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THE RICHMOND MASTODON

BY

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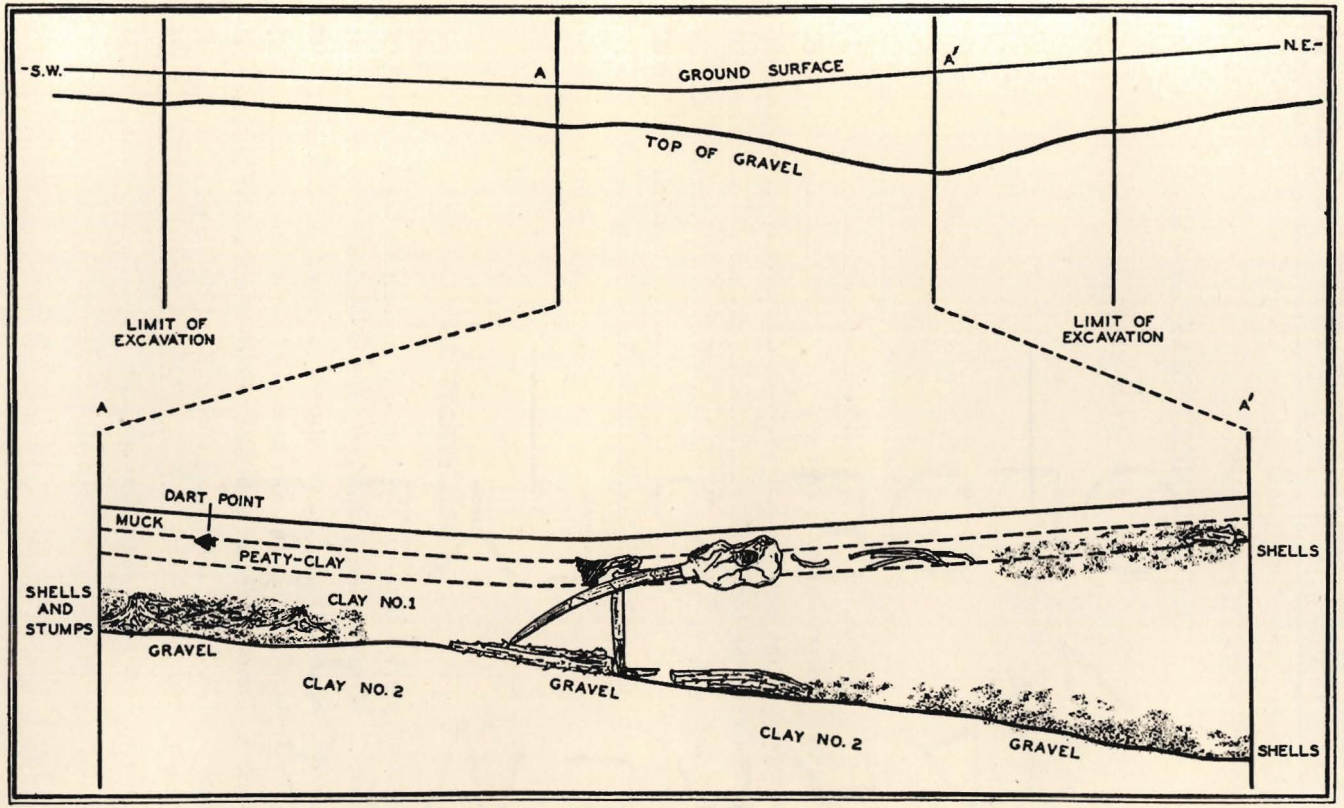

Figure 1. **VERTICAL SECTION OF THE DEPRESSION IN WHICH THE BONES OCCURRED**
The diagram A–A' below, corresponds to the portion A–A' in the profile above

Explanation and Credits

The finding of human artifacts associated with the remains of the Richmond mastodon has aroused much interest in the scientific world as well as among the general public. The paleontology of the find has not as yet been studied but a wealth of information is at hand concerning the occurrence of the mastodon and is herewith presented, together with suggestions regarding the creature's age.

Detailed field studies and adequate time and facilities for the collection of the specimen were made possible by the interest and generosity of Mr. Watts S. Richmond of Buffalo, New York, who secured the specimen for the Buffalo Museum of Science. It is therefore most appropriate that the huge fossil be named in his honor the Richmond mastodon. To Mr. Everett R. Burmaster, of Irving, New York, who co-operated in the work, the writer is under deep obligation, both for assistance in the field and for many valuable suggestions regarding the preparation of this account. Without his aid much of the present paper might never have been written. Dr. Ira Edwards, of the Milwaukee Public Museum, spent several weeks in the field and was most helpful. The staff of the Buffalo Museum of Science have assisted in many ways as have also the Museum of Natural History and the Department of Geology at the University of Rochester. Dr. William D. Merrell, Professor of Botany at the University of Rochester, has identified the plant remains. Dr. A. C. Parker, Director of the Municipal Museum at Rochester, and Dr. J. E. Hoffmeister, Professor of Geology at the University of Rochester, have made helpful suggestions regarding the manuscript. Mrs. Sanford has aided constantly, both in the field and in the writing of this report.

