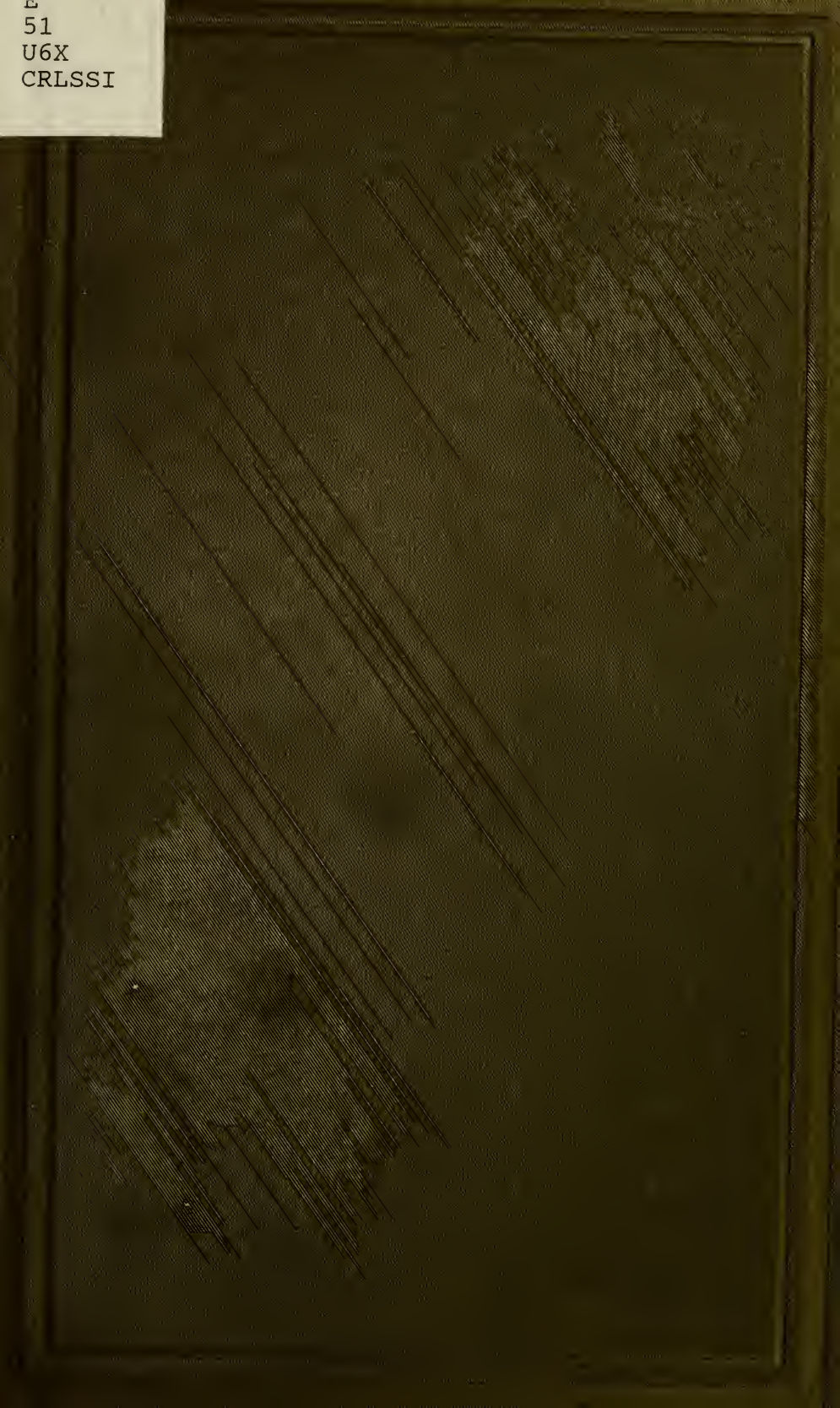

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RECENT DISCOVERIES ATTRIBUTED TO EARLY MAN IN AMERICA

BY

ALEŠ HRDLIČKA

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LETTER OF TRANSMITTAL

SMITHSONIAN INSTITUTION,
BUREAU OF AMERICAN ETHNOLOGY,
Washington, D. C., March 2, 1917.

SIR: I have the honor to submit the accompanying manuscript entitled "Recent Discoveries Attributed to Early Man in America," by Dr. Aleš Hrdlička, with the recommendation that it be published as Bulletin 66 of the Bureau's series.

Yours, very respectfully,

F. W. HODGE,
Ethnologist-in-Charge.

Dr. CHARLES D. WALCOTT,
Secretary of the Smithsonian Institution,
Washington, D. C.

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RECENT DISCOVERIES ATTRIBUTED TO EARLY MAN IN AMERICA

By Aleš Hrdlička

INTRODUCTION

SINCE the publication by the writer of critical reviews of previous reports and evidence relating to early man in North and South America,[1] only a few newer cases of this nature have accumulated, one or two of which at least demand serious attention.

From South America we have had the report of additional mineralized bones, by Dr. Juan B. Ambrosetti, for which, however, no definite claim of great antiquity has been made.[2]

There were also several newspaper and other reports, in the name of Carlos Ameghino and by other Argentinian observers, on the finding of a nicely shaped quartzite arrowpoint, of a type well known along the eastern coast of Argentina, in a femur of "*Toxodon chapalmalensis*," an animal of Tertiary provenience. The arrowpoint, Ameghino concludes, "was without doubt introduced into the femur by the Tertiary man, contemporary of the Toxodon."[3]

A much more noteworthy report on the finding of remains of early man in South America was that of the Yale Peruvian Expedition of 1911. This report, and that of the same expedition in 1912, resemble and contrast most instructively with the majority of the Argentina reports, and well deserve extended treatment.

From North America we have two remarkable reports relating to man's antiquity: One on the so-called Rancho La Brea man from the asphalt pits of California, pits known as the richest deposits of skeletal remains of Quaternary animals; and the other on the "Vero man" from Florida, whose bones were found in association with those of mastodons, tapirs, and other species from early Quaternary. Both of these finds will also be dealt with in detail in the following pages.

[1] Skeletal Remains Suggesting or Attributed to Early Man in North America, *Bull. 33, Bur. Amer. Ethn.*, 1907; Early Man in South America, *Bull. 52, Bur. Amer. Ethn.*, 1912.

[2] Compte-rendu *XIV Congr. Intern. d'Anthropologie et d'Archéologie préhist.*, vol. II, Genève, 1913; *Proc. XVIII Intern. Cong. Americanists*, London, 1914, pp. 5–8.

[3] Physis, Communicaciones, No. 9, t. II, pp. 36–39 (no place, no date). Also *La Nacion*, Nov. 22 and Dec. 27, 1917; and *Annales del Museo d'Historia Natural de Buenos Aires*, XXVI, pp. 417–450, 1915.

THE "ANCIENT MAN OF CUZCO," PERU

The Cuzco discoveries represent one of those rare fortunate instances in which a serious earlier error in the chronological determination of human remains is fully corrected by some of those who were responsible for the original claims.

In 1911–12, just before the publication of Early Man in South America,[1] in which were indicated certain fallacies in the numerous reports of geologically ancient human remains from South America, a considerable stir was caused by the announcement that human bones of "glacial age" had been found in the Cuzco gravels by the Yale Peruvian Expedition. The news reached the press, and because of the prominence of the expedition was given wide publicity long before the actual report on the finds could be made. In April, 1912, this report, by three authors, appeared in *The American Journal of Science*. It consisted of a section by Prof. Hiram Bingham, director of the expedition, on "The Discovery of Prehistoric Human Remains near Cuzco, Peru";[2] of an account by the geologist of the expedition, Prof. Isaiah Bowman, on "The Geologic Relations of the Cuzco Remains";[3] and of a "Report on the Remains of Man and of Lower Animals from the Vicinity of Cuzco, Peru," by Dr. George F. Eaton.[4]

Professor Bingham gave a concise account of the circumstances of the find, which may well be repeated practically in full.

> The Yale Peruvian Expedition was organized to do archæological, geographical, geological, and topographical reconnaissance. We spent the first part of July, 1911, in and about Cuzco. On the morning of July 6, while walking up a gulch called *Ayahuaycco quebrada* west of Cuzco, . . . I noticed a few bones and several pieces of pottery interstratified with the gravel bank of the gulch and apparently exposed by recent erosion. This led me to examine both sides of the gulch very carefully. A hundred yards above the point where the first bones were noticed we found that erosion had cut through an ancient ash heap containing a large number of fragments of bones and pottery. Still farther up the gulch and on the side toward Cuzco I discovered a section of stone wall built of roughly finished stones more or less carefully fitted together. At first sight this wall appeared to have been built to prevent further washing away of that side of the gulch. Then I noticed that above the wall and flush with its surface the bank appeared to consist of stratified material, indicating that perhaps the wall antedated the gravel deposits.
>
> Fifty feet up the quebrada another portion of wall appeared. Between this and the section first seen the gravel bank somewhat protruded. On top of the bank was a cultivated field. In order to see whether the wall extended behind this gravel bank, under the field, and whether the two portions were continuous, I excavated and found, after half an hour's work on the compact gravel, that there was more wall behind the stratified sides of the gulch. The prefect of Cuzco later helped me to secure the services of six Indians,

[1] *Bull. 52, Bur. Amer. Ethn.*, 1912.
[2] *Amer. Journ. Sci.*, 4th ser., vol. XXXIII, pp. 237–305, New Haven, Apr., 1912.
[3] Ibid., pp. 306–325.
[4] Ibid., pp. 325–333.

with whose aid we cut through the wall and found it was about 3 feet thick and 9 feet in height, carefully faced on both sides and filled in with rubble. As this type of stonework is not uncommon in the foundations of some of the older buildings in the western part of the city of Cuzco, and as it is usually called by the inhabitants Inca'c, I was at once struck by the idea that this kind of wall must be very much older than we should be led to suppose by our present ideas of Inca civilization. Such a thesis would be necessary to account for a wall completely covered over to a depth of 6 or 8 feet by a compact gravel bank, a bank later eroded to a depth of 10 feet. Further investigation in this part of the gulch revealed numbers of potsherds and bones.

A few days later I followed the *Ayahuaycco quebrada* up to its head, using a road on its east side. In various places I was struck by evidences of ancient civilization. Ash heaps, recent and ancient, a stone-paved area which may have been a threshing floor or market place, and numbers of bones and potsherds offered a most interesting field for speculation and study. Ayahuaycco means "the cadaver quebrada" or "dead man's gulch," or "the valley of dead bodies." There is a tradition that this valley was once used as a burial place for plague victims in Cuzco, possibly not more than three generations ago. Such a story appears to be well borne out by the great number of human bones that occur in the talus slopes. I was most anxious to see whether anything could be found definitely *in situ*, where the stratification had not been disturbed. After proceeding up the valley for more than half a mile it narrowed and the east side, along which I was walking, became very precipitous. The road had apparently recently been widened and this made the bank at this place practically perpendicular. About 5 feet above the road I saw what at first looked like one of the small rocks which are freely interspersed throughout the compact gravel of this region. Something about it led me to examine it more closely, and I then recognized that it was apparently the end of a human bone, probably a femur.

I was at once so impressed by the possibilities, in case it should turn out to be true that this was a human bone and had been buried centuries ago under seventy-five or a hundred feet of gravel, that I refrained from disturbing the bone until I could get the geologist and the naturalist of the expedition to witness its excavation. Prof. Isaiah Bowman, who had already made studies in the Central Andes, and was the geologist-geographer of the expedition, was at this time only a few days away making a preliminary study of the Anta Basin. On his return to Cuzco Professor Bowman was requested to make a physiographic study of the gulch in which the human remains had been found. . . .

On the afternoon of July 11 Professor Bowman and I excavated the femur and found behind it fragments of a number of other bones. These we took out as carefully as possible. They were excessively fragile. The femur was unable to support 4 inches of its own weight, and after that much had been excavated the exposed end fell off. The gravel was somewhat damp but could hardly be called moist. The bones were dry and powdery. It is difficult to describe their color. Perhaps "ashy gray" is as near as anything. The end of the femur first seen was so like the pebbles as to be distinguished from them only with the greatest difficulty.

* * * * * * *

The bones were carried to our hotel, where they were again photographed, soaked in melted vaseline, and then packed in cotton batting. On my return to the States in December the bones were submitted to Dr. George F. Eaton, curator of osteology in the Peabody Museum, for examination.

* * * * * * *

Professor Bowman's report gives geologic details and contains a number of interesting conclusions, which illustrate, in view of knowledge acquired later, how easy it is sometimes even for a specialist to be in error. He summarizes the results of his study of the case as follows:

> The bones found near Cuzco were contemporaneous with the compact gravels in which they were embedded. They were disposed in the form of a lense about 10 feet long and 6 inches thick. From (1) their disposition with respect to each other, (2) their relations with the bedding planes, and (3) their worn condition, it is concluded that they were interstratified with the gravel beds. The age of the beds thus becomes the critical factor in the interpretation. From a detailed study of the geology of the upper Cuzco basin with special reference to glacial forms, it is concluded (1) that the beds belong to a glacial series, (2) that the bones were deposited during a period of pronounced alluviation, and (3) that since the deposition of the bones from 75 to 150 feet of gravel were deposited over them and later partly eroded. The age of the vertebrate remains may be provisionally estimated at 20,000 to 40,000 years.

It is only fair to state that in the following paragraph of his report Professor Bowman points to weaknesses of the case—that there is a lack of sharp distinction between certain of the bones found with the human remains and referred to the bison, and the bones of modern cattle; that "certain canine bones gathered in connection with the human remains can not be said to be unlike those of the modern domesticated dog"; and that there is a fair possibility "that the bluff in which the bones were found may be faced by younger gravel, and that the bones were found in a gravel veneer deposited during later periods of partial valley filling."

Farther on in Professor Bowman's report some of the above points are accentuated:

> The relation of the bones to the surface of the bluff leads to some important considerations. The finding of material on the immediate face of the bluff does not merely by virtue of that position indicate with certainty natural burial during the upbuilding of the formation and reexposure as a result of present erosion. Though the bluff is very steep, a number of plant forms cling to it. These catch particles of falling or sliding material and even pieces of pottery. In a number of cases it was noted that the vegetation responsible for such obstruction in time dies, and may be entirely or almost entirely removed. Surficial objects are then left attached to the face of the bluff, from which they may be easily removed. The steeper the bluff the more difficult the retention on a sloping surface becomes. The patchy mantle of foreign material is always loose, unstratified, fine textured, and in strong contrast to the undisturbed material directly beneath it. As contrasted to such surface drift, it is noteworthy that the vertebrate remains were not on the face of the bluff, but 8 inches back from the face, measuring to the median line of the deposits; also that they were stratified with the gravels, mixed with material of about the same texture and composition, and that they lay in a nearly horizontal plane.

Some of the human bones recovered were not "powdery" but relatively fresh, and in the words of Professor Bowman:

One asks at once how the bones could be preserved for so long a period. We are all familiar with the decayed condition of bones buried for even a short period of 20, 50, or 100 years. The bones of the Cuzco man are distinctly weathered, but they do not fall apart. They are so fragile that we broke some of them in excavation, though we used great care; yet they are sufficiently firm, or at least some of them are, to display a clean mark when scratched with the knife. On the whole their comparative freshness is striking in view of a probable age of 20,000 to 40,000 years. On the other hand, it must be remembered that human bones equally well preserved have been recovered from the shell heaps and kitchen-middens of Europe; that human bones no more decayed than these have been found in far older glacial deposits in France, Switzerland, and England; and that more important than the question of state of decay is the question of conditions of burial. The position of the bones within the zone of weathering, the character of the material, the climatic conditions, and the state of the bones at the time of burial are all-important considerations which are discussed in the following paragraphs.

The bones of the Cuzco man, as well as the related vertebrate remains, all show a certain degree of erosion as if they had been for a short time in the grip of a stream. The finer details are wanting and projecting points are moderately worn. The facts that only the projecting points are rounded and the finer detail lost on the more exposed portions and that the amount of erosion is small argues distinctly in favor of the freshness of the material at the time of burial. If the bones had been decayed before being caught by the aggrading stream, their more fragile portions would be worn, though not without respect to exposure of more projecting parts. The projecting points are not necessarily the parts to decay more readily. It may be safely argued from these two conditions also that the bones were decidedly fresh at the time of burial, a condition favoring long preservation.

The bones lay in the zone of weathering, that is to say in the zone between the surface and the ground water. At the time the deposits were forming over them they undoubtedly lay for a part of the time in the ground water and not in the zone of weathering.

Finally Professor Bowman expresses his faith in the antiquity of the human remains as follows:

The original plan of the expedition did not include excavation or detailed archæologic work, nor was any effort made to do highly detailed geologic work. It was essentially an exploratory expedition. Furthermore, I came to the study of the bones, and the gravels in which they were embedded, with grave doubts as to the value of the find. A rather extended reading of anthropologic literature bearing on the antiquity of man convinced me, some years ago, that almost all of our reported cases of buried human remains in North America are not authentic, or the arguments are not sound. I expected to find some doubtful evidence that would entirely destroy any supposed value the Cuzco material might have. Upon examination the geologic evidence appeared very convincing and the proof clear. At the least a detailed study of the physiographic geology of the head of the Cuzco basin was demanded. When this study had been completed, I again returned to the bone locality, in a skeptical frame of mind, prepared to find some fact that would destroy my former arguments.

There is not the slightest thread on which I am able to hang any positive doubt, save the arch of material over the bones. It was at first thought to be either the natural arch of the top of a grave or a dividing plane between an earlier and a later deposit, and that the bones lay in the outer, later deposit, made long after the glacial period. The former hypothesis proved to be untenable, because the gravel became firm before the bones were reached, while excavating downward from the crack. In testing the latter hypothesis, a similar difficulty arose. No break could be found between the stratified gravel of figure 5 and the stratified gravel in the steepest part of the bluff. Although a search was made for signs of a break, showing that erosion was followed by alluviation, and for facts showing that the fill material contained the bones, nothing conclusive or even suggestive could be found.

Dr. Eaton's report on the bones, human and animal, in his part of this first publication on the Cuzco finds is both careful and cautious. As to the human bones, he rather dissonantly concludes that—

It is clear that no proof of great antiquity can be drawn from the characters of the human skeletal parts submitted to me, agreeing as they do in all essential respects with the bones of a recent people. Until additional skeletal material is obtained showing characters more primitive than those already noted, the burden of proof of great antiquity must rest on geological and paleontological evidence.

With regard to the animal bones, Dr. Eaton arrives at this time at no definite conclusion as to the exact species they represent or their antiquity; there is need of further comparison.

In 1912 the work of the Yale Peruvian Expedition was resumed. This time the expedition was accompanied by Prof. Herbert E. Gregory as geologist, and considerable time was devoted to a critical study of the Cuzco gravels. Dr. Eaton also accompanied the expedition as osteologist for the purpose of making needed local comparisons. The results of the season's work proved of considerable importance, particularly in relation to the human and animal remains recovered the year previous from these gravels. The report of the work, published in *The American Journal of Science* in July, 1913,[1] presents a number of highly interesting and satisfactory conclusions.

Professor Bingham, to whom American anthropologists must be grateful for having done everything in his power to ascertain the exact truth concerning the Cuzco remains, contents himself, in his brief prologue, with the statement that "while the results are not as exciting as some people wish they were, it is a great satisfaction to me to have been able to get to the bottom of this interesting problem."

[1] The Investigation of the Prehistoric Human Remains Found Near Cuzco, Peru, in 1911, by Hiram Bingham; Vertebrate Remains in the Cuzco Gravels, by George F. Eaton; The Gravels at Cuzco, Peru, by Herbert E. Gregory. *Amer. Journ. Sci.*, 4th ser., vol. xxxvi, pp. 1–29, New Haven, July, 1913.

Professor Gregory's report (p. 29) throws an entirely new light on the geological conditions in the Ayahuaycco gulch. He concludes:

It is unprofitable, from a geological standpoint, to work out the details of erosional history in and about Cuzco, because of the extensive modification of slopes and terraces resulting from cultivation and flood-water irrigation. However, the evidence indicating periodic destruction and building of terraces, even within the past 100 years, removes the necessity of ascribing great antiquity to animal bones, parts of human skeletons, and fragments of pottery found along stream banks and which may have been deposited on terraces or on banks, or in the numerous small cave-like openings in the gravels, to be transported, buried, or reexposed during alternating processes of deposition and degradation. It is interesting to note that in the canyoned tributaries of the Sappi and of streams leading from the limestone plateau and from the sandstone highlands bordering the Cuzco Basin on the south—valleys from which terraces and slides have been removed and whose banks offered no temptation to occupation, valleys whose present precipitous gravel walls are clearly of glacial age—no traces of human occupation were revealed by careful search. From these same gravels, however, mastodon bones have been collected, on the Huancaro and in the lower Cuzco Valley. The fact that these bones from the Ayahuaycco gravels are of modern types . . . obviously corroborates this view of depositional history, and also indicates important climatic changes since the Spanish conquest.

