fire-action,
- 48 quartzite pebbles broken by fire,
- one little fragment of pottery.

June 19; The black soil found so deep yesterday proved to be a large pit with some brown soil, pit 9; the contents in part:



FIG. 25. Carving in steatite $\frac{1}{2}$. From Pit 9, Rowan's farm.

a "charm" (fig. 25) cut out of soapstone (80504) and representing the human face on one side with several lines cut on the other, the hole for suspending this carved stone is under the chin of the face,

a net sinker,

broken implements of black chert,

chips of argillite and chert,

fragments of pottery, of which one showed the rim with incised decoration,

fragments of the bones of sturgeon and of deer,

fragments of shell.

June 21; This pit No. 9 has strata as follows: at the top is the regular "plough soil"; below this to a depth of 3 feet 3 inches is a brown soil containing the specimens enumerated above; below this is a darker soil 13 inches thick yielding practically the same kind of specimens; below this lies a layer of burnt sand. The diameter varies from 3 feet 10 inches at a depth of 4 feet 5 inches to 7 feet 6 inches at a depth of 6 feet and again to 1 foot 5 inches at the bottom; the total depth is 7 feet 5 inches. At the bottom of the pit were a few burnt stones broken by fire and black soil. This is a very large and interesting pit; it was worked by Mr. Merwin who found all the specimens. The amulet is the first one of the kind or the first object representing the human face that I have ever found in this vicinity.

Pit 10 was 5 feet in diameter and 3 feet 7 inches deep; the contents:

one net sinker,
 implements of argillite, whole and broken,
 one pitted pebble, broken,
 chips and flakes of argillite, jasper, chert, and white
 quartz,
 pottery,
 a fragment of a Dutch clay pipe.

The general digging produced a pestle.

June 22; We filled up pits 9 and 10 and started another trial trench or pit. The soil was rather recently packed down and very hard. Dr. Abbott told me some years ago that his father, who once owned this house and farm in excavating had struck a lot of human bones, apparently Indian skeletons and reburied them somewhere else. The fact that this place was so hard packed and also that there was much yellow loam mixed with the black all the way down points to the reburial having been made here; at any rate there was found a fragment of a human femur about five inches long, several fragments of cranium, and several finger and toe bones; the same condition of the soil obtained in another trial pit northeast of this one and there were also fragments of human bones; another trial pit (known as pit 11) showed that the soil had been disturbed for quite a distance, and contained quartzite pebbles broken by fire and percussion, argillite implements, whole and broken, and chips of chert, jasper and white quartz; it was $6\frac{1}{2} \times 4 \times 3\frac{1}{2}$ feet deep.

June 23; Pit 12 was 8×7 feet in diameter and 5 feet 3 inches deep. The contents:

two worked flakes of argillite,
 quartzite pebbles broken by fire and fracturing,
 chips of black chert,
 a few fragments of human bones.

We made several trial trenches along the edge of the bluff, northeast of the little ravine, but found nothing of interest. The ground is hard and full of tree roots and contains nothing whatever.

We started a new trench which we will call trench 2 on the

southwest of the little ravine and south of the house and garden of Mr. Klein.

Mr. Merwin took a narrow trench running along the bluff and I laid out a trench three feet wide running at right angles to the bluff eastward for myself. In Mr. Merwin's trench was found stone pit No. 1, $1\frac{1}{2}$ feet in diameter and 9 inches deep, containing seventy pebbles whole and broken, the latter mostly by fire. An argillite spearhead, a jasper arrowhead and a fragment of pottery were found in the general digging.

June 24; This day was very hot. We found stone pit No. 2 in the black soil $1\frac{1}{2}$ feet in diameter and 9 inches deep, containing 50 pebbles somewhat larger than those in pit No. 1; they were mostly broken by fire; a few argillite flakes accompanied them. We found today grave No. 1, the skeleton was apparently that of a child and the top of the skull was 2 feet 1 inch down; the skeleton was very much decomposed and there were no ribs and no vertebrae and the skull was only four inches from the pelvis. I made a drawing of it but did not photograph it as there was so little of it left. There were a lot of children around this grove and old house having a Sunday-school outing; they looked at the bones as we cleaned them off and one of them, a little girl of about twelve years asked her mother, "Do we grow that way?" The answer was in the affirmative, and the little questioner watched eagerly every move until all was safely stored away in the baskets. The general digging brought forth implements of argillite, many quartzite pebbles broken by fire and fracturing, chips and flakes of argillite, chert and jasper, small particles of mica and fragments of pottery.

June 25; Did not go to work today as it was so extremely hot, too hot to go digging; I took Mr. Merwin to Hancock St., and showed him the end of the top terrace or later terrace that ends near Lalor Street. Thence we looked at the sewer-digging which is still going on, then we went to the sand pits and examined the strata and red

lines and I showed him where most of the specimens were found and where I found the femur, the fragment of cranium, the antler and scapula, etc. The railroad cut was explained and from there down the railroad track to the edge of the bluff. From there I showed Mr. Merwin the edge of the glacial terrace bending to the southeast and the meadows. Next we went to the river shore and walked down to the Buttonwoods and down to the place where the digging machine was working excavating the centre of the channel in the river. We examined a lot of gravel that had been thrown on the shore by the machine and found one specimen of argillite (80519). Mr. Merwin had a kodak with him and took a view of the bluff and river looking up the stream north northeast and also one of the machines at work looking west from the New Jersey shore. From there we went up town to get some photographic supplies at Stoll's Store and then home; we were both nearly exhausted by the heat.

June 25 and 26; Too hot to work; the thermometer was 96 and 98 in the shade.

June 27; Sunday.

June 28; We went to work today and found in trench 2, grave 2; it was 2 feet 7 inches by 2 feet 6 inches and 1 foot 10 inches down, at the bottom. The skeleton was apparently that of a child about ten years old; only a few of the bones were left and all of these that could be safely touched and handled were saved. A little heap of charcoal was found on the east side of the grave.

The general digging produced a hammer stone, a net sinker, stone implements, whole and broken, chips of argillite, chert, jasper and white quartz, fragments of pottery, and of animal bones.

June 29; I worked in the narrow trench along Mr. Klein's fence eastward, finding nothing of special interest; I finished my trench up to the corner of the garden fence eastward and then worked southwards, filling up the old trench as I worked. Mr. Merwin worked in his trench

southwards along the bluff. We struck many pits filled with black soil and apparently of recent date, possibly made by the occupants of the house near here. This place where we were exploring was on the west side of the old house built by I. Watson in 1708, a small frame dwelling standing between it and the trenches. We found a stone pit $2\frac{1}{2}$ feet in diameter and $1\frac{1}{2}$ feet down, containing a half bushel of quartzite pebbles broken by fire, the largest not larger than a hen's egg; the sand around the pit was burnt red. From the general digging were obtained a three-cornered arrow-head, beautifully made and as sharp as new, chert and jasper implements, chips of chert and argillite, and fragments of pottery and animal bones.

June 30; I kept on working southward, finding 1 foot 9 inches down the skeleton of an animal 1 foot 2 inches long. We also found a stone pit with about the same quantity of pebbles in it as the pit of the day before. It was 1 foot 10 inches in diameter and $2\frac{1}{2}$ feet deep. There were also in it some very small fragments of pottery.

The general digging produced the usual implements, fragments and flakes, including some fragments of shell.

July 1; Grave 3 was 1 foot 7 inches down and contained only some of the bones of the feet. There are here numerous intrusive excavations refilled in recent times, probably by the early settlers and the remainder of the skeleton had probably thus been disturbed.

Grave 4 was 2 feet long and 1 foot 5 inches down and contained a few fragments of the skull and long bones of a child apparently about ten years old. We found two European beads, black with white designs on them. The general digging was much the same as usual.

July 2; The weather was still hot but a delightful breeze was blowing; we found the usual "general" objects including the bowl part of a clay pipe (80505) Fig. 26, a piece of hematite (80506) and a pitted stone.

July 3-7; It was too hot to work.

July 8; It was still hot but we went to work in trench 2; the

objects from the general digging were the same with the addition of some mica.

July 9; Pit No. 3 was 3 feet in diameter and $3\frac{1}{2}$ feet deep; the soil in the eastern part is very black and does not run deeper than the black soil generally does, but in the western part it is much deeper and here we found some thick red pottery; the contents:

broken argillite implements,
chips and flakes of argillite and
chert,

a large piece of cut mica,
pottery (79783) in thick, red,
large pieces (Plate CXIII, fig. 5),
a bone of a deer.



FIG. 26. Clay pipe bowl $\frac{1}{2}$ (80505). Rowan's Farm.

July 10; We did not work today; I went out with Mr. Merwin and his friends to show them the interesting places, the terrace, meadows and hillside all the way down to Bordentown six miles from Trenton; they saw the interesting houses there; Murat's Row, Joseph Bonaparte's House and Park, etc.

July 11; Sunday.

July 12; Grave No. 4 was 16 inches down and the disturbance was 13 by 7 inches; there were only a few teeth, probably milk teeth, and a few fragments of the skull of a child. A small copper bell (80507) was found near the skull. This grave was finished on July 14. The sun was so hot that it became dangerous to work and we stopped at noon.

July 13; Still too hot to work.

July 14; The general digging produced the usual results, and we also found seven specimens in the yellow soil from 2 to 3 feet below the surface and from 14 to 24 inches below the junction in the undisturbed yellow loam.

July 15; Pit No. 4 was 3 feet 10 inches in diameter and 3 feet 6 inches deep. The contents:

two implements of chert,
a rude argillite knife,

a broken implement of argillite,
 a peck of quartzite pebbles broken by fire and fracturing,
 an argillite boulder, $11\frac{1}{2} \times 10 \times 4$ inches, smooth but chipped on one side,
 chipped argillite,
 fragments of pottery,
 charcoal,
 bear teeth,
 deer bones,

The general digging produced a peculiar broken implement with four scratches on one side and one on the other. In the yellow drift more than two feet below the present surface were one argillite implement, a worked pebble and chipped argillite.

July 16; Rain.

July 17; The usual general digging; we began pit 5.

July 18; Sunday.

July 19; The contents of pit No. 5, which is of a rare oval shape $4\frac{1}{2} \times 3\frac{1}{2}$ feet and 2 feet 2 inches deep:
 implements of argillite,
 a small fragment of mica,
 chips of argillite,
 nearly a basketful of fragments of pottery, with an interesting design of incised lines (79785).

The pit is just in line with the bluff on the very edge and the latter must have crumbled down somewhat since the people who made the pit were here.

There was the usual general digging and a few chips of argillite were found in the undisturbed yellow loam.

The day was a delightful one, cool to work and pleasant.

July 20; Pit No. 6, also on the edge of the bluff was 3 feet 5 inches in diameter and 2 feet 10 inches deep; the soil was very light, about a shade darker than the yellow drift; the contents:

a broken argillite implement,
 a peck of pebbles broken by fire and fracturing,
 a few chips of argillite,
 a few fragments of pottery.

I abandoned my trench on the east and worked closer to the edge of the bluff to join Mr. Merwin's as nothing of interest was found at the east end.

July 21; Pit No. 7 contained a grave and was 4 feet 2 inches in diameter and 4 feet 5 inches or more deep; the grave was 2 feet 7 inches down and the disturbance was $2\frac{1}{2}$ feet long. The skeleton in this grave, No. 5, was badly decomposed, the skull was almost erect with the face looking north, the head was to the west of the body. In the pit was a large stone with a cavity, and pottery with incised decoration about one foot above the skeleton, and to the southeast of it.

The general digging produced the usual results; also a fragment of a stone axe and a fragment of a human skull.

July 22; The usual general digging. It started to rain and we had to give up work; the rain was badly needed as the ground was so hard to work, all dried out.

July 23 and 24; Rain, could not work.

July 25; Sunday.

July 26; Grave No. 6 was 2 feet 11 inches by 1 foot 7 inches, and 1 foot 4 inches down; the skeleton was the first found of an adult, it lay folded with the head to the west and on the right side; part of it was under the stump of a pine tree which was cut down some years ago; when this tree was planted by the settlers the skeleton was apparently disturbed and broken and laid back again.

We found grave No. 7 and began its exploration; between the knees were some human teeth and two triangular arrow heads.

July 27; Pit No. 7 is right under the head or the skull of grave 6. It is 4 feet 9 inches in diameter and 3 feet 10 inches deep; The head of the skeleton extended five inches into the pit which is on the west of it.

The contents of the pit:

about a peck of pebbles broken by fire and fracturing, chips of argillite, chert, and jasper, fragments of pottery, 79810 (Plate cx, figs. 3, 4, 5, and Plate cxiv, fig. 4).

July 28; Grave 8 was 1 foot 5 inches wide and 1 foot 11 inches down; it contained the bones of two individuals, one of them apparently a very young person; the two skulls faced southwest and the long bones were in a bunch above badly broken by the roots of the same pine tree that partly destroyed the bones of skeleton 6. From the general digging came a peculiarly worked fragment of argillite and fragments of pottery.

July 29; Grave No. 9 was that of a child, containing the skull and a few fragments of bones above; it was 10 inches down. The teeth had apparently not developed; and the outlines could not be traced because the burial was in the black soil; near the skull were two little copper bells (79883)¹ one implement of bone or shell tinged by the copper, two shell ornaments under the lower jaw, and near by an argillite implement, a chipped argillite, and a few fragments of pottery.

Further work was done on grave No. 7. It was 5 feet 10 inches by 3 feet 5 inches and was 2 feet 11 inches down. In this grave there were the remains of four individuals. The skulls were badly decomposed, while the long bones were in somewhat better preservation; the skulls pointed towards the south; a little below the knees were a fragment of a human skull and some teeth. The soil of the grave was very light in color and showed some disturbance; it was the material of the yellow drift; the line of contact with the black above was intact, suggesting that the latter accumulated after the grave had been filled in. In the light soil were minute particles of charcoal and a few chips of black chert.

The day was an exceptionally hot one and made the work cumbersome, but it was managed all right.

July 30; It was too hot to go digging and I took a trip with Mr. Merwin to Morris Island in the Delaware River about one mile and a half below Trenton; I have already described its importance to archaeology; we picked up a

¹ "Hawk-bells." These copper bells were early used by the Whites to trade with the Indians.—EDITOR.

few specimens from the fields. The weather was too hot even for an outing.

July 31; Still too hot for work; I attended to my plate-holders, got the prints, etc.

Aug. 1; Sunday.

Aug. 2; A delightful day; we worked in trench 2, and finished grave No. 7; we found broken stone implements at the bottom which was composed of a thick red band; the same feature was often found in Lalor field and in Wright's field on the terrace; under the skulls or the place where the skulls had been the band was disturbed for a foot below and in this disturbed yellow sand which had a diameter of two feet, I found two fire-broken quartzite pebbles, chips of black chert and one chip of argillite much water worn. The fact that the grave was deeper than the rest except one or two near the bluff showing similar features, the undisturbed condition of the junction of the black and yellow soil, the very bad state of preservation of the skulls, and the fact that no black soil was found in this grave — all these are strongly indicative of the greater age of this and similar burials. The state of preservation is particularly worth considering as in this case the yellow soil, oxidized with iron and filled with a clayey material tends rather to preserve the osseous remains, while most of the skeletons are found near the surface in the vegetable black soil which tends on the contrary to their disintegration.

We began pit No. 8 which yielded (79810-79817):

a pestle-like stone,
burnt stone,
a half bushel of whole and fire broken quartzite pebbles,
chipped argillite, chert and quartzite,
pottery,
deer bones and antler.

There was nothing unusual from the general digging.

Aug. 3; We continued pit No. 8; in it were:

Quartzite pebbles, about half of which are burnt and broken,

implements of jasper and chert,
 chips of argillite,
 a fragment of a clay pipe, well decorated,
 fragments of pottery.

The general digging produced among other things one water worn pebble from which two chips had been struck off.

Aug. 4; Rain: we could not go to work.

Aug. 5; We found in pit No. 8 a part of a human skull 19 feet 6 inches from the bluff. The skull lay with the parietal bone on the bottom. There was the usual general digging.

Aug. 6; The dimensions of pit 8 are now 11 feet 4 inches north and south, 7 feet 7 inches east and west and 4 feet 7 inches deep; another skull was found in it not far from the bottom lying on the right side facing west; on the east of it and in contact was a fire broken pebble weighing about $2\frac{1}{2}$ pounds; there were further found in this pit:
 a net-sinker,
 broken implements,
 chipped argillite,
 a chipped quartzite (79816, Plate LXXXVII, fig. 2),
 fragments of pottery,
 fragments of human bones.

18 feet northeast of pit 8 was a stone pit (pit 9) 20 inches in diameter and reaching down 10 inches below the junction of the black and yellow strata; in it were about fifty quartzite pebbles broken by fire but no charcoal nor traces of fire itself.

There was the usual general digging. In the clear yellow undisturbed drift were found several argillite chips and flakes from 10 to 15 inches below the junction.

Aug. 7; In working out pit 8 we came upon grave 10. It was 3 feet 10 inches below the surface and the skeleton lay on the left side; there were only some of the long bones left and they were very much decomposed; they resembled those of grave 7 in depth, position and state of preservation; it is evident that the grave and pit are of

the same age; there was not enough of the skeleton left to photograph. The black soil is two feet thick above the pit and apparently not disturbed at the junction with the yellow; there was no black soil in the grave at all nor in the pit; this is a strong point in favor of the antiquity of the deep burials. The red bands in the yellow spoken of before were disturbed by the digging of the grave and the pit; the soil was only slightly discolored, just enough to show the disturbance.

- Aug. 9; We found skeleton and grave No. 11; it was 3 feet 2 inches by 1 foot 9 inches and 9 inches down, it lay on the right side with the knees drawn up and the head to the southwest; the vertebrae and the bones of the feet and hands were gone, the skull in fair preservation and the teeth good. It was apparently of a person about 18 or 19 years old. The skull was covered with very small glass beads white and blue, mixed; a Dutch white clay pipe was under the shoulder and the stem of another was found near the pelvis; near the first, which lay under the right shoulder was a round object red inside which broke on touching it and between this and the pipe was a piece of graphite. Also under the shoulder was a copper object staining the bone, and near this a string of shell beads the string being partially preserved by the copper.
- Aug. 10; We photographed the skeleton and then took it up; after this the whole grave was carefully searched and some more glass beads were found, one tooth and some finger bones; the soil of the grave being close to the surface was filled with broken quartzite pebbles. There was the usual general digging.
- Aug. 11; A hearth was found 2 feet 10 inches long and 3 inches below the black soil itself 9 inches thick here. The contents:

burnt stones 31 in all,
 an argillite implement, and one of yellow jasper,
 bird bones and burnt animal bones,
 fragments of pottery, and burnt sand.

Pit No. 10 was 3 feet 7 inches in diameter and 2 feet 11 inches deep; the contents (79818-79824):

implements and chips of argillite,
chipped argillite,
chipped jasper,
fragments of pottery,
fragments of animal bones.

The soil of this pit was very light and it began just at the junction which was broken and disturbed; there were also traces of a grave; the yellow drift contained several chips and implements of argillite; and there was the usual general digging.

Aug. 13; We started to dig out the skeleton discovered the day before, but rain set in and we had to stop.

Aug. 14; Two implements of argillite in the undisturbed yellow drift were found $1\frac{1}{2}$ feet below the surface; the black soil is here 9 inches thick. The usual general digging was observed.

Aug. 15; Sunday.

Aug. 16, 17, 18; Too much rain and too wet for work.

Aug. 19; Grave 12 and grave 13 were near together (Plate *xcvii*); from the foot of grave 12 to the skull of grave 13 was 5 inches; skeleton 12 was 3 feet 4 inches by 2 feet and $9\frac{1}{2}$ inches down; it lay on the right side with the knees drawn up and apparently belonged to an old person. Grave 13 also contained a skeleton lying on the right side with the knees drawn up and the two skulls pointed in the same direction; on the foot of skeleton 12 was found a piece of what appeared to be graphite; partly under the skull of skeleton 12 were two hollow bones, very brittle; they were taken out as carefully as possible. Skeleton 12 was 36 feet from the bluff. On closer observation the little object proved not to be graphite, a number of potsherds (79893) were found in general digging near the graves (Plate *cxiv*, fig. 5). This was a good day's work done but it was terminated abruptly about 3.15 when a hard shower came up.

Aug. 21; Grave 14 was 4 feet 1 inch by 2 feet 3 inches and 11 inches down; the skeleton lay on the right side with the knees less drawn up than usual, the head pointed to the southwest; it was in a very bad state of preservation.

- Aug. 23; We found in the undisturbed yellow drift, 10 inches and more below the line of contact with the black, several flakes of argillite, lying flat; the usual general digging.
- Aug. 24; Grave 15 (Plate *xcviii*) was 3 feet 4 inches by 1 foot 9 inches and 14 inches down; it lay on the right side, knees drawn up and head to the southwest; the bones of the feet had apparently disappeared and most of the finger bones; judging from the position of the forearms the hands must have been near the chin; at the left shoulder was a little heap of animal bones, apparently of a turtle, some of the fragments seemingly having been burnt. Mr. Merwin found, and cleaned this skeleton for photographing.
- Aug. 25; We found a cache of yellow jasper, 14 inches in diameter, 1 foot down and 6 inches thick; there were 75 chipped pieces and 57 flakes (79825) lying compactly. (Plate *L.*) We found four stones 9 inches below the surface; No. 1 has evidently been used on both sides as a mortar; No. 2 is a slab and No. 3 seems to be a part of a larger slab; No. 4 is small. We found in the yellow loam a peculiar argillite slab with a groove, 10 inches below the junction; a very interesting specimen; the usual general digging.
- Aug. 26; Several specimens of argillite and a little knife of the same material were found in the yellow drift 10 inches below the junction; the usual general digging; rain stopped the work at two in the afternoon.
- Aug. 27; Grave 16 was 2 feet by 10 inches and 10 inches down; the skeleton had apparently been lying on the right side; fragments of the humeri, of the skull and vertebrae were all that were left; this skeleton had apparently been disturbed by excavations for buildings near by.
- Aug. 28; I went to town and attended to plates, photographs and other errands.
- Aug. 29; Sunday.
- Aug. 30; Mr. Merwin went away today with his father.
- Aug. 31; I took a trip down the river where a vast amount of gravel had been dumped on the New Jersey shore just

below Riverview Cemetery; this took place last month; on my way back I visited several excavations in South Trenton.

- Sept. 1; I visited trench 2 the site of our explorations to look after my tools and my work; then I went through the Park to examine several cellar excavations and over the terrace to Deutzville; no specimens.
- Sept. 2 and 3; I visited the gravel deposit on the river shore, and gave it a thorough examination finding one interesting specimen (80521) in the gravel showing artificial chipping and water-wearing.
- Sept. 4; I did not go out, not well.
- Sept. 5; Sunday.
- Sept. 6-8; I did not work as I was sick.
- Sept. 9; I tried it today in the trench; I found grave 17. It was $3\frac{1}{2}$ feet by 22 inches and $9\frac{1}{2}$ inches down; the skeleton lay on the right side, head to the west and the hands near the face; the left femur had parted from the pelvis a distance of eight inches; near the skull to the south lay a perforated pebble (Plate XCIX).
- Sept. 10; Rain all day.
- Sept. 11; Unfit for work.
- Sept. 12; Sunday.
- Sept. 13; I took a trip down the river; there was a vast amount of gravel deposited there and beautiful specimens of serpentine, quartz and argillite, showing but little wear. I did not find any artificial fractures.
- Sept. 14; Election Day.
- Sept. 15; Rain.
- Sept. 16; Rain in the forenoon; I went to Morrisville on the Pennsylvania side to see some interesting gravel that I had heard had been there excavated; I found the place; there were fifteen large boulders over two and one half feet in diameter of which seven were in situ; four were angular showing that they had not travelled far. They are of different materials, conglomerate, two varieties of granite, quartzite, argillite, etc.; one of the granites shows three surfaces; the original one of the mother rock,

very much weathered, a second, fractured by percussion and afterwards time-worn, and a third, showing actual decay while lying in its present position; all these boulders were near the surface and many are seen exposed on this old shore of the Delaware River; they are a glacial deposit and these stranded boulders can be traced for miles at a level about 25 feet higher than the ordinary level of the river. The rocks have been transported from away up the valley from both New Jersey and New York. My friend, the owner of the land who had invited me to come, took a photograph of the boulders (Plate c). A sewer-digging in this village about 700 feet to the westward showed a deposit of gravel considerably smaller in size, but with occasionally an angular boulder. No artificial specimens were found.