History of the Find

The Richmond mastodon was found in the fall of 1930 on the farm of Charles Feldheiser, situated about two and a half miles southeast of the town of Cromwell, in Noble County, Indiana. The original find was a tooth, discovered by a boy, Donovan Harper, who was living on the farm at the time. Several weeks later a search was being made for a tile ditch which had been laid a number of years before. An iron rod was thrust into the ground here and there. It finally struck something hard which digging revealed to be the skull and tusk of a mastodon associated with a few miscellaneous bones from the same beast.

Fortunately Mr. Feldheiser did not attempt to further unearth his find but communicated with several museums, among them the Buffalo Museum of Science.

Excavation and Preservation of Material

The mastodon remains were buried at a depth ranging from less than a foot up to five feet, although most of them were found at a depth of about two feet, in a clay rich in plant remains and overlain by muck. Before proceeding with a more detailed account of the occurrence and condition of the fossil a few paragraphs will be devoted to the methods used in excavating and in preparing the bones for shipment.

Inasmuch as the specimen had been partly uncovered by the finders it was thought best to begin excavation at once in spite of the winter season. The portions of the skull and tusks originally unearthed had been covered with straw. These were brushed clean and covered with burlap over which was spread straw to prevent freezing.

Excavation was started at from ten to fifteen feet from the skull and carried toward it. As soon as a bone was found digging was stopped at that particular place and it was covered with newspaper and straw. This procedure was followed until the find had been outlined. The muck was then removed from the surface and the whole banked with straw. For this preliminary work, where large quantities of material were handled, spading forks were found to be the best and safest tools to use. Before this work was completed inclement weather made a canvas cover necessary and as soon as the material had been outlined a shed 30 by 22 feet was erected over it. This shed was equipped with a stove which was tended night and day to eliminate any chance of radical temperature changes, as frost might easily have damaged the water-soaked bones. Meanwhile trenches had been started from opposite sides of the excavation to give a cross-section of the depression.

Uncovering and cleaning the matrix from the bones required infinite care and patience as there was constant danger of losing some of the smaller bones and other material. There was also danger of breaking some of the more fragile pieces. The work was done with trowels, brushes, and small wooden tools which could be whittled out on the spot to suit the needs of the user.

All of the material with the exception of the lower parts of the tusks was uncovered and photographed before any of it was removed. During this uncovering pieces of the bones began to dry out somewhat so from time to time the exposed portions were given a coat of ambroid, thinned with an almost equal part of acetone. When ambroid is applied to a damp surface it later peels off or loosens and can be brushed away, but although it does not stick, it has the advantage of causing the bone to dry more slowly. The first coat did stick to most of the material. After being photo-

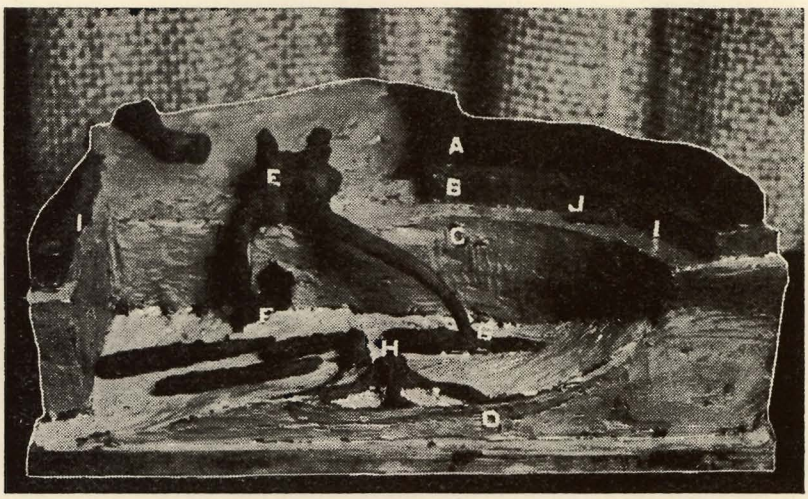

Figure 2. MODEL, SHOWING POSITIONS OF SOME OF THE BONES
(By E. R. Burmaster)

A, Muck. B, Peaty clay. C, Clay. D, Gravel. E, Skull. F, Broken tip of left tusk. G, Logs, lying under tip of right tusk. H, Stump, in place. I, Dart points. J, Charred log.

graphed, the skeleton, with the exception of the tusks and skull, was removed from the clay and placed on shelves built around the shanty and on burlap spread out on the clay floor. As soon as the outside had dried the bones were given a coat of thin ambroid, the smaller ones being dipped in a dishpan of it and the excess brushed off. Ambroid was applied to the larger bones with paint brushes. This process was repeated almost daily until the material was packed.