It will be noted that the explanations given in this paper are chiefly of negative value so far as archæological research is concerned. That man existed in South America in glacial or preglacial times, and that the human bones discovered in the Ayahuaycco Quebrada "appear to be from 20,000 to 40,000 years old" as tentatively held by Bowman, is not definitely disproven by the field studies of the present writer. On the other hand, the geologic data do not require more than a few hundreds of years as the age of the human remains found in the Cuzco gravels.

Dr. Eaton, in a further study of the animal bones found with the remains of the "Cuzco man," succeeded, in the first place, in a definite identification of the first rib, which looked like that of a bison, as that of a cow of the kind raised on the elevated pastures about Cuzco, while the canine bones may be referred to a dog.

The site of the discovery of the bones of the "Cuzco man" was carefully examined, and Dr. Eaton states:

After studying the form and composition of the walls of the quebrada and examining other deposits of bones both here and elsewhere in the Province of Cuzco, I am led to the opinion that the bones excavated in 1911 were not originally embedded in the basal gravel of the spur at the time when that gravel was itself in process of deposition, but were, in all probability, interred there at a much later time when the northeast wall of the quebrada had assumed more nearly its present contours. [P. 5.]

In regard to the bones of lower animals accompanying these human remains it seems to have been an ancient and common practice in this part of Peru to place in the human grave pieces of the flesh of llamas and occasionally, if the mute testimony of the bones can be relied on, a dog's entire carcass. There is no reason to suppose that this ancestral custom would have been discontinued

until long after the introduction of European domestic animals; and accordingly there should be nothing surprising in the occurrence of beef bones in human graves, either with or without bones of the native animals. [P. 8.]

Further search along the walls of the quebrada was rewarded by the discovery of several other bone deposits whose history seems to have been almost as closely connected with recent changes in the contours of the gravels as was the history of the deposit found in 1911. Reference has been made to a mass of talus material at the foot of the northeast wall and about 60 feet distant from the excavation of 1911. In this material, by the side of the trail, human bones were found under conditions differing from those that obtained in the interment previously described. . . . Excavation at this place brought to light parts of two human skeletons, a fragment of a llama's vertebra, a piece of charred bone, a few podial bones of some small unidentified mammal, bits of charcoal, and a small flat piece of bone, about 1½ inches long and one-half inch wide, pierced at one end. No pottery was found. The human material shows no departure from the modern Indian type of the region, and possesses little morphological interest. [P. 9.]

In following pages Dr. Eaton refers to several other graves found in the walls of the quebrada which yielded human remains in much the same condition as those of the "Cuzco man" of 1911, and were associated with individual bones of animals, in one case even those of a horse.

Some time after the return of the first Yale Peruvian Expedition from the Cuzco Valley, the human bones representing the "Cuzco man" were brought to the writer's laboratory in the United States National Museum for comparisons. Among 10 modern Peruvian femora selected at random, several showed close relation and one a practical identity in type and dimensions with the femur which formed part of the Cuzco find. The remaining bones were more or less fragmentary, but presented no characteristic whatever by which they could be distinguished from the more immediate Columbian and post-Columbian Peruvian bones. The part of the parietal, though its aspect was somewhat obscured by the soaking in vaseline to which all the specimens had been subjected, was seen to be still fairly "green." In general, the state of preservation of the bones bore but little resemblance to that of any of the remains of early man in France or elsewhere.

THE LA BREA SKELETON, CALIFORNIA

In the early part of 1914 newspapers of the United States gave wide publicity to the discovery of human bones in an asphalt pit on the Rancho La Brea, near Los Angeles, Cal. Though details were withheld, it soon became known that such a find had actually been made; and as the La Brea pits were already known as the most valuable deposits of skeletal remains of the Quaternary fauna of California, the occurrence of human bones in one of these pits was recognized as a matter of very considerable importance.

Fortunately the study of these remains and their association was early intrusted to one who commands the confidence of every American scholar in these lines, namely, Prof. John C. Merriam, of the University of California. On August 7, 1914, in *Science*, appeared his report, which shows the circumstances and scientific value of the find in their true perspective.[1] The report is so concise and to the point that it is necessary to quote it almost bodily. It reads:

In January, 1914, the Museum of History, Science, and Art, of Los Angeles, being inconvenienced by heavy rains filling the pits already in process of excavation in the asphalt deposits at Rancho La Brea, began work at a new locality, which was designated as pit No. 10. Work was started at a point a short distance southwest of a large pit from which many remains of extinct animals had been obtained in previous years. The point at which excavation was initiated was marked by a seepage from which tar had poured out in comparatively recent time. The excavation of this locality showed the presence of two vents or chimneys filled with asphalt. The chimneys were each about 3 feet in diameter and both had contributed to a hard asphaltic layer, forming the surface of the ground at this point. At a depth of about 8 feet the chimneys opened into a large dome-shaped asphaltic mass not less than 8 feet in diameter and extending downward to an unknown depth.

Remains of many kinds of animals were obtained in both chimneys, but the most interesting discovery was the finding on February 5 of an upper jaw from a human skull, at a depth of a little more than 6 feet, in the northerly of the two chimneys. Careful investigation of this vent disclosed later almost the entire skull with other portions of the skeleton. The remains evidently belonged to one individual. The bones were found ranging in depth down to a level of about 9 feet below the surface, and reaching almost to the point at which the chimney connected with the domelike reservoir below.

Realizing that this find might prove of exceptional scientific interest unusual precautions were taken in the excavations following the discovery of the human remains. Under the direction of Mr. Frank S. Daggett, director of the museum, and of Mr. L. E. Wyman, who had immediate charge of the work in the pits,

[1] Preliminary Report on the Discovery of Human Remains in an Asphalt Deposit at Rancho La Brea, by Prof. John C. Merriam. *Science*, n. s. vol. XL, pp. 198–203, New York, Aug. 7, 1914.

the excavators obtained all possible information as to the nature of the deposit in which the specimen was found, and every bone appearing in the deposit was saved. The final results of the work give us a complete map of the deposit and full list of the animal remains from the two chimneys, with their situation in the chimneys.

* * * * * * *

Purely geologic evidences of age are often exceedingly difficult to obtain in asphalt deposits, owing to the peculiar mode of accumulation, and the possibility of movement in the deposits after they are once formed. The asphalt is a residue from evaporation of oil. It accumulates either on the surface of the ground or in the midst of other strata into which it has soaked or poured. Even after the asphalt deposit has formed, the nature of the viscous material makes possible considerable movement in many directions within the mass and consequent change of position of any materials in it.

The deposits in which fossil remains have been found at Rancho La Brea are evidently in part layers formed on the surface, and in part pipes, pockets, and chimneys through which oil came up from deeply buried strata. The source of the asphalt or oil is a deep-lying formation, which is considerably folded, and is covered by approximately horizontal layers of clayey and sandy strata washed in from higher land not far away. Oil and gas have been seeping through the superficial horizontal deposit for a very long period, and have formed more or less definite channels or pipes along lines of least resistance. In some cases these pipes have evidently enlarged themselves locally to chimneys several feet in diameter.

At pit No. 10, in which the human remains were discovered, the asphalt deposit consists of two pipes or chimneys connecting with surface flows above. The chimneys arise below from a large dome-shaped asphaltic reservoir. This dome may be an old surface pool now buried and forming a part of the passageway for further upward movement of oil; or it may be an enlargement of a chimney that was originally very much smaller.

The asphalt in the chimneys and in the dome in pit 10 was largely a soft, viscous mass containing a high percentage of sand, and including in some regions many angular lumps of hard, weathered asphalt. The contents of the chimneys are entirely unlike the surrounding soil or rock. The material through which the chimneys pass is not homogeneous, but is composed of approximately horizontal strata of clay, sand, and gravel, with a small inclusion of asphaltic material in most places. The contact between the chimneys and the matrix through which they pass was everywhere sharply marked.

* * * * * * *

Bones of birds and mammals were abundant in both chimneys. In the south chimney, which is wide above and narrows sharply below, large bones are found only above the narrowing of the pipe. In the large reservoir below the chimneys only small bones appear, and these were found only in a limited space near the point of union of the lower reservoir and the two chimneys. The distribution of bones shows conclusively that they came from above, and were not carried up from the depths with ascending oil.

The total number of specimens found in the chimneys was large, and will aggregate several thousand. These bones represent a considerable variety of mammals and birds. They include bear, coyote, a wolf of the timber-wolf type, skunk, weasel, horse, antelope, rabbit, pocket gophers, field mice, eagles, owls, vultures, crows, and many other forms.

The fauna from the two chimneys in pit 10 is in general like that of California at the present time. It differs greatly from that of the pits in which

the well-known Rancho La Brea fauna is found through the absence of the great wolf, saber tooth, sloth, small antelope, camel, and many other mammals and birds abundantly represented in the typical Rancho La Brea deposits.

The only extinct form certainly recognized in the material from the two chimneys is *Teratornis*, a gigantic condorlike bird, as yet known only from Rancho La Brea, and recognized by Dr. L. H. Miller in this collection. Bones of this bird were found in a narrow portion of the north chimney at a depth of about 4 feet, and considerably above some of the human remains. As nearly as one can judge from the evidence at hand, there seems a reasonable chance that the giant *Teratornis* was a contemporary of the human being whose remains appear in the north chimney of pit 10. The evidence does not present clear proof in favor of this view, but appears to balance in that direction.

The extinct California peacock and two other extinct species are doubtfully reported from the north chimney, but there is doubt as to their having been introduced in the same manner as the other bones making up the fauna.

A small collection found near the upper end of the north chimney contains a number of birds, which, according to Dr. Miller, are quite different from those certainly known from the two chimneys. The matrix in which this small collection was found is also different from that in the chimneys. It seems probable that these specimens really represent an older fauna embedded in a relatively ancient deposit through or near which the north chimney passed.

A portion of the lower jaw of a young horse found at a depth of about 5 feet and near the *Teratornis* in the north chimney is more slender than any lower jaw of the common extinct horse found in the typical Rancho La Brea fauna. The writer has not, however, compared it with fossil specimens of exactly the same individual stage of development. In slenderness it approaches more closely the jaw of the existing domestic horse. The space between the back teeth and front teeth seems shorter than that in the domestic horse, and is of nearly the same length as in the extinct species from Rancho La Brea. A more careful study of immature specimens from Rancho La Brea in comparison with very young modern horses will be necessary before one can speak authoritatively with reference to the specific determination of this specimen. It will be very interesting to know whether this is an extinct species which lived in California until a comparatively recent time and was contemporaneous with man, but became extinct before this country was visited by white men. The alternative hypothesis is that it represents the colt of a modern horse which fell into the pit within the last century and a half.

The fact that the fauna from the two chimneys is nearly or quite identical with that of the present day, while the typical Rancho La Brea fauna differs greatly and shows close resemblance to the life of the earth at a remote time, makes it evident that the fauna represented in the chimneys of pit 10 pertains to a period much later than that in which the typical Rancho La Brea animals lived. The collection from the chimneys represents a time so close to the present that the types of life were nearly the same as those in the region at the present day. The giant *Teratornis*, and possibly several other extinct forms in this fauna, may indicate that the asphalt in these chimneys was trapping animals at a time removed by some thousands of years from the present. On the other hand, it may be that these species were living here within historic time. A third possibility is that the bones of such extinct species as are found here have been removed in some way from an older deposit and found a resting place in the chimneys in comparatively recent time. Still more remote is a fourth possibility that in Pleistocene time these chimneys connected with an open pool far above the present surface of the ground; that bones of a few

animals trapped at that time sank to the position in which they were found in the excavations; and that after the removal of the upper deposits by erosion the later or younger fauna was trapped and mingled with the few bones of earlier date.

The human bones were all found in the north chimney, where the history of accumulation is more complicated than in the south vent. The pit containing the human remains also contains all of the presumably associated specimens representing extinct animals.

The human remains were found rather widely scattered between a depth of about 6 feet and 9 feet. The whole collection of human bones seems to represent one individual. The bones are generally very much worn. The wear in some cases suggests movement within the pit in such a manner that sand in the tar, or resting against the wall of the chimney, has cut away the bone by long-continued rubbing.

Enough of the human skeleton was found in the pit to give a fairly satisfactory idea as to the characteristics of the individual it represents. The skull is that of a small person of middle age, possibly a woman. The brain case is relatively as large as that in some of the living native races of America. According to Dr. A. L. Kroeber the racial characteristics do not differ decidedly from those of people whose remains have been excavated in mounds on Santa Rosa Island off the coast of southern California. So far as the characteristics of the skeleton are concerned, it is not necessary to suppose that we have here an individual who lived at a remote time when the human family was in a relatively low stage of evolution. This skull is not comparable to those of ancient races of the Neanderthal or earlier types. On the other hand, one must not forget that people of a fairly advanced stage of brain development were already in existence at the beginning of the present or Recent geological period.

The characters of the human remains taken by themselves indicate that this person lived either within the present or Recent period, or at a time not earlier than the end of the Pleistocene period immediately preceding it.

A summary of available information regarding the age of the human skeleton found in pit 10 at Rancho La Brea is as follows:

1. The evidence of geologic occurrence in the asphalt chimney, taken by itself, counts for relatively little owing to the peculiar conditions under which these deposits are formed. In so far as this is of value it suggests an age later than that of the tar pits containing the typical Rancho La Brea fauna.

2. The fauna associated with the human remains in pit 10 is quite different from the typical Pleistocene Rancho La Brea fauna, and must have inhabited this region at a different period. The fauna in pit 10 is closely related to that of the present or Recent period. It is distinctly later in age than the typical Rancho La Brea fauna.

3. The characters of the human remains, taken by themselves, show a stage of development similar to that of man of the present day and not earlier than man of the latest Pleistocene time.

4. The evidence as a whole indicates that the human skeleton from pit 10 is of a period much later than that of the typical Rancho La Brea fauna, the time being either within the Recent period or not earlier than the very latest portion of Pleistocene time. The possible association of the human remains with extinct forms, such as the giant *Teratornis*, may indicate some antiquity for the human being or may indicate comparatively late persistence of birds or mammals now extinct in this region.

5. Measured in terms of years, it is not possible to give a definite estimate of the age of the skeleton from pit 10. It may suffice to state that this person

did not live in the period of the low-browed, Neanderthal, Pleistocene man of Europe. It belongs to the distinctly modern stage of evolution. It does not necessarily belong to the present historic period, but can not be considered as having antedated it by many thousands of years. The age of this specimen may perhaps be measured in thousands of years, but probably not in tens of thousands.

6. The study of the remains at pit 10 is a problem similar to that presented by the occurrence of an arrowhead found in a comparatively recent asphalt deposit encountered in the University of California excavations of 1912. The arrowhead was found embedded in a deposit somewhat similar to that in pit 10, and the fauna associated with it was in general of Recent aspect.

7. The final summing up of all evidence relative to the antiquity of the Rancho La Brea skeleton will depend on a very detailed and exhaustive study of the typical Pleistocene Rancho La Brea fauna, of the fauna from the later tar deposits like that of pit 10, and of the existing fauna of California. No one of these three factors is as yet satisfactorily known. Until they are all known, the last word on the subject can not be written. The significance of this statement may seem larger when reinforced by the remark that the skeletons of a large percentage of our living species have never yet been carefully studied in the way in which this work must be done for use in investigations such as those concerned in this problem.

From whatever point of view this specimen is considered, it is well worth exhaustive scientific investigation.

By the kindness of Mr. Daggett, director of the Museum of History, Science, and Art, of Los Angeles, the writer was enabled to see the La Brea human remains, though only through the glass of the case in which they were exhibited; and the results of his observations agree entirely with those of Dr. Kroeber, mentioned in the preceding pages. The color of the bones approximates that of asphalt, and they show, as Professor Merriam indicates, the effects of considerable wear by the sand in the asphalt. They must have been subjected in no small degree to motion in the pit. The wear has changed somewhat the appearance of certain parts, particularly the lower jaw, having caused the disappearance of the chin, so that to a superficial observer this part would look almost receding. Whatever anthropological characteristics can be observed in the skull indicate this to be of ordinary type and one which agrees essentially with that of the California Indian. The small size of the skeleton does not indicate dwarfishness, but merely a small female, such as are not rare among the "Diggers" and some other California Indians. The fact that so many parts of the skeleton, and particularly the skull as well as the lower jaw, were found in the pit, points to the engulfing of either a whole body or most of the skeleton. There is a possibility that the bones may have found their way into the asphalt from a grave, but a body may also have sunk in the pit accidentally or have been introduced.

As to the presence of bones of the extinct "*Teratornis*" in the same "chimney" with the human bones, we should hardly be justified in

drawing from this fact any far-reaching conclusions. In a viscous and mobile medium, such as the asphalt of these pits, association of other bones with the human remains may easily be a mere accident and can be of no definite chronological value.

Taking everything into consideration, there is nothing in the La Brea find which would enable the anthropologist to accept the remains as representative of any Americans earlier than the Indians.

A recent letter to the writer from Professor Merriam conveys the information that he is engaged in preparing a final report on the case, which will soon be ready for publication.

THE BANKS WHERE VERO SKELETONS I AND II WERE DISCOVERED (SEE ARROWS)

Taken from the highest elevation on the opposite bank of the canal.—(A. H.)

THE "FOSSIL" MAN OF VERO, FLORIDA

Preliminary Remarks

The discovery of "fossil human remains" at Vero, on the eastern coast of Florida, was recently announced by Dr. E. H. Sellards, State Geologist.[1] In the early part of October a more extended report on these finds, by the same author, appeared,[2] and other communications on the subject were sent to scientific journals.[3] Meanwhile, generous invitations to visit Vero were extended by Dr. Sellards to a number of scientific men interested in the subject, as a result of which the last few days of October found his camp at Vero filled to capacity. The party included, besides Dr. Sellards and Mr. H. Gunter, his assistant, Dr. Rollin C. Chamberlin, of the University of Chicago, and Dr. T. Wayland Vaughan, of the United States Geological Survey, geologists; Dr. O. F. Hay, of the Carnegie Institution of Washington, vertebrate paleontologist; Prof. George Grant MacCurdy, of the Peabody Museum, Yale University, archeologist and anthropologist; and the writer. A stay of two to five days was made by the several members of the party, and, notwithstanding insects, rain, and finally a partial flood, the locality of the finds, together with the vicinity, was fairly well examined. (Pl. 1.) The reports of the members of the party on the results of their observations, including a preliminary account of similar nature by the writer, will be found in the January–February, 1917, number of *The Journal of Geology*, and are referred to later in this memoir. In this place is presented a more complete account of the subject so far as it relates to the human bones.

History of the Discoveries

The essential features of the history of the discoveries, as given by Dr. Sellards in the *Eighth Annual Report of the Florida State Geological Survey*, are given below. The account is preceded by a brief summary, which reads as follows:

[P. 123] A new and very important locality for vertebrate, invertebrate, and plant fossils was found in 1913 at Vero on the Atlantic coast in central-eastern

[1] Sellards, E. H., On the Discovery of Fossil Human Remains in Florida in Association with Extinct Vertebrates, *Amer. Journ. Sci.*, ser. 4, xlii, pp. 1–18, 1916.

[2] Human Remains and Associated Fossils from the Pleistocene of Florida. *Eighth Ann. Rep. Fla. State Geol. Surv.*, 1916, pp. 121–160.

[3] Human Remains from the Pleistocene of Florida, *Science*, n. s. vol. xliv, pp. 615–617, New York, Oct. 27, 1916.

Florida. The feature of especial interest at this locality is the presence of fossil human remains in association with the Pleistocene vertebrates. Human remains have been found at this locality in two separate strata which differ in age, the one being superimposed upon the other. The contemporaneity of man and the Pleistocene fossils is based not upon a single discovery, but upon successive discoveries, including bones from two human skeletons and in addition flints and implements made by man. The geologic conditions at this locality fortunately are favorable for a correct placing of the fossils, as the older human remains are here found in a fresh-water stratum which rests upon marine shell marl and is overlaid by a laminated fluviatile deposit. Although lying near the surface, the possibility of the human bones representing a recent burial is excluded by the fact that the overlying laminated stratum is undisturbed. The condition of preservation as well as the abundance of the associated Pleistocene fossils is such as to show that they could not have washed

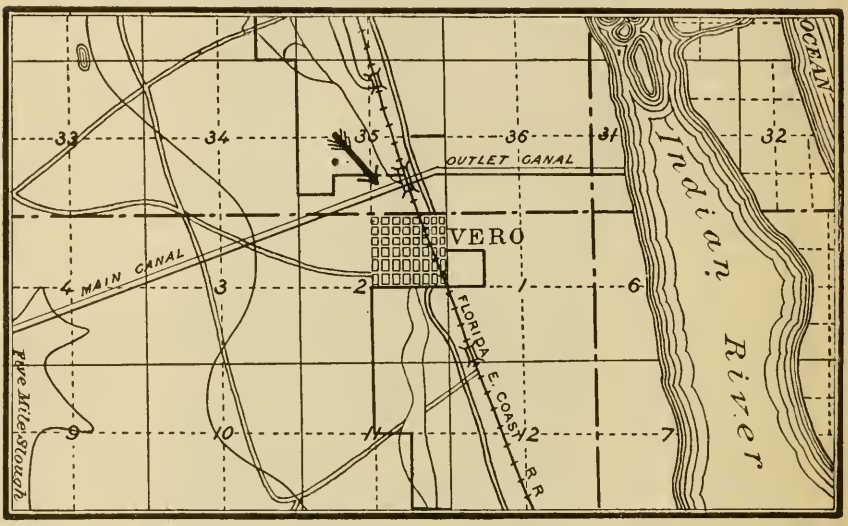


FIG. 1.—Vero, the drainage canal, and vicinity. The arrow points to the location of the finds. (From survey map furnished the Smithsonian Institution by William H. Kimball, chief engineer in charge of the construction of the canal.)

into this deposit from an older formation. There is thus conclusive evidence that the human remains and the associated fossils are contemporaneous. These associated fossils, including mammals, birds, batrachians, reptiles, and fishes, afford incontestable evidence of the Pleistocene age of the deposits.