Sept. 17; It rained in the morning and it was unfit for digging. I went to the deposit of gravel from the digging machine below Riverview Cemetery. Just about four hundred yards below the steamboat wharf on the New Jersey side several small deposits had been made by the machine, and behind these a wash-out had been caused by the waste water which came with the gravel when it was dumped; this exposed the original deposit of the terrace beyond the talus; the virgin strata that were laid down long before the Delaware had carved out its present bed are beautifully exposed. I found three specimens, Nos. 1, 2, and 3 of this date. No. 1 (80520) is of white quartz, very large and much water-worn. No. 2 is a natural flake of argillite (80522) and was found on the smaller exposure referred to above where the cave down was made by the waste water. It had apparently been deposited by the digger with the clay and then had been exposed by the rain. No. 3 is a pebble of variegated argillite (80523), much water-worn with some interesting fractures; this was found on the lower deposit of the two smaller ones nearer to the steamboat wharf.

Sept. 18; General digging only; chips and flakes of the various

- minerals; later I found a skeleton but it was too late to excavate it.
- Sept. 19; Sunday.
- Sept. 20; I worked in trench 2 again. I found that someone had been excavating here without my knowledge or permission. The skeleton which I had found on Saturday was gone. I decided not to dig here any more.
- Sept. 21; It rained in the morning; in the afternoon I visited the sewer-digging on Liberty Street but found no specimens.
- Sept. 22; Rain again. I went to the gravel dump on the river shore but could not find any specimens.
- Sept. 23; Very wet, as it had rained all night; I visited some cellar excavations in South Trenton and saw some excavations in Morrisville, but found nothing of interest.
- Sept. 24; It rained all night and all day.
- Sept. 25; Rain in the forenoon; in the afternoon I went to the gravel dump on the river returning by way of Liberty and Lalor Streets; no specimens.
- Sept. 26; Sunday.
- Sept. 27; I went to Millham where a deep excavation was made for a new building; while I was there the rain started again and I had to leave.
- Sept. 28; I had other work which I could not postpone longer.
- Sept. 29; I visited the old trench again and was told that if I wanted to dig any more I must ask permission over again from Mr. Willey; this I did not do.
- Sept. 30; I visited the river shore again and followed it down for three miles, but no specimen turned up.
- Oct. 1; I worked over the fields in Broad Street Park to look for another place to dig; Mr. Wright gave me permission to dig in his land anywhere I liked; there are several places where a trench could be put in, but the promise is not very strong; but we will try it.
- Oct. 2; I visited the Lalor Street sewer today; near Liberty Street the sewer is very deep and a coarse gravel is struck at the bottom; I examined all the material thrown out here and the new digging, but found nothing of interest.
- Oct. 3; Sunday; I could not go out of the house being lame with rheumatism.

- Oct. 5-10; I was still unable to go out having rheumatism in both shoulders and hands.
- Oct. 11; Bronchitis developed also, with pain in the lungs; I had to go to bed.
- Oct. 20; I came downstairs and tried to stay but had to go back to bed. I stayed in until Oct. 24.
- Oct. 25; I had my first outing and went to the diggings at the old house; I took home my camera and some tools that were still there. I felt bad and feared to come down again.
- Oct. 26; I tried to go to the sand pits in Deutzville. There have been great changes there and large exposures of sand are shown on three sides. I made a search for specimens and examined the banks with the trowel, but nothing turned up.
- Oct. 27; I could not go out today as I felt too bad.
- Nov. 1; I took an outing again today and went to the river shore but had to go home speedily with a severe pain in the lungs; I did not go out until Nov. 8.
- Nov. 8; I visited the sand pits in Deutzville but found nothing of interest in the way of specimens. What a beautiful exposure these sand pits do offer, what an instruction in geology! It is to be lamented that the school children are not brought here for their instruction.
- Nov. 9; Rain.
- Nov. 10 and 11; I had rheumatism and could not go out.
- Nov. 12; I visited the sand pits again but found no specimens. I could not walk very well with the rheumatism in the hip.
- Nov. 13; I was unable to go out.
- Nov. 14; Sunday.
- Nov. 15; Rain. I could not walk as I was lame in hip and knee.
- Nov. 16; I went to Deutzville and visited all the sand pits, but found no specimens.
- Nov. 17; I could not go out this morning; too sick and lame.
- Nov. 19; I visited the sewer excavation on Liberty Street and the cellar excavations in Millham. No specimens.
- Nov. 20; I visited all the sand pits in Deutzville, but found nothing.

Nov. 22; I could not go out this morning as I had rheumatism in my legs and feet, also in my hands.

Nov. 23; Rain; I still have rheumatism.

Nov. 24-26; Bad weather.

Nov. 27; I went to Deutzville to all the sand pits but found no specimens.

Nov. 28; Sunday.

Nov. 29; I started packing.

Nov. 30; I packed specimens.

Dec. 1; I continued packing.

Dec. 2-4; I was sick.

Dec. 5; Sunday.

Dec. 6; I continued packing.

Dec. 7; I visited Ahrendt's sand pit on the right hand side.

Mr. Ahrendt is taking down a high bluff on Crow Creek in a systematic way, which presents beautiful exposures of the bedding of the drifts of sand and fine gravel, indicating the different currents. One ice-pit was plainly visible and a six inch thick stratum of fine dust (loess?) two and one half feet broad.

A friend who was with me took several views of the bank. Plate CI shows the ice pit marked X just in front of where I am standing. The whole length of the bank is 225 feet. I found three specimens (80525) showing the type of gravel usually found in these deposits. This is the south shore of Crow Lake or Crow Creek, about 700 feet southeast of the place where the human femur and the fragment of cranium were found in 1899 on the north shore of the same stream.

The rest of the month was much of it spent in packing specimens; I was sick a great deal and put in as many days as I could of work.

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May 21; I visited a sewer-digging on Woodside Avenue, Hillcrest. The sewer was laid out during the making of new streets, through woodland. There is a strange fascination in watching an excavation in virgin soil, where no plough, hoe, nor pick has been. The deposit is shown in its original condition; disturbances made by the natural plant growth from the surface, are recorded, and the underlying water deposits are shown to be covered, as with a protecting cloak, with the remains of generations of plant life; no human agency, apparently, has intruded upon nature, and every shovelful of earth thrown out seems like an insult to Mother Earth. I watched the digging all day, but found no traces of artificially fractured stones nor of early man. It may be considered sterile territory; at the bottom is a stratum of reddish clay, sand and Columbian gravel, mixed with oxide of iron; above this are blue and gray clays and overlying these in turn a yellow clay; these are all beneath the dark soil at the top. The pebbles which occur are of a medium size and of these those of white quartz are in a majority; these are not much bruised. No specimens today.

May 23; I went to Deutzville and found a pit $5\frac{1}{2}$ feet in diameter and $4\frac{1}{2}$ feet in depth in Ahrendt's sand-pit; the contents: chips of black chert and of argillite, several stones broken by fire (80615), a few fragments of pottery (80614), a fragment of antler of a deer (80613), and two layers of charcoal, one within eight inches of the top and the other on the bottom.

May 24; I visited the sand pits again; a large pile of sand now blocks the access to the pit of yesterday. There were no further specimens.

May 25; Rain. I took my camera up town to get a new screw for attaching it to the tripod; as they said the camera was of so old a pattern that they could not provide the

- screw I took it to a machine shop on Warren Street and had one made to order. I went there again in the afternoon and got the screw; on the way I examined a water trench on Front Street; the diggers struck here a somewhat disintegrated original rock at a depth of four feet, the overlying gravel being of the same kind as on Centre Street; I examined all the gravel thrown out but found no specimens.
- May 26; I went to take views of Achpoachquissings Creek, and took six, the weather being fine.
- May 27; I went to town, attending to my plates and other errands; on my way I visited an excavation on State Street, near Stockton; the gravel is very fine here, with pebbles no larger than hickory nuts; it is interesting as the street runs along the bluff of Assanpink Creek, its northeast shore. I found no specimens today.
- May 28; I went to a sewer-digging at Trenton Junction and examined all the material dug out; also I watched the digging and examined the sewer walls, but found nothing of interest.
- May 29; Sunday.
- May 30; I visited all the sand pits at Deutzville and from there went to South Trenton. No specimens.
- May 31; I visited the sewer-diggings on State Street and other streets, and the excavations on Hamilton Avenue. No specimens.
- June 1; I made arrangements for a boat to go to Morris Island, and packed photographs to send to Dr. Peabody; then I went to a sewer-digging on Grand Street; here the material is all sand, hardly a pebble can be found. I found nothing of interest.
- June 2; I took a trip to the river shore, down to the Buttonwoods then across the lock to the hill-side, along the bluff and to the White Horse Road where there was a recent exposure in the Columbian Gravel; I found four specimens of this date, as follows: No. 1 and No. 2 were both found in situ ten feet below the surface in the Columbian gravel (80616 and 80617). The latter presents

fractures frequently found on specimens from Indian village sites, but in this case they are water worn; this is interesting as this specimen was found at so great a depth. No. 3 (80618) is from the surface of the ground and presents a sharp chipped edge. No. 4 (80619) includes two specimens of limonite, usually found at this place in the Columbian gravel, but the surface of shining black is not common; the specimens may be of interest to some one, so I saved them.

June 3; Rain. I did not go out.

June 4; Rain.

June 5; Sunday.

June 6; I visited the sewer-diggings on Hillcrest. I found interesting deposits of clay and gravel and large blocks of gneiss which had to be blasted in the course of excavation. No specimens.

June 7; There was rain in the forenoon; in the afternoon I went to Front Street to examine a sewer trench there. I found one specimen of argillite eight feet below the surface (80620); it was apparently fractured by nature only but it seems to tell the same story as other naturally fractured argillites of its former separation from the outcrop of argillite at Byram where the Delaware had to cut its way through; judging from the altitude of the position in which it was found, it must have been transported very early and been detached from the mother rock at or near the surface.

June 8; I examined a sewer-digging in South Trenton, and found one specimen with interesting fractures six feet down (80621). I tried to hire a boat for the season to go to Morris Island, but could not because there were none to hire. The boatmen would not let for hire this way; I called at several places last week, whenever I heard that there was a boat to hire, but did not succeed.

To hire one for a day only would come too high by the week, as they would charge for the hour twenty-five cents; and then to row down and back again is so much time lost too.

- June 9; I called on Mr. Lacey but did not find him at home; he is the owner of the front, or upper part of the Island. I did also call on Captain Clegg, but could not hire a boat. At eight p. m. I called on Mr. Lacey again and found him this time. He offered me his boat on the Island whenever I wanted to use it; I accepted with thanks.
- June 10; Rain in the morning; in the afternoon I went to a sewer-digging but I found no specimens.
- June 11; I caught a cold yesterday and could not go out.
- June 12 and 13; I was still sick and could not go out.
- June 14; I went to the Island and found Mr. Lacey at the Ferry; I crossed with him in his boat. I went to the upper end and made a search for a place to open a trench; there is a sandy ridge over the upper end and at the eastern side of the Island extending down to Mr. Lacey's house and below. Most of the chips (80623) and broken stone are found on this ridge on the surface. There is, however, a ridge on the western side of the Island extending in a southerly direction, and this I have not yet examined. I opened a trench on the east side on the sandy ridge to-day and found a soil with a loam not unlike the loam on the Lalor Farm. From the surface for eight inches down is a black or dark soil, not very black, but darker than the deposit on which it is resting. This is Trench 1; I have to make trial diggings until I find a place worth exploring. I found pit 1; the contents: whole pebbles, unburnt, stone broken by fire, and two tessuars¹ (80622). I found that the much talked of red bands are here also; there was one $1\frac{1}{2}$ feet below the surface; the soil as a whole is sandy and appears (so far) to be much like that of Lalor Field. (80624 is a stone from the red band and 80625 is a grooved axe from the surface of Morris Island.)
- June 15; I visited all the sand pits in Deutzville today and walked over the fields on the terrace to Broad Street Park, but found no specimens.

¹ Split pebbles with sharp edges.

- June 16; Rainy in the morning, so I did not go to the Island; I went to Deutzville during the afternoon, but found no specimens.
- June 17; Rain in the morning; after it ceased, I went to Bonaparte Park and field, and Crosswicks Creek, but I found no specimens.
- June 18; I worked on my drawing, not feeling well enough to go out.
- June 19; Sunday.
- June 20; I went to the Island and worked on Trench 1 until noon, when I became ill and had to go home; it was very warm.
- June 21; It was too hot to go digging and I worked on my chart; the afternoon brought a terrific shower and thunder-storm.
- June 22; Still very hot, but I managed to go to Deutzville; found a grooved axe 80626 on the surface of Ahrendt's sand pit. In this same excavation for sand I found a very interesting pit. Mr. Ahrendt told me that in digging loam his man had struck a bone; he showed me the place and there I found a pit which had been dug from a lower level than the present surface. I made a careful measurement and found that the mouth of the pit was $1\frac{1}{2}$ feet deeper than the present surface under a heavy red band. The overlying deposit was composed of six inches of black soil and one foot of yellow loam; this yellow loam presented a series of curled red bands that extend for hundreds of feet and are plainly seen in the long exposure (Plate cxxv). The heavy red band directly over the mouth of the pit was unbroken, as were the other red bands above, and the junction of the black soil with the yellow. The pit was twenty-two inches in diameter and one and one half feet deep, and rested on a heavy band of red clay about two inches thick; below this were loam and sand showing stratification and with the sand increasing in proportion downwards. The pit contained charcoal in very small particles and on the bottom, two fragments of animal bone. About three inches

to the east of the top of the pit embedded in the red band covering the mouth of the pit, I found a chipped argillite (80627) lying undisturbed. About three feet west of the pit I found a water worn pebble (80628) lying flat in the same level clay band that the argillite was found in. The bone fragments (80629) found in the pit were $2\frac{1}{2}$ feet from the present surface and a foot down from the mouth of the pit. The principal one has been identified by Dr. G. M. Allen as the femur of a bison. It is shown on Plate CXX, about $\frac{2}{3}$ its natural size.

June 23; I attended the funeral of a friend.

June 24; I tried to find a man to help me dig; the one who promised to come did not; I tried in vain in several places and finally, on my way home, I found one who promised to come on Monday. I was told of the finding of some peculiar stones at the Hillcrest sewer; I went there and found that the sewer extended through the woods and unoccupied land; there is much medium gravel with white quartz, quartzite pebbles and water worn black chert, also much clay mostly blue gray in color; all the fractures on the pebbles that were examined are of natural origin, frost and percussion having apparently produced the latest; no specimens today.

June 25; I did not go out today.

June 26; Sunday.

June 27; The man who promised last week did come, but he wanted steady work and that, of course could not be assured him.

June 28; I could not work alone; the digging at the Island is too hard and I could not make any headway; this morning it rained, but the afternoon was fine.

June 29; I went to the sand pits and Deutzville but did not find any specimens.

June 30; I visited the Island again and worked in the trench. I also strolled along the shore on the east side and found several specimens. A rude chipped implement (80630); a notched stone sinker (80631); a large flake of argillite (80632); a rude axe (80633); a piece of

chipped argillite (80634) and an incomplete chipped implement (80635). The trench does not promise much and the digging without help is very laborious and slow. I have had several men coming to the house, but they wanted steady work, which I could not give them. The day proved very hot.

July 1; I went to the sand pits and strolled over the terrace. No specimens today.

July 2; I examined the sewer-diggings at Hillcrest and one on State Street and Cadwallader Place, but found no specimens.

July 3; Sunday.

July 4; I was ill and could not go out.

July 5; I went on the Island but found nothing.

July 6; I visited all the sand pits, but found nothing of interest; one specimen from the surface is a net-sinker.

July 7 to 10; I was not well and could not go out; the weather was too intensely hot.

July 11; I visited several excavations in the Columbian gravel on White Horse Road, but found no specimens.

July 12; I went to the sewer-diggings at Hillcrest and at Trenton Junction, but found no specimens.

July 13; I worked in Trench 1 and elsewhere on the Island. Mr. Lacey gave me the loan of a man of his crew on the Island to help me dig; his name is Peter. We opened numerous trenches on the upper part of the Island. A peculiar condition is revealed here; I can not find out the level of occupation; there seem to be different levels, such as: first, six inches of a very light top soil, then two inches of still lighter soil, then four inches of packed soil, very hard and black, such as a muddy deposit under water would produce. Below this the yellow sand is found again. It seems that this condition is the result of an overflow of the stream even here on the highest part of the Island, and yet the deposits appear not to be of recent date. The pit to be described seems to be of the present level. There is evidence of a considerable quantity of soil having been

thrown on top of the common surface, like a semicircular embankment about two hundred feet in extent and opening to the south. Excavation showed no specimens in the embankment; it is probably recent. Another recent level was found by trial trenches dug to the west and north at the head of the Island. The specimens: a notched agricultural implement (80636); a celt of argillite (80637) found in disturbed soil one foot below the surface in one of the northeastern trial trenches. Fragments of pottery (80638), argillite chips (80639), and a three cornered arrow head of black chert (80640) found one foot down in the black layer in the northwestern part of the Island, quartzite pebbles (80641) broken by fire and battering. The pottery and argillite chips, pebbles and some small fragments of charcoal were found in pit 1. A stone pit, 2 feet in diameter and 1 foot 9 inches deep, was found at a place where a large tree had apparently once stood. The sun was very hot today.

July 14 to 17; I was not able to work.

July 18 and 19; Rain; I made the drawings of the pit and of the deposit where the bison bone was found.

July 20; I went to the Island again and as I could not get the man I had before I worked alone; I made some more trials on the upper end and along the bluff on the west side down to near the place where the old house stood. I found the top soil to vary in color from dark to very light, but it contained nothing new. The lower end of the Island could not be studied on account of the crops being there. I found nothing of interest here, nor could I fasten on any habitation-site; there seemed nothing to point to a permanent dwelling site like those on the hillside.

July 21; A trip to the sand pits, terrace, Deutzville, etc., did not reveal anything new, except an interesting exposure of the complete wall of a new sand pit; this I discovered about dusk and so left it for tomorrow.

July 22; I repeated my visit to the sand pit in order to make

a drawing of the new wall; I made measurements and a search for specimens in the vicinity.

July 23; I visited the sand pit again and found one specimen (80643) a chipped argillite, $2\frac{1}{2}$ feet below the surface in the yellow loam, undisturbed; I did not notice any heavy red band above the specimen, but several bands occurred below. I found yesterday in Deutzville a probably natural stone (80642) which had been thrown out of an excavation for a gate-post; the cross section showed six inches of black soil at the top, above one and one half feet of yellow loam, then four feet of gravel in which the post hole had been driven two feet. The specimen came from the top of the heap thrown out and its original depth I cannot give, but it is surely from the gravel. A specimen of rock with fossils (80644) was found in the gravel at a depth of twelve feet.

July 24; Sunday.

July 25, 26 and 27; I did not go out; on the 25 the thermometer registered 96° .

July 28; I went to Deutzville today; it was still too hot to work on the Island. I examined the large exposure in Ahrendt's sand pit again I found one specimen with interesting fractures (80645); it was twelve feet below the surface in sand and fine gravel; the exposure now gives a fine chance for observation.

July 29; I again visited Deutzville, but found no specimens.

July 30; I found in Deutzville another interesting exposure in the sand pit, but today found no specimen in it. I had been informed that an excavation was going on on State Street, and I took a car on Centre Street and went there; in grading the street a cutting was made several feet deep showing the gravel. No specimens.

July 31; Sunday.

Aug. 1; I went to Deutzville and found an interesting place in the yellow drift. It was a pit or disturbance made from a level lower than the present one beneath nearly a foot of undisturbed yellow loam and fourteen inches of black soil; it resembled somewhat the pit where the bison

bone was found, but here there was only charcoal; charcoal also appears above the top of the pit as if washed over it, and in addition is found a horizontal distance of ten feet. Another place near by presents a peculiar clay stratum, the work of water either among or behind some huge ice masses; this appears to be the most distinct of several such clay deposits found by me in this pit and elsewhere.

Aug. 2; I visited Ahrendt's sand pits again and found in the northernmost two specimens (80646 and 80647). They were lying on the bottom of the open trench, eight feet below the surface, apparently in place. The yellow soil here, which they dig away and sell for molding sand, is three and one half feet thick, packed very hard and richly supplied with red bands. The Indian pits, dug from the upper strata, can easily be distinguished from the surrounding soil by their looser texture; water apparently packs the soil much tighter than the influences of time and the atmosphere.

Aug. 3 and 4; I was lame and could not go out.

Aug. 5; I visited the sand pits and found several natural pits into which the yellow loam had penetrated; of one of these I made a drawing a week ago or more; they are beautifully shown in the long wall of Ahrendt's sand pit. I found no specimens, although I worked in the exposures with the trowel. I felt too weak to go to the Island to dig.

Aug. 6; Mr. Ahrendt is contemplating digging off a high place near the hill; I made a search near the place but found nothing new.

Aug. 7; Sunday.

Aug. 8; Rain all day.

Aug. 9; I went to the sand pits in the afternoon as the morning was too wet; a large cave-in had exposed a lot of gravel fifteen feet below the present surface and within fifty feet of the south shore of Crow Creek; this is nearly opposite to the place where the human femur was found on Dec. 1, 1899. Among several interesting water-worn

pebbles was one incrustated with sand and probably oxide of iron; I took it at first for a piece of yellow loam and tried to wash it off, but after I found out what it was I left it alone; it appeared to be ice-scratched and resembled some of the specimens found at the Railroad Cut in the deposit containing the human femur; besides this the specimen (80648) shows flaking and I believe the design intended by the chipper was the hand axe; the flaked faces are very much water-worn but not so much so as to lose the evidences of design. The condition is just what one would expect considering the journey down the valley for some distance in company with the gravel.¹

Aug. 10; Rain all day.

Aug. 11; I went to the Willow Street sewer digging but found no specimens; a trench for a water pipe on a side street had been cut through a layer of mica schist or gneiss into gravel again; several large boulders had to be blasted in the process; probably these are the remains of a large mass of the material, now partially disintegrated.

Aug. 12; I went to Deutzville and visited the new trench on the highest point on the surface in Deutzville and the terrace. There are here six inches of black soil over four and one half feet of yellow loam; below this a fine grained sand is found but no gravel. Occasionally we find isolated boulders, nothing like a stratum of them. I found specimen (80649), a white quartz. Eight feet down and ten feet apart, in this trench are two great boulders. The one to the left is in situ and measures 24 by 20 inches; it is apparently a hard conglomerate with much quartz and of a light color. The other boulder measures $3\frac{1}{2}$ by 3 feet and is a red sandstone slab; it is not in situ as when the sand was dug out from below it, it slipped down about eight inches. I took two photographs showing these boulders. There is here no stratification

¹ While resembling a chipped implement this is probably a natural glacial pebble with natural chipping.—EDITOR.

save a thin seam of pebbles at the level of the yellow loam. Isolated boulders of various sizes and shapes, angular and water-worn, are found in the Trenton gravel or fine sand at all depths from the surface down to the "boulder bed" from six to twenty feet below.

Aug. 13; I did not go exploring as I had some errands in town.

Aug. 14; Sunday.

Aug. 15 and 16; Rain.

Aug. 17; Rain in the morning; in the afternoon I went to Deutzville, but the banks were badly washed and had caved in; I made a search, but found no specimens.