One end of the only humerus found was badly cracked. Very thin ambroid was poured into this broken portion several times at

intervals of a day or two. As a result this humerus came out in good condition.

Most of the vertebrae, toe bones and other small bones were packed in barrels of sawdust. The ribs, the leg bones, atlas, etc., were covered with excelsior and then wrapped in burlap which had been soaked in thin plaster of paris. This was covered by an outer coat of plaster of paris. In the case of the largest of these bones, leg bones, etc., another cover of burlap and plaster was added which in turn was followed by a second coat of plaster. Numbers could be written on the outside of each package while the plaster was still wet.

The large tusk was a problem in itself. It still retained its original shape but was badly cracked in several places. Tusks have frequently been broken in the process of recovery. The clay was carefully removed from this tusk until it was possible to jacket it for nearly two-thirds of the circumference except for the tip. Before jacketing it was covered with a coating of clay mixed with water until of the proper consistency to be applied with the hands or a brush. This would permit the jacket to be removed easily. The jacket was built of thin plaster into which was worked excelsior previously soaked in water. The procedure was to take a handful of wet excelsior, work the plaster well into it with plenty of excess and then apply it to the tusk. Short pieces of board were built into this jacket to strengthen it. After the exposed portion of the tusk was jacketed it was entirely undercut in two places and jacks were placed under it. The tusk was slowly raised until it colled be rolled over and onto blocking placed ready to receive it. The jacket was continued to the tip and a clay joint made between it and the remainder of the jacket so that the smaller part could be removed easily. The two parts of the jacket were sealed together with plaster reinforced with burlap.

The basal portion of the smaller tusk was badly shattered. It was jacketed before removal. The remainder of the tusk was removed before being packed. The skull was reinforced with plaster before it was jacketed. Two small pieces of timber were built into the under side of this jacket so that it could be carried more easily.

Excavation, cleaning, and preparing the bones required approximately six weeks. Warm weather near the end of that period caused water to pour into the excavation but fortunately the work was so

nearly completed that but slight damage was done. It was necessary to employ a power pump that the work might be finished.

It was not definitely known at that time whether or not more bones might be found outside the excavated area or below the horizon al-