The occurrence of fossils at Vero was brought to Dr. Sellards's attention toward the end of 1913 by Mr. I. M. Weills, a local collector. Their presence—

[P. 124] first became known as a result of the construction of a drainage canal made by the Indian River Farms Company. Throughout the greater part of its course this canal, which extends from the coast several miles inland, cuts through the surface materials, including sand, marl, and muck beds, and into marine shell marl. In the marine marl, invertebrates are found in abundance and in an excellent state of preservation, while in the sands, fresh-water marls, and muck beds, vertebrates and fresh-water invertebrates are not infre-

quently preserved. The chief locality for vertebrate and plant fossils, however, is at the public road crossing one-half mile north of Vero, where the canal cuts into an old stream bed. The canal enters the stream bed about 500 feet west of the crossing, and follows it while passing under the bridge and for 500 and 600 feet beyond, or for a total distance of about 1,000 feet. [Sketch map, fig. 1.]

[Pp. 125–126] The marine shell marl into which the canal cuts, No. 1 of the section shown in text figure 2, is a part of the extensive series of marine marls which border the Atlantic coast, beginning on the north near St. Augustine, where the marl is known as "Coquina" rock, and extending south to the Everglades of Florida, beyond which the shell marls give place to the shallow-water limestones of extreme southern Florida. These marls and limestones are known by their invertebrate fauna to be of Pleistocene age. . . .

The sands which as a rule overlie the shell marls are in part of marine origin, having accumulated in shoal waters or as beaches and dunes at the time the sea withdrew from the land, and are thus contemporaneous in age, or nearly so, with the marine shell marls. However, in ponds, streams, and lakes fresh-water marls, sand, and muck deposits accumulated which rest upon and hence are of somewhat later age than the marine marls, and it is in deposits of this kind chiefly, as would be expected, that the land and fresh-water fossils are preserved.

The basal marine deposits have been designated by Dr. Sellards as stratum No. 1, the superimposed "sand and

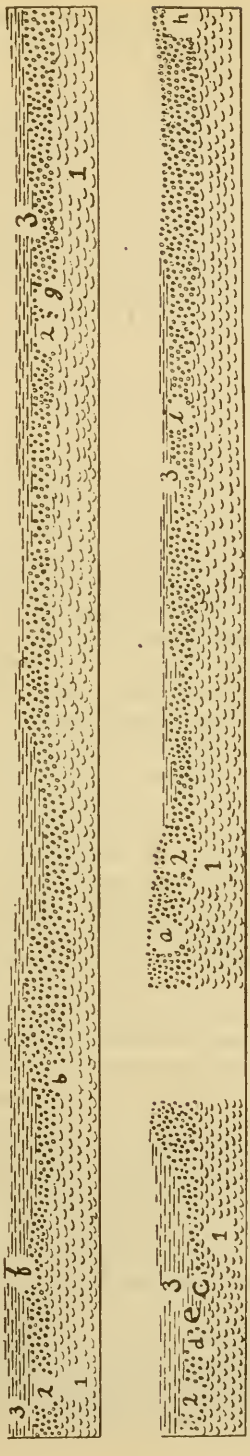


FIG. 2.—Sketch showing the strata exposed in the canal bank at Vero. Horizontal scale, 1 inch equals 73 feet; vertical scale, 1 inch equals 25 feet. The section here represented is that of the north and south banks of the canal from the Florida East Coast Railroad bridge west a distance of 512 feet. The break in the sketch indicates the entrance of the lateral canal from the south. The strata exposed are: (1) A marine shell marl found generally throughout this part of the State and cut into by the canal here as elsewhere; (2) a fresh-water sand, muck, and marl bed containing fresh-water invertebrates, plant and vertebrate fossils, including human remains; (3) an alluvial bed consisting of incoherent sand, muck, and vegetable material containing plant and animal fossils and human remains. Human skeletal remains have been found in stratum No. 2 at *a* and at *c*. Markings on a bone and on a proboscidian tusk were found in this stratum at *b*. Flints and bone implements were found in this stratum at *c* and at *d*. Human skeletal remains, pottery, and implements were found in stratum No. 3 at *e* and at *f*. (After Sellards.)

marl" stratum as No. 2, and "the alluvial bed" resting upon this as stratum No. 3. Stratum No. 1 has already been defined. Stratum No. 2—

[P. 128] includes cross-bedded river-wash sand, partially decayed wood and muck, sand stained brown by organic matter, and at places fresh-water marl rock. The distinctly cross-bedded sands of this stratum are found near the base, and it is here chiefly that the decayed wood and muck occur lying in stream channels in the shell marl. The brown sand contains in places many fresh-water shells, and grades into the fresh-water marl, which in places includes at the top as much as 2 feet of rather hard rock. Vertebrate and fresh-water invertebrate fossils occur throughout this bed from the cross-bedded sands at the base to the marl rock at the top. It is from this bed also that the first human fossils found at Vero were taken.

Stratum No. 3 is described thus:

[Pp. 129–130.] Resting upon this sand and marl bed and in places cutting into it is an alluvial deposit consisting chiefly of vegetable material intermixed with sand, grading at the top in places, as is true also of the bed beneath, into a fresh-water marl. The average aggrading of the stream valley by this alluvial material amounts to about 2 feet, although locally where the stream cut deeply into the underlying bed this deposit reaches a maximum thickness of 5 or 6 feet. This alluvial deposit contains vertebrate and plant fossils and in the fresh-water marl occasional invertebrates. Human remains are found in this deposit also, their place in the section being indicated in text figures 1 and 2.

Between the marine marl, No. 1 of the section, and the sand and marl stratum holding human and other vertebrate fossils, No. 2 of the section, there exists no persistent well-marked break in deposition. There is, however, a change from marine to fresh-water conditions, and accompanying this change one finds evidence of stream action, materials from the land having been washed in and deposited in channels in the marine shell marl. On the other hand, there are places in the section where the sand and shell beds of the marine deposits dovetail into the succeeding fresh-water deposits in such a way as to indicate continuous deposition. It is probable that the fresh-water deposit indicated by No. 2 of the section represents at this locality the closing phase of the marine marl formation, the change to fresh-water conditions having been brought about by a slight shifting of the strand line.

Between this older stream deposit, No. 2, and the alluvial bed which follows, No. 3, there is on the other hand an abrupt, well-marked, persistent break, the top surface of stratum No. 2 being extremely irregular. The alluvial bed, No. 3, the initial phase of which is represented by pronounced stream action, conforms to the irregularities of the older deposits. Stratum No. 3 represents possibly the filling of the stream channel which followed the late Pleistocene depression referred to on page 126.

One of the abundant and easily recognized fossils of stratum No. 2 is the Columbian elephant, *Elephas columbi*, and for convenience of reference this stratum may be known as the *Elephas columbi* zone or horizon. An abundant fossil in stratum No. 3 is a deer which is referred provisionally to the modern *Odocoileus osceola*, and this stratum may be known as the *Odocoileus osceola* zone.

The human remains. First skeleton.

[Pp. 131–132.] In October, 1915, Mr. Ayers, while examining the stratum which contains the vertebrate fossils, found some bones in place which seemed probably to belong to a human skeleton. In order to verify the place of the

bones in the section he then called Mr. Weills, and together they removed the bones. The parts of the skeleton obtained include the right and left femur, lacking the extremities; right patella; left tibia and fragments of the right; right fibula; right calcaneum; right and left astragalus; left navicular; external cuneiform of the right foot; right metatarsals one to four; left metatarsals three to five; a part of the shaft of the left humerus; right os magnum; three metacarpals; and three phalanges. All of these bones pertain apparently to the same specimen, representing a small individual. From the lower margin of the lesser tuberosity to the upper margin of the inner condylar notch, the femur measures 29 cm., the corresponding measurement on the femur of a large modern adult being as much as 32 cm. The extremities of the larger limb bones of this skeleton are but poorly preserved, a condition common to many of the bones in this sand, although the bones found in muck in this bed are as a rule more nearly complete.

The section of the bank at the place where these human bones were found is as follows:

	Feet.	Inches.
Sandy hard marl rock	1	3
Sand stained brown by organic matter	3	9
Marine shell marl to water level in the canal	5	9

The marl rock and the brown sand beneath represent stratum No. 2 of the general section (text figure 2), the alluvial bed, No. 3 of the section, being absent at this place. The human remains were imbedded in the brown sand about 3 feet from the base or 2 feet from the ground surface as it existed previous to the construction of the canal.

That the sands in which the human remains are found represent a continuation of the stratum holding the other vertebrate fossils there can be no question, as the section is continuous along the canal bank and the deposits identical in appearance. *Elephas columbi*, *Equus leidyi*, and other extinct species are found at an equal or higher level in the beds on either side of the human remains. From the marl rock which lies at the top of the section the writer obtained, within 6 feet of the place where the human skeleton lay, a premolar tooth of a fox, representing not the common gray fox of that region, but either an extinct species or possibly the red fox, *Vulpes pennsylvanicus*, which at present is not known in Florida. In immediate association with the human bones were the scapula and astragalus of a deer, which is also found elsewhere in the sand, being one of the common fossils of the bone bed. In addition a hyoid bone of the sloth, *Megalonyx jeffersonii*, and pieces of the teeth of the mastodon, *Mammut americanum*, have been collected from the canal bank at the place where the human bones were found.

Second skeleton.

[Pp. 140–142.] In February, 1916, Mr. Ayers obtained a human right ulna which, although not found in place, was recognized as having been derived from the bank, since the degree of mineralization was similar to that of the associated vertebrate fossils. The skeleton from which this bone came, however, was not located at that time. Again, in April, 1916, Mr. Ayers found the distal end of a humerus, which, although not in place, had recently fallen from the bank. The discovery of this bone led to the location in the bank of other bones belonging to the same skeleton to which belongs also the ulna found three months earlier. The place of these bones in the section may be seen from the photograph [pl. 6, fig. 1], which shows the left ulna, femur, and radius as they lay in the bank. All of these bones were at the base of

stratum No. 3, lying at the contact line between this and the next older stratum. By reference to the general sketch showing the canal banks [fig. 2] and to the more detailed sketch [fig. 3] it will be seen that at this place the later stream deposits, stratum No. 3 of the section, cuts sharply into the older formation, and for a short space cuts entirely through stratum No. 2 and into the shell marl beneath. [Figs. 4, 5.]

The bones from this skeleton were taken from the bank by Ayers, Weills, and the writer. In addition to the ulna and humerus, there were obtained from cavings from the bank a part of a sphenoid bone, scapula, and a left upper incisor, and in place in the bank the left ulna, a femur, radius, base of a jaw, parts of the skull, and two metatarsals. The first bone found in place was the left ulna, of which the proximal part only was present, although the

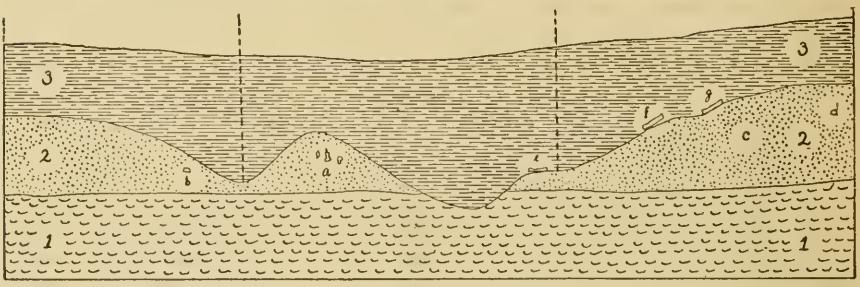


FIG. 3.—Sketch showing the strata exposed in the south bank of the canal from 452 to 480 feet west of the bridge. Horizontal and vertical scale, 1 inch equals 4 feet. Nos. 1, 2, and 3 in the sketch represent strata 1, 2, and 3, respectively, of the general section. At one place near the middle of the exposure stratum No. 2 is cut out by stratum No. 3. The dividing line between 2 and 3 here as elsewhere is well marked and is unmistakable. Human bones are found in stratum No. 2 at *a*, this being the place from which the writer obtained a human astragalus, an external cuneiform, and parts of the pelvis in place, as well as some other bones and flints from siftings. At *b* in this stratum was found a flint spall. A type specimen of a turtle, *Terrapene innoxia* Hay, was found in this stratum at *c*. A foot bone of a horse was found at *d*. Other fossils were obtained in this stratum. Bone implements were obtained from the sand near *a* and near *d*. Stratum No. 3 consists of alternating beds of sand and muck which conform to the irregularities of the underlying deposits. Human bones were found at the contact line between 2 and 3 at *e*, *f*, and *g*. A number of other bones were also found in this stratum lying at or near the contact line. This stratum contains also numerous bone implements, pottery, and a few arrowheads and ornaments. (After Sellards.)

distal part lacking the extremities was later obtained a few inches farther back in the bank. The bone next found, the left femur, of which only a part of the shaft is preserved, was lying near the ulna and at about the same level. Another piece from the shaft of this bone was obtained the following June, having been found several feet farther back in the bank. The radius, of which the proximal part only was obtained, was found 5 feet north of east of the ulna and at the same place in the section; that is, at the bottom of the bed of sand and alluvial material. Owing to the slope of the bed at this place, however, this bone lay at an actual level fully 2 feet lower than the ulna. The jaw and the parts of the skull were found chiefly between the ulna and the radius and from a few inches to 2 feet farther back in the bank. One of the foot bones, a fifth metatarsal, was taken about 8 feet east of the ulna and at an actual level, owing to the change in slope, above that of the radius and approximately the same as that of the ulna. Above the human skeleton 4

feet of alluvial material are found at this place, consisting of alternating layers of sand and muck, which in places grade into soft, fresh-water marl having a thickness of as much as 2 feet. Fossil plants, including leaves, stems, and seeds, are found in the muck bed. The plants apparently are but little changed from their original condition. While excavating in this bank in June additional pieces of the skull were found as well as a part of the shaft of the right femur and an additional incisor tooth.

By reference to the text figures and to the description of the fossils it will be seen that the bones of this skeleton, lying at the contact line between strata 2 and 3, are found on either side and around the bones found in place in the older stratum No. 2. The position leads to the suggestion that the bones lying at the base of stratum No. 3 were derived from stratum No. 2, and that only

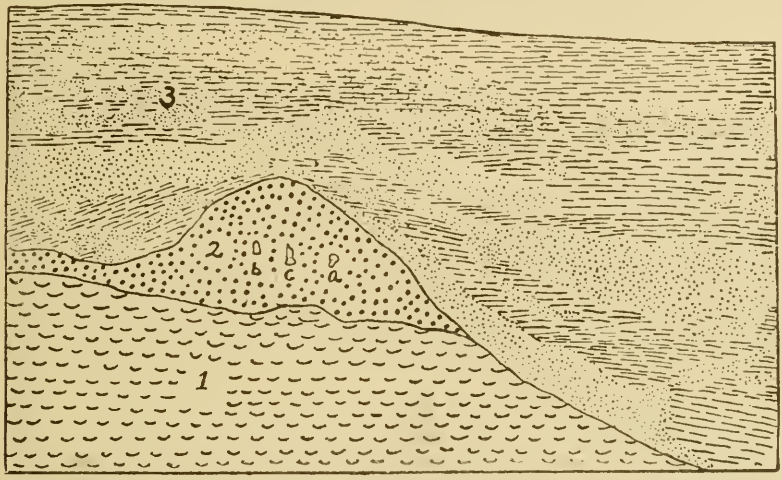


FIG. 4.—Detail of section of the bank on the south side of the canal from about 458 to 468 feet west of the bridge. Scale, vertical and horizontal, 1 inch equals 2½ feet. Nos. 1, 2, and 3 represent strata 1, 2, and 3 of the general section. Human bones were found in stratum 2 at *a* and at *b*. The scapula of a deer was found at *c*. The overlying material consists of alternating layers of sand and muck which had not been disturbed. These conform to the irregularities of the underlying formation. (After Sellards.)

one skeleton is represented by the two finds. This may be true, since there is no duplication of parts, and a large individual is represented in each instance. It is well to remember, however, that human remains characterize stratum No. 3, a fact indicated by an abundance of pottery, many bone implements, arrowheads, and other small flints.

In June, 1916, while excavating near this place, 465 feet west of the bridge, Dr. Sellards—

[Pp. 135–136] found human bones in place in the older stream deposit, stratum No. 2 of the section. The section at this place is as follows:

	Feet.
Alluvial deposit consisting of alternating beds of sand and muck, representing No. 3 of the general section	2½
Dark-colored sand, representing No. 2 of the general section	1½
Shell marl, representing No. 1 of the general section to water level, about	4

The exposure in the canal bank at the place where these bones were found is shown in the accompanying sketch and in the photographs. . . . The top surface of stratum No. 2 here, as elsewhere, is irregular, the irregularities being filled by the overlying deposits. At the spot where the human bones were found, owing to stream wash previous to the deposition of the overlying deposit, the fresh-water stratum, No. 2 of the section, is only 18 inches thick. The human bones were found in this sand about 10 inches above the base. The overlying alluvial beds are stratified, and, as usual, conform to the irregularities of the underlying formation. The human bones at this place were found and removed by the writer in the presence and with the assistance of Isaac M. Weills and Frank Ayers. The first bone found was a right astragalus; the second bone taken in place was the right external cuneiform, which lay at the same level and about 10 inches from the astragalus. About 12 inches farther back in the bank was found a piece from the right pubes and a part of the left

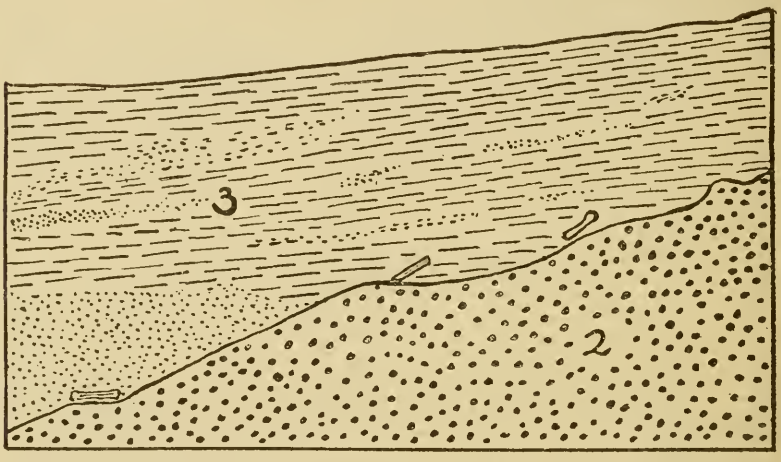


FIG. 5.—Detail of the section of south bank from about 470 to 478 feet west of the bridge. Horizontal and vertical scale, 1 inch equals about 2 feet. Human bones were found at or near the contact line between strata 2 and 3. The strata Nos. 2 and 3 correspond to strata 2 and 3 of the general section. No. 3 is an alluvial deposit made up of alternating layers of sand and muck which were undisturbed. (After Sellards.)

ilium, including that part of the bone which articulates with the sacrum. Upon sifting the sand in which these bones were imbedded there was obtained, in addition, two phalanges, a section from a limb bone, and some other human bone fragments.

The dividing line between strata 2 and 3 of the general section here as elsewhere is well marked and unmistakable, and the human bones lay in stratum No. 2. The overlying laminated deposit is undisturbed, and hence the bones can not represent a recent burial. The vertebrates associated with these bones are listed in a subsequent paragraph.

A list of fossils—

[P. 139] found in stratum No. 2 in association with human bones, flints, and implements on the south bank of the canal from 460 to 470 feet west of the bridge. The bones found in place in stratum No. 2 at this place include the following: *Odocoileus* sp., left scapula and teeth; *Elephas columbi*, tooth fragments; *Equus leidyi?*, part of a tooth; *Tapirus haysii?*, part of a tooth;

and *Didelphis virginiana*, part of the lower jaw. Upon sifting the sand the following additional species were obtained: *Sylvilagus* sp., teeth and part of lower jaw; *Dasypus* sp.?, dermal plate; *Sigmodon* sp., teeth; *Neofiber alleni*, teeth; *Chlamytherium septentrionalis*, dermal plates; *Blarina* sp.; *Cryptotis floridana;* bird, humerus and part of radius; *Alligator mississippiensis?*, teeth, dermal plates; batrachian, leg bone; snake, jaw and fangs; as well as acorns and fragments of wood. Of these fossils the scapula of the deer was found within a few inches of the human astragalus and at the same level, while the other specimens were found nearby, none of them being more than 5 feet from the human bones.