Aug. 18; I heard of an excavation at the Laval Turbine Works, at Millham; the deposit here which I examined years ago is of twelve feet of sand with few pebbles, overlying the stratum of white quartz and clay. An excavation was making here for an additional building but it was not deep enough to reach the quartz stratum, for which I was very sorry. A man showed me some animal teeth found in the sand; I investigated and found that the bones of a horse, evidently buried long ago from the present surface, had been found four feet down in the sand.

Aug. 19; A visit to Deutzville was taken today, and a search was made through all the sand pits. I found two water-worn specimens (80650 and 80651). It is possible that one was a net sinker and that the other may have been chipped before it became water-worn. They were both from the gravel. A new trench is now started on the highest point of the terrace, just east of the place photographed last week; it shows about eight inches of black soil and two feet of yellow; below that there is a stratum of coarse sand densely filled with minute white quartz pebbles, the size of a pea and smaller, worn perfectly round; this is different from the green sands found here before, and is undoubtedly due to an overwash over the Columbian gravel which lies to the northeast of here; the excavation, which is an excellent chance for observation, will be continued westward and southward

taking down the above mentioned highest point on the terrace. This chance could not be duplicated without the expenditure of several thousands of dollars.

Aug. 20; Sunday.

Aug. 21; I visited the sewer-diggings at Hillcrest, and watched the operations but found no specimens.

Aug. 22; I found two pits at Deutzville, but did not disturb them as so much digging was going on in the neighborhood; I worked over the terrace, but found no specimens.

Aug. 23; Deutzville again; I made measurements for the preparation of a chart showing both the natural and the artificial pits in the exposure. Found charcoal in artificial pit (80653).

Aug. 24; In Ahrendt's sand pit I found a water-worn stone (80654) lying on the bottom of the open trench fifteen feet down in undisturbed gravel. A high bank running parallel with Crow Creek was taken down and the sand dug away until this gravel was struck, which is used for concrete walls. It is the gravel I have often referred to in my notes as presenting the pebbles with the short breaks and glacial striae. The open trench is on the other side of the stream and about four hundred feet away (eastward), from the place where the femur was found.

Aug. 25; I made a chart of the pits, artificial and natural.

The cross section of the deposit follows:

- | | | |
|---|---|-----------------|
| A | Black soil | 6 inches. |
| B | Yellow drift | 42 inches. |
| C | Whitish sand | 30 inches. |
| D | Irregular red clay band | 1 inch. |
| E | Greenish gray sand | 3 to 6 inches. |
| F | Red clay | 6 to 12 inches. |
| G | Fine gravel | 3 to 4 inches. |
| H | Greenish gray sand. | Many feet. |
| I | The boulder bed; large pebbles mixed with coarse, yellowish sand. | |

(B) contains red bands from one quarter to one eighth of an inch in thickness, over a thicker red clay band,

irregular and from one quarter to one half of an inch thick. (C) contains a series of whitish clay bands one half of an inch in thickness or less.

(I), the boulder bed begins at a depth of from twelve to fifteen or eighteen feet below the present surface.

The artificial pit begins four feet below the present surface and is itself one foot in depth. The thicker red clay band which covers the pit divides in two at this place and its sections are three or four inches apart. For a horizontal distance of four feet about the pit the red band is filled with brown discolored sand and small particles of charcoal. In the yellow drift, similarly there are traces for five inches vertically and four feet horizontally of minute particles of charcoal. The particles are one or two inches apart, scattered, not touching one another, apparently washed apart, or separated by the force of water. Above this the drift seems undisturbed and the red bands unbroken.

Seven feet east of the centre of the artificial pit and three feet lower in the same exposure is a natural pit, interesting as shedding light on the association of man's presence with the inundation of the territory. The importance of the pits found lately and the opportunity of digging in Ahrendt's sand pits without expense demanded a close and immediate attention and, as the Island promised little and required help, it was concluded to postpone the latter and to attend to the sand pits. The trench at this high point shows that the elevation was not due to the heaping up of the yellow soil (blown by the wind as has been alleged), but to an upheaval, the beginning of which lies deeper, below the yellow soil and sand.

Aug. 16; Rain all day; I finished the chart and sent it to Dr. Peabody at Saranac Inn, New York.

Aug. 27; I visited the sand pits again and found two specimens (80655, and 80656). The former in shape seemed to resemble some of the stone hammers I have seen that came from South America; the latter lay on the surface

near a pile of sand, but I could not tell where it came from. The rains yesterday were very heavy and did considerable damage to the sand pits.

Aug. 28; Sunday.

Aug. 29; I visited the Columbian gravel on Broad Street (White Horse); I found two specimens in the pits where material has been taken out; one (80658) from ten feet down is disintegrating; the other (80659) from twelve feet down is a water worn pebble of an odd shape. There is still a fine exposure of the deposit here as the gravel is continuously dug and carted away.

Aug. 30; I visited the sand pits and found three specimens: No. 1 was found in the gravel near Crow Creek; the gravel occurs fifteen feet below the surface and contains water-worn pebbles with two surfaces, an older and a newer; this specimen of quartzite (80660) has the appearance of a turtleback and to have been water-worn after the chipping. No. 2 (80661) is a naturally fractured argillite, showing what appears like a heavy coat of patina. No. 3 (80662) is a natural flake showing this same superficial deposit; all the specimens are from the deep gravel.

Aug. 31; I took six views with the camera. Three were taken within a few hundred feet of the place where the artificial and the natural pits were found near together. The strata approach the surface like a rainbow, with the ends buried deep in the ground. I took two views of the new trench working towards the highest point on the terrace, looking south and one view looking west south-west (Plate cxxv). Where the rainbow strata appear there is hardly any yellow soil above them, but to the west there are three and one half feet of it or more, probably collected in the eddy, back of the elevation (?). The fact that the yellow loam begins to the south and the edge of the hill or bluff seems to indicate some sort of counter action; the combination of the stream or current from the north and northeast and the rising tide from the south may possibly help to account for it.

A search was made in all the pits, but no specimens were found.

- Sept. 1, 2, and 3; Rain, not fit for an outing.
- Sept. 4; The weather was still threatening, with actual rain in the afternoon, and during the night.
- Sept. 5; Labor Day; it was very hot; I took a trip to the River shore, but found nothing of interest.
- Sept. 6; I visited the sewer trench at Mill and Warren Streets, and found three specimens; No. 1 was found eight feet below the surface among big rocks, some of which had had to be blasted. The specimen (80663) has an appearance of artificial shaping, water-worn after chipping and resembles the hand axe, and the partly chipped stones found on village sites, with one smooth place for the hand-hold. It was found in situ; the rocks mentioned in some places in the trench are $\frac{3}{4}$ part of the bed rock and are of the same kind as the rocks found at an outcrop on the Pennsylvania side at Edge Hill. No. 2 (80664) lay on top of the pile of gravel thrown out of the same trench. No. 3 (80665) was found in the heap of gravel thrown out, but within the pile, not on its surface; it is of traprock of which the nearest outcrop is twenty three miles north, between Raven Rock and Byram, where the Delaware has worked its way through the rocky barriers of this and other materials. The thermometer registered 96°.
- Sept. 7; I visited the sand pits today and all the exposures and found a specimen (80666); it came from twelve feet below the surface, from the gravel mentioned before containing the pebbles with two surfaces; the trench was near Crow Creek, extending towards the Canal.
- Sept. 8; A visit to the sewer trenches on Fair Street and Mill Street, brought to light three specimens: one was a piece of sandstone with probably artificial fractures (80667) to lay in gravel four and one half feet below the surface and was thrown out while I stood there on the edge of the trench; No. 2 (80668) came from about seven feet down and lay on top of a pile of gravel thrown

out, according to the man who told me, only yesterday. No. 3 (80669) which is probably artificially chipped, lay among a pile of gravel left over from the filling in of the trench east of Warren Street; its exact position cannot be identified; the gravel begins at a depth of from one to one and one half feet below the surface, and the specimen shows that it had been in the gravel, but how deep cannot now be known. There was more material on top here formerly, but it was taken off when the street was graded many years ago. Fair Street shows a top deposit over the rocks of several feet of a yellow loam, not identical with that on the terrace, but it seems to be darker than that on Lalor Field, and it is probably not so heavy. We find the red bands in the loam here too, but at uneven intervals, and much thicker, and darker than those of the terrace; probably much organic matter is mixed here with the deposit, from the influence of the stream in former periods. After the men left Mill Street, and turned into Fair Street, working to the south they encountered huge boulders and in some places bed rock in their excavations; dynamite was frequently used. Mixed with the three and one half to four feet of loam is a gravel of medium size and small pebbles lie among the boulders.

Sept. 9; I visited the same place again; the loam diminishes towards the south and rests upon the gravel uncomfortably, that is the surface of the latter is not even, very rough, with elevations and deep places. I found two specimens; one was thrown out while I was there by the man who was completely hidden in the trench about six feet deep; the other was on top of the heap and had been thrown out previously to my coming. The former specimen (80670) looks like an argillite that had been used and water-worn afterwards, and the latter (80671) I believe to show chipping. The place is very interesting and demands watching, especially the yellow loam which is taken out before the gravel is reached.

Sept. 10; I was not feeling well and did not go out.

- Sept. 11 to Sept. 18; I was very sick with bronchitis.
- Sept. 19; I got out of bed, but the wind was in the east and I did not venture out of doors; I wrote to Professor Putnam about my health.
- Sept. 21; I went out of doors for the first time and visited the sewer excavation on Fair Street. The loam rests here now entirely on bed rock; the crevices are filled with loam and pebbles, and the often noted clay bands are found in the loam, but the latter is nearly forty feet lower than that of the terrace and, as mentioned, of a darker color; it is, however, similar to that found on Decatur Street and elsewhere nearby at the same level; this is evidently due to settling in muddy water moving with very little current or perhaps with none at all. The loam thins out to the south while the north end of the street shows it five feet thick; here is where some Indian burials were struck some years ago during some water pipe excavations. I found today three specimens; an interesting natural flake (80672) showing a bulb, found at the bottom of the trench, a natural argillite flake (80673), found at the bottom of the trench in the loam, and a chipped pebble (80674) from the gravel, a fine grained stratum three feet below the present surface.
- Sept. 22; I visited Ahrendt's sand pits again, the first time since being sick. It is slow work for me walking, as I feared the draught of the summer cars. As I said before Mr. Ahrendt had the high bank cut down which was opposite his house on the southern shore of Crow Creek; a cut of fifteen feet; after the top was taken off there was a stratum of gravel, the one so often referred to as showing two faces; this was thrown out into high heaps for sale in making concrete. Here about four feet below the present surface, within eighteen feet of the shore of the Creek I found a piece of argillite showing the natural veins of the formation of the rock (80675). It was lying in the trench on the bottom and had evidently been struck with the shovel; but I cannot tell whether in situ or how deep it had been, only how I found

it. The gravel is much mixed with the red sand or loam from the Columbian, which is found about two miles east of this place.

Sept. 23; I visited the sewer trench, where bed rock was frequently met with, and fragments of it are piled up outside in an immense heap of debris. I found an argillite pebble (80676), water-worn; many of this kind are found but I saved this one for comparison. I am still very weak and cannot stay out as long as I formerly could.

Sept. 24; I could not go out.

Sept. 25; Sunday.

Sept. 26; I visited the South Trenton sewer-digging; argillite is plentiful in the gravel, but I found no specimens.

Sept. 27; The sand pits were visited today; I found a natural argillite (80677) in situ in the gravel, seven and a half feet down.

Sept. 28 and 29; I felt too sick to go out.

Sept. 30; I visited the sewer trenches in South Trenton; nothing of interest was found.

Oct. 1; All the sand pits in Deutzville were visited today. The new excavation is now fifteen feet deep down to the boulder bed; a clear sand, very coarse is found on top of the boulders. The yellow loam here at the high point is four feet thick for a long distance; in low places, real basins to the northwest, it is five feet and over in thickness; I found no specimens here, but in the trench near the Creek where a lot of gravel is thrown out, and the trench is five feet deep (originally eleven feet) I found the following specimens. No. 1 was found in situ about eleven feet from the original surface; it is a flat slab of stone (80678) with regular grooves and with one face smoothed by sand, ice or gravel passing over. No. 2 was found in situ on the bottom of the trench and about nine feet below the original surface; it is seemingly a chipped stone, water-worn after chipping (80679) but probably natural. No. 3 was found in situ from eight to nine feet below the original surface; it is

a naturally fractured pebble (80680), water-worn or sand-worn after fracturing; such fractured stones I have frequently found in this stratum of gravel from three to ten feet below the original surface; many that I have found were apparently burnt. No. 4 was found in situ seven feet below the surface, a white quartz specimen, artificial (?) [80681, probably natural fracture]. No. 5 was found in situ like the others but at the west side or end of the same trench not over six feet below the original surface, but in the same undisturbed stratum of gravel; it is a naturally fractured argillite (80682). No. 6 is a small circular piece of argillite (80683) showing probably natural fractures.

Oct. 2; Sunday.

Oct. 3; I did not go out.

Oct. 4; I visited the sewer excavation in Fair Street, which is now ten feet deep to the bed rock; among the gravel masses from the crevices were found the following three specimens at a depth of ten feet, and at a height of twenty feet above the falls of the Delaware. No. 1 looks like the butt-end of a palaeolithic implement (80684); No. 2 is an argillite (80685), whether chipped or not I could not tell, as it had a heavy coating of sand and patina and I did not wash it off; No. 3 is an interesting fractured pebble¹ (80686); this was washed as it was too full of dirt to recognize anything on it; No. 4 is a fossiliferous rock (80687).

Oct. 5; I visited the trench again, but found no specimens.

Oct. 6; I visited Deutzville again and found three specimens in the old trench near the Creek, five feet below the new (cut down) surface. No. 1 (80688) a natural argillite showing interesting fractures, No. 2 (80689) a water-worn pebble,² and No. 3 (80690) a water-worn argillite more frequently found in the gravel. I saved

¹ A fine red-brown sandstone quartzite, broken at one point by a forced blow after transportation.—J. B. W.

² This is a fine quartzose conglomerate. A water-worn oval pebble pitted by sand-blast, fractured at obtuse end at two periods. Fractures may be artificial.—J. B. W.

it for comparison. The other pits show nothing new; the last one, running to the bluff is making progress. The very top of the elevation shows a black soil of six inches and under this a yellow drift of two and one half feet thickness. Southwest of here in the slight depression there are nearly four feet of it over the stratified sand. The red bands are numerous and close to each other, disappearing near the top as found in all the trenches on the terrace before.

Oct. 7 and 8; Rain.

Oct. 9; Sunday.

Oct. 10; I went to the sewer-digging in Fair and Decatur Streets. Loam is still found on top of bed rock. In Fair Street I found, eight feet below the surface in gravel below the loam on top of the bed rock, a (naturally?) chipped argillite (80691). I watched the excavators and saw the specimen thrown out by the man in the trench, and then measured the distance. I worked with the trowel in the loose material thrown out but found no more specimens. The loam seems to be different to the touch from that of the terrace; it feels greasy, probably on account of the dark material mixed with it. The bed rock is water-worn on top, apparently washed over and smoothed before the loam and pebbles were deposited. The top now as the trench moves southward shows a modern deposit, a recent filling in by man of about six to eight inches.

Oct. 11; I did not go out.

Oct. 12; A new excavation was visited today in Turpin Street; it is below, or southwest of Broad Street and just on the bank or ancient shore of the Delaware; it is not far from where the "large rock" on Centre Street stood. The sewer is deep and the material is very coarse especially at the eastern end. The boulders present great variety and most of the outcrops above are represented; they are mostly water-worn and vary from the size of a baseball to one of two feet in diameter, with the large ones predominating. Argillite is abundant but two thirds

of it is angular, a feature I have noticed for years; of course the mother rock is only twenty-three miles away and the chances of rolling and rounding are not so great as when the journey is twice as long; then too it was liberated by the ice earlier than the material further up. Still the action of the stream in breaking the rocks, deepening its bed and sending down fragments to a lower level went on and will continue to go on as long as there is a stream to flow. The excavators were able to dig and disturb this deposit in the narrow street, but were not able to pack it back again as the mighty waters had done and consequently an immense mass had to be carted away. There was practically no sand amongst the boulders, rarely was a small pocket encountered; no bed rock was found only loose gravel. This deposit seems to be a part of that called in my notes the boulder bed met with in Deutzville and in the former sand pits on Hancock Avenue. I found today three specimens in this gravel. No. 1 is a water-worn specimen (80692) which shows many fractures made before the water-wearing; No. 2 and argillite (80693), flat, somewhat water-worn but apparently shaped before water-wearing; it bears some resemblance to an Eskimo knife; No. 3 is also a flat argillite (80694), but very large, seemingly chipped on the edges. All these specimens came from an undisturbed coarse gravel from a depth of from eight to ten feet. All were in situ; I saw them dug and thrown out.

Oct. 13; I visited Deutzville; the new trench in Ahrendt's sand pit shows an interesting bank. There is a thin gravel stratum and above this the red bands are very dark and plentiful; below this there are also red bands with sand in between; no specimens here today. The old trench near the Creek is still in operation; I found a specimen (80695); it was five feet below the present surface and six inches below the line of contact of the yellow with the sand and gravel; it is apparently a chipped argillite but may be natural, showing veins and cross veins. I saw it dug out and thrown on the pile outside.

- Oct. 14; I visited Turpin Street but found no specimens; it is a sight to see all these boulders heaped up in the narrow street.
- Oct. 15; The Fair Street sewer was visited; I made a search with the trowel in the large heap of loam thrown out but only found two specimens of no special interest. The chief obstructions to the excavators here are the masses of very hard fine grained granite in which five blasts of dynamite had been tried with little success.
- Oct. 16; Sunday.
- Oct. 17; I visited the diggings on Turpin Street; no specimens. In the afternoon Dr. Peabody of Cambridge called and a trip to Deutzville in his company was made; I showed him all the points of interest and the different pits here, also the place where the bison bone was found, the new and old pits, etc.; I found a specimen (80697) in situ four feet below the present and ten feet below the original surface. It is an argillite slab with interesting fractures.
- Oct. 18; I visited the sewer trenches on Turpin and Decatur Streets, but found no specimens.
- Oct. 19; I visited the Fair Street excavations; more pebbles are found in the loam but they are of medium size about that of a man's fist; the larger ones are on the bottom; considerable argillite is found among the larger ones. I found specimen, probably natural (80698), six feet below the surface in the loam.
- Oct. 20; Rain all day.
- Oct. 21; I was sick and could not go out.
- Oct. 22; Sunday.
- Oct. 23; I visited Deutzville today and found four specimens. No. 1 (80699) from Ahrendt's sand pit six inches below the surface, a chipped quartzite pebble (80699)¹; No. 2, from ten feet down in undisturbed gravel, a water worn pebble split into two parts and with the sharp edge battered (80700); No. 3 (80701) from nine feet below the surface in Ahrendt's sand pit in situ; it

¹ Quartzite, artificial.— J. B. W.

may present glacial striae and natural fractures; No. 3 (80702), from the gravel nine feet down presents interesting flat faces. A new trench or sewer excavation near the entrance to the Riverview Cemetery shows the same gravel stratum as at Deutzville, three to four or more feet below the surface. It is the same gravel as at the Railroad Cut and has often been referred to in my notes. A new excavation for a cellar on Centre Street was also examined.

Oct. 24; I visited the sewer excavation on Fair Street but found no specimens.

Oct. 25; Rain.

Oct. 26; I visited a sewer excavation in Hillcrest; here is mostly clay filled with pebbles, but there are not many of them fractured, and none artificially so.

Oct. 27; An excavation on Parkside Avenue, Cadwallader Place was visited; here was a splendid exposure of gravel of a medium grade; very large boulders up to five feet in length of trap, granite, etc. are met here. I found a fossil coral¹ (80703) in the gravel nine feet below the surface; I have never before found this variety. I found specimen (80704) that looks like a broken chipped implement with the point missing. Another specimen (80705) was found on the surface and I have no knowledge how deep or where the specimen had been originally; this place was cut down four or five feet several years ago and now has to be graded and cut down again. At the eastern part near the railroad and canal a cut was made through a bog now three feet below the surface; it is represented by a black layer eight inches thick; below this is clay mixed with gravel. The latter end of the afternoon was spoiled by rain.

Oct. 28; I visited the new water power plant where the Assanpink enters the Delaware; gigantic excavations are made here. Already thirty feet of ashes and refuse that had to be dug through make solid walls on each side of the excavation; here is a sample of an artificial deposit,

¹ Favosites sp.

probably one hundred years old. Fifteen feet further in the river gravel afforded a place for investigation. The bed rock was struck at that depth. I examined the gravel taken out by the machine but found no specimens. I also visited the sewer excavation in Fair Street. Here now very little gravel, is found, mostly all bed rock. It is a crystalline rock of coarse texture and of a light gray color. No specimens.

Oct. 29; I did not go out.

Oct. 30; Sunday.

Oct. 31; I visited the sewer trench near the Riverview Cemetery. Very fine gravel is met here and a layer of manganese. Found a specimen (80706) composed of the portions of a single specimen found twenty feet apart; only natural fractures. From there I went to Deutzville. On the Trenton side of Crow Creek new, shallow water-trenches have been dug discovering medium gravel all the way through. About one foot of yellow loam lies above and then six inches of black soil. In this water trench was found an oval boulder, two feet long and two feet thick, one foot nine inches below the present surface; it lay on top of the gravel and the men rolled it aside.

Nov. 1; I visited the water power bank excavation and examined the gravel there; then I went to the sewer excavation on Fair Street, where very little gravel is found now. The loam seems to rest upon bed rock. I examined a cellar excavation on Centre Street; there was a deposit of yellow loam six to eight inches deep, then a fine gravel for three feet, the pebbles varying from the size of a walnut to that of a base-ball; below is a very coarse gravel like that in Turpin Street. No specimens.

No. 2, 3, and 4; Rainy.

Nov. 5; I visited a cellar excavation at the corner of Olden and Greenwood Avenue. The yellow loam is here from two and one half to three feet thick and rests upon stratified sand. Several ice pits on the eastern and western walls show plainly the washing in of the loam and fine gravel on top of the cross-bedded sands. I found speci-

men (80707) in the yellow loam about two feet, six inches below the present surface. It looks like a hand axe that had had a sharp edge on one side, and was then battered and water-worn; the material seems to be some kind of jasper [Calcedonic quartz].

Nov. 6; Sunday.

Nov. 7; I visited the diggings at the river and at Fair Street, but found no specimens.

Nov. 8; The weather was too bad to go out.

Nov. 9; Still very bad weather, and I did not feel well enough to go out.

Nov. 10; I visited the sewer-digging at Fair Street; no specimens.

Nov. 11; I visited the river excavations. The gravel brought up from one excavation is modern gravel, that is, it is full of the relics of the white man, such as leather, brick, tin, iron, glass, etc. I watched the other excavation where the clear gravel is reached and dumped on the side.

Nov. 12; I visited Deutzville. The yellow loam is now three and one half feet thick on top of the high point. It apparently increases in depth towards the west. I went over the terrace, when a snow storm came up and lasted a little while. Nothing of interest to-day.

Nov. 13. Sunday.

Nov. 14; Deutzville was again visited and all the sand pits, but I found no specimens.

Nov. 15; The excavations at the mouth of the Assanpink Creek and on Fair Street were visited, but there were no specimens.

Nov. 16; I did not go out.

Nov. 17; I visited Cadwallader Park, the deep basin with the large glacial rocks on the surface; no specimens.

Nov. 18; The excavation at the River and the Assanpink Creek was visited; I found two specimens on a pile of gravel taken out ten feet below the river bottom. I also visited the sewer excavation on Fair Street. They now find much fine gravel in the direction towards the bridge and they have also encountered a recent filling. I found no specimens at this place.

Nov. 19 to 28; I was lame and unable to walk.

Nov. 29; I did some packing. In the afternoon I went to the river excavation but did not find anything.