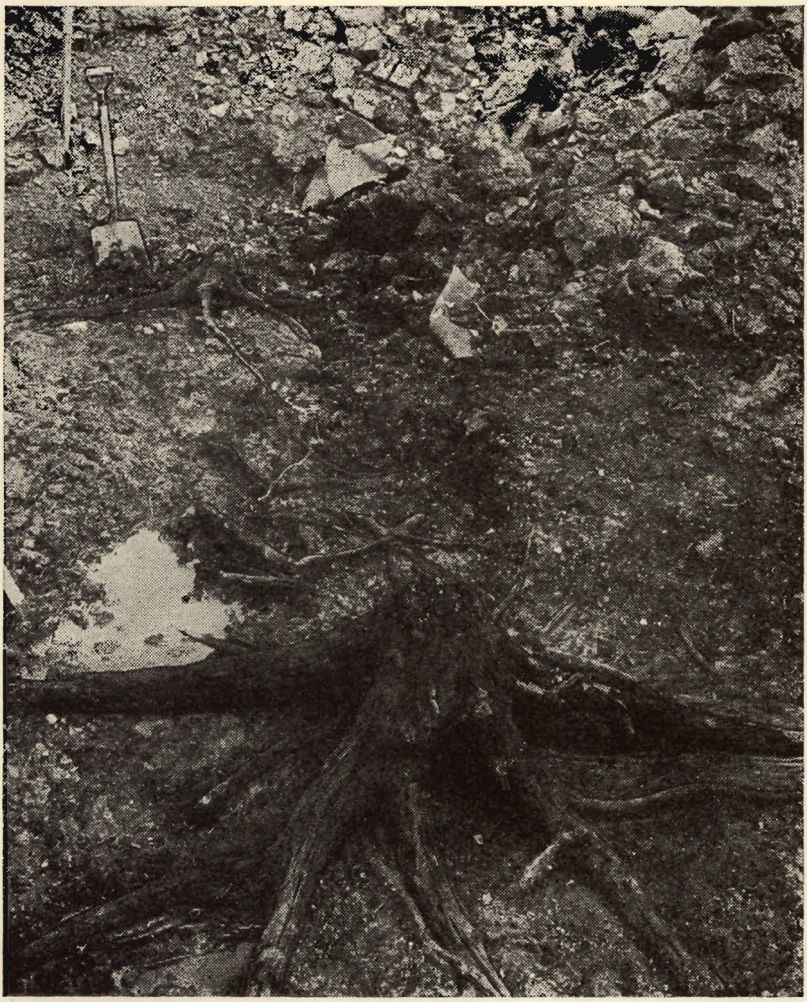

Figure 3. STUMPS, STANDING ON THE GLACIOFLUVIAL GRAVEL

ready explored, so work was resumed in June, 1931, and six more weeks were spent in hunting for more of the fossil and collecting data on the deposit in which it occurred. One broken vertebra was

all that was found of the specimen but the time was well spent, as an abundance of other data having a bearing on the age and occurrence of the creature was obtained.

During this time the excavation was extended to cover an area roughly rectangular and approximately 110 feet long and 80 feet wide. Sections showing the thickness of the various beds to the top of the gravel outside this area were obtained with the aid of a well augur. A section of the strata from the surface to the gravel was taken in tin trays and treated with glycerine in much the same way that varved clays are handled. Specimens of the trees found on the gravel were coated with clay and jacketed with plaster and excelsior in the same way that the tusks had been treated.

Description of the Deposit

The shallow depression, a partially filled kettle, in which the mastodon occurred was approximately eight hundred and fifty feet above sea level, two hundred feet in diameter and roughly circular. The east and north sides rose somewhat more steeply than the south and west sides. It had been occupied by a pond within the memory of some of the older inhabitants of Cromwell and is situated about one hundred feet west of low ground that may have been a drainage line in times of high water. At present this lower ground is occupied by a ditch.

The surface deposit in the depression was a mucky soil varying in thickness between six inches and one foot. (See figures 1 and 2.) The upper part had been disturbed by cultivation for a number of years. A dart point was found in the lower part beneath the disturbed portion. This mucky soil graded downward in most parts of the excavation into a clay which contained a large percentage of plant material, so much, in fact, that the workmen termed it "peat." This material was approximately one foot in thickness and was missing in places. It will be referred to here as a peaty clay. Below it was a clay (Clay No. 1), the upper part very rich in plant remains which became less plentiful downward until near its base, but were to be found throughout the stratum. This clay varied greatly in thickness, being eight and one half feet thick in one place and pinching out entirely around the rim of the depression. Throughout a part of the excavation numbers of the shells of pond molluscs were to be found in the upper part of the clay and in the

Figure 4. BONES, AS THEY LAY AFTER REMOVAL OF THE COVER

peaty clay. Most of the mastodon bones were found near the contact of the peaty clay with Clay No. 1. Bits of charcoal were also found at this horizon and a dart point which will be considered later.

Below Clay No. 1 was a gravel containing a strong admixture of clay. This graded rapidly downward within one to one and a half feet into a clay with an admixture of sand and gravel or a purer clay. This clay is designated as Clay No. 2; it was exceedingly plastic.

In the base of Clay No. 1, and resting on the gravel were a number of tree trunks, most of them rather small with the stubs of numerous branches still showing which gave the impression that they had not been transported. The butt of one of these was charred. In addition to these were found in place the stumps of trees which had once grown on the surface of the gravel. (See figure 3.) The larger roots of these stumps all extended toward the margin of the depression, away from the water. One of these stumps was the remnant of a tree with a trunk about one foot in diameter. Others were smaller.

Associated with the roots of these stumps and near some of the tree trunks were cones and needles of black spruce. Similar cones were found throughout Clay No. 1. Pond shells were also found associated with these stumps and trunks and at other places throughout the base of Clay No. 1.

A microscopic study of Clay No. 1 shows that in addition to the very minute fragments composing the major part of the material there are somewhat coarser fragments of quartz which are very angular. Samples taken at both the top and bottom of the stratum were similar in this respect. The clay was tested for calcite with hydrochloric acid in the field but no reaction was obtained except at or near the base of the stratum.

On the north side of the excavation two thin beds of sand were encountered. These were about 0.1 of a foot thick and 0.3 of a foot apart. The top of the upper bed was 5.3 feet from the surface. The clay above the sands gave no reaction when tested with acid but the sands reacted strongly. Calcite is present in the gravel and in Clay No. 2.