Additional human bones: In April, 1916—

[P. 142] while excavating in the north bank of the canal, 419 feet west of the bridge, Mr. Weills obtained at the contact line between strata Nos. 3 and 2 a single human toe bone. From the same bank, 450 feet west of the bridge and at approximately the same place in the section, Mr. Weills obtained in June, 1916, an unworn human molar tooth. Since the canal at this place is fully 100 feet wide from bank to bank, it is doubtful if these specimens, although at the same place in the section, belong to the skeleton found directly opposite in the south bank.

Artifacts: In April, 1916, while excavating in layer No. 2 on the north bank, 370 feet west of the railroad bridge, Mr. Weills obtained in "immediate association" with various bones of fossil animals—

[P. 134] a fragment of bird bone and a tip of a proboscidian tusk, which have markings which apparently were made by tools. These two specimens were both found in place near the base of stratum No. 2, on the north bank, 370 feet west of the bridge.

[Pp. 136–139.] In stratum No. 2, at the locality on the south bank, 460 feet west of the bridge, Frank Ayers found in place a thin sharp-edged flint which undoubtedly is a spawl from the manufacture of some kind of a flint implement. The place of this flint in the bed is about a foot farther in the bank than the human bones and 3 or 4 feet farther east. . . . Upon sifting the sand from this stratum at this locality five additional small flints were obtained. They may be spawls, although it seems more probable that some of them at least are small implements.

[P. 140.] With the small flints obtained from sifting the sands [of stratum No. 2] in which the human bones were imbedded was found a piece of a bone implement. Subsequently, while sifting the sand from this stratum about 10 feet farther to the west (475 feet west of the bridge), a second small implement and also a small flint was found. The bone implements are polished and nicely finished. The second implement found, which is practically complete, is sharp pointed at one end and beveled at the other, probably for insertion into a shaft. While neither of these implements were found in place, the sand was carefully handled, and there was little or no chance of their coming from any stratum other than No. 2 of the section.

All the human bones recovered are mineralized. Comparison with a fossil animal bone from the same locality and a human bone from a sand mound near Vero gave Dr. Sellards the following results:

Analysis of recent and fossil bones from Vero, Florida [*p. 133*]

	No. 1	No. 2	No. 3	No. 4
Specific gravity	2.0627	2.8357	2.6293	2.7505
Moisture at 100° C.	10.72	2.07	4.09	3.89
Volatile matter	19.59	8.92	8.22	10.30
Phosphoric acid, P_2O_5	27.24	32.27	30.88	32.00
Calcium oxide, CaO	39.75	46.80	45.69	48.31
Insoluble matter, silica, etc	0.60	1.11	3.61	1.39
Iron and aluminum oxides	0.13	3.71	1.85	0.76

No. 1 is from a recent human tibia taken from an Indian mound near Vero. Fla. Surv. coll. No. 5537. No. 2 is from the right tibia of a man taken in place in the Pleistocene bed at Vero. Fla. Surv. coll. No. 5200. No. 3 is from the femur of *Canis* sp. from the stream bed at Vero. Fla. Surv. coll. No. 5449. No. 4 is from the front part of the jaw of *Megalonyx jeffersonii*, from Vero. Fla. Surv. coll. No. 4374.

[P. 160.] The men of the stage of the Pleistocene represented by stratum No. 2 of the section at Vero were then making flint implements, a fact fully established by the discovery in place in the Pleistocene bed of a spawl from such an implement. They apparently were also making bone implements, two of which have been obtained from screenings from the Pleistocene deposit. They probably had also acquired the art or custom of engraving on bone, this conclusion being supported by the discovery in place in the Pleistocene bed of a bone and of a proboscidian tusk having markings which seemingly were made by tools. Further support of this fact is derived from the presence in the formation of small flints obtained from screenings which may have served as tools for this purpose.

As to layer No. 3, Dr. Sellards has already been quoted as stating that [p. 142] "human remains characterize stratum No. 3; a fact indicated by an abundance of pottery, many bone implements, arrowheads, and other small flints." He adds, on the following page:

A considerable amount of broken pottery is found in this horizon particularly at the locality on the south bank 450 to 475 feet west of the bridge. Bone implements are also numerous and were made evidently to serve a diversity of purposes. Well-worked flint arrowheads are found also, as well as occasional spawls from the manufacture of flints. The pottery, flints, and bone implements, however, are not confined to this locality on the south bank, but are found also in the same horizon on the opposite side of the canal.

[P. 159.] The cultural stage of man contemporaneous with stratum No. 3 was quite advanced as indicated by the presence of pottery, ornaments, and a diversity of bone implements. These artifacts are numerous in this horizon, and as the deposit is stratified and undisturbed it is quite impossible that they could have been placed there by burial.

Dr. Sellards proceeds then to enumerate in detail the plants and fossil animal bones found in strata 2 and 3 (pp. 143 et seq.).

Plants:

Plant remains in stratum No. 2 of the section at Vero are not numerous. In this respect this horizon differs from the alluvial bed which follows, in which is found an abundance of plant stems, seeds, and at places well-preserved leaves. The only recognizable plants obtained from this horizon are acorn cups, although in places are found stems and pieces of wood. The plant stems upon exposure to the air shrivel up; the wood also has a tendency to fall to pieces upon drying.

[P. 147.] Acorn cups, acorns, and other seeds are numerous, as are stems and pieces of limbs; in places also where the conditions are favorable leaves are well preserved. The plant remains indicate a diversified flora representing a hammock type of vegetation, the term "hammock" being used in Florida to apply to a mixed timber growth, which usually includes a number of deciduous species. This type of vegetation occupies limited areas and contrasts with the pine lands, which are extensive.

Invertebrates:

[P. 143.] Fresh-water invertebrates are abundant in stratum No. 2 of the section and have been collected from several places in the bank. The species present are given in the accompanying list. These have been identified by Dr. Paul Bartsch, who states that all of the species are represented in the recent fauna. This is in marked contrast to the vertebrates among which are many extinct species.

With the land and fresh-water invertebrates are found a number of marine species represented chiefly by young or small shells which were probably accidentally included at the time the deposits accumulated. From the marl rock near the top of the stratum was obtained a single specimen of *Ostrea*, which, however, was probably introduced into the formation either by man or in some accidental manner.

Vertebrates:

[P. 144.] The vertebrate fauna from Vero is obtained from the fresh-water stratum No. 2, and from the fluviatile deposit No. 3, none of the material so far as definitely known having been derived from the underlying marine marl. The vertebrate fossils occur in considerable numbers, although, as is usually true of stream deposits, the skeletons are for the most part disassociated. While all classes of vertebrates are represented, the mammals are by far the most abundant.

Many families are represented, some by extinct, others by living species; but the mammals are the most numerous. They include:

LIST OF MAMMALS FROM STRATUM 2 (P. 158)

Didelphis virginiana	Elephas columbi	Smilodon sp.
Megalonyx jeffersonii	Neofiber alleni	Canis ayersi, sp. nov.
Chlamytherium septentrionalis	Sylvilagus sp.	Procyon lotor?
	Sigmodon sp.	Equus litoralis
Dasypus sp.?	Cryptotis floridana	Cameloid indt.
Equus leidyi	Blarina sp.	Bison sp.
Tapirus haysii?	Vulpes pennsylvanicus	Hydrochoerus sp.
Odocoileus sp.	Equus complicatus	Lutra canadensis
Mammut americanum	Peccary indt.	

LIST OF MAMMALS FROM STRATUM 3 (P. 158)

Didelphis virginiana	Sylvilagus sp.	Procyon lotor?
Chlamytherium septentrionalis	Sigmodon sp.	Lutra canadensis
	Neotoma sp.	Lynx sp.
Dasypus sp.?	Scalopus sp.	Ursus indt.
Odocoileus osceola	Vulpes pennsylvanicus?	
Neofiber alleni	Canis sp. cf. C. latrans	

Dr. Sellards's opinion: On the basis of the foregoing data, Dr. Sellards reaches the conclusion that, so far as Skeleton I is concerned—

[Pp. 133–134.] Since the stratum holding the bones lies near the surface, the possibility of the human bones having been placed in it by burial must be considered, although in case of a burial it seems probable that more of the skeleton would have been found. Since being dug, the canal has gradually widened by the caving of the banks, and at the place where the human bones were found the rock at the top of the section had broken from the ledge and lay inclined on the canal bank, having moved somewhat from its original position. When in place, however, this rock rested above the human bones. The sand in which the bones were imbedded had not been disturbed. Moreover, the human bones are thoroughly mineralized, and it is highly improbable that a recent skeleton, if placed in these beds, would have become equally as well mineralized as the much older Pleistocene bones. Without doubt the mineralization of the bones is the result of the slow chemical changes by which bones are altered while being fossilized, a process which at this locality has affected alike, although in a slight varying degree, all of the bones of the deposit.

As to Skeleton II, Dr. Sellards believes (p. 139) that the bones cannot represent a recent burial, as is "evident from the undisturbed condition of the laminated beds lying above this stratum" which contained them. Speaking of stratum No. 2 in his summary, he also reiterates that "the human remains are fossils normal to this horizon and were not introduced by burial." In conclusion, Dr. Sellards ventures to state unqualifiedly (p. 160) that, "By these discoveries in Florida the contemporaneity of man with a Pleistocene fauna is definitely established for the first time in America." Similar decisive statements are found in his correspondence and in his other publications on the subject.[1]

Critical Consideration of the Vero Finds

In deciding questions of so great importance as the presence of the remains of early man in any part of the American Continent, it would seem only prudent that in any given case final positive conclusions should be deferred until the evidence shall have been submitted to and considered by those who through their training and experience can be assumed to have special qualifications for the

[1] An article by Dr. Sellards under the title "Further Notes on Human Remains from Vero, Florida," appeared since this report is in print in the *American Anthropologist* (April–June, 1917). It reasserted the author's belief in the antiquity of the bones, without producing any new data.

interpretation of the phenomena involved, and until all room for serious doubt concerning the age of the finds shall have been removed. It is particularly regrettable that in the Vero case anthropologists could not have had the opportunity of examining the evidence on the spot while the human remains were still *in situ*, rather than after everything relating to human occupancy had been removed and after far-reaching conclusions concerning the age of the remains had received wide publicity.

It is scarcely safe for the geologist or the paleontologist to assume that the problem of human antiquity is his problem. Although it is only just to acknowledge that geology and especially paleontology can be, on occasion, of the greatest aid to anthropology in determining the age of human remains, yet these branches are not adequate in themselves to deal with the subject. In all cases in which the remains of man are concerned, be they cultural or skeletal, there enters a most important factor into the case which does not exist for the geologist and paleontologist, namely, the *human element*, the element of man's conscious activities.

Like inorganic materials, the remains of plants and animals are passive objects, affected only by the action of living plants and animals and that of the elements. In the main they find their resting places accidentally, and, unless they sink into the soil or are displaced by some agency subsequent to their deposition, they constitute safe evidence of contemporaneity with other similar objects and with the geologic components of the same horizon. Not so, however, with the remains of man. Accidentally or intentionally he introduces cultural objects into the ground, and from the earliest known times has buried his dead at varying depths, thus introducing his remains into deposits and among other remains with which otherwise they had no relation.

There have been accidental deaths in rivers and bogs, and in certain cases human bodies have remained on the surface of the ground unburied, but such instances have been always, as they are to-day, very rare. Still more rare must have been the abandonment of unburied bodies in numbers; this would happen only after a battle, a massacre, or a great pestilence. But what chance would human skeletons left in this way upon the surface have of becoming actually included, in any degree approximating entirety, natural relations of the parts and a good state of preservation, in a slowly forming geological stratum, and so of becoming true paleontological specimens, synchronous with the bones of animals and other organic materials in the same deposits? The chance is too slight to deserve serious consideration. The bones, with the exception, perhaps, of those of some compact part, as a hand or a foot, would be broken, scattered, gnawed by animals, weathered, split, moss-eaten, root-

eaten, and in nearly all cases wholly or largely destroyed. The same thing happens constantly with the skeletons of the larger animals whose bodies remain on the surface of the ground. What is preserved of them in the geological formations consists usually of individual teeth or bones, or at most of a few related parts, yet animal bones are on the whole more durable than human bones, and there are immeasurably more of them. For every human body abandoned on the surface of the earth there were probably millions of carcasses of animals; and this applies even more forcibly to prehistoric times, when men were scarce and animals much more numerous.

What slight chance, then, can there be of finding in any stratum, but especially in one of slow accumulation, a fairly complete and well-preserved human skeleton of equal age with the deposit? And if one such marvel should happen, what chance would there be of the discovery within a few rods distance, at almost the same depth, and in a distinct geological formation, of a like skeleton? Surely such a chance would be infinitesimal; and if such skeleton or skeletons are actually found in ancient strata, it is only reasonable to expect that scientific explorers should make every possible effort to find a more probable explanation of their presence than that of original deposition, before announcing their contemporaneity with the inclosing deposits and with the animal bones found in those deposits.

But there are other considerations in cases of this nature which must receive due attention, and these are all anthropological.

In the first place, anthropology has a right to expect that human remains of whatsoever nature assigned to great antiquity should show some adjustment in structural type to such antiquity. It is not sufficient in any such case to endeavor to explain the presence of modern forms by the unsupported statement that such might have occurred in an earlier age. So much has already been accomplished in unraveling man's history, and so much material evidence, cultural and skeletal, has been gathered relating to this history, that the anthropologist is well justified in demanding actual, generally acceptable precedents for such assumed occurrences. Thus pottery is not known to have existed in any part of the world before the neolithic age, while strictly modern forms of the skull and bones, beginning with the upper Aurignacean or the Solutrian cultural periods, are not much older. Suppose, now, a modern type of pottery and modern forms of skeletal remains were found together—what probability would there be of the finds being so ancient as to date from another geological epoch? And if, further, the remains were accompanied by modern forms of bone and stone implements, and if all the objects, skeletal and cultural, resembled to the point of practical identity those of the modern natives of the neighborhood or general region—would not the anthropologist be fully justified in demanding over-

whelming and unequivocal proofs that the bones and artifacts in question were not recent before they could be assigned to geological antiquity?

Even this, however, is not all. In considering the problem of human antiquity in any region anthropology must take into consideration the broader aspects of the case and ask whether, in the light of our actual knowledge, the presence of man in that region during the specified geological period was probable, or even possible. This is of especial importance on the American Continent for the reason that man here is not autochthonous, but must have immigrated from some other part of the earth. Thus the first question to be considered in every case on this continent where we are confronted with the problem of man's antiquity is, Could man have been present in the locality in question, or even in America, during the period to which the finds seem to belong or are being attributed? This difficult question fortunately can be met with something more than mere hypotheses.

According to all indisputable evidence which we now possess man's age is comprised well within the Pleistocene and Recent periods; that is, within possibly 500,000 to 600,000 years. By far the larger part of this time, however, was required for his cultural development, physical differentiation, multiplication in numbers, acclimatization to new environments, and his spread over the immense territories of the Old World, the warmer parts of which were his cradle. Before all these results were accomplished or were far advanced man evidently could not have reached the distant, isolated New World; and there is much evidence that this was not reached until very late in man's history, in postglacial times or at the earliest toward the end of the Quaternary. As late as the Aurignacean culture period, approximately 15,000 to 25,000 years ago, man had not yet fully reached modern standards in physical development, had made no pottery, knew no metals, did not extend to northern Europe, left no evidence that he knew even the crudest navigation, and can not possibly be conceived of as having been numerous enough to reach the northeasternmost limits of Asia, from which alone there was a practical way open to the American Continent. How could we have, then, in this country man of even much greater antiquity? These considerations can not be easily passed over. They rest on a mass of realities and would have to be completely explained away before anthropology could admit the presence of geologically early man in the New World.[1]

[1] More detailed discussion of various phases of the subject will be found in the writer's reports on Skeletal Remains Suggesting or Attributed to Early Man in North America (*Bull. 33, Bur. Amer. Ethn.*, 1907); Early Man in South America (*Bull. 52, Bur. Amer. Ethn.*, 1912); The Most Ancient Skeletal Remains of Man, 2d edition, 1916, reprinted from *Annual Report of the Smithsonian Institution, 1913;* and The Genesis of the Indian, *Trans. Nineteenth Intern. Congress Americanists,* Washington, 1917.

Still another consideration is that, had man reached the American Continent in early times and spread over it so as to reach the outlying regions, such as Florida, he would necessarily have been represented here by large numbers. But large numbers of even nomadic tribes could not but leave numerous material remains over wide areas, some of which at least by this time would have been discovered. As it is, however, we have not a single fact, not a single specimen, to prove the existence in America of any such ancient population. There are on record a number of reports of the finding of ancient remains in both North America and South America; but on critical study by archeologists and anthropologists the claims made have invariably proved to be doubtful, or without any scientific foundation. Most of the reports are simple errors, while others merely represent cases in which the circumstances of the find were such that no definite proof as to the age of the remains will ever be possible one way or the other. Outside of these cases there is a great void. Taking into account the strong scientific as well as public interest in all that relates to man's antiquity during the last 50 years, with the amount of actual scientific exploration in caves, rock-shelters, and other sites where the remains of ancient man would be most likely to be preserved, that has already been carried out in this country, the absence of demonstrably ancient remains constitutes very potential testimony against the presence of an early American population. Here is a most serious obstacle that must be removed by those who would assert man's geological antiquity in America before the claim can be legitimately accepted.

It is plain from the foregoing that those who would establish conclusively the presence of early men on this continent have before them a much larger, more complex, and more serious task than might at first have appeared. Moreover, it is a task which can not be dealt with adequately as a subordinate issue of a distantly related branch of science, but demands the full attention of those specially trained in the subject and dealing critically with similar problems in other parts of the world, together with the assistance of all affiliated forms of investigation.

The Vero Remains

The Vero finds, studied in the light of the foregoing considerations, fall very far short of the requirements of great antiquity, as will now be shown.

The conditions surrounding the finds, as observed by the writer, were about as follows:

GENERAL OBSERVATIONS

Before 1912 there existed on the flats about half a mile north of the small town of Vero a sluggish and probably inconstant fresh-

water stream, known as Van Valtenberg Creek (fig. 6). This drained a small territory into the near-by brackish Indian River or Sound, and when flowing was the best fresh-water supply in the vicinity. About three-quarters of a mile from its mouth the creek received a small tributary, known as North Fork. It is in the area partially inclosed by the two streams that our main interest centers, for it was about the southern branch of the Y formed by them, not far from the junction, that all the human remains were discovered.

The two terminal branches as well as the main stream were doubtless instrumental in building up during their overflows the flats about them. At the same time they eroded in a very irregular man-

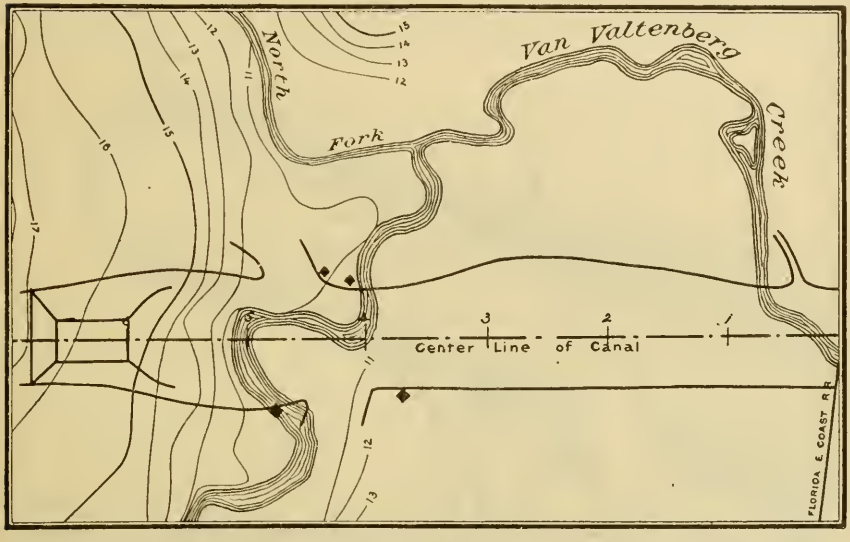


FIG. 6.—The creek near Vero before the excavation of the canal. The position of the human skeletal remains is indicated by the solid squares. The canal is in heavy black lines. (From survey map furnished the Smithsonian Institution by William H. Kimball, chief engineer in charge of the construction of the canal.)

ner the older underlying sandy deposits and made themselves broad shallow beds, which gradually became filled with muck. These beds can be traced to-day from a distance by the more abundant vegetation, including trees, which grows from the rich soil. The bed of the southern, or main, branch had been cut across, between 125 and 225 feet from its former junction with the northern affluent, by the drainage canal, so that it can now be seen in an almost complete transverse section, with all its characteristics. The muck beds of the northern branch and of the main stream lie somewhat north of and beyond the canal, except near the railroad bridge, where the main stream also appears to have been cut across. Mr. William H. Kimball, chief engineer in charge of the construction of the canal, was kind

enough to furnish the writer with copies of the original surveys (figs. 1, 6, 7), which show these conditions.