Nov. 30; All the sand pits were visited; the old ones were all caved in and the frost last night penetrated the sand to a depth of one half of an inch and loosened it. Mr. Ahrendt's new pit had also caved in on account of the rain, but the men had finished cleaning it so I had a good chance to observe the new exposure; at the bottom there is still to be seen the overwash from the Columbian gravel; this quartz-sand is five feet thick and rests on the boulder bed, showing beautiful cross-bedding. On top of this is a sharp greenish sand four to six feet thick and above this a light colored sand several feet thick; then come four or five feet of yellow loam and a foot of black soil. The yellow drift now covers the elevation in an even layer and the uneven surface of the sand has disappeared. Very few boulders are found and strange to say, no ice pits. I worked with the trowel in the abandoned pits but found nothing. Among the large pebbles thrown out by the workmen in a pit where gravel is dug for concrete for cellar walls I found a natural stone of interest (80709). I have no idea how deep in the gravel the specimen lay, but it certainly came from the gravel which is here found eleven inches below the present surface, along the Creek.

Dec. 1; Rain and snow.

Dec. 2; I visited the excavation at the mouth of the Assanpink Creek; the gravel now taken out comes from fifteen feet below the river bottom I found a natural specimen (80710) in this gravel.

Dec. 3; I visited the same place again; I made a search over the gravel taken out and found two argillites with natural, but interesting fractures (80711, 80712). I also looked in the rear of the Anvil works, where none of this gravel is deposited, but did not find any specimens. The weather is very cold, unusually so.

For much of the remainder of the month I was too sick to leave the house.

IV. APPENDIX.

J. EDMUND WOODMAN (NOW PROFESSOR OF GEOLOGY, UNIVERSITY OF THE CITY OF NEW YORK): REPORT TO PROFESSOR F. W. PUTNAM, ON THE GEOLOGY OF TRENTON. 1897.

The direct results which have followed from my recent short survey of the Trenton area can be given very briefly. . . . My examination covered all the vertical sections exposed by Mr. Volk's work, and the country for some miles around was visited.

In the trenches which were open at the time of my visit, there is a certain fixed horizon, below which even Prof. Salisbury recognizes the glacial nature of the gravel and sand. It is conceded that all below this was formed at the close of the Glacial Period, by a vast flood of melted ice, which bore from the ice-front upstream boulders and gravel and sand, and dropped them here in a large delta. It is well recognized that such a catastrophic agent would be very variable in intensity, and that this would produce varied deposits, giving that sudden change from boulders to sand, cross-bedding, etc., which are so characteristic of the Trenton gravels. Occasionally, too, detached pieces of ice floating down stream would drop boulders where they appear out of place; and thus we get large masses of rock, roughly rounded, in certain places embedded in fine sand and gravel. I speak of this because exactly this phenomenon occurs in the area occupied by the paleoliths, and to my mind is only explainable by ice-rafting. The horizon mentioned above consists of an irregular stratum of mixed clay and sand, in many places accompanied by a distinct layer of small pebbles, for the most part well rounded.

Above this the usual order in the trenches is (1) greenish sand in which, I understand, some of the implements have been found; (2) red clay with a smaller percentage of sand than the pebbly layer of undoubted delta age, mentioned at the head of this paragraph; (3) sand; (4) red clay, not so persistent as the other clay bands; (5) sand, which when (4) is not present is a part of (3); (6)

the upper red band; (7) sand, running up into black loam gradually. None of the layers of sand show any structure-lamination, cross-bedding, etc., where seen by me.

The lowest clay band (2) is quite different from the sand above or below it. The color is of course due to iron; but the compact character of the mass is *not* due, except slightly, to cementation by that iron — it is due distinctly to the large amount of fine material in it, material so fine that the particles are readily brought within the limit of cohesion. The layer is very irregular, at times expanding into knots, in places becoming very thin, in others branching.

It has been held that this band is distinct from and newer than the glacial surface below. But in certain places the former coalesces with upward projections of the latter, and there is no possible way by which a separation of the two could be made in the field. In my opinion, the two are contemporaneous, and were made by the same processes which have produced similar phenomena in other mixed clay and sand strata in the Cretaceous-Tertiary coastal-plain series. In many places the sand between the two clay bands is in the form of mere pockets; and implements found there, unless subsequently intruded, were brought there by some agent at the close of the series of actions which formed the Trenton delta. There is, as far as I know, no evidence for subsequent intrusion. The sand and clay bands above here are not so easily studied, and will require more careful scrutiny.

This I may say, however. From what I have seen thus far, I can find no ground for making a time-interval between the lower red band and the sand and red bands above. As to the agency which deposited the whole mass: it must have been (1) wind, (2) water, (3) floating ice. There may have been a combination of all three, in some proportion and it is my belief that this is true. The red bands have been called "segregations"; and it has been considered that the material originally in the deposit was all brought by wind, and is therefore newer, or at least may be much newer, than the delta. These arguments may be answered in part now, and I firmly believe that further field work will refute them entirely. In the first place, the bands themselves *cannot* be segregations. It is most improbable that particles of clay can be segregated for any

considerable distance. Some lateral motion does perhaps take place in concretionary processes; but it is always very slight, and no such segregation is known, which extends over acres of territory. What *has* taken place is the segregation of the iron which colors the bands. This lowest band, to which I paid most attention, certainly contains a very appreciable amount of clay, and the coloring has not produced the band. Why should the iron, in segregation, follow and stain the clay, rather than the sand? Because sand is highly pervious, and clay difficultly so. The result is seen in very many regions where clay and sand alternate, and the appearance must be familiar to most of those who have viewed this field.

It has been said that the irregularity, the knottiness of these bands, stamps them as new — how, I do not know. Precisely similar bands occur below the level of the delta, both in the region where Mr. Volk is now working, and in almost all the other places I have seen. The cause there is evident and is the same as in the case under discussion. Yet no one thinks of calling these delta-bands eolian — or segregational, except as the staining is due to segregation. The irregularity is due, without doubt, to the entrance into and the saturation of the clay by water containing the hydroxide of iron. Of course the bulk of the clay will then increase, and the loose sands will allow the band to buckle up and become contorted. In this lowest red band I found what I thought then to be an eolian pebble. At present I am in doubt about its origin, and shall have to examine it more carefully. The major part of it shows good water-action, and the “eolian” part may be a fracture which has been worn by water. The argument that because the disputed deposits are due to wind they are recent, is not valid, even if they *are* in part due to that agency. I found a number of well-marked eolian boulders in positions, in other parts of the delta, which make it extremely improbable — all but impossible — that they have been intruded subsequent to the delta-building. They were in dumps and taluses of delta boulders in localities where the delta runs clear up to the loam; but not being in place, they could be accepted only as indications, and not as absolute evidence. Further field-work is needed to establish the point that they suggest. However, Mr. Volk found in my pres-

ence one undoubted eolian slab in situ and closely packed in among the other pebbles and cobbles of the delta-cut, in such position that it could not possibly have been intruded. It was 4 feet below the top of the delta. A number of other cases were noted of the same age but not so clear as to origin that they would be convincing to a skeptic.

The conclusion to which this evidence points is so simple and natural that I wonder no one has used it before. Prof. Wright was the first to suggest it, but he had little evidence upon which to base his theory. Briefly, the indications point to the following: at the closing stages of the delta-building, the water over it became shallower, as was inevitable. At last, under normal conditions, the top of the deposit was about at water-level. The great and sudden changes in character of the sediments of the delta prove what we should naturally expect — that the volume of water which bore these materials was subject to abrupt fluctuations. Hence, when under normal flow of water the surface of the bank was almost exposed to the air, an extra onrush of the flood would at any time deposit enough material so that when the Delaware was reduced again to normal volume, the delta would protrude into the air in places. Wind and all other subaerial actions began to operate immediately, and if time allowed in any part of the exposed surface, faceting would result on some of the pebbles.

This alternation of wind and current action must have been frequent, and of considerable duration, in proportion to the time occupied in building the whole delta.

In more sheltered portions of the delta, especially at the margins, such floods would appear only in their later stages, with by no means the head of water which characterized the main part of the flood. Hence fine sand and mud would be laid down. This would account for such phenomena as your banded area presents. Moreover, the quiet nature of the actions which went on there would explain how such paleoliths as might be dropped remained undisturbed. In regard to the aqueous or eolian origin of the disputed bands, the microscope ought to give some aid. As soon as I can get time, I shall examine the samples collected by me.

CAMBRIDGE, *June 11, 1897.*

DR. J. B. WOODWORTH (NOW ASSISTANT PROFESSOR OF GEOLOGY,
HARVARD UNIVERSITY) REPORT TO PROFESSOR F. W.
PUTNAM, ON THE GEOLOGY OF VICINITY OF
TRENTON. 1899.

In pursuance with your request that I should visit the vicinity of Trenton, N. J. for the purpose of examining the geological relations of the deposits which have from time to time afforded human relics, I went on the 27th of May to that city and put myself in communication with Mr. Ernest Volk who conducted me to the various trenches and cuttings likely to afford an insight into the problem with which I had to deal. I shall limit this report to a discussion of the two localities in which bones have recently been found, viz, the Hancock Ave. pits affording the bone which you told me was evidently a part of the skeleton of a musk-ox, and the Lalor field including the extension to Dr. Abbott's place on which human skeletons were recently exhumed in the Lalor sands.

The locality at which the musk-ox bone was found affords in its present artificial condition a group of sand pits exposing to a depth of 10 or 12 feet the texture and structure of the deposits which make the terrace bordering the Delaware in South Trenton. These deposits are gravelly sands showing well-marked cross-bedding, the prevailing dip of the cross-beds being southward, though occasional reversals appear as if back-currents set in during the time of deposition. It was in one of the gravelly layers at about 12 feet from the surface that Mr. Stryker, a laborer engaged in excavating sand, found the bone which has been referred to the musk-ox. I found Mr. Stryker at work in this pit and questioned him concerning the circumstances of his obtaining the bone. So far as inexperienced testimony goes, I saw no reason either in the circumstances of his report nor in the nature of the overlying gravels for doubting that the bone came from the depth claimed. I have not seen the bone in question nor did I find any fossil in place in these beds. A circumstance which attracted my attention was the occurrence of slightly sand-blasted pebbles in this deposit at a depth of about 5 feet below the present turf-covered surface.

There is a modern wind and rain-wash derived deposit capping the terrace here, having a thickness of about two feet. In this layer, particularly at the base, sand-blasted pebbles are common. But this lower zone of glyptoliths is interstratified with sands and gravels of an origin like that which must be assigned to the main deposit already described. From the character of the materials in the deposit and the form of the terrace, I conclude that this portion of the Trenton gravels is a shallow river deposit of the time of the last or third glacial epoch probably contemporaneous with the retreat of the ice from the Belvidere moraine in the Delaware River valley. Towards the close of this phase of extra-glacial deposition the waters of the river either because they fell off in height or because of the shoaling of the floor by deposition bared the gravels to the atmosphere long enough for sands to be blown by the winds across their surface. A feature which is characteristic of the Trenton gravels and which I am not able to say occurs in the glacial field proper at least in New England, is the abundant evidence that the pebbles of this deposit have been reassorted by running water after a period of fluvial deposit and disruption as by frost. Many of the pebbles appear to have been freshly fractured before their deposition in the Trenton gravel beds and not to have journeyed far in this last episode. I interpret this to mean that the materials were urged forward from time to time in floods of the river, in the intervening time being subject to fracture under atmospheric conditions. Many of the fractured quartz pebbles may be explained as well by exposure to the sun's heat as to frost. (See J. Walther, *Die Denudation in der Wueste*, etc.) This possibility is the greater when the new surface of the water-worn pebble lies uppermost on a level with sand-blasted pebbles as was the case with one I obtained from the pit in which the musk-ox bone was found. My examination of the region was too limited to enable me to speak with more definiteness concerning the Trenton gravels. I can only state my opinion in closing these remarks upon them that they bear every mark of being late glacial accumulations not older than the terminal moraine.

The Lalor sands which succeed to the Trenton gravels on the south and east appear to be in part contemporaneous with these beds. The beds on account of their position to the south of the

gravely accumulations accord with this opinion. Evidences of water action in stratification appear in several pits northwest of the Lalor field in deposits which appear to be intermediate between the finer sandy gravels and the typical massive bed on Lalor field.

In the two pits which I examined on the Lalor field and near the ravine on Dr. Abbott's place stratification could not be detected. A secondary structure was however very well marked. It consists of irregular bands of inosculating ferruginous clayey material usually more or less horizontal but locally vertical, and clearly due in all cases to segregation of iron oxides through the action of percolating water. The process is apparently now going on. The extent to which it has been developed is the only index of its antiquity and this development may well have taken place in the post-glacial epoch. The process is akin to that of the formation of the loess-puppen or concretions in glacial clays and silts. In no case did I observe that actual consolidation had yet set in. The structure assumes some importance by reason of Mr. Volk's observation that the skeletons last exhumed on Dr. Abbott's place appear to have been involved in beds which exhibit the development of these bands. The photographs of stone implements from the Lalor field show that the relics were buried with the accumulating sands. I saw stones similarly bedded but found no implements in this position. The human bones just mentioned were removed before I reached the locality so that it was impossible to see the immediately overlying sediments, but I examined the side of the trench a few inches from the spot where the bones rested. This wall exhibited the segregation bands which have been referred to. These were interrupted by the cutting and so far as I could determine must have continued over the skeletons in question. If the skeletons had been buried subsequent to the formation of the bands, it is certain that this wall would have been disturbed unless the pit was sunk with the same care as that observed in making the present trench. The testimony of Mr. Volk is to the effect that the bands were continuous over the skeletons.

A fact of some interest as showing the condition of the surface on which the Lalor sands were laid down came to light on digging in the bottom of the trench just mentioned. I came upon yellow gravels which appear to have been left by the removal of the fine

sand from the surface. Two specimens of sand-blasted quartz pebbles with the cut side up were found in this layer, showing that before the Lalor sands were laid down the region was a land surface. The bearing of this evidence on the fine Lalor sands is not conclusive but it is favorable to the assumption that wind has had some part in their accumulation. It would also suggest that their formation dates from the closing stages of the Trenton gravels at least that part of the Trenton gravels which as has been noted also shows signs of wind action. The occurrence of angular stones on and in the Lalor sands indicates occasional floods bearing ice, but I am not certain that all the blocks and boulders which I saw upon the surface rest upon the newest deposits for it is possible that knolls of older gravels rise to the surface and carry these erratics.

In concluding this report on the Lalor sands I wish to draw attention to their resemblance to many local deposits in New England resting on our till and washed drift alike, which have a loess-like structure, often a thickness of 4 or 5 feet, stand up in steep banks, and contain angular stones where these may have washed in from higher ground. With these the Lalor sands have many points in common, differing mainly in the fact that they have developed in close proximity to a great river whose waters at a former time undoubtedly reached the surface on which these sands have been deposited.

The following scheme expresses my opinion of the general relation of these beds and the Trenton gravels.

Post-glacial Period . . .	{	Soil	Soil
		Eolian Sand and Rain Wash	Lalor Sands
Last Glacial Period . . .		Trenton Gravels	

As to the occurrence of the human relics in these deposits I have no observation to offer, I saw no implements or bones in place and can only refer to the information given me by Mr. Volk and to the photographs which have been submitted to me.

In regard to the question of talus which has been raised here at Trenton, I may state that the deposits which I examined showed no sign of talus deposition, that is on a slope under the influence of gravity alone. I would suggest that a search be made for traces of mollusca or other forms of life lower than man contem-

poraneous with the Lalor sands. Such may yet be found and afford some light on the relative ages of deposits made so near to the close of the Ice age. It should be stated that in the case of these deposits the Lalor sands are the most open to doubt.

CAMBRIDGE, *June 1, 1899.*

PROFESSOR G. FREDERICK WRIGHT, (NOW PROFESSOR EMERITUS,
OBERLIN COLLEGE) TO PROFESSOR F. W. PUTNAM. NOTE
ON THE GEOLOGY OF THE TRENTON GRAVEL NEAR
MOUTH OF CROW CREEK. 1899.

The human femur found by Mr. Ernest Volk in the Trenton gravel on Dec. 1st, 1899, occurred near the mouth of Crow Creek, a brooklet which rises on the summit of the Trenton gravel a little East of the Lalor farm. Its total length is about half a mile, and it cannot drain an area of much more than a square mile. The general elevation of the Trenton terrace through which it runs is from forty to fifty feet above the Delaware River. It enters the Delaware flood plain just south of the Cemetery about half way from the Rail Road bridge to the Lalor farm. (This is an estimate, perhaps it is three quarters). The edge of the Trenton terrace on the south side of Crow Creek is at the full height fifty feet. The femur was found about three hundred yards east of the Cemetery. Between the two places the canal and the Rail Road run through a slight depression. But the gravel surface east of the Rail Road is not more than ten feet lower than the general level, i. e. it is fully forty feet above the Delaware. The femur was found 360 feet back from Crow Creek and entirely beyond the reach of any reasorting of gravel which it may have done. The level of the terrace here corresponded to that on the south side of the creek, and the whole appearance of the bank showed that the deposit belonged to that of the main stream when swollen with glacial floods, and choked with glacial débris it flowed forty feet above its present level. The forty inches of coarse, pebbly gravel shown in the photograph indicates this. The pebbles average from four to six inches, while several I measured were more than a foot in diameter. One was 15 x 9 x 4 inches, and on the surface about 100 feet distant were two partly buried boulders, one of which was three feet in diameter. The photograph on page 521 of my *Ice Age in North America* shows an exposure of this gravel taken by Dr. Abbott for me in 1889, about 100 feet south west, and so

much nearer the creek. This overlying pebbly deposit indubitably belongs to the coarsest of those laid down by the glacial floods at Trenton, and has remained absolutely undisturbed, until the excavation which exposed the specimen, while the cross-bedded, unconsolidated strata of fine sand in which it was found underneath the thick pebbly stratum preclude the possibility of accidental or fraudulent burial.

The slight depression in the surface spoken of is such as naturally occurs in the delta deposits of such a vast stream as the Delaware was during the melting of the glacial ice over its headwaters. During portions of the year the flow of water must have been slight compared with that towards the end of Summer, thus laying bare large stretches of the depositing gravel of the delta. At such times the inhabitants could wander over it at will, and could then build fires upon it, and lose their implements. The later floods would disturb these camping places and bury the specimens for preservation to the present time. It should be noticed also that the depth of seven feet here corresponds to a depth of fifteen or sixteen feet in the higher portions of the delta terrace, where some of Dr. Abbott's specimens were found at those and even greater depths.

OBERLIN, OHIO, *December, 1899*

DR. ALEŠ HRDLÍČKA, (NOW ASSISTANT CURATOR IN CHARGE OF
PHYSICAL ANTHROPOLOGY, UNITED STATES NATIONAL
MUSEUM) REPORT TO PROFESSOR F. W. PUTNAM,
ON THE HUMAN FEMUR AND PARIETAL. 1899.

(Plates CIII-CVIII.)

The specimen you referred to me for examination is a part of the shaft of a left, and, so far as can be seen, adult and normal human femur. The piece represents that part of the femoral shaft which is situated between the trochanters and the distal third of the bone. The anterior wall of the specimen reaches somewhat higher than the posterior, which ends just about below the minor trochanter.

From a purely anatomical standpoint, the bone is in no way especially remarkable. The proportions and structure of the shaft, its thickness and the size of the medullary canal, agree with the same characteristics in average American femora. In strength, the bone, if of a female, is somewhat above, if of a male, very slightly below, the average of eastern Indian femora. In shape, the bone shows a marked antero-posterior flattening of the upper third of the piece, or platymery. This corresponds very closely to a similar flattening below the minor trochanter, which is found very frequently and often pronounced in the femora of Indians, but is generally less marked in those of the Eskimo, whites and negroes. The outer lip of this flattened portion shows a bulging, which, as can well be seen in the photograph, is equally found in the femur of a Mexican Indian, used for comparison, but is only little marked in the Eskimo femur shown in the same photograph. Both the subtrochanteric flattening and its bulging outer border are in all probability due to the action of the gluteus maximus muscle, the long, rough, linear insertion of which runs posteriorly along this border. In the Eskimo, so far as can be determined from the femora of six skeletons of these people, in the collection of the American Museum of Natural History, the subtrochanteric

flattening and the bulging of the external border or lip of the femur in this location are, even in the strongest men, quite insignificant. Below the flattening, the Trenton specimen becomes gradually almost cylindrical. The *linea aspera* is plainly to be seen, but not prominent. There is but little indication of the normal femoral curvature forward.

Various measurements of the Specimen.

Diameter antero-posterior at about the middle of the upper flattening	2.1 cm.
Diameter lateral of the upper flattening	3.2 cm.
Circumference of shaft slightly above the inferior end of the piece	7.6 cm.
Diameter of the medullary canal at this end	2.4 × 2.2 cm.
Thickness of the walls of the shaft	3-6 mm.
Thickness in the majority of places	5 mm.

The piece of bone is apparently very much altered chemically. Its color and consistence are those of a slightly dirty chalk. The bone does not crumble, but its surface is easily rubbed away by the hand or scratched by the finger-nail. It could be used as a crayon on a blackboard. The finer structure of bone is, however, still fairly traceable. Besides the above characteristics, the specimen shows a number of artifacts. The piece has been cut in a regular way inferiorly, and at least partly cut or bevelled superiorly. The upper part of the medullary canal looks as if it had been gouged out.

On the postero-internal part of the medullary surface, near the upper extremity of the bone, is seen a deep artificial groove, running from above downwards for the distance of about three cm. The posterior surface of the bone is perforated in the median line by two openings,—one, a larger one, situated near and extending to the broken superior border; the other is 3.1 cm. below and may have originally been the nutritive foramen, which is often seen in this locality in femora, but it has been irregularly enlarged and modified. The bone shows on its surface numerous irregularities, due to small losses of substance in the outer table, such as could

be produced by knocks or rubbing. On the anterior surface, over the flattening, are fine superficial longitudinal and oblique scratches. Finally a little below the middle of the piece, on its antero-internal border, there is an oblique cut 1.45 cm. long made by a sharp though not fine edge of some object. The lower end of the bone has several, apparently recent, longitudinal fractures.

The Trenton bone described above was subjected to comparison with a fragment of a parietal bone found nearby in the talus; with a number of fragments of human bones from the ancient mounds in Florida (specimens from the Peabody Museum); with parts of skulls from ancient burials under the floors of the ruined houses in Cave Valley near the Mexican Casas Grandes; and with fragments of a skull which I recovered from a stone mound, containing many more or less burned human bones, in the ruins of Totoate, Jalisco, Mexico. The Casas Grandes and Totoate specimens are preserved in the Am. Mus. of Nat. Hist., and are the only specimens in the anthropological collection of the Museum which approach the Trenton bone sufficiently to deserve comparison with the same.

The majority of the Florida mound specimens show a peculiar brownish gray discoloration, much differing from that of the Trenton specimen. All the pieces are proportionately heavier than the Trenton bones. There are three fragments, however, one of a femur and two of humeri, which are chalky white, of almost a chalky consistency and decidedly lighter than the other pieces from the same mounds.

Most of the portions of the Cave Valley skulls show a similar, though in a number of instances a shade darker, yellowish superficial discoloration, as the Trenton specimen. The diploe is more or less whitish; some of the bones are quite white and chalky, yet in general they have not reached fully the degree of chalkiness of the Trenton femur.

The portions of the Totoate skull, which can be compared with the Trenton specimen were found by the writer among the more or less charred remains of many skeletons, which, together with charcoal and pottery filled the cavity of a large stone crypt. The age of these bones cannot be accurately determined; they are, judging from the records about the region, at least three hundred

years old, but may be older. Petroglyphs, found about the ruin and also on a few stones in the wall of the crypt, cut from one half to one cm. deep into a hard volcanic rock, were found in many instances to be largely effaced by the action of atmospheric influences. The surfaces of the pieces show a slight yellowish discoloration. The bone, especially in a few of the pieces, is light, whitish and chalky, approaching closely in these characters the Trenton femur; in other pieces the bone is somewhat more firm, yet it can be scratched by the nail without much difficulty.