Occurrence of the Bones

The mastodon bones were all found at practically the same horizon at the point where the clay graded upward into the peaty clay and

at this horizon fragments of charcoal occurred. Extending below this was the broken left tusk which reached to the gravel approximately three feet beneath the skull and five feet beneath the surface at this point. The end of the right tusk also extended down into the clay, almost to the gravel, and rested on the fallen trunks of some trees. As the skull was lying bottom side up and was larger than some of the other bones, the upper teeth were within a short

Figure 5. PORTION OF FEMUR, UNDER SIDE, WITH CLINGING SHELLS

distance of the surface, so that the first discovery, a tooth which was found some feet from the skull, was in all probability knocked loose by a plow.

The position in which the bones occurred is shown in figure 4, which is a composite of several photographs taken from directly above. Practically all the material found is seen here. Although concentrated in an area about twenty by thirty feet, the skeleton taken as a whole had no semblance of order, but some of the ankle bones and the vertebrae seen near the skull were perfectly articulated.

As has been noted the skull was lying on its top. The stump of the left tusk remained in the skull but was broken off a short distance from it. The next two feet of the tusk were badly shattered and another break separated this portion from the remainder which stood vertically in the clay with the tip broken off against the gravel. (See figures 1 and 2.) As previously mentioned the right tusk lay intact although cracked in several places. The attachment to the skull was not perfect, the relative position of tusk and skull being slightly shifted, but the shift was small and the tusk had approximately the same position in relation to the skull as during life. In life the tusks of this specimen pointed outward and upward. There is a remarkable discrepancy in the size of the tusks, the left tusk being five feet shorter than the right one. Both tusks although broken were complete and had not been broken during the life of the animal. The lower jaw was broken in one place but lay right side up on the left tusk with the anterior facing the anterior of the skull.

The pelvis was in excellent condition and was found in front of and a little to the side of the skull. Near it was a femur, its position indicating that it had moved but little since becoming disjointed. Beneath this femur were found numerous small shells which clung to it when it was raised. (See figure 5.)

Several pieces of ribs were found beneath the side of the skull. One of them had been broken during the life of the animal, the ends had slipped by each other and it had mended in that position. This can be seen in figure 6. A floating rib was found near the pelvis. Most of the other ribs which were recovered were found lying back of the skull although two may be seen lying between the pelvis and the lower jaw. Many of the ribs were broken. The single humerus which was found lay on the opposite side of the skull from the femur. The radius and ulna from both forelegs lay back of the skull and on the same side as the humerus.

From among the data presented regarding the occurrence of the bones there are several facts selected for special emphasis.

(1) The skull was lying on its top and there were several ribs under it.
(2) The pelvis was in front of the skull.
(3) The smaller (left) tusk was broken and both tusks were sticking into the clay.
(4) Although the bones were scattered some of the smaller ones (as ankle bones) were still articulated.

Flint Dart Points

Two dart points were found. (See figure 8.) The first of these, the butt of which was broken, was discovered about fifteen feet south and a little west of the skeleton. It lay at the contact of the clay with the overlying peaty clay, the same horizon at which the mastodon was entombed.

The second dart point, the tip of which was missing, was found about twenty feet north of the skeleton and was not as deeply buried. It lay in the muck beneath the disturbed soil, too deep to have been

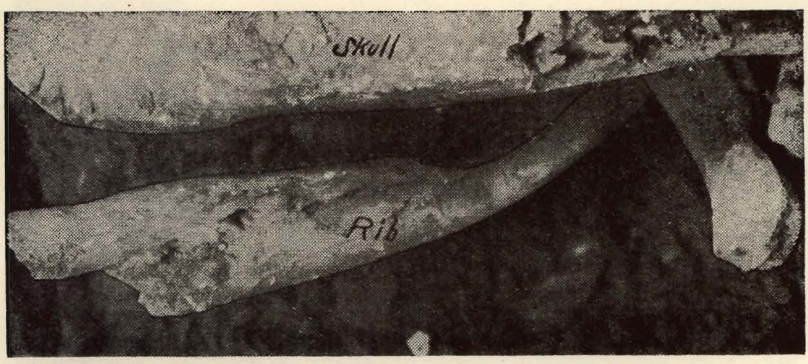

Figure 6. RIB, BROKEN AND MENDED DURING LIFE OF THE ANIMAL

plowed under. Both of these dart points had the same flaking quality as freshly mined flint indicating that they had been buried long enough to regain this property.

Photographs of these dart points were examined by M. R. Harrington, Curator in Charge, The Southwest Museum, California. The following is a quotation from a letter written by him to Everett R. Burmaster.

"If the points had been found out here, especially in Nevada, Arizona, or New Mexico, I should have called them dart points probably made by the Basketmaker people, who seem to have been at their height about 1500 B. C.