Below the muck bed of the southern branch, along the southern bank of the canal down to and beyond the railroad bridge, and along most of the bank opposite, are seen marine and alluvial-aeolian deposits, which can be separated into three or possibly four strata. The lowest, beginning on the average about 5 feet from the surface and of unknown depth, is an old marine deposit, consisting of triturated shell with some marl and whitish sand. This layer is not yet consolidated and yields numerous fossil shells, but no vertebrates. It is layer No. 1 of Sellards.

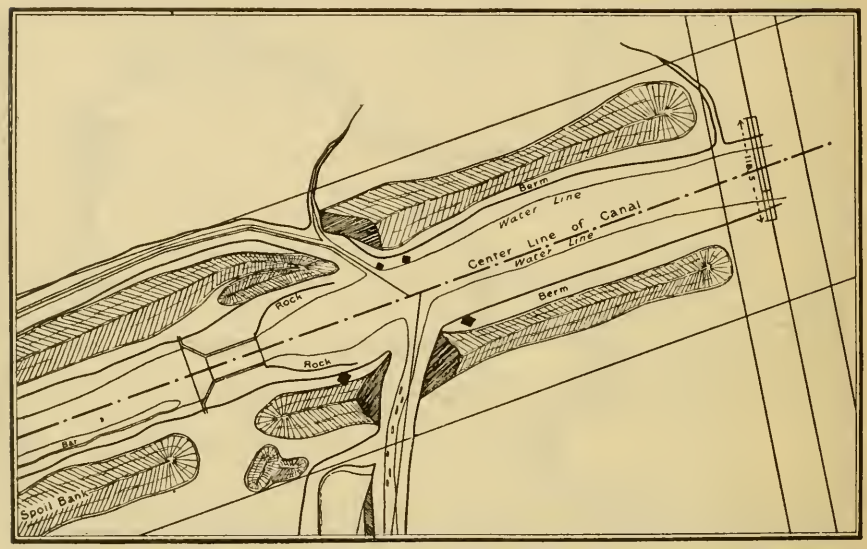


FIG. 7.—The Vero Canal, between the spillway and the railroad bridge. The solid black squares indicate the location of the human remains. (From topographical survey furnished the Smithsonian Institution by William H. Kimball, chief engineer in charge of the construction of the canal.)

Upon layer No. 1 rests unconformably, and in many places without any definite boundary line, Sellards's stratum No. 2, a thick, compact layer of brownish sand, the upper darkest portions of which show more or less "toughening" or induration, though not enough to prevent slicing with a good hoe (see pl. 2.) This indurated portion is called a "rather hard rock" by Sellards (p. 128), a characterization which it does not seem to deserve. The layer yields numerous and generally isolated or fragmentary bones of fossil vertebrates of Pleistocene age. If we accept its darkest and most compact portion as the upper limit of the layer, as suggested by its color, induration, and absence of roots, then the upper line of demarcation is quite uniform along the banks of the canal, but laterally, as seen in the wall of the southern lateral drain, it shows much

irregularity and old disturbances. Sellards, however, regards everything above layer 1 as layer 2 except the muck deposits of the stream beds.

Above the dark portion of layer 2 conditions differ. In that part of the southern bank which represents the bed of the southern affluent or extension of Van Valtenberg Creek it is overlaid in great unconformity by black, in places fresh-looking, muck, in which lie partially rotted, partially still well-preserved, trunks and roots of trees, and in which occur also smaller or larger patches of loose white sand, or sand and marl, or shell detritus, that in cross section give the deposit an appearance of partial, irregular lamination or stratification. This is layer 3 of Sellards. It or its sandy "pockets" have also yielded numerous fossils of vertebrates of for the greater part extinct species.

Along the remaining parts of the southern bank layer 2 is covered by lighter compact nonindurated alluvial sands, which reach to near the surface. This layer is pierced from above by many roots, but contains no muck. It has yielded a few veterbrate fossils.

This layer in turn is overlaid in certain areas if not generally by fresh-water marl of uneven thickness. So far as seen by the writer the thickness of this marl ranges from a few to perhaps as many as 10 inches, but the lower portions merge so gradually into the deposits beneath that the exact limits of either are hard to determine. Wherever a fresh cut was made into this marl along the new exposures made under the writer's direction, it was found to be of the consistency of fresh mortar; in older exposures, however, the marl is "set" or hardened, though even where well consolidated it hardly deserves to be classed as solid rock or stone in the ordinary meaning of these terms. This layer of marl, where it exists, with a dusting of white wind-blown sand and the low, thick vegetation, forms the surface of the ground.

The foregoing is a general nontechnical view of the deposits at Vero, more particularly in the southern bank of the canal, as observed by the writer in about 160 feet of fresh exposures made under his direction. It agrees essentially with the descriptions published by Dr. Sellards, with the few exceptions noted. Though the points of difference are of no great consequence the writer could only feel that too much weight has been given to the "rock" in layer 2, as well as to that on the surface, and to the "stratification" of the muck deposits.

HISTORY OF THE FINDS

An account of the circumstances of the various finds of human remains in the Vero deposits has been given by Dr. Sellards, and

but little further could be learned; yet there are a few points of interest and, in one or two cases, of real importance, that call for discussion.

The first skeleton.—Mr. Ayers, who discovered the first skeleton, was kind enough to accompany the writer to the southern exposures, where he indicated the location of the find (pl. 2). He remembered that the bones were not regarded at first as human or as of greater consequence than others in the banks, and no special attention was paid to the exact condition of the deposits about them, which, however, seemed to show nothing peculiar. The bones lay between about 2 and 2½ feet below the marl of the surface, a hardened section of which had broken off at this point and was still lying on the sand in front of the bank at the time of our visit. They "were all close together, the whole space which they occupied not being over one and a half feet in width; they were not scattered at all, nor piled up, but lay side by side as they would in the body."[1] The bones were extracted by Messrs. Ayers and Weills, the latter of whom also spoke to the writer of their "natural relations," particularly in the case of a lower limb, where the tibia, patella, and femur were found in the relative positions they occupy in the skeleton.

Remarks.—Taking all this into consideration, with the fact that although the upper parts of the skeleton have been lost—in all probability as the result of the dredging—yet enough remained to represent most of the parts of the two lower limbs, the presence of the human remains can be explained satisfactorily in only two ways, namely, by sudden complete accidental inclusion of a human body into the deposits, or by a burial.

But the sudden inclusion of a body would necessitate the presence of either bog or quicksand, which it is plain did not exist in the Vero formations, or a great inundation of waters charged with the heavy sands that were found to inclose the remains, in such quantities that on settling they would completely and permanently cover the corpse. In this latter case, however, practically the whole or most of the homogeneous and not very thick layer No. 2 would have to be regarded as the result of such an inundation, while the animal bones therein, which would necessarily have been brought in by the current, might be of any derivation and age; hence the human remains would lose all claim to age commensurate with that of the fossil vertebrates which these bones represent. They would be only as old as the inundation, while the animal bones might be of any antiquity.

A slowly flowing water charged with silt will cover with more or less sediment any submerged immovable object in its course, and the suggestion might be made that something of this nature may have happened to the human body during some ordinary overflow of the

[1] Quoted from a subsequent letter of Mr. Ayers to the writer.

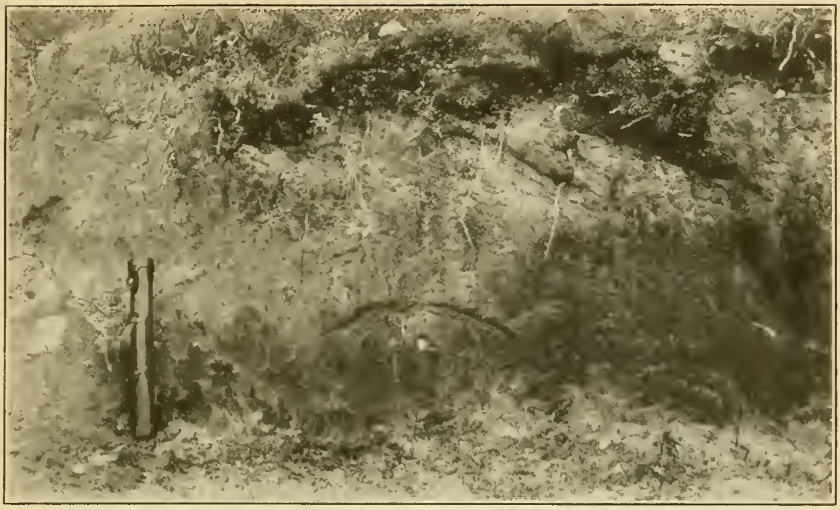


FIG. 1.—EXPOSURE OF THE SOUTHERN BANK A FEW FEET IN THE REAR OF THE SPOT WHERE VERO SKELETON I WAS FOUND

Curved line, with a white spot underneath, in the middle, was made with a piece of wood by Mr. Frank Ayers to indicate the position of the skeleton (which he discovered and removed from the bank). The uppermost portion of the photograph reaches the surface of the ground. Scale 1:13

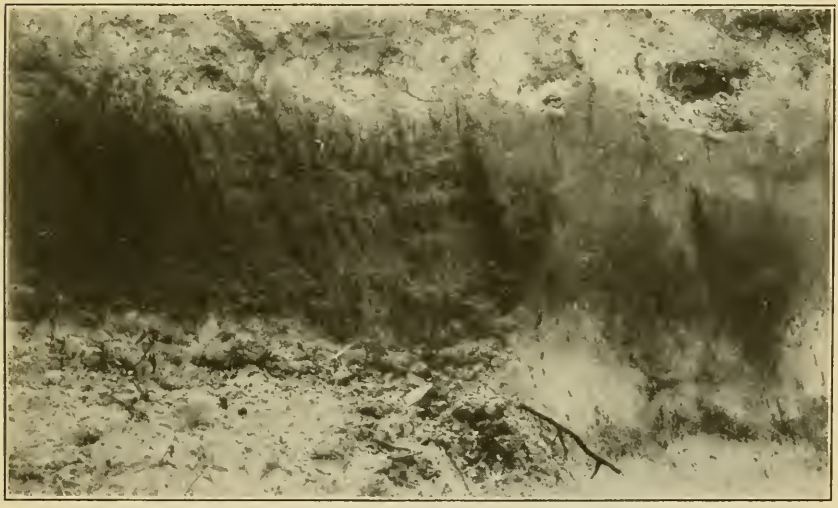


FIG. 2.—EXPOSURE OF THE SOUTHERN BANK A SHORT DISTANCE (PROBABLY LESS THAN 6 FEET) IN THE REAR OF WHERE VERO SKELETON I WAS DISCOVERED

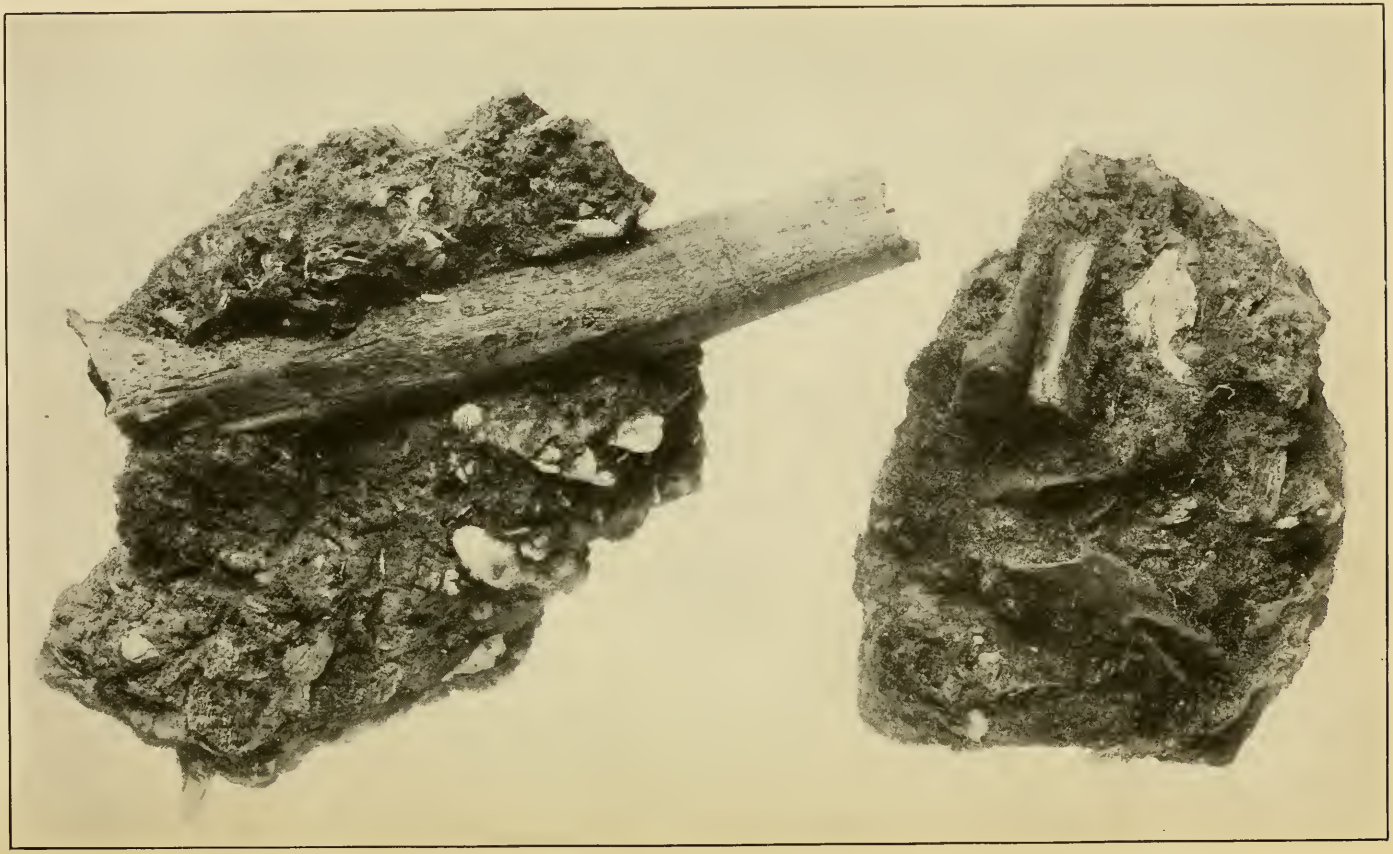
The photograph shows well the dark layer No. 2, with the lighter sand and marl above. The left half of the exposure here shown was made with the help of a light fork, the right half with that of a hoe, showing how moderate is the induration of these deposits. The marl of the top layer was here of the consistency of soft mortar which could be readily crushed or molded in the hand

INCLUSION OF HUMAN BONES IN A SOLID CONGLOMERATE OF SAND, SHELLS, DETRITUS, AND HUMUS, OF RECENT FORMATION

From Demere Key, off Fort Myers, west coast of Florida. (Collected November, 1916, by A. Hrdlička)

HUMAN SKULL "IN CONCRETE" AND FILLED WITH HARD BRECCIA.

From Demere Key, off Fort Myers, west coast of Florida. Specimen collected several years ago by Samuel L. King, of Bristol, Tenn. (No. 293,056, U.S.N.M.)



HUMAN BONES INCLUDED IN HARD ROCK

Collected at Demere Key, west coast of Florida, in November, 1916, by A. Hrdlička

old creek. A human corpse, however, is a large object and more or less buoyant, according to its state of decomposition. It would not tend to sink into fairly compact older sand deposits, but would be rolled or would float until caught by some obstruction. Then it would be covered to greater or less extent by other floating objects, as weeds, branches, etc., and the moving sands next to the bottom, with some silt, would begin to pile up, especially on the side facing the current; but what height of water, amount of carried matter, and length of submergence would be necessary to cover the whole human body so that on recession of the waters it would no more become reexposed by the winds, by animals, or by other overflows? Was all or any of this possible on the Vero flats?

Although there are many happenings in nature which after a time we can not fully trace, yet it will probably be conceded that there is little likelihood of an accidental introduction of the skeleton under consideration into the stratum where it was found. And if not included accidentally, it could have got there only by intentional burial.

In examining the ground a few feet back of the spot where the bones lay it was seen that an aboriginal burial in the formations would even now be feasible, and conditions were surely not more unfavorable a few hundred years ago. The fresh-water marl on the surface was hard only in places, in others it was of the consistency of fresh mortar; but the whole layer is probably not old. Its consolidation on exposure is rapid. There are harder "rocks" in Florida that cover recent human burials (see pls. 3–5). A formation such as this surely could not have excluded the possibility of an Indian interment. Below the marl are the easily worked upper sands, offering no difficulty for excavation; and still lower is the more or less toughened dark sand of layer No. 2, which even to-day could be penetrated without great difficulty by a primitive man with a well-pointed bone or stick or antler (pl. 2, fig. 2). With patience, which the Indians seldom lacked, it could even be scraped away by means of a shell or of fragments of pottery. As to depth, the Indians buried from close to the surface to as deep as 5 feet or more, but the large majority of their graves are found between the depths of 2 and 4 feet. The skeleton under discussion was at a depth of somewhat more than 2 feet.

Second skeleton.—As to the bones of Skeleton II, there are a number of interesting circumstances which deserve close attention.

In the first place, three of the bones which fell out or were dug out of the bank and lay exposed for some time to the elements, became considerably bleached. The significance of this seemingly unimportant occurrence will be seen later.

In the second place, considerable difficulty has developed regarding the question of depth at which the skeleton lay. Dr. Sellards (p. 142) says that "above the human skeleton 4 feet of alluvial mate-

rial are found," but his photographs and figures showing the location of the bones and drawn and reproduced "to scale" do not bear out this statement. They show that the remains lay in an inclined plane—a circumstance also of some importance—and at the following depths:

Depth of occurrence of Skeleton II, as given by photographs and drawings by Dr. Sellards[1]

Illustrations (Sellards's Report)	Ulna (base of layer 3)	Femur (base of layer 3)	Radius (base of layer 3)	Astragalus, etc. (elevated part of layer 2)
	Feet below surface	*Feet below surface*	*Feet below surface*	*Feet below surface*
Photograph of a section of the bank (pl. 17, fig. 1)[2]	2.1	2.5	3.7	([3])
Fig. 14, a drawing of same exposure as the preceding	1.9	2.2	3.2	([3])
Fig. 6, sketch of the strata in the southern bank	2.4	2.7	3.9	3.1

[1] All from *Eighth Ann. Rep. Florida State Geological Survey*, Oct., 1916.
[2] A foot scale accompanying the photograph fully confirms these measurements.
[3] Not indicated.

The above measurements make also necessary a modification of Dr. Sellards's statement on page 142, that the radius "lay at an actual level fully 2 feet lower than the ulna." The difference in level between the ulna and the lowest part of the radius, as shown by the photograph in his plate 17, is actually only 1 foot 5 inches.

Another point in connection with Skeleton II which calls for explanation or rectification is that embodied in the first sentence of the second paragraph on page 142 of Dr. Sellards's report, which reads: "By reference to the text figures and to the description of the fossils it will be seen that the bones of this skeleton lying at the contact line between strata 2 and 3 are found on either side and around the bones found in place in the older stratum No. 2." Neither the text, nor figures 5 and 6, nor photograph 1 on plate 17, bear out this statement.[1]

Still another uncertainty concerns the association of animal bones with the bones of this human skeleton. On page 139 of his monograph, Dr. Sellards enumerates a rather large number of bones of fossil vertebrates "which have been found in stratum No. 2 in

[1] Since this was written the point was called to the attention of Dr. Sellards, from whom the writer has received the following answer: "With regard to the place of the bones at the contact line between strata 2 and 3, the words 'on either side and around' are best replaced by the word 'near.' Some were found not so far in the bank, while others were farther in the bank than those in No. 2. All of the bones on the contact line, however, were farther west than those in No. 2, hence the word 'around' is not strictly applicable."