A portion of a parietal bone from the deposits at Trenton shows on both surfaces a yellowish discoloration, similar to that which is seen in many patches on the ventral surface of the Trenton femur; the bone is also very largely, if not entirely, devoid of animal matter. Its texture is quite firm; the edges of the piece are dulled and bevelled, and the external surface shows a number of superficial scratches running all in nearly the same direction. The piece has been recently broken into three fragments, the edges of which are sharp and very little damaged. The specimen is in general more yellowish and less chalky than the femur, its surfaces are somewhat smoother and it does not show anything, unless it be the bevelling of some of the edges (looking as if cut), which would denote human work. (Plate CVIII.)

The preceding notes show that there are specimens of bones which, so far as the state of the bone is concerned, could not, or could but with difficulty, be distinguished, by the naked eye, and without chemical aid, from the Trenton femur, and this applies even more to the Trenton parietal. Various shades of yellowish discoloration on the surface of bones is common and could not be regarded as any distinctive character. The Trenton specimens show, however, several features of their own. There are the regular scratches on the surface of both bones; and the several unquestionable marks of intentional man's work on the femur. The determination of the age of the two bones, however, must be based principally on their location with regard to geological formation.

PROFESSOR F. W. PUTNAM: PART OF REPORT OF THE DEPARTMENT OF ANTHROPOLOGY, AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK, 1899, p. 15.

“The Exploration of the Trenton Gravels and of the Delaware Valley. This important research has been continued through the year by the generous patronage of Dr. F. E. Hyde. Mr. Ernest Volk has thus been able to continue his daily examination of the glacial gravel as it is removed by the railroad company, or of the underlying sand as it is dug away for the use of the potteries, or with his trowel to enlarge his trenches inch by inch. During this careful work numerous stone implements have been found *in situ* in what is admitted by several competent geologists to be the deposit made at the closing of the glacial period. He has also secured a portion of the scapula of a musk ox which was found in the sand layer underlying the true glacial gravel. On the first day of December last, Mr. Volk himself discovered and removed with his own hands a fragment of a human femur, which was *in situ* seven feet from the surface in the sand layer beneath the undisturbed glacial gravel, the true Trenton gravel of all geologists. Photographs and careful observations bearing on this most important discovery were made; and there seems to be no reason to doubt that this bone is as old as the deposit in which it was found. The bone is very white and chalky, and upon its surface can still be traced a number of striae having the appearance of glacial scratches, like those on a highly polished pebble taken from the same layer a few feet distant. On December 6th Mr. Volk found three fragments of a portion of a human parietal in the talus about twenty-five feet from the spot where the femur was discovered *in situ*. These pieces of a human skull were lying on the recently fallen talus in such a position that it was evident they had been dislodged from the sand layer under the gravel. Like the femur, they are chalky, striated and slightly stained by iron derived from the gravel. The three pieces fit together and form part of a parietal bone. Mr. Volk has also discovered in one of his deep trenches, at about six feet from the surface, fragmentary remains of portions of three skeletons lying near together and below an

unbroken, unmixed thin stratum of sand. The geological conditions relating to this discovery are not yet fully understood; but that the age of these skeletons is very great there can be no doubt. Mr. Volk has also been able to carry on an exploration of an Indian site on the lowlands near Trenton, from which he has obtained several skeletons in good condition, as well as a large quantity of artifacts of various kinds. It is hoped that Mr. Volk's employment in archaeological researches in various parts of the upper Delaware valley may be continued."

PROFESSOR F. W. PUTNAM: PART OF REPORT OF THE DEPARTMENT OF ANTHROPOLOGY, AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK, 1902, p. 9.

"Among the new exhibits installed during the year is the special exhibit of a portion of the material obtained by Mr. Volk during the researches in the Delaware Valley which have been carried on under my direction for over twenty years. The expenses of this research for the past five years have been generously met by Dr. F. E. Hyde of the Board of Trustees. This exhibit is placed in a case in the west corner hall of the second floor. It shows as conclusively as we can expect from such a complicated geological area, that man was in the valley at the time certain of the glacial deposits, and those immediately following were made. The discovery of the cut human femur *in situ* in glacial gravel, seven feet from the surface, and the discovery of the human skeletons below undisturbed sandy strata, six feet from the surface, and the discovery of chipped stones and implements, under various geological conditions, are here illustrated by the specimens and by photographs and diagrams. The evidence here presented has been regarded as conclusive, by competent geologists acquainted with the locality, in proving the great antiquity of man in the Delaware Valley. It seems that we may now infer that he was there certainly during the later glacial deposits at Trenton, if not during pre-glacial time. The exhibit tells the story as we know it, and it is open to all to read it as they will."

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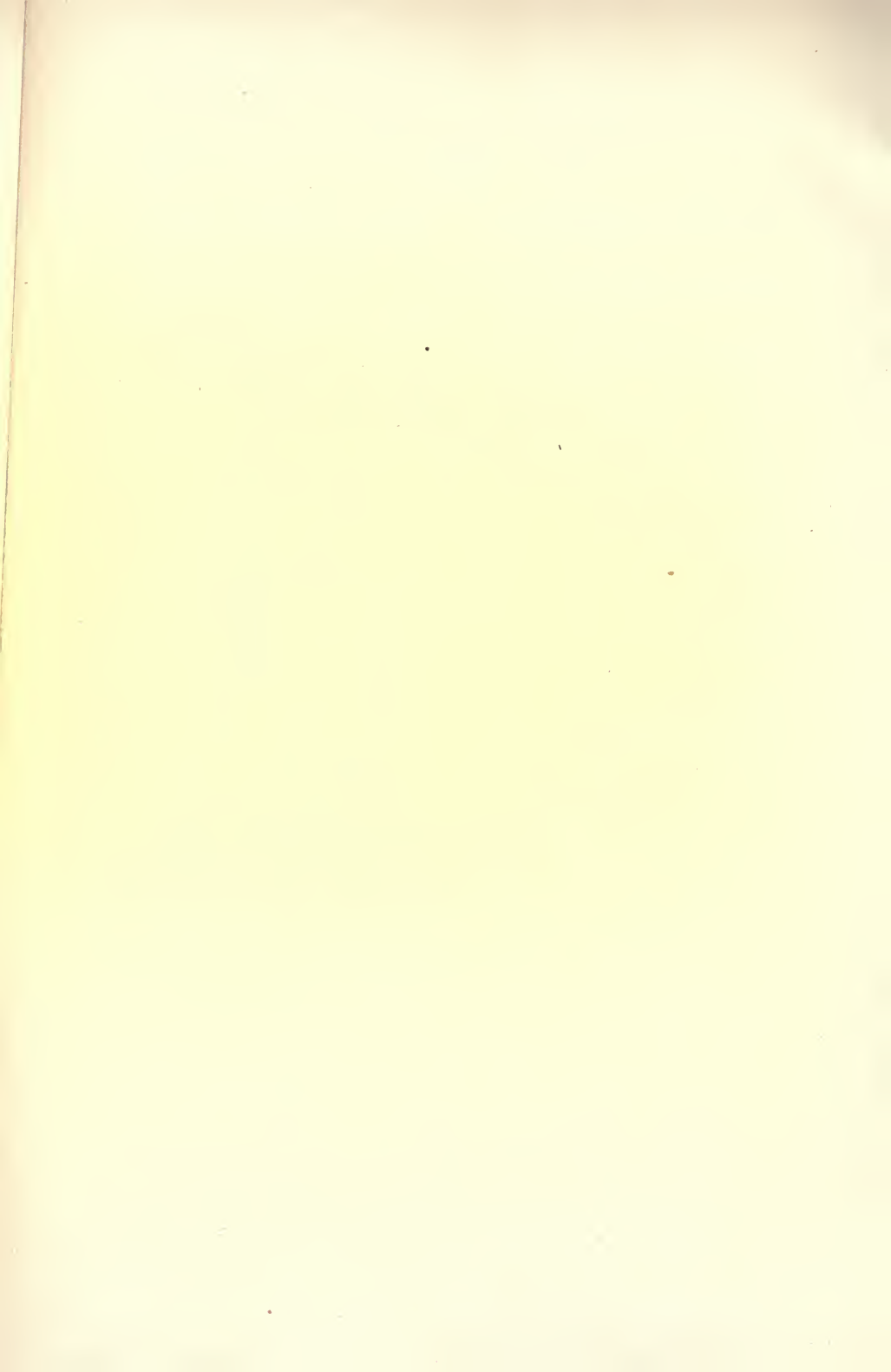
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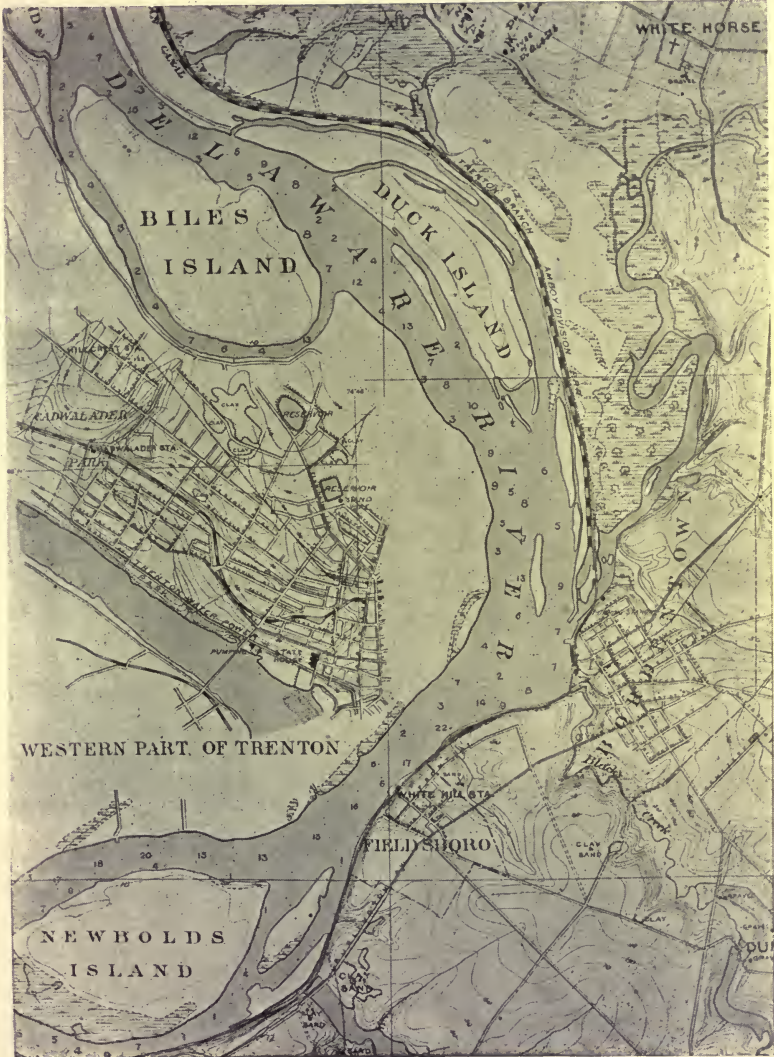




MAP OF TRENTON (A)

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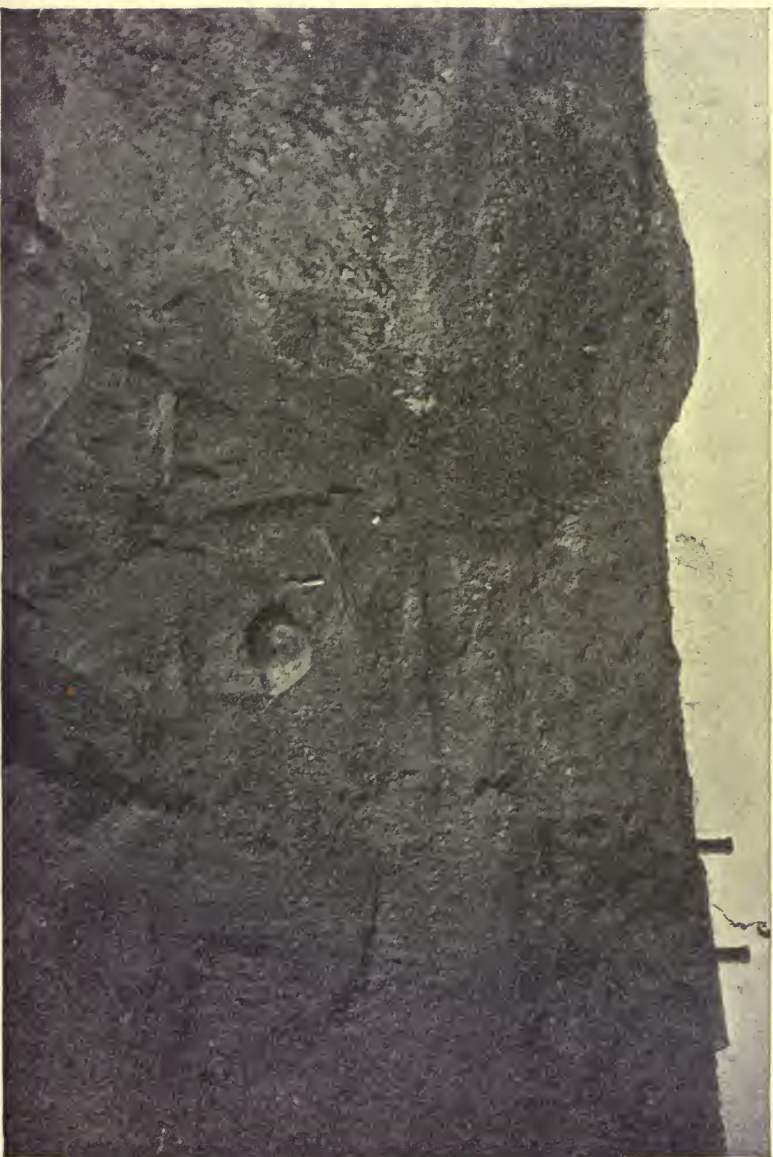


MAP OF TRENTON (B)

Reproduced from Geological Survey of New Jersey by permission of Henry B. Kümmel, State Geologist.



VIEW OF COLUMBIA GRAVEL IN THE SAND PIT NEAR ST. MARY'S CEMETERY



TRENTON GRAVEL ON HANCOCK AVENUE



WATER-WORN ROCK (GLACIAL DEPOSIT) NEAR LALOR HOMESTEAD



TRENTON GRAVEL ABOVE THE BED-ROCK, CADWALLADER PARK



BED ROCK UNDERLYING TRENTON GRAVEL, HERMITAGE AVENUE



TRENTON GRAVEL, ASSANDPINK VALLEY. SHOWING REDISPOSITION



DEPRESSION RUNNING PARALLEL WITH THE HIGHER TERRACE, WEST OF HANCOCK AVENUE



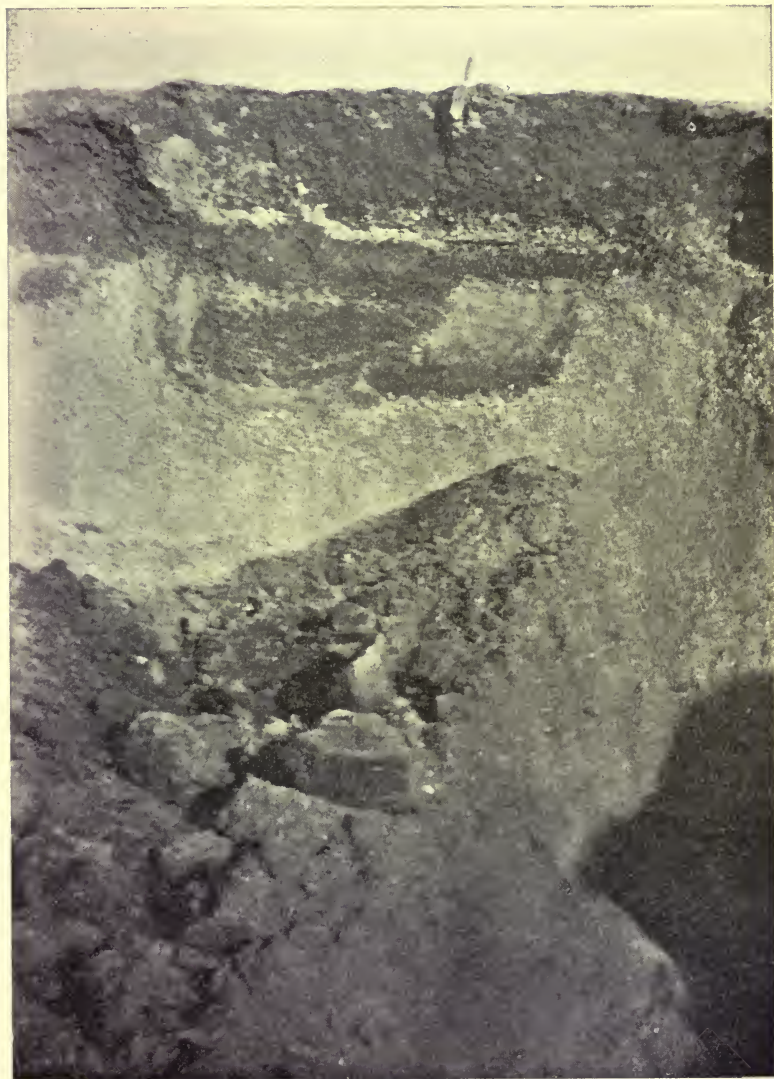
UPPER END OF MORRIS ISLAND LOOKING NORTHWEST



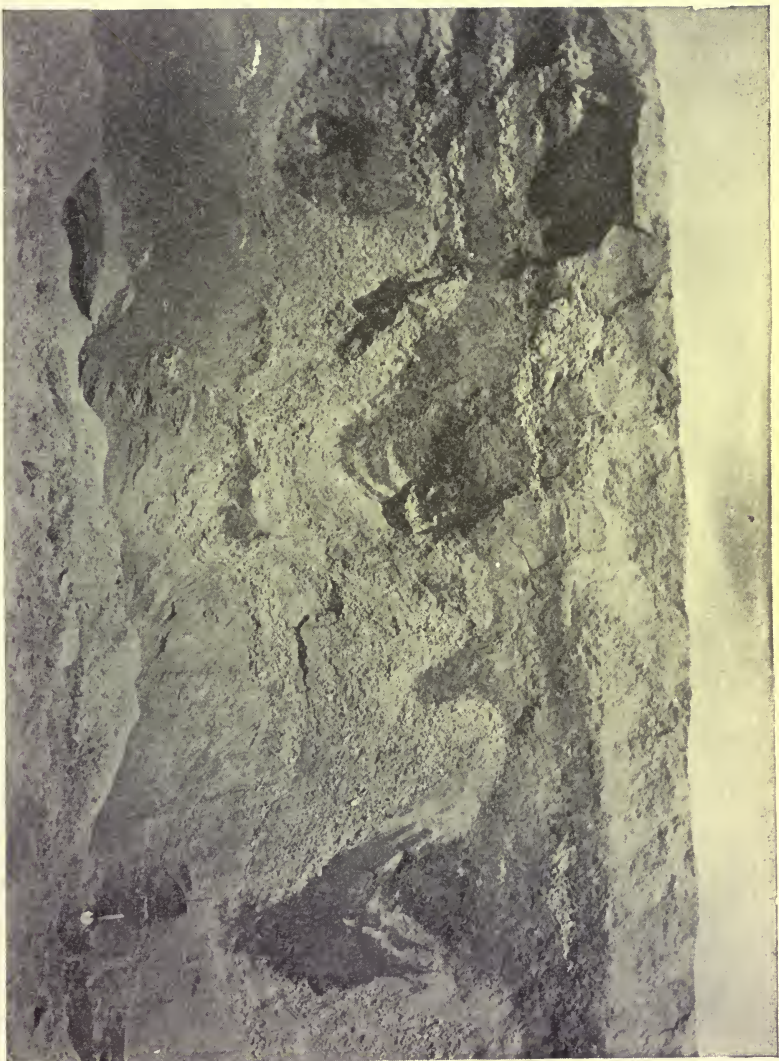
600' SAND PIT, HANGOOK AVENUE



COX'S SAND PIT. NEARER VIEW OF PLATE IX



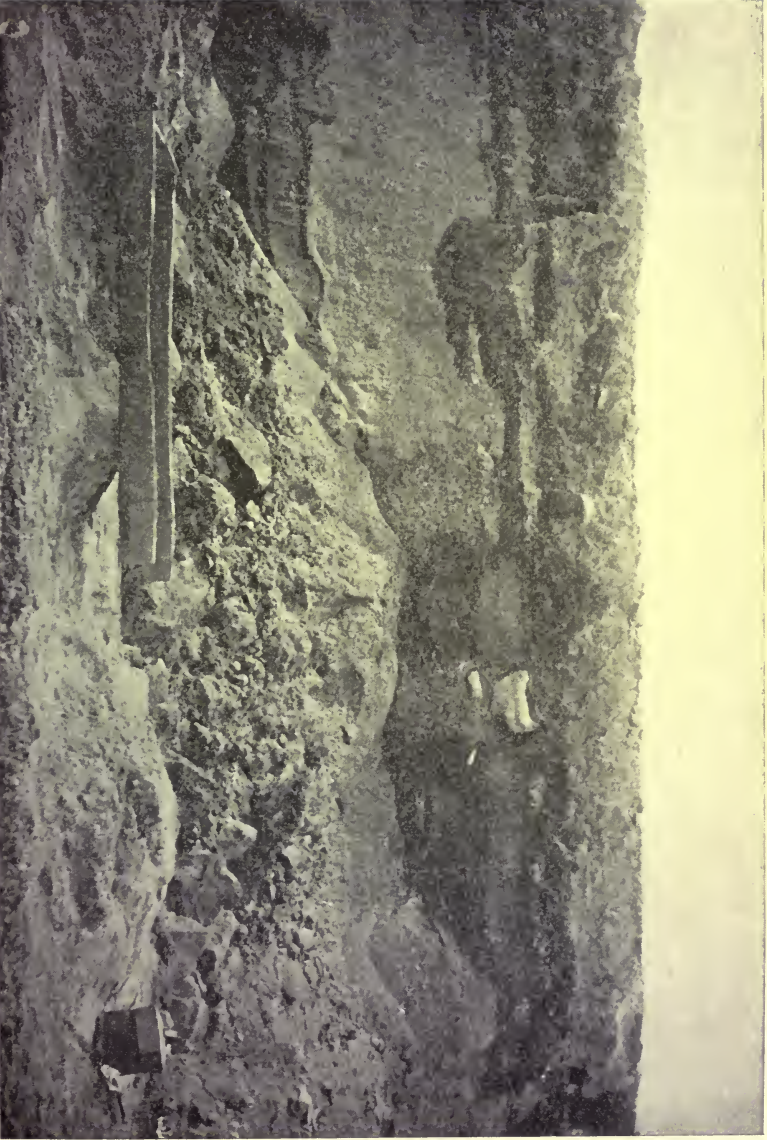
COX'S SAND PIT, LOOKING EAST



COX'S SAND PIT, "ICE PITS"