"I should also say that the points represent a later type than those we found in Gypsum Cave associated with ground sloth, horses and camels or the points found with the extinct bison at Folsom, New Mexico."

In the opinion of Burmaster, "The dart points are similar to those

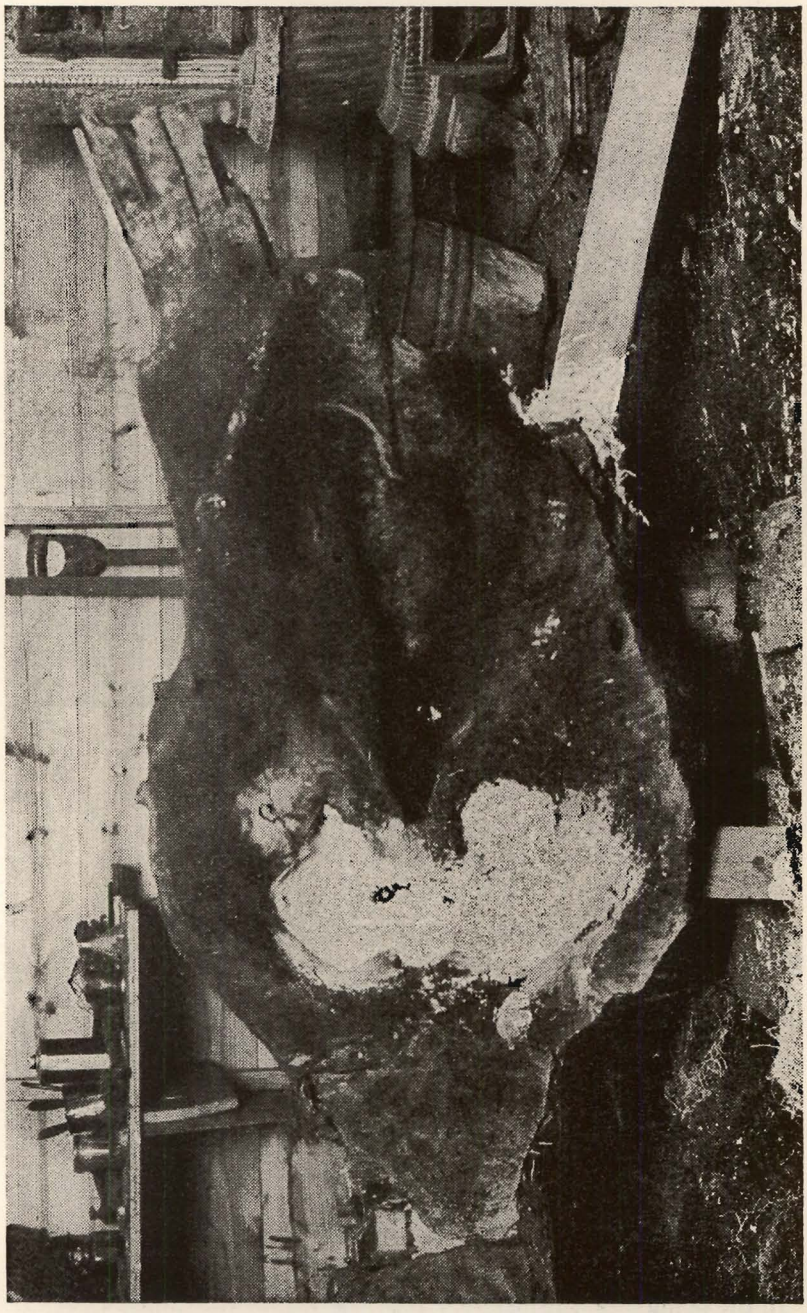

Figure 7. THE SKULL

found in Western New York at the sites of some of the oldest Indian occupations."

Masses of twigs and small branches were found overlying and associated with some of the bones. The character of this material did not indicate that it had been the contents of the stomach.

Interpretation of the History

It will never be known just how the Richmond mastodon died or what happened to the missing parts of his skeleton. However in the light of the data presented above, the writer wishes to point out possible interpretations and to make some suggestions regarding those which seem to him most probable.

It has been noted that within the memory of some of the inhabitants of the region the little depression from which the mastodon was removed contained a pond. This pond, somewhat deeper, undoubtedly, existed at the time of the introduction of the creature. That the mastodon was not brought in by glacial ice is evident. It does not seem probable that he floated in for there is no evidence of a body of water large enough to have accomplished this, although it is not impossible that such a body did exist during times of spring freshets. Moreover, had the carcass floated in it should have grounded on high land rather than in a depression. Breaking up of the carcass and differential flotation could hardly account for the absence of many of the ribs. Neither could it explain why the ankle bones are present while tibia and fibula are missing, nor why both scapulae are missing while one humerus and the radius and ulna of each foreleg are preserved. Lastly, grounding of the carcass could not have caused the left tusk to become embedded in the clay in the manner in which it was found.