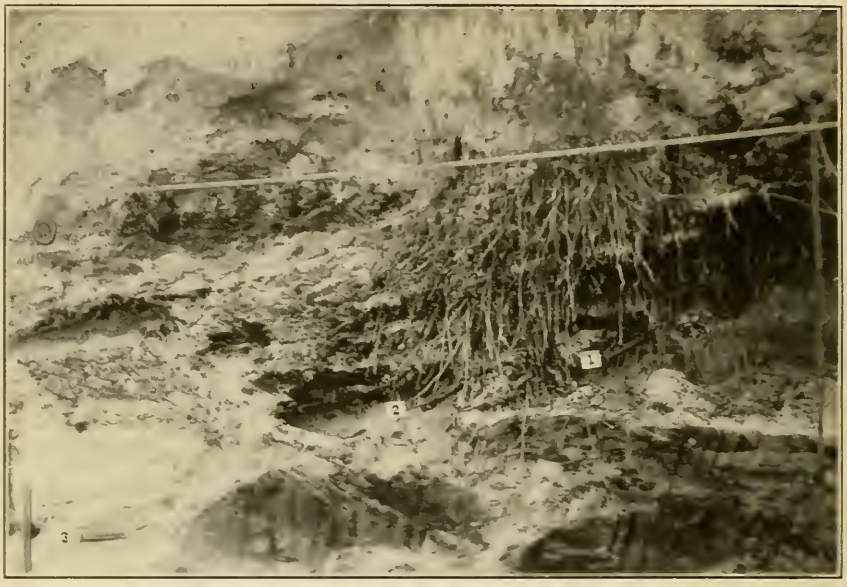


FIG. 1.—LOCATION OF VERO SKELETON II

The original surface is indicated by the light line. (After Sellards)

FIG. 2.—EXPOSURE OF THE MUCK AND SAND BED IN WHICH VERO SKELETON II WAS FOUND

The picture shows the deposits a few feet back of where the human bones lay. *LL.*—Logs in the muck. 2.—Layer 2 of Sellards. 3.—Muck and sand deposits of the stream, or layer 3 of Sellards: white dotted line is the dividing line between the deposits and the dump: the vertical lines are slight ridges left by the hoe. Vertical scale: The measured distance from the original surface (white dotted line) to the lowest portion of muck is 3 feet

association with human bones, flints, and implements on the south bank of the canal from 460 to 470 feet west of the bridge." If in the sketch of the section from 452 to 480 feet, given in figure 6 of Dr. Sellards's report, verticals are drawn at 460 and 470 feet, we find included only relatively small portions of layer 2 in which no animal fossils are indicated, while, judging from the descriptions and illustrations, the larger part of the human bones lay beyond the 470-foot line and outside of layer 2. The question is whether under these circumstances it is strictly correct to refer to the relation of the human and other vertebrate bones as "association." This whole matter suggests vividly views of the South American paleontologist, Ameghino.

Finally, an item of importance, but omitted from the illustrations in Dr. Sellards's report, is the find described as follows (p. 142): "One of the foot bones, a fifth metatarsal, was taken about 8 feet east of the ulna and at an actual level, owing to the change in slope,[1] above that of the radius and approximately the same as that of the ulna." This position is in the midst of layer 3 at its greatest thickness, as seen in plate 6, figure 2.

It is further regrettable that the positions of the numerous potsherds, bone implements, arrowheads, etc., that "characterize stratum No. 3" (p. 142) and a "considerable amount" of which were "found in this horizon, particularly at the locality on the south bank 450 to 475 feet west of the bridge" (p. 143), were not indicated in such illustrations as figures 6 or 14 of Dr. Sellards's report. As the human bones lay, collectively, about 462 to 475 feet above the bridge in the same locality, some of the artifacts at least may have been in close proximity to the skeleton. This is especially true of the large, well-shaped arrowhead, which according to the report of Professor MacCurdy, based on written information from Dr. Sellards, was found between strata 3 and 2, 470 feet west of the bridge. This description places it in exactly the same focus with the bones of Skeleton II and in close proximity to them, if not in actual association.

Remarks.—Dr. Sellards's explanation of this second find of human bones in the Vero deposits is (p. 142): "The position leads to the suggestion that the bones lying at the base of stratum No. 3 were derived from stratum No. 2, and that only one skeleton is represented by the two finds. This may be true, since there is no duplication of parts, and a large individual is represented in each instance." Of this the suggestion referring all the bones to one skeleton is probably correct, though there is an indication that another human skeleton may have lain in the vicinity. We have a tooth from the place that did not belong to Skeleton II.

[1] This phase is not quite clear.

But great difficulty is encountered if we try to harmonize observed conditions with the opinion that all the bones of Skeleton II were derived from stratum No. 2. If the skeleton had been inclosed within this layer and the sand over the larger part of the remains had been subsequently washed away, how could we explain that the bones thus exposed, some of which are small and light fragments, happened to remain, and remain at different levels? Is it not reasonable to assume that they also would have been rolled or washed away or sunk to one horizon? How could some of the bones, as the radius, have reached almost double the depth of others? After exposure and before being covered with the sediments and muck of layer No. 3, how could the bones, or at least some of them or some part of a bone, have escaped bleaching or weathering? We have seen that the three bones which fell out of the bank before the skeleton was located all show decided bleaching as a result. How could the fifth metatarsal, which shows the same color and the same fossilization as most of the other bones of the skeleton, have come to lodge in the midst of the muck of layer 3, above and to the east of the radius, as explained by Sellards (p. 142[1])? It might possibly have been brought there by a rodent, but the same agency could not have been instrumental in placing some of the other bones of the skeleton.

Respecting the question of antiquity, it would really not matter much whether the skeleton lay in the lowest part of layer 3 or in layer 2, the remains of which in this place did not even show induration—it could have been introduced with equal facility in either stratum; but conditions are such that the assumption of its having been included in stratum 2, as already outlined, would involve us in difficulties seemingly not susceptible of satisfactory explanation.

A more important problem is whether the skeleton represented an accidental inclusion or a burial. The bones are broken and were in a considerable measure dissociated, as if they might have lain for a time exposed to the elements and have been dragged and trampled by animals, conditions which would normally precede an accidental covering and inclosure of such remains. If, however, we look closely into the matter, it is soon felt that the actual facts as shown by the bones are not compatible with such a conclusion.

The entire area covered by the bones, including the few parts found by Sellards in layer 2, was an ellipse about 12 or 13 feet in its longest and evidently less than 7 feet in its transverse diameter. This is altogether a too moderate scattering to admit of the theory that part of the body or of the bones were dragged about by animals. The

[1] "One of the foot bones, a fifth metatarsal, was taken about 8 feet east of the ulna and at an actual level, owing to the change in slope, above that of the radius and approximately the same as that of the ulna."

writer had the opportunity in two instances of observing what happens with human bodies abandoned on the surface of the ground. One was on the battlefield in the Yaqui-Mexican war and the other in Mongolia, where the dead are disposed of by being dropped on the ground in any convenient place and left to be devoured by animals. On both of these occasions, after a few days of exposure, the bones were found widely scattered, while those of the hands and feet and the ends of the long bones had invariably been eaten. In some instances limbs or large parts of limbs and even heads were seen to have been dragged to a considerable distance. About Urga, the capital of Mongolia, conditions were such that although traces of hundreds of recent surface burials were seen, it was impossible to find a single long bone sufficiently well preserved for purposes of study; and this statement applies equally to other parts of the skeleton except the skull. Nothing reminding one of such conditions exists in the Vero skeleton under consideration. The epiphyses, unless broken, are perfectly preserved, and there is not a scratch or a tooth mark on any of the bones. Moreover, so many parts are preserved that the indications point to the original presence of the whole skeleton. Some of the missing parts, as the spine, which decompose readily, have probably been lost through decay, while other absent parts have almost surely been lost during the months intervening between the time when the remains were first exposed and when they were excavated. We know that at least three months elapsed between the finding of the first and already bleached bone that dropped out of the bank and the excavation for the rest of the skeleton.

As to the bones having been trampled and broken by animals, nothing was found to suggest such an occurrence. There is no sign of crushing and splitting. The fractures in all the long bones are transverse, and they are sharp, fresh. This description applies equally to the bones of the skull, and even the ribs show clean breaks and not such as would take place in a fresh bone. The fractures in general bear the characteristics of breaks due to stress, as might obtain within the strata, not those due to direct violence. The pelvic bones and scapula alone look as if they might have been damaged by trampling, but their condition might have equally resulted from pressure within the deposits. Such defects are well known from ordinary older burials.

Finally, there is no trace on the bones of the effects of weathering. There is no sign of scaling of the surface or of longitudinal splintering, such as takes place under exposure. The bones are smooth, and what remains of them is in a perfect state of preservation. These facts oppose very conclusively the theory that the body from which the bones came lay on the surface of the ground, where it suffered

dissociation and scattering, finally becoming incorporated in the stratum then in the process of formation. The facts strongly indicate, on the other hand, that the remains were buried while the flesh still covered the bones; that the burial included the whole body; and that the dissociation and fragmentation occurred later owing to movements, stresses, root action, and other agencies operating on or within the deposits inclosing the body. Taking into consideration the nature of the elastic and still only partially decomposed materials that form layer 3, in the lower part of which in all probability the burial was made, we are justified in accepting not only as a possibility but as a certainty the view that considerable settling and other movements must have taken place in this stratum, to which must be added the settling following on the decay of the soft parts of the corpse itself. Roots of trees doubtless always abounded in layer 3, as they do to-day, and these are capable of producing considerable displacements of objects in their vicinity, above all if torn out of the ground when a tree is uprooted. Those who have wide experience in excavating for skeletal remains know how often these show disturbance even under more favorable conditions for their preservation in position than in the instance here dealt with.

A sudden accidental burial of the individual represented by Skeleton II can be even more readily excluded than was the case with Skeleton I. The muck overlying the bones, although marshy, was of a consistency which would not have allowed the sinking in it of a human body. A more conclusive proof of an artificial rather than an accidental burial, however, lies in the fact that the remains when found were distributed in an inclined plane, not in a horizontal position. With an Indian burial this would be natural, with an accidental inclosure very improbable.

The presence of several small bones in what appeared to have been a remaining elevation or ridge of the eroded stratum No. 2 can be explained only by the assumption of their introduction into the stratum subsequent to its deposition. This may have happened during the burial or subsequently. If these bones and the remaining parts of the skeleton after being found had been exposed by the excavators from above as well as from the side, conditions would have been seen much more clearly and the explanation would have been made easier.

There was some hope that the quality of the sand in the various bones might throw light on their original derivation, and to test this four of the specimens were examined, two from the base of stratum 3 and two from the elevated part attributed to stratum 2. Differences were actually found, but these were of unexpected nature. One bone from each locality showed the presence of coarse sand with relatively large, rounded granules, while the other bone from each

ADVENTITIOUS STRATIFICATION IN THE DUMPS ON THE SOUTHERN BANK OF THE CANAL

Original surface line runs, as far as ascertainable at this point, between *o–o*

locality showed the presence of similar sand but in small and angular grains. Bones of Skeleton I yielded a mixture of the two kinds, while in stratum No. 3 above Skeleton II the nature of the sand varied according to the place from which secured.

In support of the antiquity of Skeleton II and of the impossibility of introduction of the bones through burial, Dr. Sellards speaks of the "undisturbed" condition of the lamination in stratum No. 3, above the bones. This lamination where exposed in vertical sections is irregular (pl. 6, fig. 2) and limited to bands of varying length—the cross sections of irregular pockets or patches of wind-blown or water-borne sand and marl. There is no complete or regular stratification. Owing to these conditions little if any value can attach to the bands. If portions of the deposits were thrown out as in making a grave and then thrown back, a rearrangement might occur which in time, after seepage and thorough settling, would not be distinguished from the surrounding undisturbed parts. In old graves, except under unusual conditions, all signs of disturbance of the ground are absent or obscured. That a secondary lamination readily takes place in moved deposits is best shown right at Vero in the deposits thrown out by the dredges, which show wherever exposed sectionally a more or less marked banding (pl. 7).

There is another consideration in connection with Skeletons I and II which well deserves attention. The chance of one human skeleton becoming accidentally buried would be a rare one, but nevertheless might occur; but what infinitely smaller chance there would be of the accidental occurrence repeating itself at nearly the same depth, in another formation, 150 feet away, as in this instance. As already suggested, a number of human bodies might be left lying exposed after a battle or a massacre, but what chance, even then, would there be of two such bodies 50 yards apart becoming inclosed in distinct deposits, so compactly and in so good a state of preservation as were the Vero skeletons?

Thus from whatever point of view we approach the subject, if we seek to establish the great age of the Vero remains as Dr. Sellards and one or two of his friends have tried to do, we meet with very serious difficulties. How much more reasonable it is to consider both these occurrences as ordinary intentional interments, made in the fossil-bearing Vero deposits long after the extinction of the many animal species whose bones are found in the same muck and other materials. That some of these old bones would lie near or even come to be associated with the human remains is only natural.

OTHER HUMAN SKELETAL REMAINS FROM VERO

Besides the two skeletons discussed, a tooth representing one individual, and two small bones representing two other persons, were dis-

covered. The tooth was found near Skeleton II, while the other parts, one a toe bone of an adult and the other a tooth of a small child, came from the northern bank nearly opposite, where they lay "at the contact line between strata Nos. 3 and 2," at a distance of 10 yards from each other. About these bones very little can be said, for we do not know whether they represent skeletons the other parts of which have been removed by the dredges, or whether these other parts are still in the formation. Individual small bones and teeth, besides, are easily displaced and carried about. The only thing they indicate is that in the same vicinity there were probably burials that were not discovered. All three specimens are in perfect condition, a fact which precludes the possibility of exposure for any length of time on the surface. Their position can hardly be explained, as was attempted by Dr. Sellards with Skeleton II, on the assumption that they have all been washed out from layer 2. If not thus explained, however, and if all the human bones at Vero are accidental inclosures, as claimed by Dr. Sellards, then we are confronted with the most miraculous occurrence—the superposition in a little wild spot of the far-away wide inhospitable flats of eastern Florida of several human skeletons in different geological horizons.

The demonstration of the antiquity of the human remains at Vero is verily a task of peculiar difficulties and discouraging complications for those who are responsible for bringing these remains into the forum of scientific discussion.

The Skeletal Remains

In examining and trying to identify racially human skeletal remains, we may well bear in mind that such remains of whatsoever provenance are bound to show more or less of individual peculiarities or aberrations from the average of the type to which they belong; and that the more minute our examinations the more numerous will such aberrations appear. Such individual fluctuations or peculiarities, however, have but little weight. Each bone of the skeleton has its own partially correlated and partially independent range of variation, which extends normally over hundreds of specimens, hundreds of individuals. Some of these variations are reversive, some progressive, while still others, and they are perhaps in the majority, are more or less incidental and without much meaning. Hence, if we consider any given skeleton, any given bone, we are bound to find in it, on detailed scrutiny, various exceptional features, to which the less experienced might readily assign undue significance. The duty of the anatomist is to distinguish and rely only on those substantial characters which have a real value for racial determination. This will be kept in view in the following description of the Vero skeletons.

DESCRIPTION OF THE BONES

Skeleton I

The parts of this skeleton that have been recovered and now lie spread out before the writer are as follows:

Femora: Both, without the ends (part of head of one present).
Tibiæ: Right—only distal ⅓. articular facet separated. Left—minus the upper or proximal end.
Fibulæ: About ⅔ of the shaft of left fibula.
Patella: Right.
Os calcis: Right.
Astragali: Both.
Scaphoid: Left.
External cuneiform: Right.
Metatarsals: Right 1st, 2d, 3d, and 4th; left 3d, 4th, and 5th.
Humeri: Lower (distal) ⅓ of left humerus.
Metacarpals: Three specimens.
Os magnum: Right.

In color the bones when not bleached range from dirty-brownish to almost black, or bluish-black. The fresh breaks, of which there are many, show mostly a much lighter brownish color, approximating that of ordinary clay. In a few places the bones are black, as if calcined by fire. The interstitial spaces are infiltrated or packed with dark and somewhat indurated but crumbling sand, which with the cement used for repairs largely accounts for the weight of the specimens. Parts that can be freed from the sand, while showing mineralization, are not very heavy. Many of the breaks in the bones are so fresh that they must have occurred when the bones were disturbed by the dredge or during the process of their extraction.

The bones show no artificial markings or effects due to gnawing by animals. Some of the missing parts have disappeared by decay; others have been broken off and lost. There is no exfoliation of the surface in any specimen. A few longitudinal cracks are seen, but the light-colored surface showing within indicates that this splitting is of recent date, probably since the bones were recovered. The surfaces of some of the bones are slightly roughened by the action of the soil, but no part shows any traces of ancient exposure to the elements. The number of bones present indicates that there had been very little disturbance of the remains before their exposure by the dredge; and together with the lack of weathering and the state of the bones in general it indicates also a sudden inclusion of an undecomposed and entire body in the deposits where found—an inclusion which, as shown by former discussion, could be satisfactorily explained only on the theory of intentional burial.

The skeleton is plainly that of a woman, probably adult. Judging from approximations made on the long bones, she was about 150 cm.

(approximately 4 feet 9 inches) high, a stature which is common among the majority of Indian tribes. She was of only moderate muscular strength, but, so far as indicated by the bones, entirely normal.

In type the bones, while showing as usual individual peculiarities, are strictly modern. It would be superfluous to go into detailed description of every feature, as this would be but to repeat descriptions of ordinary Indian bones. There is nothing about the specimens that would suggest, even faintly, exceptional antiquity or variation in type from the Indian.

The femur (pl. 8) is well built, with moderate normal curves, moderate linea aspera, subdued platymery (as general in Florida) and popliteal space concave from side to side, as in the modern bone. The shape of the shaft, nearly elliptic on the left, shows a slight approximation to the prismatic on the right, where the bone is somewhat stronger. These are ordinary features among Indians. The measurements of the bone at the middle of the shaft and at the point where the upper flattening is most pronounced are as follows:

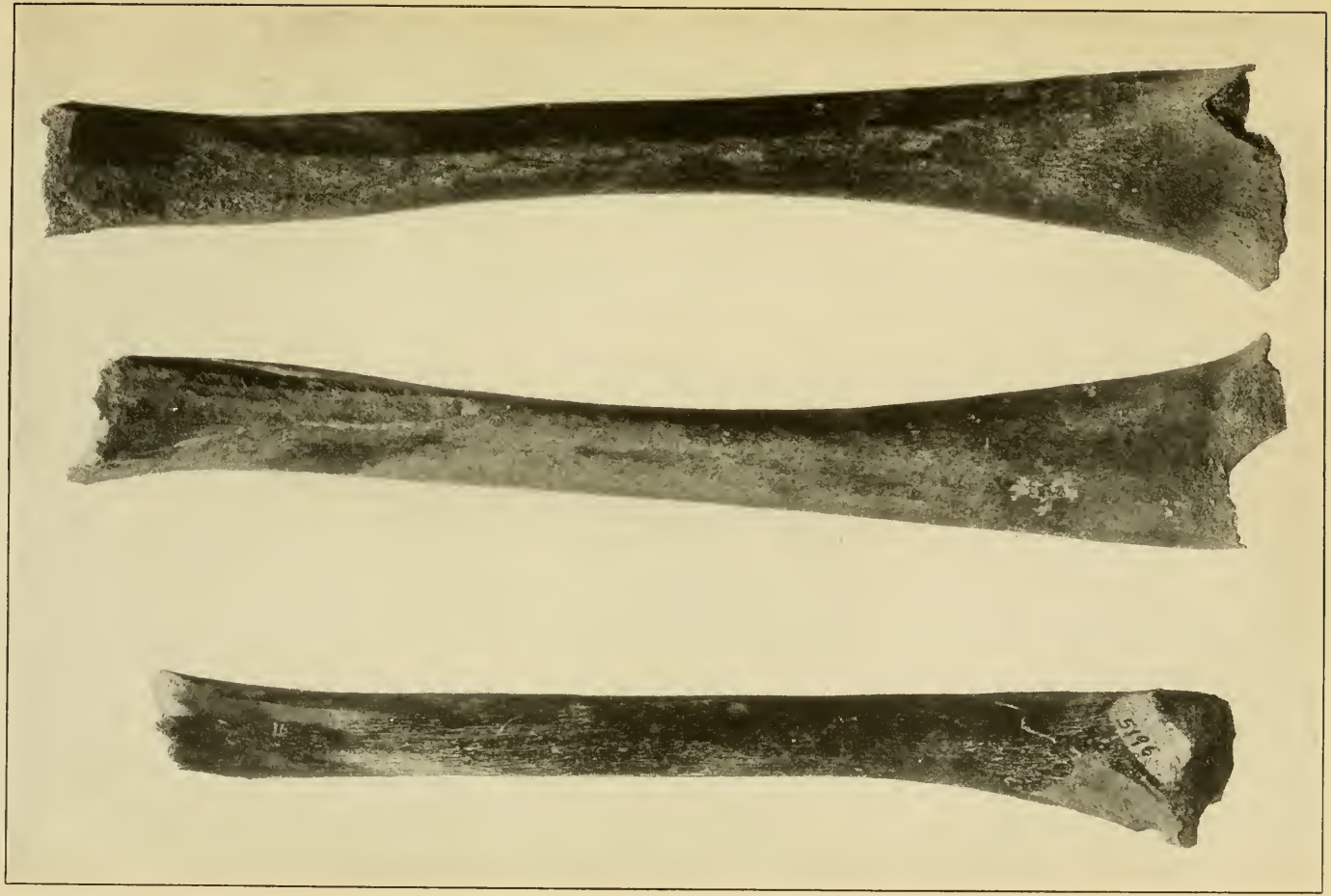
Femora of Skeleton I

	Right.	Left.
At middle:		
Diam. antero-posterior maximum.....cm..	2.45	2.35
Diam. lateral [1].....cm..	2.15	2.2
Index $\left(\frac{\text{diam. lat.}\times 100}{\text{diam. ant.-post.}}\right)$.....	*87.7*	*93.6*
At subtrochanteric flattening:		
Diam. maximum.....cm..	2.75	2.8
Diam. minimum.....cm..	2.1	2.1
Index $\left(\frac{\text{diam. min.}\times 100}{\text{diam. max.}}\right)$.....	*76.4*	*75.0*

[1] Taken with the linea aspera touching the middle of the shaft of the compas glissière between the two branches applied to the sides of the femur.