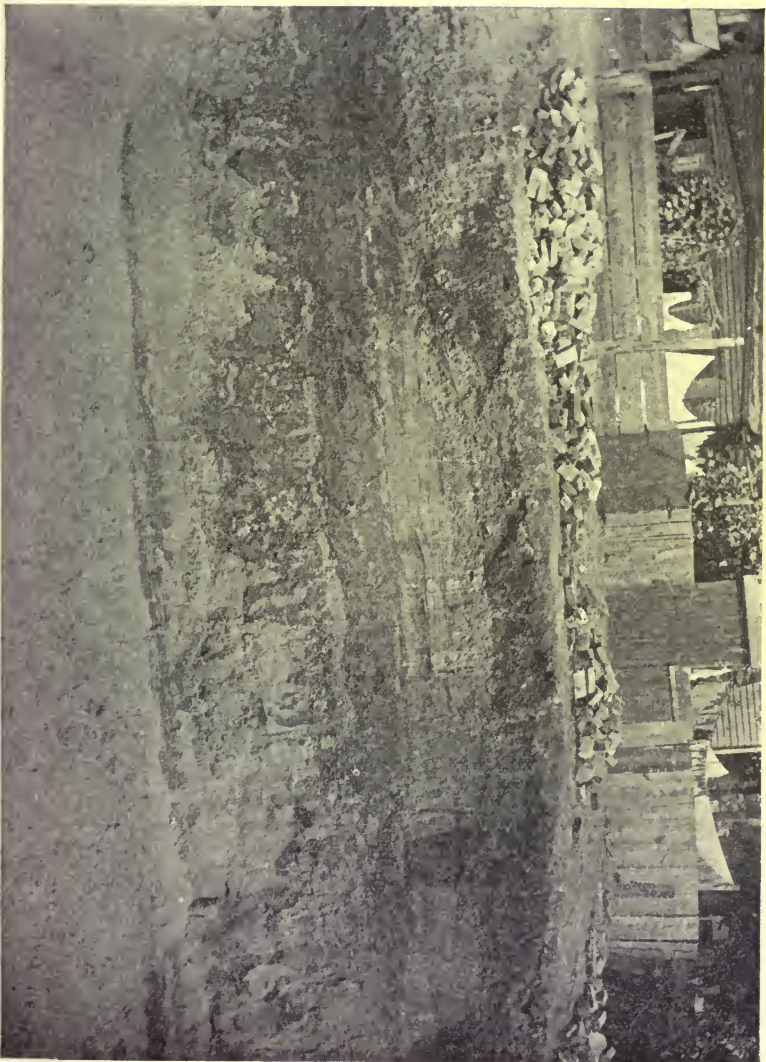
COX'S SAND PIT. "ICE PIT"



COX'S SAND PIT. GLACIAL DEPOSITS



COX'S SAND PIT. CLAY DEPOSITS AND PITS WITH LARGE BOULDERS



SAND PIT ON JENNIE STREET, BETWEEN ADELIN AND CASS STREETS



CELLAR EXCAVATION IN THE DEPRESSION WEST OF HANCOCK AVENUE



SECTION OF TRENTON GRAVEL AT COY'S SAND PIT



BILBEE'S SAND PIT. CLAY STRATUM NEAR SURFACE

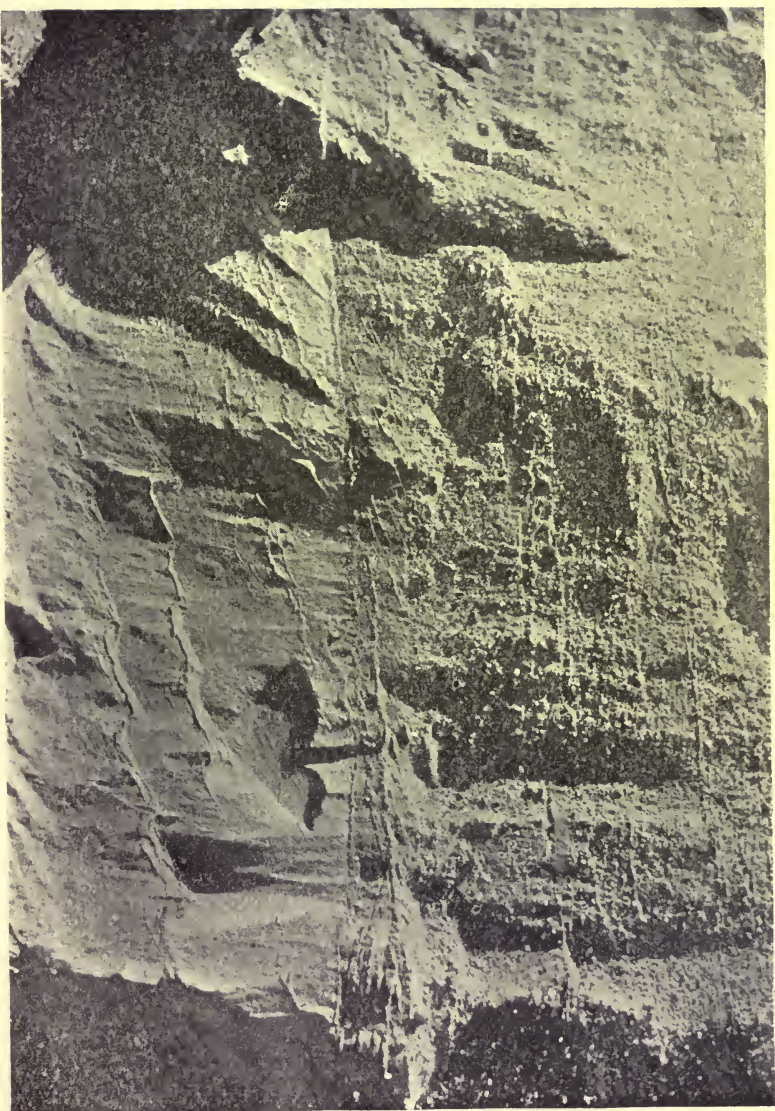


DISTANT VIEW OF EXPOSURE IN BROAD STREET PARK, OCTOBER 27, 1893

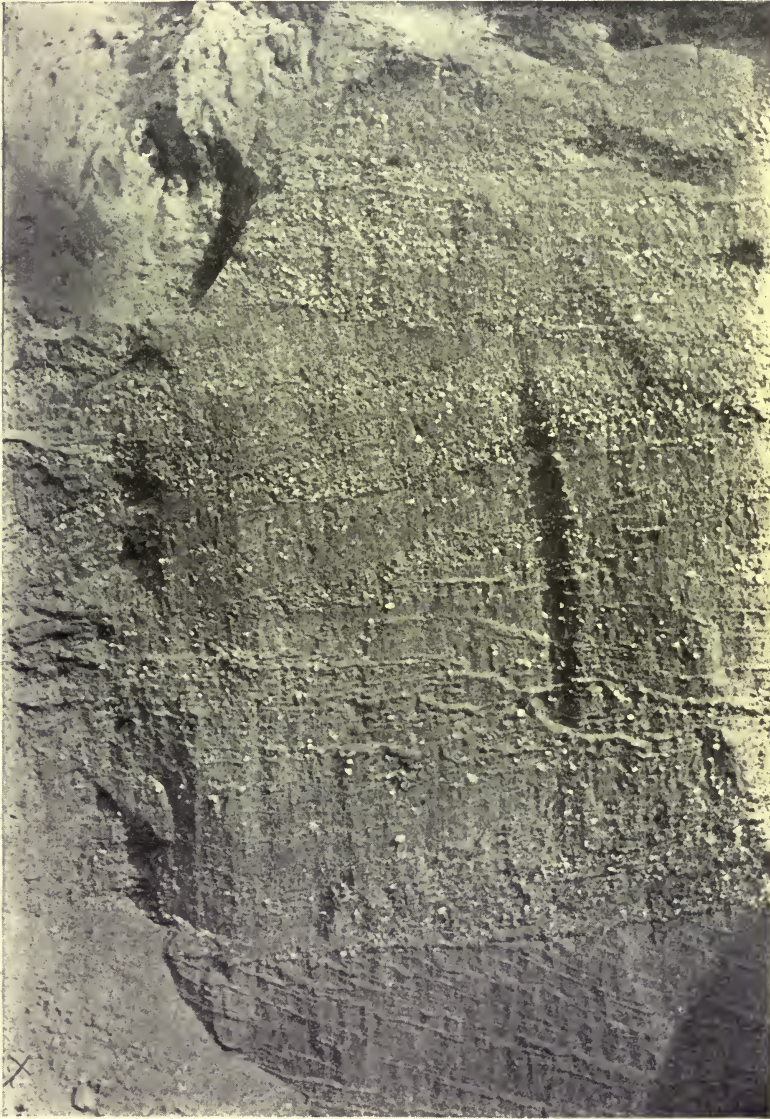


NEAR VIEW OF EXPOSURE IN BROAD STREET PARK

The three pebbles near the surface mark the junction of the black and yellow soil.



BILBEE SAND PIT



BILBEE'S SAND PIT, SHOWING STRATIFIED GRAVEL; SAND BELOW WITH RED CLAY BANDS 15 TO 20 FEET FROM SURFACE



LALOR FIELD. LONG TRENCH A, AUGUST 17, 1897



LALOR FIELD. LONG TRENCH (1), AUGUST 31, 1897



LALOR FIELD. TRENCH 1, 1891



GRAVE 9. LALOR FIELD, TRENCH 1, 1891



GRAVE 7, LALOR FIELD, 1891





GRAVE 6, LALOR FIELD TRENCH 1, 1891



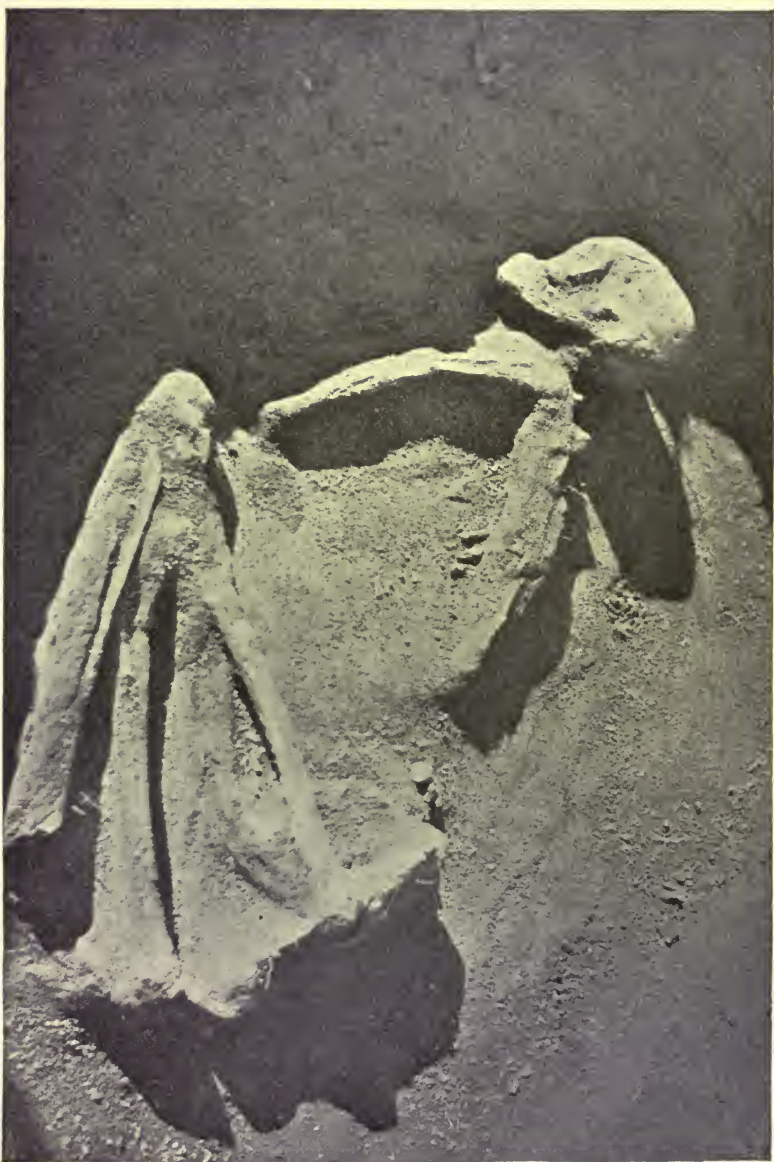
GRAVE 2, SKELETON 1. WRIGHT'S FIELD, 1891



GRAVE 3, SKELETON 1 WRIGHT'S FIELD, 1891



GRAVE 4, SKELETON I, WRIGHT'S FIELD, 1891



GRAVE 1, SKELETON 1, WRIGHT'S FIELD, 1891



GRAVE 6, SKELETON 1. WRIGHT'S FIELD, 1891





WRIGHT'S FIELD, 1891





LARGE GRAVE, LALOR FIELD



ACHPOACHOUSSING CREEK, UPPER END



EXPLORATIONS IN THE LOWLAND



ACHPACHQUISSING CREEK, LOOKING NORTHWEST



THE WESTERN SHORE OF ACHPOACHQUISSING CREEK



THE TRENCHES AT THE RIDGE ON THE EASTERN SHORE OF THE CREEK



BURIAL, LOWLANDS, 1892



LARGE PIT, LOWLANDS, 1892



ACHPOACHQUISSING CREEK, LOOKING WEST



LOWLANDS, TRENCH 9



LOWLANDS, LOOKING TOWARDS THE TERRACE



THE WATSON HOUSE, BUILT IN 1708





A CACHE OF 76 CHIPPED PIECES AND 57 FLAKES OF YELLOW JASPER, P. M. 79825
ROWAN'S FARM, AUG. 25, 1909



LOWLANDS, DISTANT VIEW OF TRENCH 9



GRAVE 14, LOWLAND, TRENCH 9



GRAVE 18, LOWLANDS



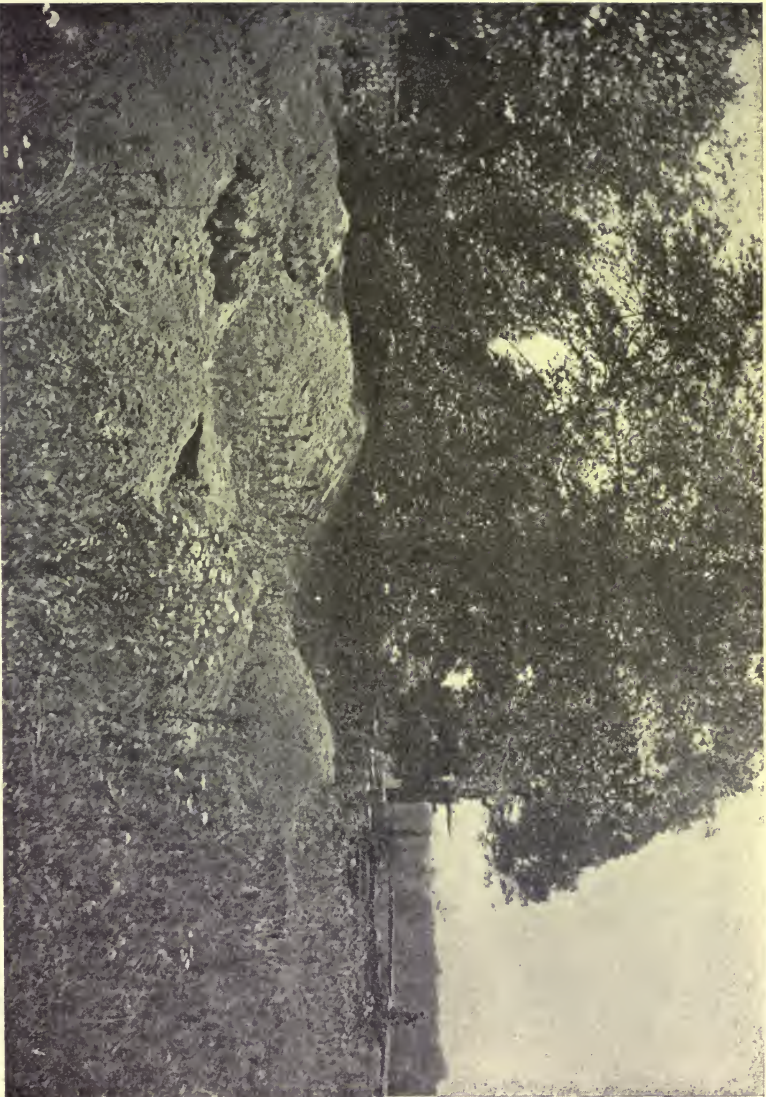
YELLOW SOIL, A SPECIMEN IN PLACE



YELLOW SOIL. A SPECIMEN IN PLACE



YELLOW SOIL, A SPECIMEN IN PLACE



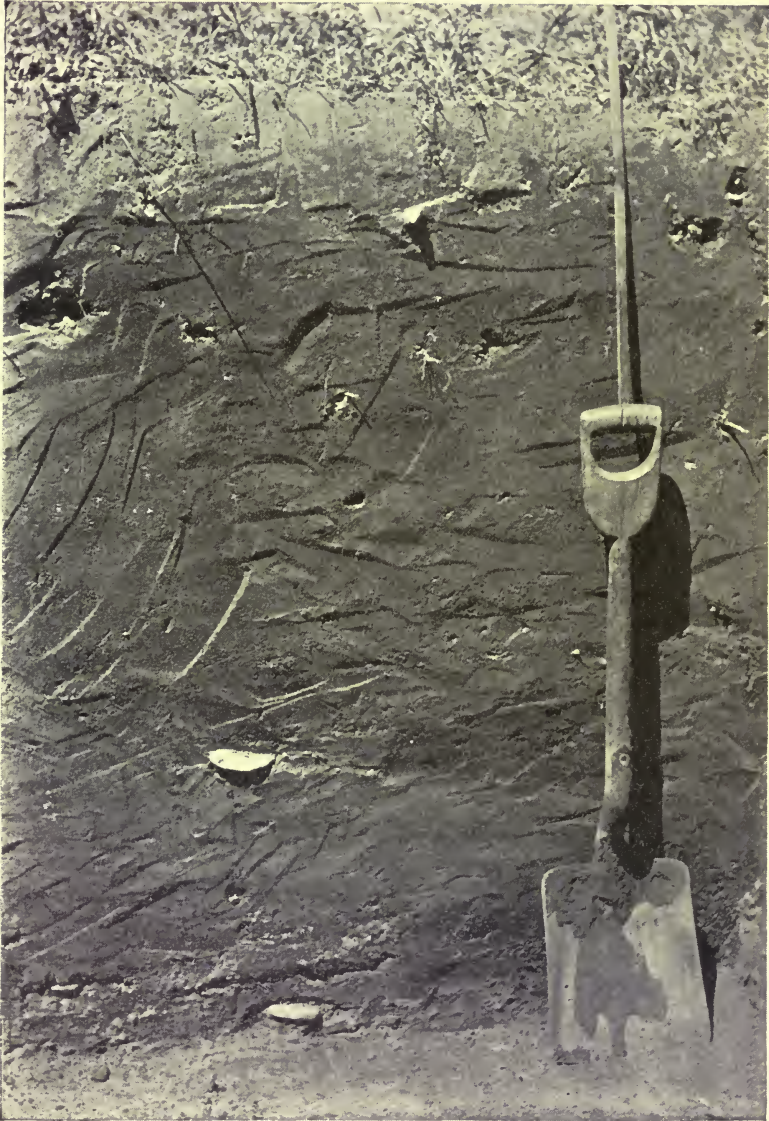
LALOR FIELD TRENCHES. JUNE 25-28, 1897



CHERT SPECIMEN IN PLACE, JUNE 26, 1897



ARGILLITE SPECIMEN IN PLACE, JUNE 23, 1897



VERTICAL SECTION OF THE TERRACE



LALOR FIELD, SPECIMEN 4, AUGUST 10. 1897



LALOR FIELD, SPECIMEN 6, AUGUST 10, 1897



A CACHE OF 11 CHIPPED KNIVES OF ARGILLITE. P. M. 71120

THEY ARE 10 INCHES BELOW SURFACE OCT. 10, 1927



SPECIMEN 8, AUGUST 26, 1897



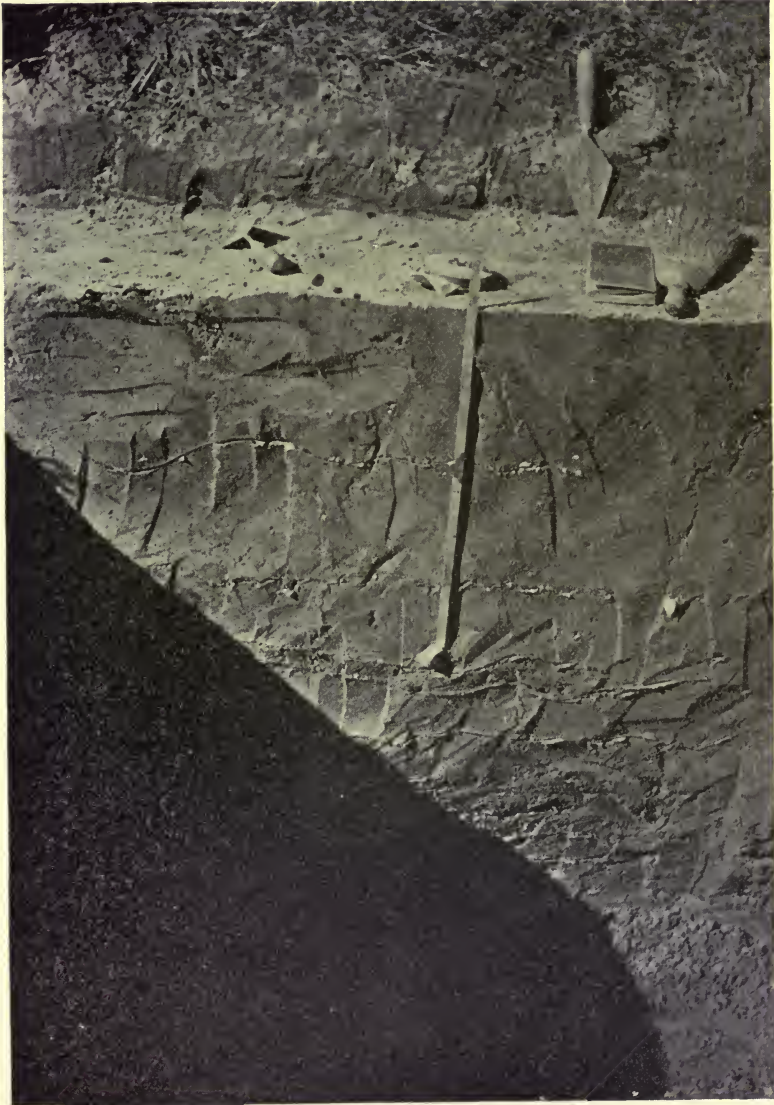
LALOR FIELD, SPECIMEN I. AUGUST 27, 1897