Just how the various parts of the skeleton came to be in the positions in which they were found is open to question. They may have been moved somewhat by carnivorous beasts, man, or by ice action, but it does not seem probable that the skull or pelvis was moved to the positions which they occupied, at least not by ice. At the time of his death the mastodon sat back on his haunches, his head falling backward and to the right. The heavier right tusk caused that side of the skull to tip downward and the smaller left tusk was therefore lifted upward. Pond ice freezing on this tusk broke it

rate of deposition is postulated, and the length of time since glacial times is assumed to be 30,000 years. This figure is a conservative one, not leaning toward either extreme and serves to illustrate the point. The figure for the thickest accumulation of sediment is used because it is probable that this point represents the most continuous and uniform sedimentation. Practically no sedimentation took place for some time after glaciation at the points where the tree stumps were found and in other shallow parts of the basin. Based on this data it took about 2850 years for a foot of sediment to accumulate and the mastodon entered the pond 5,000 to 6,000 years ago. It is possible that the clay accumulated much more slowly than the peaty clay and the muck and this would make the creature still more recent.

Regardless of the accuracy of this data it is certain that a great many things happened between the time that the glacier left and the time when the mastodon entered the pond. Trees grew and died; molluscs throve, died out and were introduced again. The rain had time to wash in a great deal of clay, and many generations of plants lived and died.

The dart points offer another line of evidence regarding the age of the find. As has been previously noted these do not date back many thousands of years and this is not inconsistent with the estimate previously made.

The mollusc shells associated with the skeleton are interesting from the age point of view, although they offer no very exact information. Fourteen species have been identified,[4] only three of which are extinct forms. These are

Gastropods,	total—9	extinct—3
Pelecypods,	total—5	extinct—0

It is the opinion of the writer that the material is not much over 5,000 years old and that it may be considerably younger than this.

[4] Robertson, Imogene O., Hobbies, The Magazine of the Buffalo Museum of Science, Vol. 12, No. 5, Jan. 1932, pp. 108–109.

Man, like the wolf, hunts in packs. His methods are more efficient, faster, and more effective; but basically primitive man and the wolf must have hunted the larger creatures in the same way for neither had any means of killing their prey quickly. Man had many advantages over the wolf; he did not have to leap in, bite, and leap quickly out,—he could hurl his spears and cast his darts from a safer distance. Man had another weapon to aid him in this kind of hunting, fire, before which the mastodon as well as any other animal in its path would flee.

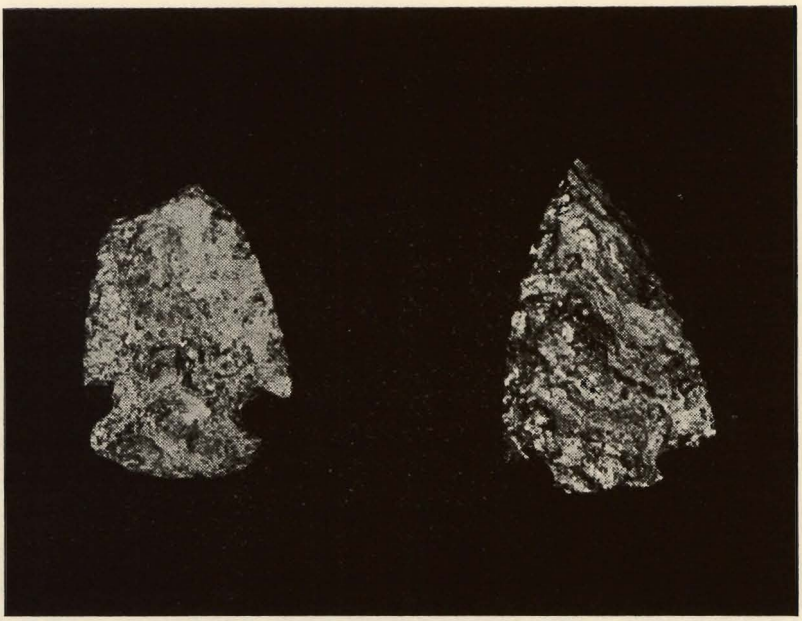

Figure 8. **DART POINTS, NATURAL SIZE**

It has recently been shown by Max Uhle[2] that man and the mastodon were contemporaneous, at least in South America.