Compared with the Eastern Algonquian, the Vero femora (Skeleton I) are slightly subaverage in their dimensions, but individually they could be readily duplicated. The mean index of the shaft at the middle is 90.7 in the Vero bones and 91.2 in the female Munsee.[1] At the upper flattening the mean index of the Vero bone is 75.7, that of the Munsee 73.6. These are very close resemblances; but there is something of even greater importance. Among Indians in general, the left femur in the middle of the shaft shows a slightly lesser development antero-posteriorly (linea aspera) than the right, and it shows also a slightly more pronounced flattening in its upper part. The Florida femora show in both respects precisely the same conditions.

[1] *Bull. 62, Bur. Amer. Ethn.*, pp. 63–64.



THE FEMORA AND LEFT TIBIA OF VERO SKELETON 1

The tibia, normally developed, measures at the middle of the shaft 2.6 cm. in its antero-posterior and 1.9 cm. in its lateral diameter. The corresponding average measurements of Delaware tibiæ were, respectively, 2.6 and 1.93 cm.[1] We could hardly ask for a closer resemblance. The index at middle is *73.1* in the Vero bone and averages *74.5* in the left tibiæ of the Delaware, less than 1.5 points difference, and much less than the individual variation in a single tribe. Twelve Florida female tibiæ, from various parts of the State, give for the same proportions respectively 2.84, 1.97, and 69.4, dimensions also not far different, and a few individual bones match the Vero tibiæ almost exactly.

The Vero tibia presents also an interesting shape of the shaft. If we examine tibiæ from Florida at large, we find that in the majority of cases the bones are distinguished by a decidedly convex inner surface, a characteristic also frequently met with among the tibiæ of the Algonquian tribes farther north; and it is precisely this form which is found in the tibiæ of Vero Skeleton I.

To summarize, the features of the femora and tibiæ of the skeleton under consideration are, according to all indications, Indian, and of the type of Indians who peopled the Florida peninsula and other parts of the eastern coast up to historic times. Should the Vero skeleton be of geological antiquity, then we would have to accept the view that in size and type no change has taken place in the inhabitants of the region between the early Pleistocene (to which all the Vero finds are referred by Hay, who rather oversupports Sellards's views) and the Columbian period. This would mean new natural history of man, new anthropology.

Part of a fibula present shows a weak development of the bone; otherwise there is nothing exceptional.

The part of left humerus shows that the bone was of the usual plano-convex Indian type, and quite platybrachic, as usual among the Indians.

The patella is of ordinary form and, as is true of all the bones of the skeleton, of moderate size. Its dimensions compared with the average measurements of Eastern Algonquian female patellæ are as follows:

Measurements of Patella

	Vero Skeleton I	Munsee Females (Mean)
	Centimeters	*Centimeters*
Height, maximum	3.8	3.93
Breadth, maximum	4.0	4.02
Thickness, maximum	1.7	1.73

[1] *Bull. 62, Bur. Amer. Ethn.*, p. 68.

The os calcis is damaged, but what is left of it shows ordinary form. Compared with other Indian calcanei it appears to be somewhat higher and shorter, but these are doubtless individual peculiarities which can be matched in other Indian specimens. The two measurements of the bone which can be ascertained, and similar measurements of female Delaware calcanei, are as follows:

Os calcis

	Vero Skeleton I	Munsee Females (Mean)
	Centimeters	*Centimeters*
Length, maximum	7.0	7.3
Breadth, maximum	(?)	.....
Height, minimum	3.75	3.6

The astragali (see pl. 13, fig. 1) show certain peculiarities which are frequently encountered in this bone in Florida remains. Thus, there is a marked depression superiorly in the neck, and the lateral tubercle on the posterior facet for the calcaneus is considerably developed. The dimensions of the bone, as well as the relation of these dimensions to each other, are also quite similar in the Vero bones and others from Florida:

Astragalus

	Length (maximum)	Breadth (maximum)	Height (maximum)	Br.-L. Index	H.-L. Index
	Centimeters	*Centimeters*	*Centimeters*		
Vero (Skeleton I), mean	5.32	3.68	2.78	*69.0*	*52.1*
Florida in general (16 female bones)	5.28	3.76	2.84	*71.0*	*54.0*

The first right metatarsal measures 5.7 cm. in maximum length, which is but slightly below the average for this bone among our Eastern Indians. Apart from a few unimportant individual peculiarities neither this nor any of the remaining bones of the skeleton show anything noteworthy.

Taken as a whole, the skeleton is plainly that of an individual possessing the essential osteological characteristics of the Florida and Eastern Indians; and until proved to be something else it can not possibly be classified by the anthropologist as anything else than a skeleton of an ordinary Indian.

Skeleton II

The second skeleton, though its parts as found were more segregated, is even better represented than the first. The parts saved are as follows:

Skull: Sixteen pieces; also part of the lower jaw and a tooth.

Upper limbs: Lower half of left humerus; both ulnæ, lacking distal ends; upper half of left radius; two phalanges; part of a metacarpal.

Trunk and pelvis: Part of right scapula; 6 fair-sized pieces of ribs; part of left ilium, with articular surface for sacrum; part of left pubes, with part of the acetabulum.

Lower limbs: About one-third of right and three-fourths of left femur (shaft); part of right tibia; part of left fibula; right astragalus; right third cuneiform; and parts of three metatarsals.

The bones differ considerably in color as well as in consistency from those of Skeleton I. With the exception of three of the pieces which fell out of the bank and were more or less bleached by exposure, the bones are of a uniform brown color, the brown of vegetal origin as found in many stagnant waters as well as running streams in Florida. It is a color derived from the muck, and permeates the bones throughout their structure. It is the exact color of nearly all the bone implements and other bone artifacts recovered from stratum No. 3 (the muck layer) at Vero, and indicates that the human bones belong to the same layer.

The bones, or what is left of them, are in a remarkably good state of preservation. They show no signs of weathering, washing, or of cutting or gnawing, with the exception of a few marks of the teeth of a small rodent on the left femur.

The fractures in the bones are as a rule transverse, none of the specimens being split. Some of the fractures are very recent, others older; but whatever the age of the fracture, the edges are invariably sharp, without signs of wear. These conditions point on the one hand to fractures produced at the time of, or subsequent to, the dredging, and on the other hand to breaks due to stress, probably after the bones were already partly mineralized within the deposits.

Anthropologically, the skeleton is quite interesting, not because of indications of antiquity, which may be said at once to be entirely absent, or aberrance in type, but because of its rather superior modern characteristics, particularly as regards the cranium. The skull and bones are Indian, but they seem to belong to a type such as can occasionally be found among the Eastern Algonquian, or among the Sioux, rather than in Florida. At first it seemed that the skeleton might be that of a mixed blood (Indian-white), or even of a white man, but a detailed study of the bones has definitely removed this impression.

The skeleton is that of a man somewhat advanced in life. The individual was of tall stature, possibly not less than 5 feet 10 inches, robust, and normal.

The skull (pls. 9, 10) is large, finely shaped, of thoroughly modern features, and unusually thin. It shows a normal nasal process of moderate breadth (about 2.1 cm.); orbits with fairly sharp borders; glabella and supraorbital ridges subdued; forehead not high but well built; the sagittal region oval from side to side; the temporal ridges only mildly marked and at their nearest approach running at

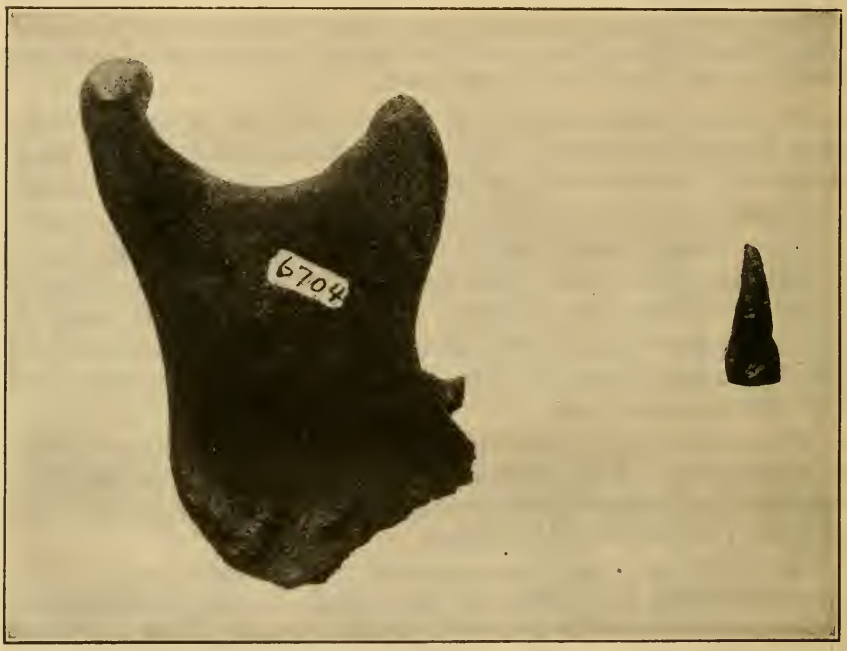


FIG. 8.—Portion of the lower jaw of Skeleton II; median incisor found in the vicinity of Skeleton II.

a distance of 7 cm. from the median line; parietal eminences gently developed, the occiput smooth and blunt; and the outline of the vault as viewed from above forming a fine ellipse. The thickness of the parietals ranges from 3 to 4 mm., which for a strong Indian is decidedly exceptional.

The mastoid process shows normal masculine development; the auditory meatus is rather large and in cross section nearly circular; the zygomatic processes were of moderate masculine strength.

The lower jaw (fig. 8), although finely molded and full-sized, is thin, like the whole skull, and the facial parts could not have been heavy. The right ascending ramus of the lower jaw is 6.9 cm. high

RIGHT SIDE OF SKULL OF VERO SKELETON II

The bleached frontal portion is of nearly the same shade in the photograph as the clay with the help of which the specimen was reconstructed

TOP VIEW OF THE RECONSTRUCTED SKULL OF VERO SKELETON II

and 3.55 cm. in minimum breadth; the form of the bone is strictly modern; the muscular impressions are well marked. The tooth which evidently belongs to this skeleton is the left median upper incisor. It is of moderate size, the total original length not having exceeded 2.3 cm.; the root dorsally and in median line measures 1.3 cm. The crown is worn down to about one-half its original size, so it is difficult to determine the original form of its buccal surface, but it is seen that this was somewhat concave or shovel shaped, as in Indians, though the concavity was probably less pronounced than in most members of the race. There are, however, full-blood Indians in whom this concavity is slight and in rare cases it is entirely absent.

The *femora* are strong, with normal curves, and not pilasteric. The location of the minor trochanter is exactly as in modern bones, which is important. There is a fairly large third trochanter, but this is a feature which is found in both whites and Indians and has little if any racial or evolutionary significance. A characteristic which speaks strongly for these femora being Indian is the marked flattening of the shaft below the trochanters; in whites this flattening is generally less pronounced. The dimensions of the bones, which show in the main how closely the Vero man represented by the skeleton under consideration resembled in development the modern Indian, are as follows:

Measurements of the Femora

	Vero Skeleton II.		Average male, Florida.	Munsee.	Sioux.	U. S. whites.
	Right.	Left.				
At middle:						
Diam. ant. post.....cm..	2.9	2.8	3.02	2.91	3.15	2.95
Diam. lat.....cm..	2.7	2.7	2.69	2.58	2.79	2.85
Index.....	*93.1*	*96.4*	*89.1*	*89.0*	*88.6*	*96.8*
At upper flattening:						
Diam. maximum.....cm..	.....	3.5	3.36	3.28	3.55	2.97
Diam. minimum.....cm..	.....	2.3	2.51	2.37	2.66	2.39
Index.....	.....	*65.7*	*74.7*	*72.4*	*75.0*	*80.3*

So much for groups; but there are in larger series of Indian femora individual specimens that practically duplicate in measurements that from the Vero deposits.

The *humerus*, even more if possible than any of the other bones, is Indian in type. It is strong without being massive. The septum shows a medium-sized perforation; these perforations occur in all

races but are especially common in Indians. The surface of the shaft is smooth, and only a faint ridge indicates the position of the supracondyloid process, as usual in Indians. Finally, also in harmony with the Indian type, the shaft is plano-convex in shape, and platybrachic. Its dimensions slightly below the middle are: Diameter lateral (greatest breadth), 2.2 cm.; diameter antero-posterior (least thickness), 1.4 cm.; at middle they were probably 2.3 by 1.5, with the index of *65.2*. The left humeri in the Munsee[1] gave for the corresponding dimensions 2.2 by 1.64 cm., with the index of *74.6;* while 211 left male humeri of various tribes gave, respectively, 2.15, 1.59, and *73.9*, with a considerable number of individuals duplicating exactly the proportions of the Vero bone. On the other hand, 626 left male humeri of whites averaged 2.21 by 1.86 cm., with the index of *84.1*—a radically different condition.

The *ulnæ* (pl. 11) show moderate normal curves and well-marked muscular impressions. The right bone is perceptibly stronger than the left. The shape of the shaft, especially on the left, approximates a lateral prism, instead of the more common ordinary prism; this, however, is only an individual variation which is met with occasionally among both whites and Indians. The arterial foramen is situated in both bones near the anterior instead of in the vicinity of the interosseous border; but this, though less common, is also found not infrequently in the ulnæ of both whites and Indians.

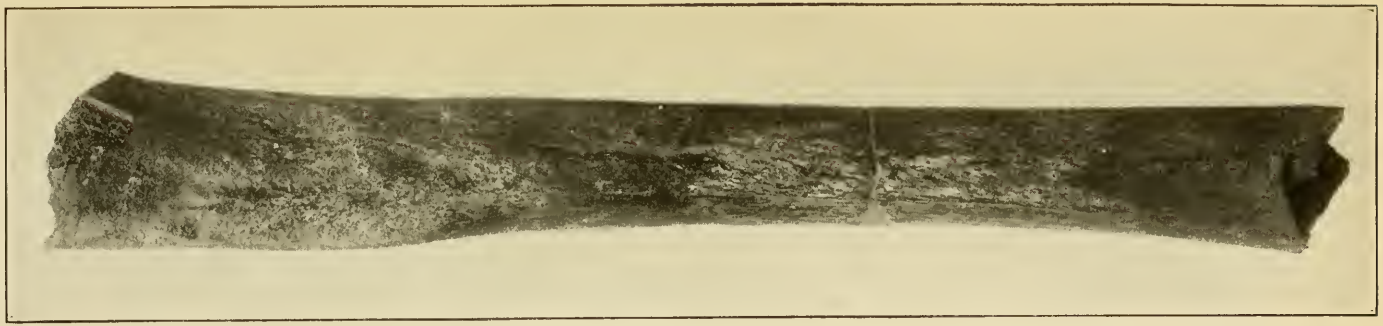
The *radius* (pl. 12) is rather slender, but well molded; the tuberosity is somewhat submedium in size, in consequence of which the neck antero-mesially is longer than usual; but externally and posteriorly it is as in other radii. None of the somewhat exceptional features of the ulna and radius here mentioned are in the direction of more primitive forms of these bonds, but quite the reverse.

The *ribs* are of moderate masculine proportions and of ordinary form. The parts of scapulæ and pelvic bones present show no features of special interest. The vascular canal in the supraspinous fossa at the base of the acromion is unusually large in the Vero specimen, but this characteristic has only an individual significance.

The *tibiæ* (pl. 13) were typically prismatic (shape No. 1) and strongly built. The *fibulæ* were strong, not fluted.

The *astragalus* (pl. 13) shows a marked fossa anterior to the trochlear surface as in Skeleton I from Vero, and as found in astragali of Florida and other Indians; otherwise, the shape is not exceptional. Its dimensions compared with those of other Indian astragali are as follows:

[1] *Bull. 62, Bur. Amer. Ethn.*, p. 53.

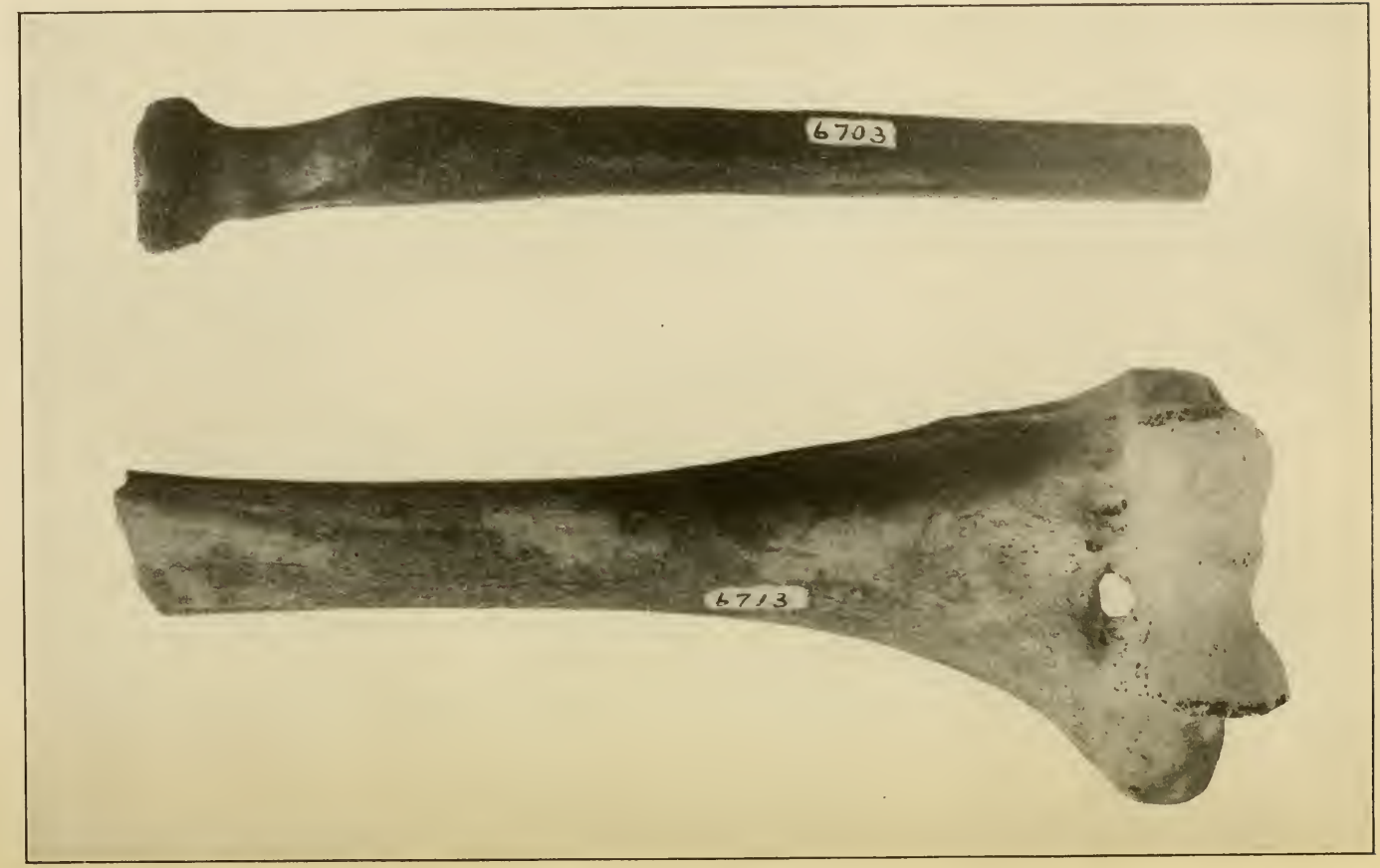


A

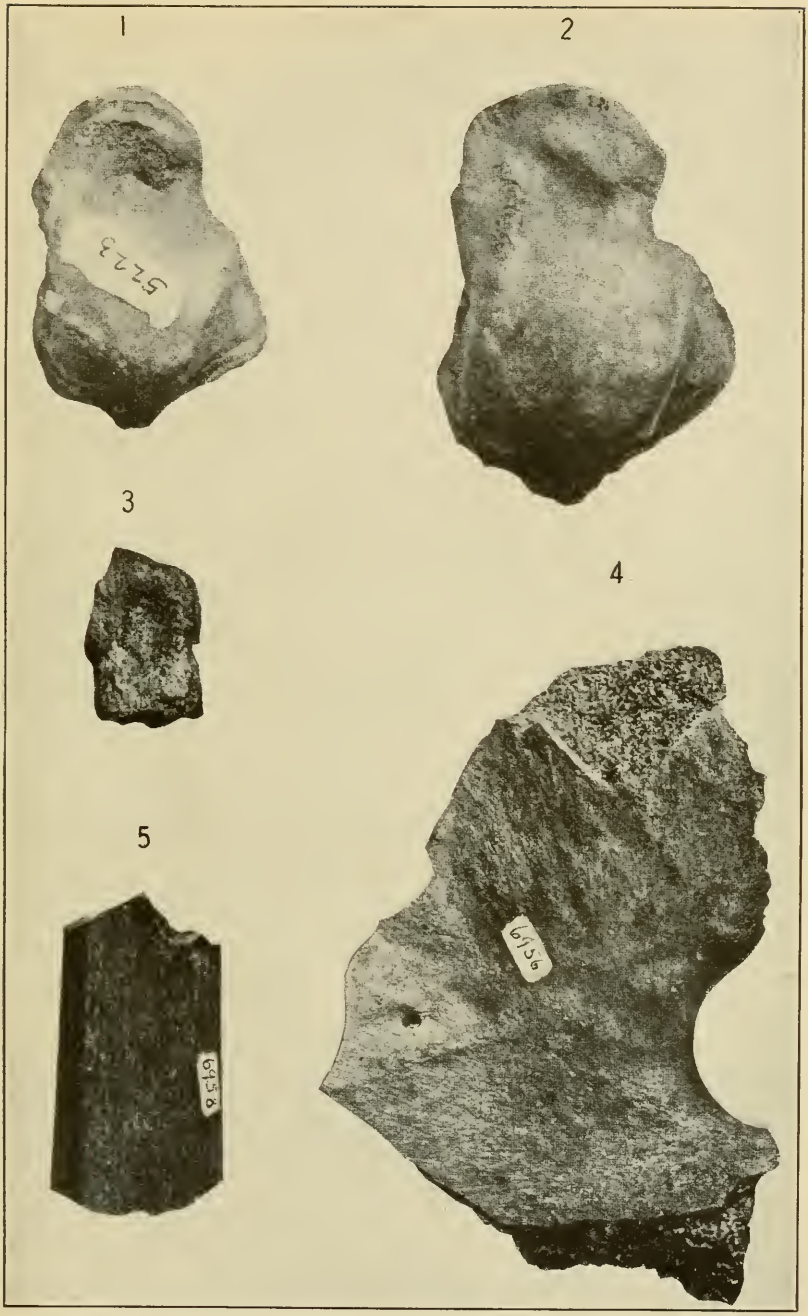
B

LEFT FEMUR (A) AND RIGHT ULNA (B) OF VERO SKELETON II

Bones not reduced to quite the same scale



HUMERUS AND RADIUS OF VERO SKELETON II



1, RIGHT ASTRAGALUS OF VERO SKELETON I; 2, RIGHT ASTRAGALUS OF VERO SKELETON II. 3, 4, 5, PARTS OF SKELETON II (NO. 5, TIBIA) (AFTER SELLARDS)