LALOR FIELD, SPECIMEN 3. AUGUST 27, 1897



LALOR FIELD, SEVERAL SPECIMENS IN PLACE. SEPTEMBER 3, 1897



LALOR FIELD, SEPTEMBER 3, 1897



LALOR FIELD, "PROFESSOR HOLLICK'S SPECIMEN," SEPTEMBER 13, 1897



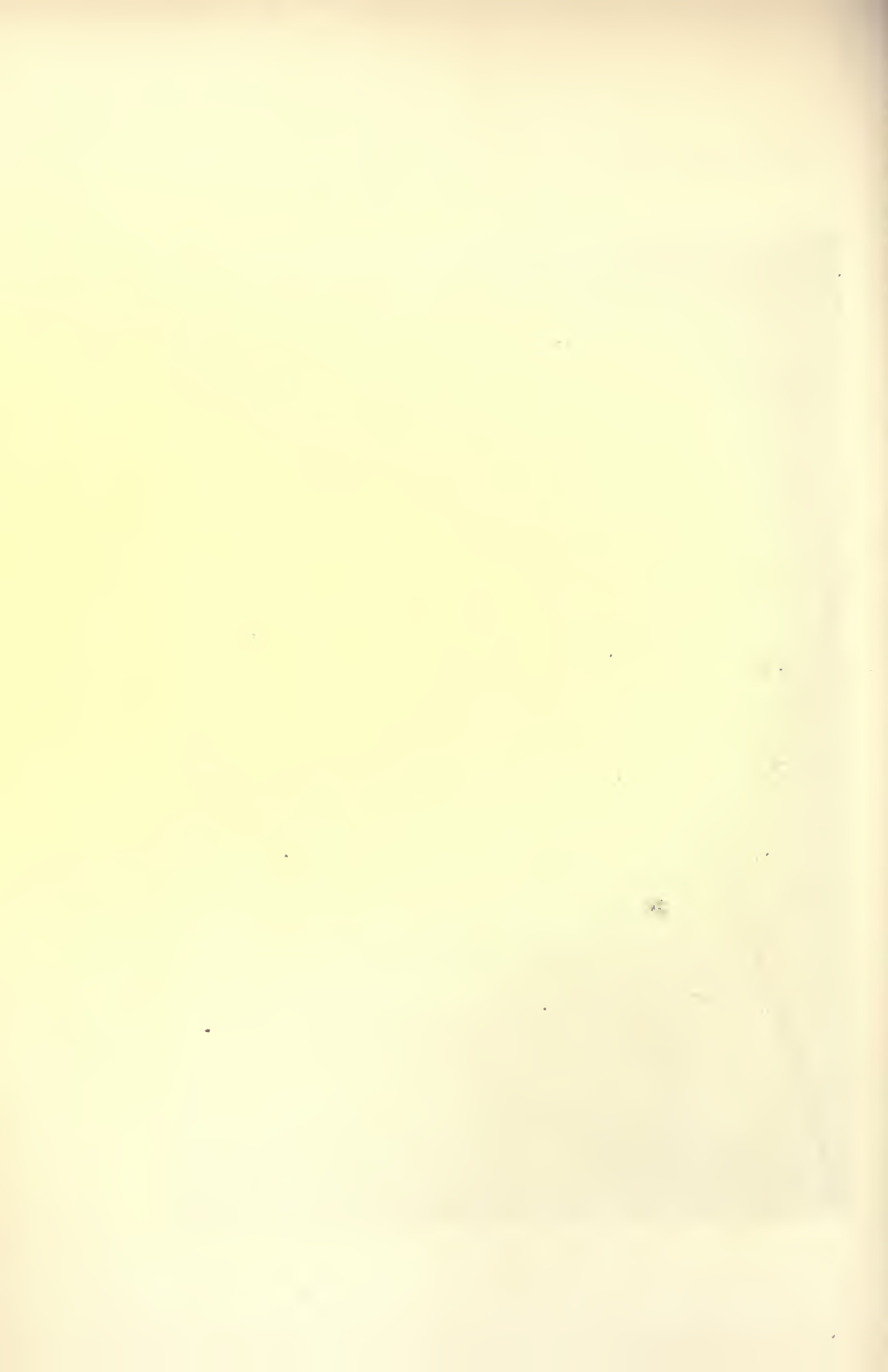
LALOR FIELD, CHERT-PEBBLE IN PLACE. SEPTEMBER 13, 1897

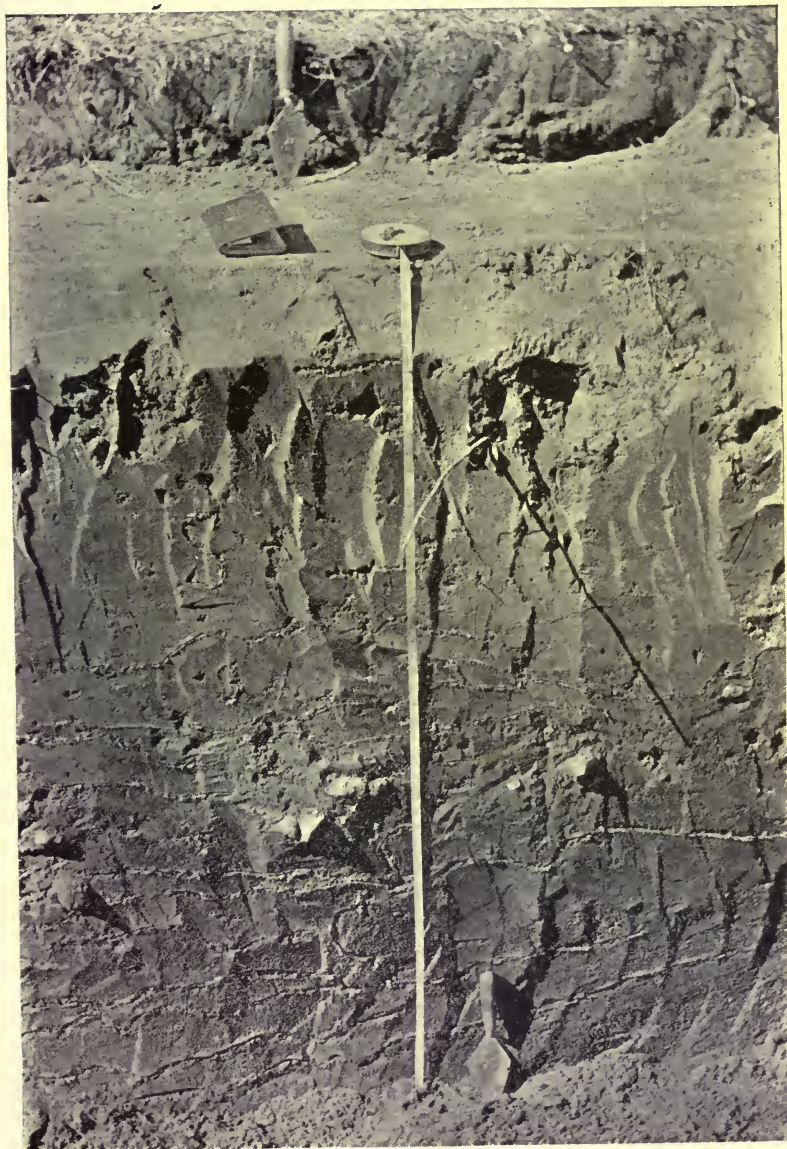


LALOR FIELD, SPECIMEN I. SEPTEMBER 14, 1897



LALOR FIELD, SEPTEMBER 17, 1897





LALOR FIELD, OCTOBER 4, 1897



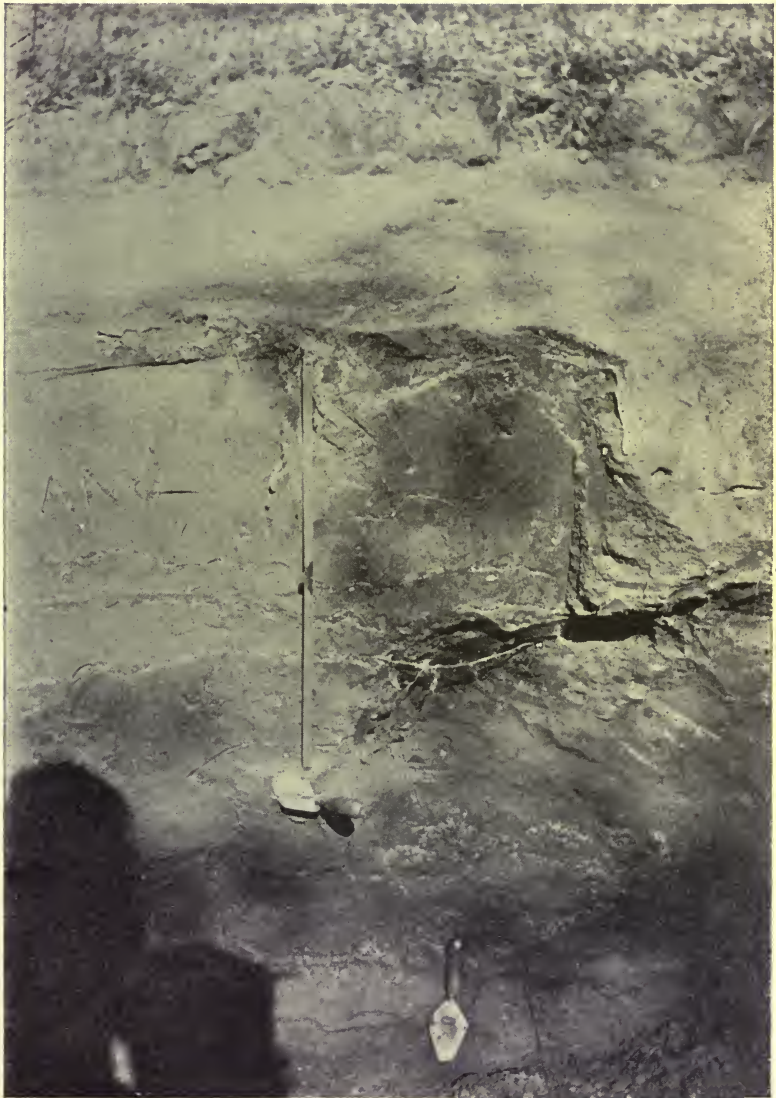
LALOR FIELD, OCTOBER 11, 1897





LALOR FIELD. STRATUM OF GRAVEL WITH YELLOW SOIL ABOVE AND BELOW





LALOR FIELD, OCTOBER 14. 1897



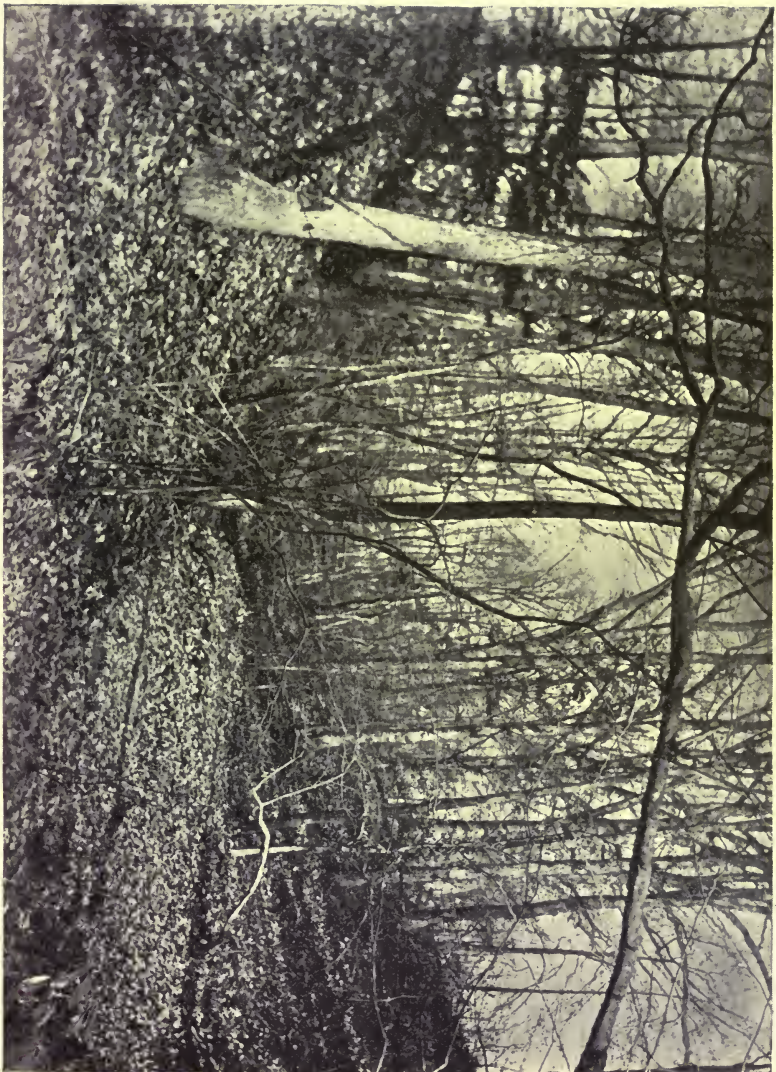
LALOR FIELD, OCTOBER 28, 1897



TRENCH A, THE HIGHEST POINT ON THE BLUFF, OPPOSITE RIVERVIEW CEMETERY



SOUTHERN END OF RAVINE, DR. ABBOTT'S FARM



VIEW IN THE RAVINE, LOOKING NORTH, DR. ABBOTT'S FARM



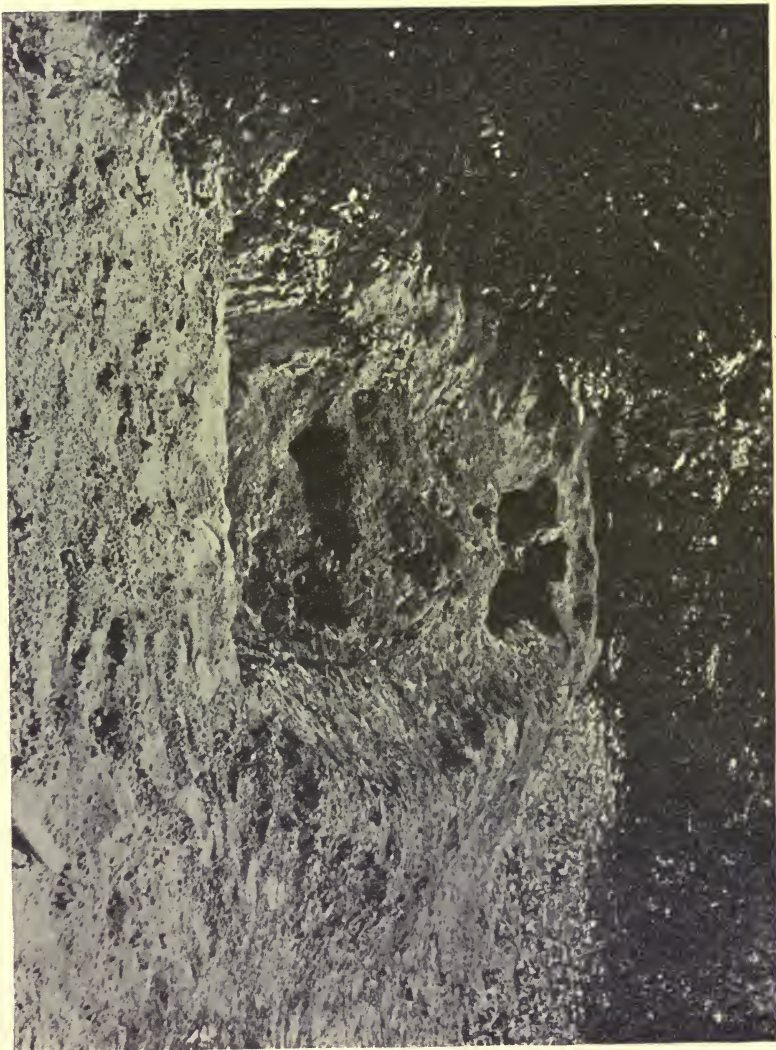
VIEW IN THE RAVINE LOOKING SOUTH. DR. ABBOTT'S FARM



VIEW IN THE RAVINE, LOOKING WEST. DR. ABBOTT'S FARM



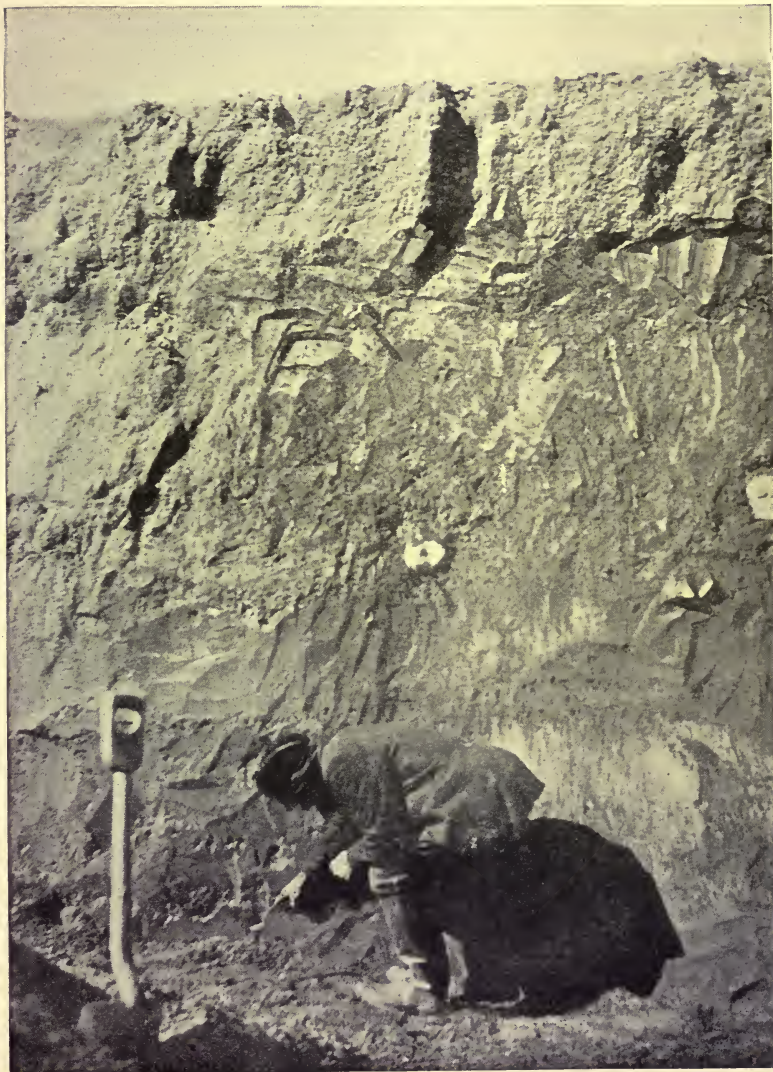
SOUTH END OF TRENCH I NEAR RAVINE



TRENCH 1, LOOKING SOUTH NEAR RAVINE



TRENCH 1, NEAR RAVINE. THE TROWEL MARKS THE DEPTH OF THE SKELETONS



SECTION OF TRENTON GRAVEL ON HANCOCK AVENUE, LOOKING WEST. THE MAN IS POINTING TO THE SPOT WHERE HE PULLED OUT THE PIECE OF SCAPULA OF MUSK OX (PL. LXXXVII, FIG. 1) ON MARCH 13 1899



1. Portion of scapula of musk ox $\frac{1}{2}$. A. M. 12285. From Trenton gravel.
2. Chipped quartzite $\frac{1}{2}$. P. M. 79816. Rowan's farm, Aug. 6, 1909.
3. Fractured chert $\frac{1}{2}$. P. M. 71012. Sewer excavation, Trenton, Aug. 28, 1906.



"RAILROAD CUT," DEUTZVILLE



"RAILROAD CUT," LOOKING NORTH, DECEMBER 1, 1899
SHOWING WHERE HUMAN FEMUR WAS FOUND



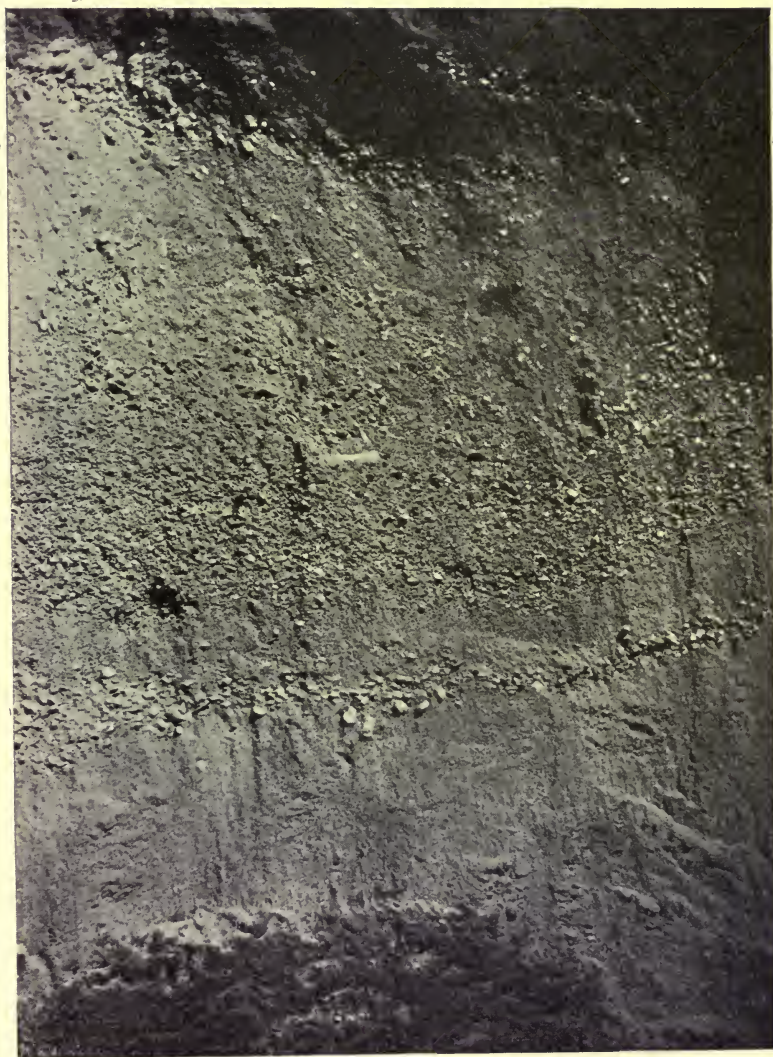
"RAILROAD CUT," LOOKING NORTHWEST, DECEMBER 1, 1899
SHOWING WHERE HUMAN FEMUR WAS FOUND



"RAILROAD CUT," DECEMBER 1, 1899



"RAILROAD CUT." WHITE PAPER MARKS THE SPOT WHERE THE CHIPPED PEBBLE WAS FOUND, DECEMBER 9, 1899



COX'S SAND PIT. ANTLER FRAGMENT IN PLACE



COX'S SAND PIT. ANTLER FRAGMENT IN PLACE TO THE LEFT OF THE MAN



COX'S SAND PIT. ANTLER FRAGMENT AND OVERLYING GRAVEL STRATA



COX'S SAND PIT, WITH ICE PITS



GRAVES 12 AND 13, 1809



GRAVE 15, 1909



GRAVE 17, 1909



GLACIAL GRAVEL AT MORRISVILLE, PENNSYLVANIA



AHRENDT'S SAND PIT ICE PIT (X)



1. (Upper figure). Fractured stone $\frac{1}{2}$. P. M. 71061. Cox's sand pit, July 15, 1907.
2. (Lower figure). One of the large pieces (showing bulb) of fractured argillite $\frac{1}{2}$. P. M. 80585. From a cache of many similar pieces. Cellar excavation, Trenton, July 23, 1908.