Although it is impossible to directly connect the dart points found during the excavating with the Richmond mastodon, it is certain that at least one of them dates from approximately the same time, as it was found at the same depth and under the same conditions. The other was not so deeply buried but it is possible that it is equally

[2] Uhle, Max, Späte Mastodonten in Ecuador, Twenty-third International Congress of Americanists, Proceedings, New York, 1928, pp. 247–258.

old. It seems probable that man and the Richmond mastodon were contemporaries and that humans visited the identical spot at about the same time that the mastodon died there. Beyond this less certainty exists. It has been suggested that the fire may have played a part in driving the creature into the pool and that inasmuch as no other remains of similar age were found it is not logical to assume a widespread forest fire. Man is the only agent that could have lighted and directed a small fire for the purpose of trapping a single animal.

Possibly the Richmond mastodon was killed by a band of primitive hunters. Driven, perhaps for days, prodded by stone pointed darts and finally harassed by fire he sought refuge in a little pool. The butt of the most deeply buried dart point was broken. Possibly this was done while the tip was buried in the flesh and protected. The tip of the other one was missing. It may have been broken against a tree or a bone. These darts may have pulled loose from the animal before he died. Other dart points may have been missed in the process of excavating as the clay came out in chunks and equipment did not permit a careful examination of all of these chunks.

All of the explanations advanced have assumed that the mastodon entered the pond at a season when it was not frozen. It is just as logical to assume that the pond was frozen over and that the various parts of the animal were pulled about on the ice by beasts or man.

Before discussing the age of the fossil it is necessary to present a brief interpretation of the history of the spot in which it occurred. The gravel and Clay No. 2 are of glaciofluvial origin and the basin was formed by the uneven deposition of glaciofluvial material. A section made through the side of the basin also showed waterlaid glacial material, sands, gravels, and clays, except at the top where postglacial formations occur, clay and muck. The formations thicken and thin rapidly, and the size of the sediments varies greatly indicating varying and shifting currents such as might be expected near the front of a glacier.

The area has been mapped by Leverett [3] as "Undulating gravelly or sandy drift not definitely morainic." The glacial deposits were evidently laid down as outwash in front of an ice sheet.

All the formations above the gravel have accumulated in post-

[3] Leverett, Frank, U. S. Geol. Surv., Monog. 53, Pl. 6, 1915.

glacial times. Conditions must have been suitable for life, both plant and animal, very soon after the departure of the ice, for trees grew on the surface of the gravel. These trees grew around the margin of a little pond which occupied only the deeper part of the basin at this time. They were not closely spaced as the branches of many of them covered the trunks nearly to the ground. The roots grew landward rather than toward the water. Needles, twigs, and cones accumulated on the gravel as they do in the forest today. Molluscs lived in the pond. For some unknown reason, perhaps a minor climatic change, the pond became larger, the trees died and fell over; perhaps they were killed by flooding. Molluscs lived where previously pine needles had fallen.

All the time clay had been accumulating in the pond, and as the area covered by water became greater, the area of sedimentation increased accordingly. Clay covered the logs and stumps as well as filling in the deeper part of the pond. The clay was supplied from the higher ground by rain wash and as this material has been subjected to prolonged weathering calcite is absent. Pond plants grew and died, becoming more abundant as the water became more shallow. During the deposition of the last foot of clayey material plants became very numerous. Following the early history of the pond stage there was a time when shelled molluscs were infrequent. But they again became numerous in the deeper parts during the deposition of the upper part of the clay and the lower part of the peaty clay.

The latest depositional feature was the formation of nearly a foot of muck. The spot has been artificially drained by a tile ditch.

Estimate of Time

The mastodon probably entered the pond not earlier than the time when the peaty clay began to form, and possibly somewhat later than this as the bones may have settled since first deposited. The pond already had a long history when he entered. The greatest depth from surface to gravel was about ten and one-half feet, and at least eight feet of this had been deposited before the advent of the mastodon. It is very difficult if not impossible to make any estimates of the rates of accumulation of the sediments. They probably varied somewhat from time to time but some rather interesting and perhaps not entirely meaningless results are obtained if an even

rate of deposition is postulated, and the length of time since glacial times is assumed to be 30,000 years. This figure is a conservative one, not leaning toward either extreme and serves to illustrate the point. The figure for the thickest accumulation of sediment is used because it is probable that this point represents the most continuous and uniform sedimentation. Practically no sedimentation took place for some time after glaciation at the points where the tree stumps were found and in other shallow parts of the basin. Based on this data it took about 2850 years for a foot of sediment to accumulate and the mastodon entered the pond 5,000 to 6,000 years ago. It is possible that the clay accumulated much more slowly than the peaty clay and the muck and this would make the creature still more recent.

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