Astragalus

	Length, maximum	Breadth, maximum	Height, maximum	Module (mean diam.)	Breadth-length index	Height-length index
	cm.	*cm.*	*cm.*	*cm.*		
Vero Skeleton II, right	6.4	4.4	3.4	4.73	*68.7*	*53.1*
Florida (at large), right, male	5.91	4.14	3.2	4.42	*70.1*	*54.2*
Sioux, right, male	6.14	4.54	3.43	4.71	*74.0*	*56.1*
Munsee, right, male	5.7	4.27	3.27	4.41	*74.9*	*57.4*
United States, whites	6.3	4.5	3.4	4.73	*71.6*	*53.8*

As in the case of Skeleton I from Vero, the astragalus is marked by somewhat excessive length; but there are not a few individual Indian astragali from Florida and elsewhere which duplicate its proportions. Its very close approximation in both absolute and relative proportions to the astragalus of the whites is probably accidental.

The remaining few bones of the foot are without special interest.

Considering the skeleton as a whole, the conclusion is inevitable that it is that of an Indian; yet there remains some persistent doubt whether it is not the skeleton of a white-Indian individual. If not, there remain only two other possibilities: one that it is an exceptional, superior skeleton of a Florida Indian of Algonquian origin, the other that it belonged to an individual from some non-Floridian tribe. It should be once more emphasized, however, that all the features in which the various parts of the skeleton differ from those of an ordinary Florida Indian are features pointing toward higher or more modern development. There is no feature of the skeleton that would suggest even remotely an individual more ancient or anthropologically more primitive than the Indian.

Additional Human Bones from Vero

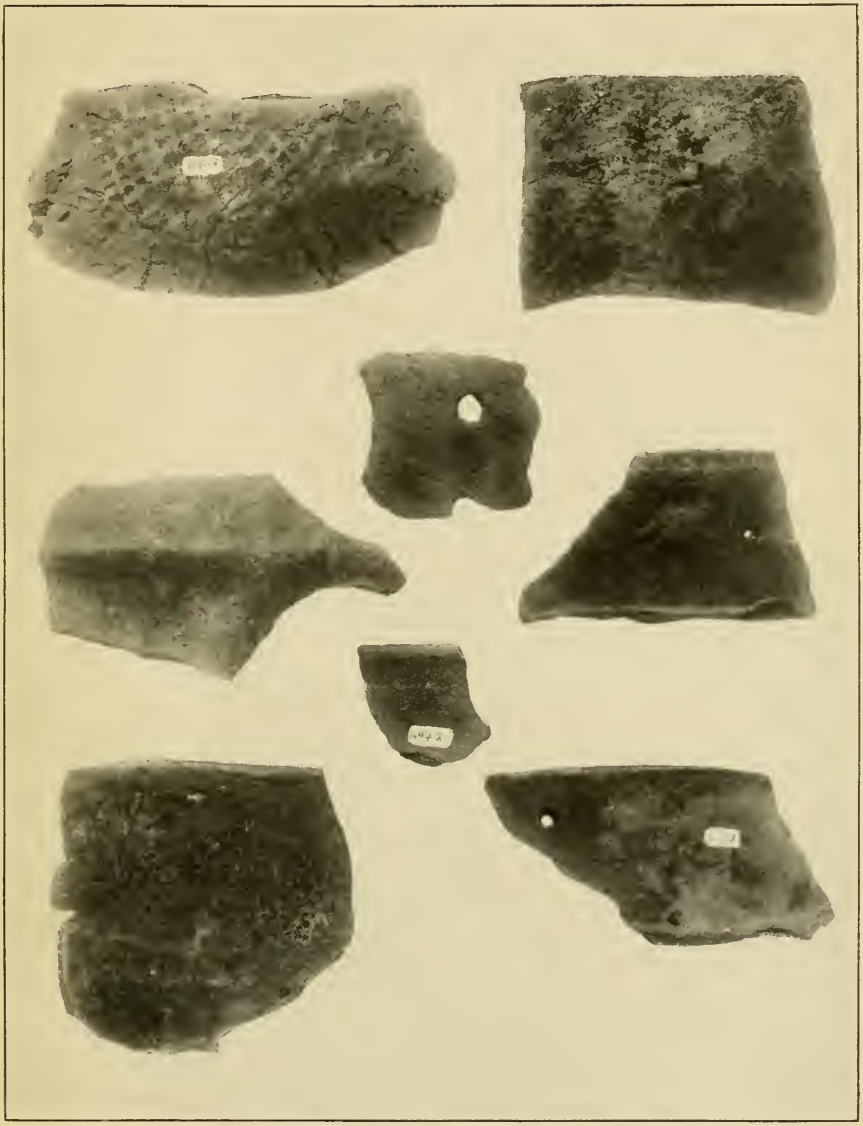
Near Skeleton II was found a tooth which is characteristically and most typically Indian (fig. 8). It is an upper median incisor, probably of the left side, and belonged to an advanced adolescent or a young adult, possibly a female. Its dimensions are: Total length, 2.0 cm.; maximum breadth of crown, 0.85 cm. The cutting edge is but slightly worn, as frequently found in Indian adolescents; the outer surface is decidedly convex from above down; and the inner or buccal surface is deeply hollowed out, or shovel-shaped, as is typical with Indians. With rare exceptions such hollowing out is met with only among Indians and the more closely related branches of the yellow-brown race.

The tooth found in the northern bank is the crown shell of the second left upper molar of a child. It is of moderate size and shows only some individual variations from other Indian teeth of that nature.

General Conclusions

The only conclusions concerning the Vero bones that the writer can arrive at, after a painstaking study of the locality and the specimens and after having given due consideration to the opinions of others, are that they are remains of modern Indian type; and that, so far as the two skeletons are concerned, they represent intentional burials. As to the latter point, all other explanations, on being tested, prove so much weaker or so unnatural that they have to be discarded.

The age of the strata and the determination and age of the animal remains found in them are matters quite irrelevant to the discussion of the human bones. The deposits could be much older or much younger than claimed; they could be original or secondary—all this is immaterial so long as they could have been penetrated a few hundred years ago by man who wanted to bury his dead; and that they could have been thus penetrated at any time up to the present there is no question. The pottery and implements, as is true of the bones, are of modern Indian type (pl. 14). It would be futile to try to explain this away by unsubstantiated theories of a possible great antiquity of such modern forms, culturally and anatomically. No one could give consideration to theories which would do such violence to known facts. That such speculations have been indulged in on other occasions would be a poor excuse for trying to have us accept the theories they advance as facts, especially on this continent. Those in whose work credulity and fancy have no part, and who possess sufficient hard-earned experience in these matters, can be convinced of the presence of geologically ancient man in America only by facts that will make all conscientious doubt on the subject impossible. As chances of peculiar associations of human bones or human artifacts are infinite, anthropology in this country must expect to be called upon again and again to pass on alluring claims of the antiquity of such objects. But the burden of proof of the antiquity of such finds lies, and will always lie, with those who may urge such claims. They must show clear, full, conclusive evidence acceptable to anthropology; and no beliefs, opinions, or "convictions," even though advanced by men otherwise highly deserving, can ever take the place of real and sufficient evidence. Our colleagues in collateral branches of science will be sincerely thanked for every genuine help they can give anthropology; but they should not clog our hands.



POTSHERDS FROM THE FOSSIL-BEARING VERO DEPOSITS (LAYER NO. 3)

ADDENDA

Mineralization of the Bones

The "fossilization" of the human bones from the Vero deposits is, as already mentioned, somewhat unequal. On attaining permission from Dr. Sellards, two fragments of fair size, one from the Vero Skeleton I, designated No. 5201, and the other from Skeleton II, designated No. 6957, were subjected for chemical analysis to Dr. E. T. Wherry, assistant curator, Department of Geology, United States National Museum. Besides these, Dr. Wherry was given part of a recently received Indian humerus from the Perico Island, Tampa Bay, Florida; part of a rib from the mineralized skeleton from near Osprey, west coast of Florida, for many years in the possession of the National Museum; and part of an ulna from an old surface communal burial on one of the keys off Little Sarasota Bay, Florida. This last specimen, taken entirely at random, was to serve as a "trial horse" for Dr. Wherry; but as its analysis proved to be uncommonly interesting, it is included in the report.

The results of the analyses show a difference in mineralization between the bones representing the two Vero skeletons. They show the presence in both of considerable organic matter. They differ quite markedly from those made for Dr. Sellards.

A comparison of the results with those pertaining to the three bones of undoubted Indian derivation and antiquity measurable only by a few hundreds of years, shows that one of these is much more mineralized than either of those from Vero; one, that taken at random from our collection, very closely approximates the bone from Skeleton II; while the third shows somewhat lesser changes.

It is plain there is nothing in the results of these analyses that would point to any great antiquity of the Vero specimens.

Report on the Analysis of the Bones, by Edgar T. Wherry

"The fragments submitted showed more or less admixture of sand and clay; these impurities were removed as fully as possible without destroying any notable amount of bone substance, and the bones were powdered in an agate mortar and analyzed as follows:

"For determination of all constituents except fluorine a 0.4-gram sample of each specimen was weighed out, heated for 2 or 3 hours at 110°, and the loss in weight recorded as moisture. The sample was then ignited for an hour over a complete combustion burner, and the

loss in weight recorded as volatile matter; this comprises firmly combined water, carbon dioxide, and organic substances.

"The sample was then dissolved in dilute nitric acid, and the solution filtered, the residue being ignited and weighed and examined microscopically. In every case it proved to be made up of quartz-sand and clay; and, as such material is clearly a mechanical admixture with the bone, it was deducted in each case from the total weight of sample taken, so that the percentages of material calculated would represent material combined in the bone substance and the results on the several samples would be directly comparable.

"The nitric acid solution was heated to boiling, made slightly alkaline with ammonia—a small amount of mixed phosphates being thereby precipitated—and an excess of acetic acid was added. Calcium phosphate then went completely into solution, while the phosphates of aluminium and iron remained insoluble, and were filtered out, ignited, and weighed. The amount of iron was so small that it was not separately determined. When the precipitate was large in amount it was fused with sodium carbonate, dissolved in nitric acid, and the phosphate removed by ammonium molybdate, and determined as magnesium pyrophosphate; the phosphoric oxide found was deducted from the total precipitate, and the remainder recorded as Al_2O_3 ($+Fe_2O_3$). When the amount of precipitate was small, the phosphoric oxide in it was calculated on the basis of the compound $AlPO_4$ and subtracted as before.

"The acetic acid solution, from which aluminium had been removed, was diluted to a definite volume and divided into two equal parts. To one part ammonium oxalate was added and the calcium oxalate precipitated was filtered out, ignited, and weighed as CaO. To the filtrate from this ammonia was added and the magnesium-ammonium phosphate precipitated was ignited and weighed as the pyrophosphate, from which the MgO was calculated. Phosphoric oxide was determined in the remaining half of the acetic acid solution by titration with a standard solution of uranium acetate; the amount in the aluminium precipitate being added to give the total P_2O_5.

"For the determination of fluorine a fresh sample weighing 0.4 gram was dried, mixed with pulverized quartz, and heated to 200° with specially concentrated sulphuric acid in a stream of dry air, acid fumes carried over being removed by filtering the air through dry asbestos, and the gases being collected by bubbling through water. The hydrogen fluoride dissolved in the water was titrated with standard sodium hydroxide solution, and the percentage of fluorine present in the bone thus obtained.

"The specific gravities were determined on the powdered bone, using the picnometer, at about 20°.

"The analytical results obtained are tabulated below in the order of decreasing moisture+volatile matter content, and the corresponding increase in total mineral matter."

Chemical analysis

	Part of the right tibia of "a man taken in place in the Pleistocene bed at Vero" (analysis given by Dr. Sellards).	No. 5201, Sellards; bone belonging to Skeleton I of Vero (analysis by Dr. Wherry, U. S. N. M.).	No. 6957, Sellards; bone belonging to Skeleton II, Vero (analysis by Dr. Wherry, U. S. N. M.).	Portion of an ulna taken at random from a lot of bones probably post-Columbian from a key in Little Sarasota Bay, western Florida (Wherry).	No. 227224; rib from a mineralized skeleton in U. S. N. M. from Osprey, Florida. (Wherry).	No. 292065; humerus from an Indian burial on Perico Island, Tampa Bay, Florida. (Wherry).	Femur of fossil *Canis* sp. from the stream bed at Vero (analysis made for Dr. Sellards).
Specific gravity	*2.84*	2.80	2.50	2.50	2.84	2.35	*2.62*
Moisture at 100° C	*2.07*	2.95	3.67	3.56	6.88	6.16	*4.09*
Volatile matter	*8.92*	10.27	16.21	12.38	7.77	17.73	*8.22*
Phosphoric acid (P_2O_5)	*32.27*	36.29	31.37	35.08	34.49	32.91	*30.88*
Calcium oxide (CaO)	*46.80*	44.22	40.49	45.01	29.72	39.09	*45.69*
Insoluble matter, silica, etc	*1.11*	.....	.....	.....	.....	.....	*3.61*
Iron and aluminium oxides	*3.71*	2.81	4.04	.26	17.55	.37	*1.85*
Magnesium oxide	*N. d.*	.77	.85	.67	1.26	.72	*N. d.*
Calcium fluoride (CaF_2)	*N. d.*	2.38	2.81	2.57	1.95	2.49	*N. d.*
Total	*97.72*	99.69	99.44	99.53	.....	.....	*96.96*

Artifacts

The artifacts from the Vero deposits comprise, as stated by Dr. Sellards, numerous fragments of pottery, of bone implements and other objects, of stone implements and rejects. All these objects have been studied in detail by Prof. George Grant MacCurdy, whose observations are soon to be published in the *American Anthropologist*.[1] Thanks to the courtesy of Dr. Sellards, the whole collection has also been sent for examination to the United States National Museum, where it has been carefully inspected by Prof. W. H. Holmes.

On the whole the objects indicate a rather advanced stage of primitive hunting and fishing culture, comparable with that of the Indians of the Southeastern States. The potsherds look remarkably

[1] An excellent detailed report on these, fully corroborating the above expressed fact, has recently been published by Dr. MacCurdy (*Amer. Anthropologist*, April–June, 1917).

fresh for specimens of "geologic" antiquity. The bone implements show little if any effects of weathering, are clear and sharp in outlines, and for the greater part exhibit exactly the same coloration and seemingly also the same partial mineralization as do the bones of Skeleton II. This is a fact of considerable importance, because it demonstrates that the skeleton belonged to the same layer (the muck layer, No. 3).

Had the artifacts not been found in a layer which bears also the bones of long-extinct animals, no one could have thought for a moment of attributing them to any people other than the ordinary American Indian.

Professor Holmes's report on the pottery, which he subjected to a special examination, follows:

REPORT ON THE POTTERY, BY W. H. HOLMES

"I have examined with great care the pottery fragments obtained from the site of the discovery of human remains associated with Pleistocene deposits near Vero, Florida. They represent small and moderately large vessels, ranging in form from simple cups to deep bowls and shallow, wide-mouthed pots—forms in common use among the Indian tribes of Florida. Compared with corresponding ware from the Florida sand mounds and from occupied sites generally throughout Florida and southern Georgia, no significant distinctions can be made in material, shape, indications of use, or embellishment. Many of the fragments bear traces of use over fire, being coated quite thickly with hardened soot. The decorated pieces show impressions of checkered paddles or stamps identical in character with the prevailing decoration of the Indian earthenware of Florida. The pottery as well as the bone implements from this place indicate clearly that it is the site of an ordinary Indian village and the archeologist acquainted with Indian customs would expect to find burials at usual depths beneath and about the site. The reference of these artifacts to a people of geological antiquity can but illustrate the lack of appreciation of the ordinary conditions and phenomena of Indian occupancy on the part of those who first brought these finds to the attention of the public."

W. H. HOLMES.

Sic transit gloria hominis Veroensis.

A New Publication Concerning the Vero Remains.

Just as the last revision of the foregoing report has been completed, still another publication concerning the Vero remains and the deposits reaches the author. It bears the general title of "Additional Studies in the Pleistocene at Vero, Florida,"[1] and includes five papers, as follows:

The Fossil Plants from Vero, Florida, by Edward W. Berry.[2]

Fossil Birds Found at Vero, Florida, with Descriptions of New Species, by R. W. Shufeldt.

Vertebrata Mostly from Stratum No. 3 at Vero, Florida; Together with Descriptions of New Species, by Oliver P. Hay.[3]

Review of the Evidence on which the Human Remains Found at Vero are Referred to the Pleistocene, by E. H. Sellards.

Supplement to Studies in the Pleistocene at Vero, Florida, by E. H. Sellards.[4]

The reports by Messrs. Berry, Shufeldt, and Hay deal with the antiquity of the various organic remains from the Vero deposits, and can have no special interest for the student of the antiquity of the human remains found in the same deposits so long as the contemporaneity of the human and other remains is not definitely established so as to be acceptable to anthropology. As to Dr. Sellards's report, it is partly a reprint of that in the *American Anthropologist* (April–June, 1917) and for the rest is paleontological. It brings, however, several rather valuable photographs relating to some of the human finds which show well the nature of some of the deposits and what has been described as stratification. Dr. Sellards's conclusions, as previously, are that—

"The human remains and artifacts are contemporaneous with extinct species of mammals, birds, reptiles, and at least one extinct species of plant, as well as with other animal and plant species that do not at the present time extend their range into Florida. The age of the deposits containing these fossils, according to the accepted interpretation of faunas and floras, is Pleistocene."

As the interest in the Vero deposits continues there is a strong hope that a human burial in much better condition than those thus far found may be discovered. Meanwhile the amount of painstaking work carried out on the organic non-human remains from the locality must surely be most welcome to all paleontologists.

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[1] From the *Ninth Annual Report of the Florida State Geological Survey*, 1917, 17–82.

[2] Published also in *Journal of Geology*, Oct.-Nov., 1917, 661–666.

[3] Has published also a paper "On the finding of supposed Pleistocene human remains at Vero, Fla.," *Journ. Wash. Acad. Sci.*, 1917, vii, 258–260.

[4] Refers also to the following two communications: Note on the Deposits Containing Human Remains and Artifacts at Vero, Fla., by E. H. Sellards, *Journ. Geology*, Oct.-Nov., 1917, xxv, 659–660; Further Studies at Vero, Fla., by Rollin T. Chamberlain, *Journ. Geology*, Oct.-Nov., 1917, xxv, 667–683.

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