EXTERNAL VIEW OF TRENTON FEMUR
MEXICAN ON LEFT, ESKIMO ON RIGHT



ANTERIOR VIEW OF TRENTON FEMUR
MEXICAN ON LEFT, ESKIMO ON RIGHT



INTERNAL VIEW OF TRENTON FEMUR
MEXICAN ON LEFT, ESKIMO ON RIGHT



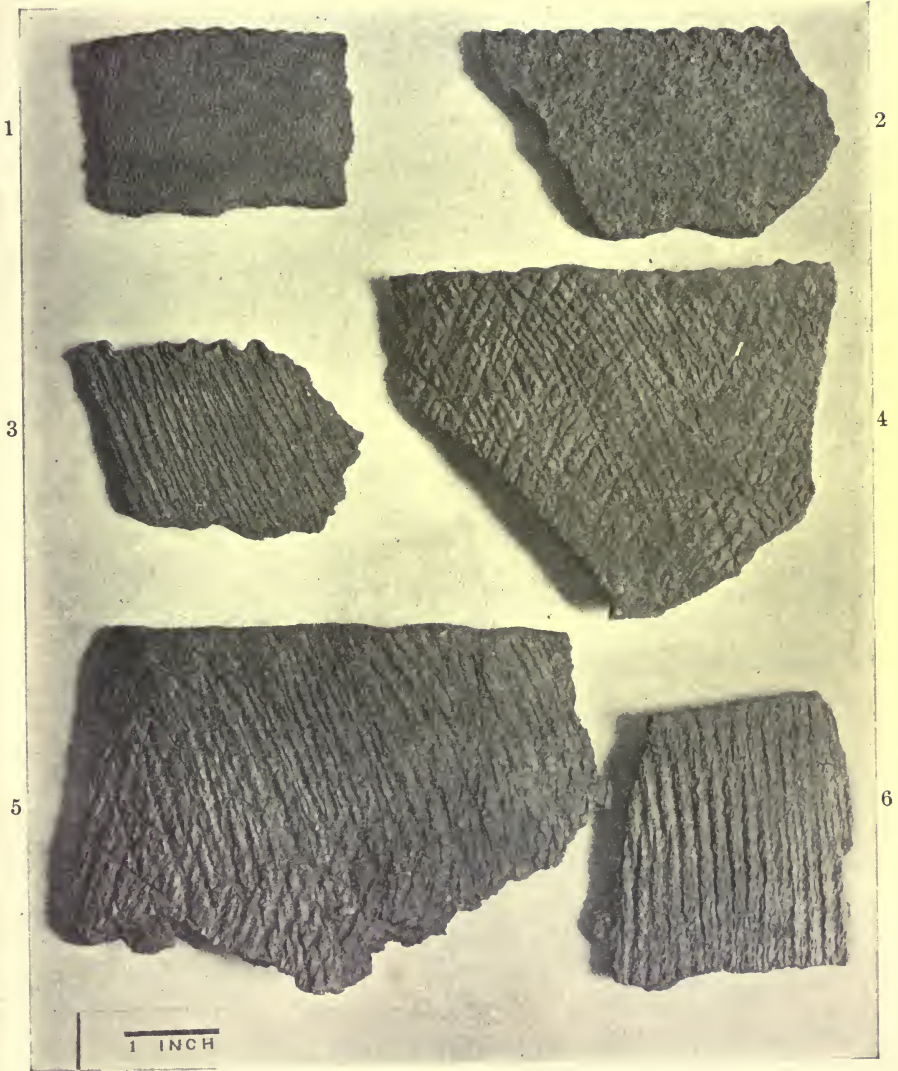
POSTERIOR VIEW OF TRENTON FEMUR
MEXICAN ON LEFT, TWO ESKIMO ON RIGHT



THE TWO PIECES OF THE TRENTON FEMUR IN THE CENTRE, SHOWING THE INTERNAL STRUCTURE. CORRESPONDING PORTIONS OF FEMUR OF AN INDIAN FOR COMPARISON ON LEFT AND RIGHT



PORTION OF HUMAN PARIETAL FROM TRENTON GRAVEL DEC. 7, 1899



CORD-MARKED POTSHERDS

- | | | | | | | | |
|----|-------|----------------------|-----------|----|-------|----------------------|---------------|
| 1. | A. M. | $\frac{20}{11285}$. | Lowlands. | 4. | A. M. | $\frac{20}{11816}$. | Rowan's farm. |
| 2. | A. M. | $\frac{20}{11828}$. | " | 5. | A. M. | $\frac{20}{11827}$. | Lowlands. |
| 3. | A. M. | $\frac{20}{11259}$. | " | 6. | A. M. | $\frac{20}{11260}$. | " |



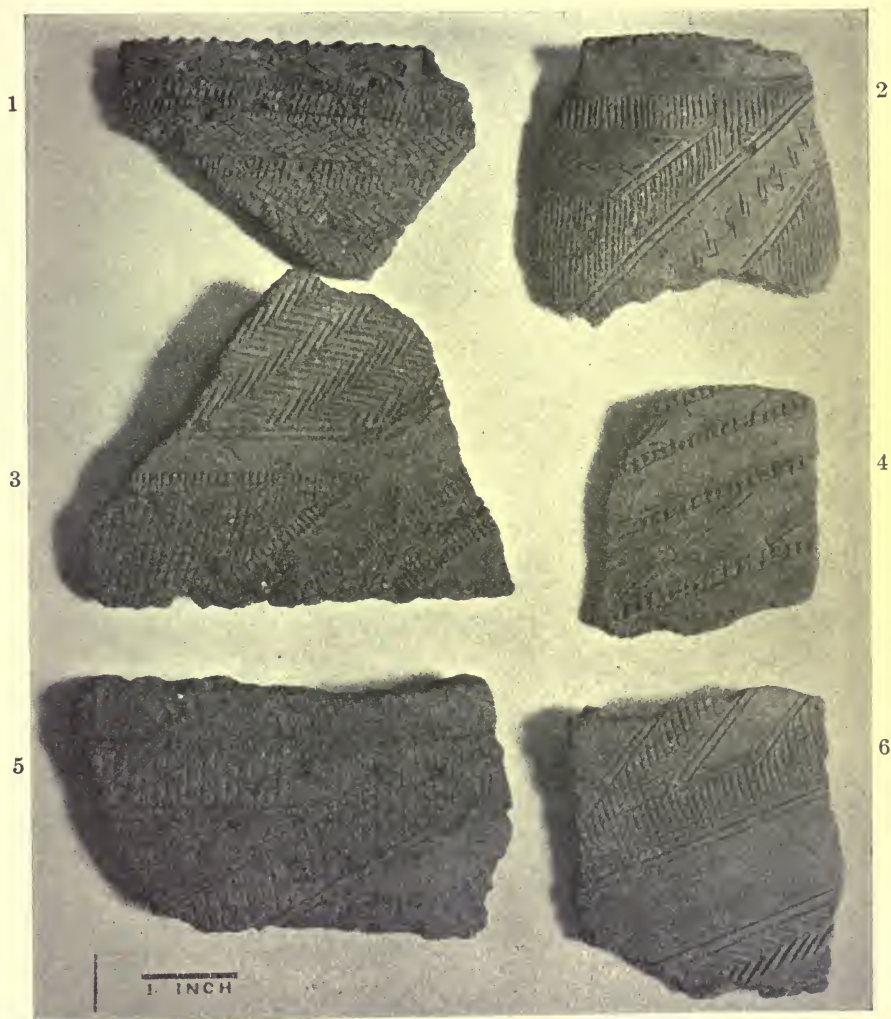
CORD-MARKED AND INCISED POTSHERDS

1. A. M. 10087. Lowlands. 2. A. M. 10081. Lowlands.
3, 4, 5. P. M. 79810. Rowan's Farm.



CORD-MARKED AND INCISED POTSHERDS

1. A. M. 13177. Lowlands. 2, 4. P. M. 79807. Rowan's farm.
3, 5. A. M. 13178. Lowlands.



INCISED POTSHERDS

- | | | | |
|--------------------|-----------|-----------------|-----------|
| 1. A. M. 17180. | Lowlands. | 2. A. M. 17735. | Lowlands. |
| 3, 6. A. M. 17202. | " | 4. A. M. 17217. | " |
| 5. A. M. 17208. | Lowlands. | | |



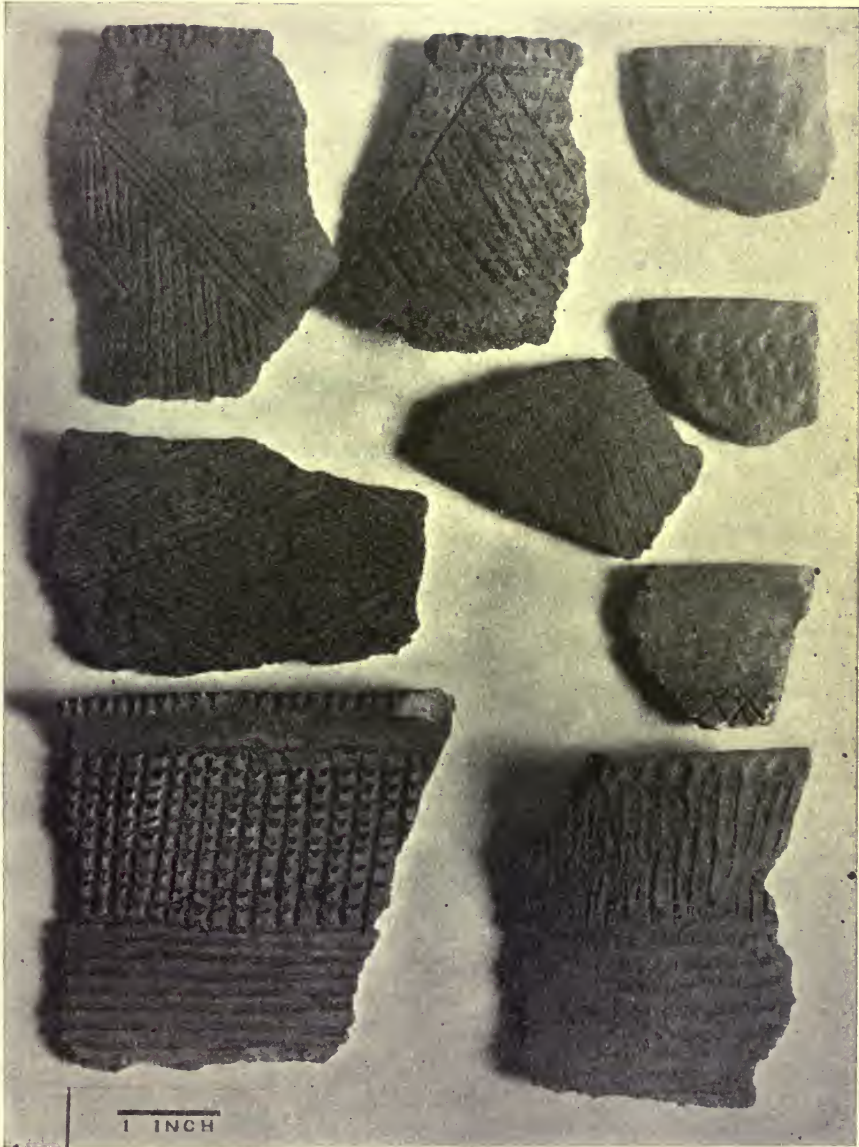
INCISED POTSDHERDS

1. A. M. 5887. Lowlands. 2. A. M. 10107. Lowlands.
3. A. M. 11250. Abbott's farm. 4. A. M. 10223. Lowlands.
5. P. M. 79783. Rowan's farm.

1

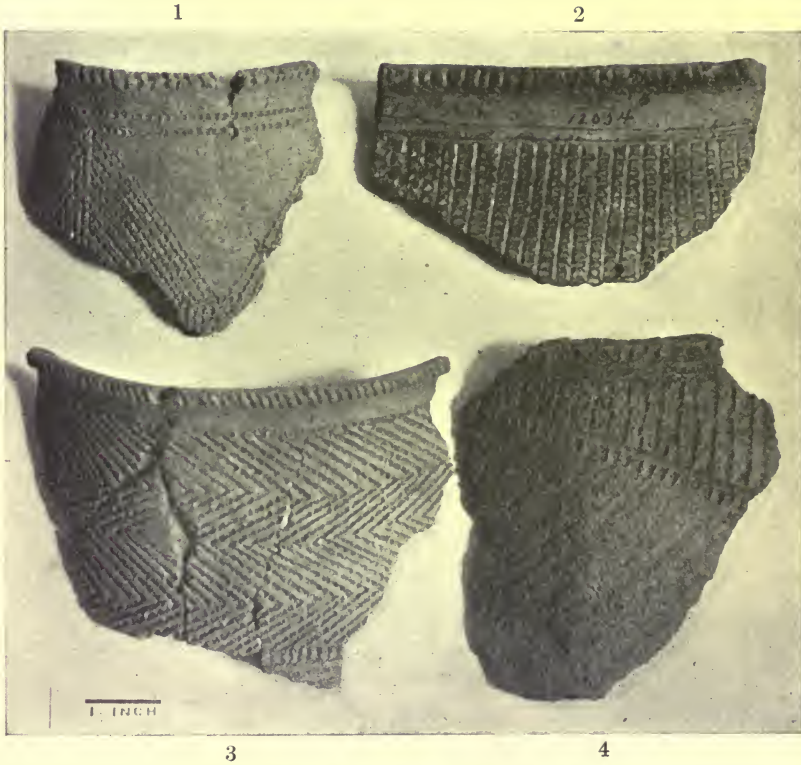
2

3



STAMPED AND INCISED POTSDERDS

- 1. A. M. 122801, Abbott's farm.
- 2. A. M. 12021, Lowlands.
- 3. P. M. 80501, Rowan's farm.
- 4. P. M. 79810, Rowan's farm.
- 5. P. M. 79893, Rowan's farm.
- 6. A. M. 12338, Lowlands.
- 7. A. M. 12198, Lowlands.
- 8. A. M. 12128, Lowlands.
- 9. A. M. 12468, Lowlands.



STAMPED AND INCISED POTSDHERDS

- | | |
|---------------------------|---------------------------|
| 1. A. M. 10021, Lowlands. | 2. A. M. 12054, Lowlands. |
| 3. A. M. 10095, " | 4. A. M. 10092, " |

1

2

3

4



5

6

7

1 INCH

8

9

10

CHIPPED PIECES FROM THE YELLOW SOIL, 5 CHERT, 8 QUARTZITE, ALL OTHERS ARGILLITE ALL FROM LALOR FIELD TRENCHES

- 1. A. M. 10977. 2. A. M. 113011. 3. A. M. 10958. 4. A. M. 10981. 5. A. M. 13012.
- 6. A. M. 11301. 7. A. M. 11375. 8. A. M. 11332. 9. A. M. 11365. 10. A. M. 10955.



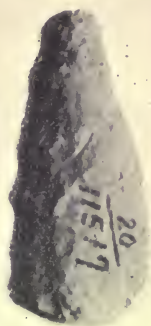
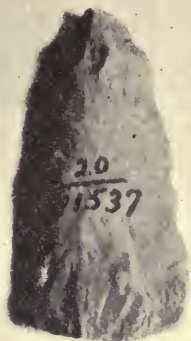
CHIPPED PIECES FROM THE YELLOW SOIL. ALL ARGILLITE. ALL FROM LALOR FIELD TRENCHES

- | | | |
|-----------------|-----------------|-----------------|
| 1. A. M. 13013. | 2. A. M. 13073. | 3. A. M. 11418. |
| 4. A. M. 11430. | 5. A. M. 11428. | 6. A. M. 11440. |

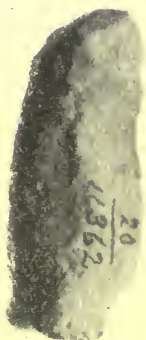
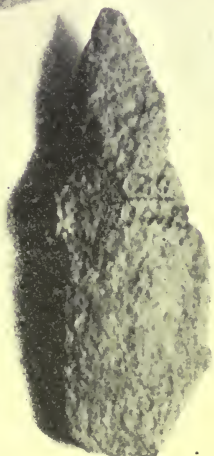
1

2

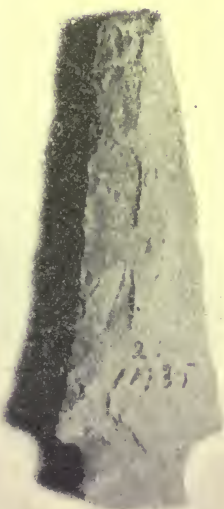
3



4



5



1 INCH

6

7

8

CHIPPED POINTS FROM THE YELLOW SOIL. ALL ARGILLITE. ALL FROM LALOR FIELD TRENCHES

1. A. M. ²⁰11337.

2. A. M. ²⁰10999.

3. A. M. ²⁰11517.

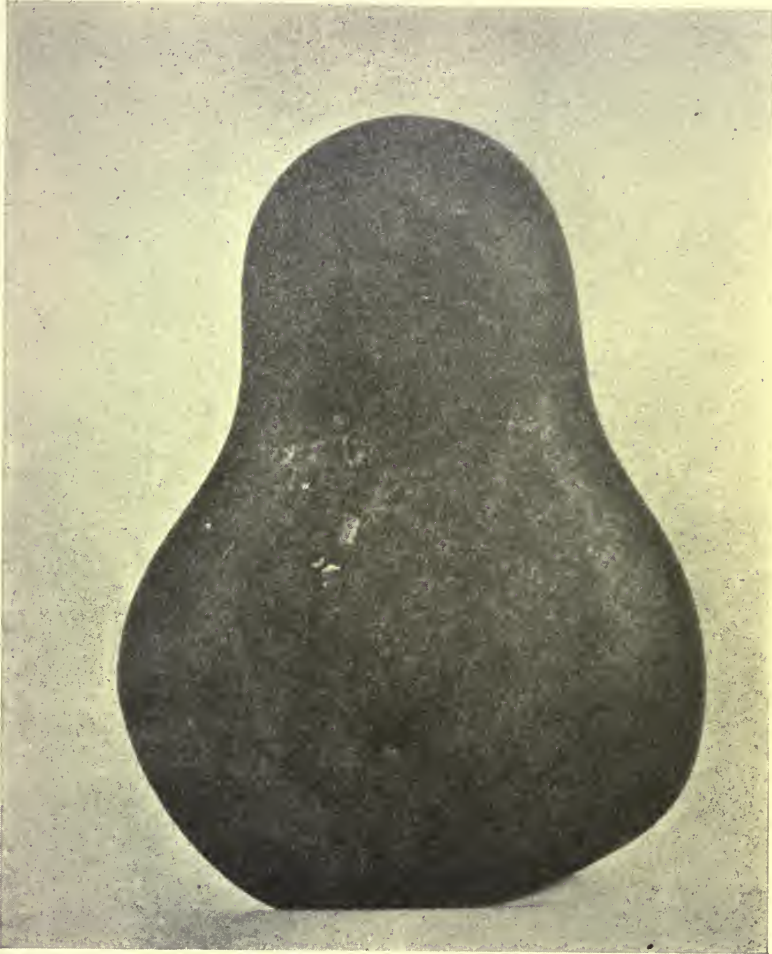
4. A. M. ²⁰11215.

5. A. M. ²⁰11362.

6. A. M. ²⁰10938.

7. A. M. ²⁰11335.

8. A. M. ²⁰10965.



A PEBBLE WITH GLACIAL STRIAE OR ARTIFICIALLY MADE CUTTINGS, FOUND IN THE GRAVEL, 6 FEET 10 INCHES BELOW THE PRESENT SURFACE



FEMUR OF A BISON, $\frac{2}{3}$. JUNE 22, 1910

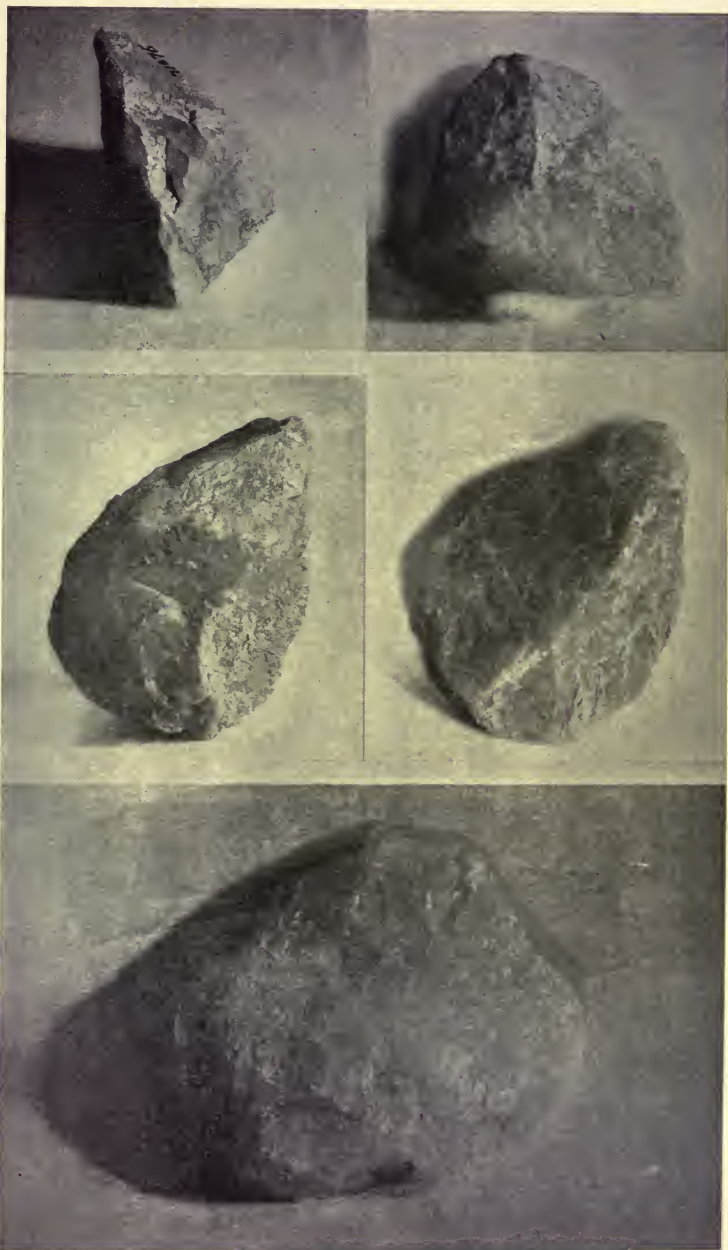


CACHE OF OVER 64 CHERT BLADES, P. M. 71121. CELLAR EXCAVATION, TRENTON

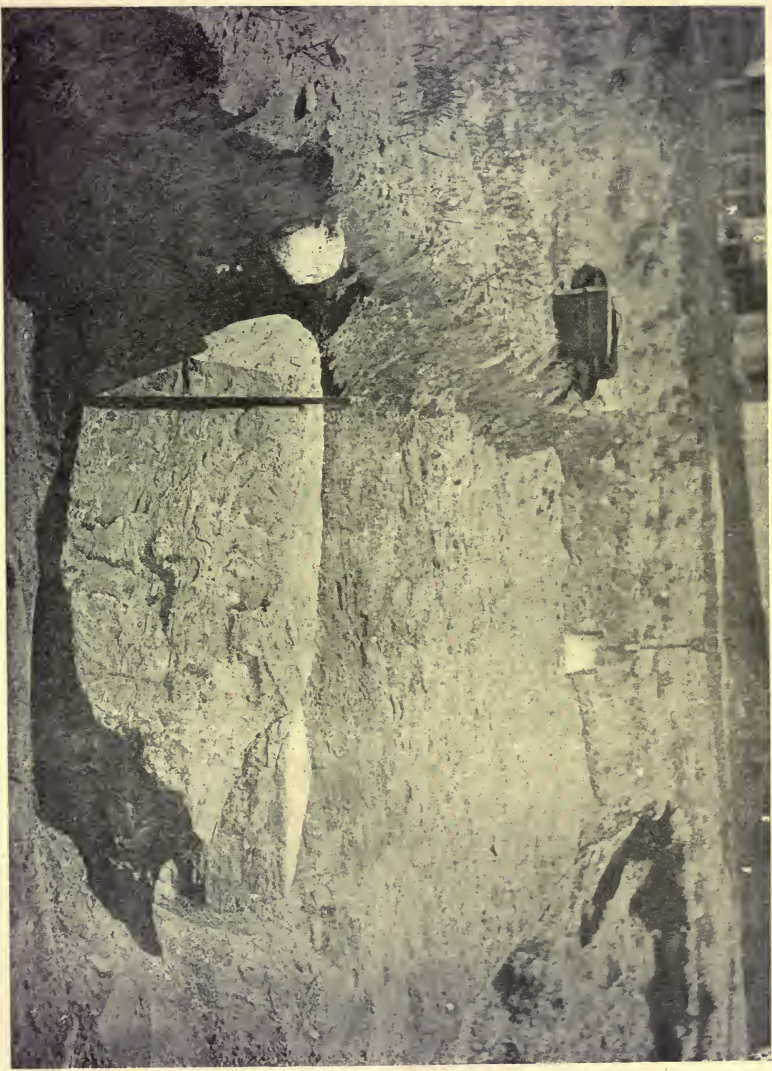


PROBABLY ARTIFICIALLY CHIPPED QUARTZ FROM THE TRENTON GRAVEL
TWO VIEWS OF EACH SPECIMEN

1, 2 (upper) P. M. 71101. 3, 4 (middle) P. M. 71050. 4, 5 (lower) P. M. 71069.



PROBABLY ARTIFICIALLY CHIPPED QUARTZ FROM THE TRENTON GRAVEL,
1, 2 (upper) P. M. 71076. 2, 3 (middle) P. M. 71075. 4 (lower) P. M. 71071.



BOULDER NEAR SURFACE AT AHRENDT'S SAND PIT





CURVED STRATA AT AHRENDT'S SAND PIT

~~NON-CIRCULATING~~

~~NON-CIRCULATING~~

~~NON-CIRCULATING~~

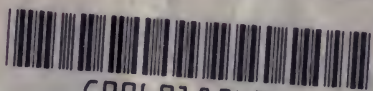
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