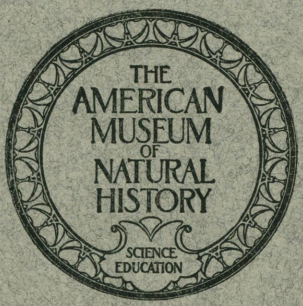
ANTHROPOLOGICAL PAPERS
OF
THE AMERICAN MUSEUM OF NATURAL HISTORY

VOL. XXIII, PART VII

THE PUNIN CALVARIUM.

BY

LOUIS R. SULLIVAN AND MILO HELLMAN.



AMERICAN MUSEUM PRESS
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1925

THE AMERICAN MUSEUM OF NATURAL HISTORY

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Introduction

In November 1923 the writer discovered a human calvarium in Quebrada Chalan, Punin, near Riobamba, Ecuador. He was at that time leading a field party of the American Museum of Natural History engaged in a reconnaissance of the Punin ash-beds. This field-work was part of a regular plan for the study of the mammals of Ecuador by the author, and the investigation of the fossil-bearing horizon was made possible through the generosity of Mr. Childs Frick, who financed the work at Punin.

Punin is a small village near Riobamba, in Central Ecuador. It lies on the great interandean plateau and the vicinity has a mean elevation of somewhat more than 9000 feet. This region is within the sphere of influence of several extinct or quiescent volcanoes, as well as some that may be fairly classed as active. The great surface mantle of volcanic ash that overlies this area and which was apparently deposited, for the most part, in Pleistocene time, could have originated from any one or from several of these sources which include Chimborazo, Tunguragua, Altar, Sangay and the more remote Cotopaxi.

The Punin fossil field is by no means a recent discovery. Work has been done there at different times, but apparently no systematic attempt has been made to secure a comprehensive collection of the fossil fauna. An important paper on the Punin beds was published by Reiss and Branco[1] in 1883, based upon rather scanty material gathered by Reiss and Stübel, and Alfred Simson, in his *Travels in the Wilds of Ecuador*, 1886, (page 20), describes the abundance of fossil remains in the ravine near Punin.

The topography of the region is best described as a great basal plain above which rise low hills, greatly eroded, with steep ravines or *quebradas*, and with evidence of severe rain action in the sheer gashes which are cut into the slopes of ash. With regard to the Quebrada Chalan, where most of the fossils were found, it seems likely that the main topographic features were the same in Pleistocene time as they are today. That is to say, the Quebrada existed as such and the ash was deposited in a layer which can be seen to have followed the contours of the ravine. Differences in color show that the ash was laid down at different times and one thin stratum, very dark in color, furnishes a good clue as to deposition and sequence of the strata because it is unmistakable in appearance, regardless of the conditions of erosion. Furthermore, our

[1]Uber eine Fossile Saugethier-Fauna von Punin bei Riobamba in Ecuador. Pal. Abh. 1, heft 2, 1883.

rather superficial reconnaissance led me to believe that this black stratum always lay above the ash where fossils were found.

The bones were encountered in greatest abundance in the quebradas, notably the Quebrada Chalan and the Quebrada Taguan nearby. We had not the time to investigate other cañons, although informed by the natives that they had found bones there. The evidence would lead one to believe that all of the well-formed ravines of the region may hold remains of a fossil fauna. The open hillsides and the flat plains areas yielded nothing to induce extended search, and seemingly the bones were collected in the ravines either because volcanic activity drove the animals to seek shelter there, where gases and ashes overwhelmed them, or else forage conditions were such as to draw them into crowded concentration. I incline to the belief that the deposition of ash was a rapid one and that the fauna of the region was caught and preserved by a volcanic cataclysm.

Bones are found exposed all along the steep slopes of the quebradas where erosion has cut through the compacted ash. At first glance it looks as if the bones were badly scattered and that the streams had tumbled them about in great confusion. The limited amount of excavation which we made showed this impression to be unwarranted, for bones in situ were quite apt to be elements of a skeleton concealed within the bank. Wherever stream action had washed a skeleton out of the ash single bones were found lying on the surface and no association might be attempted for such a specimen. The stratum of ash which carries fossils is not very deep, but a few feet in most places, and although the aspect of this bed changes somewhat with the locality, being darker where water can seep into it, or denser or looser in texture as the case may be, still it can be easily recognized, as a rule, for what it is.

The human cranium was discovered by Mr. G. H. H. Tate, the field assistant, on November 2, 1923. The skull was in a low bank, directly over the water-course of the Quebrada Chalan, down which a trickle of water flows normally but which is subjected to torrential violence when rains are heavy. As soon as enough of the bank had been removed to see that the specimen was human, excavation was suspended and photographs were taken.

The bank at this point is about six or seven feet high and the ash rests upon a floor of syenite which is swept clear by the water. Consequently any bones that might be weathered out of the bank would be carried on down the quebrada by the first heavy rain. Most of the ash strata are compacted into a tuff, a tough, semi-elastic formation, but

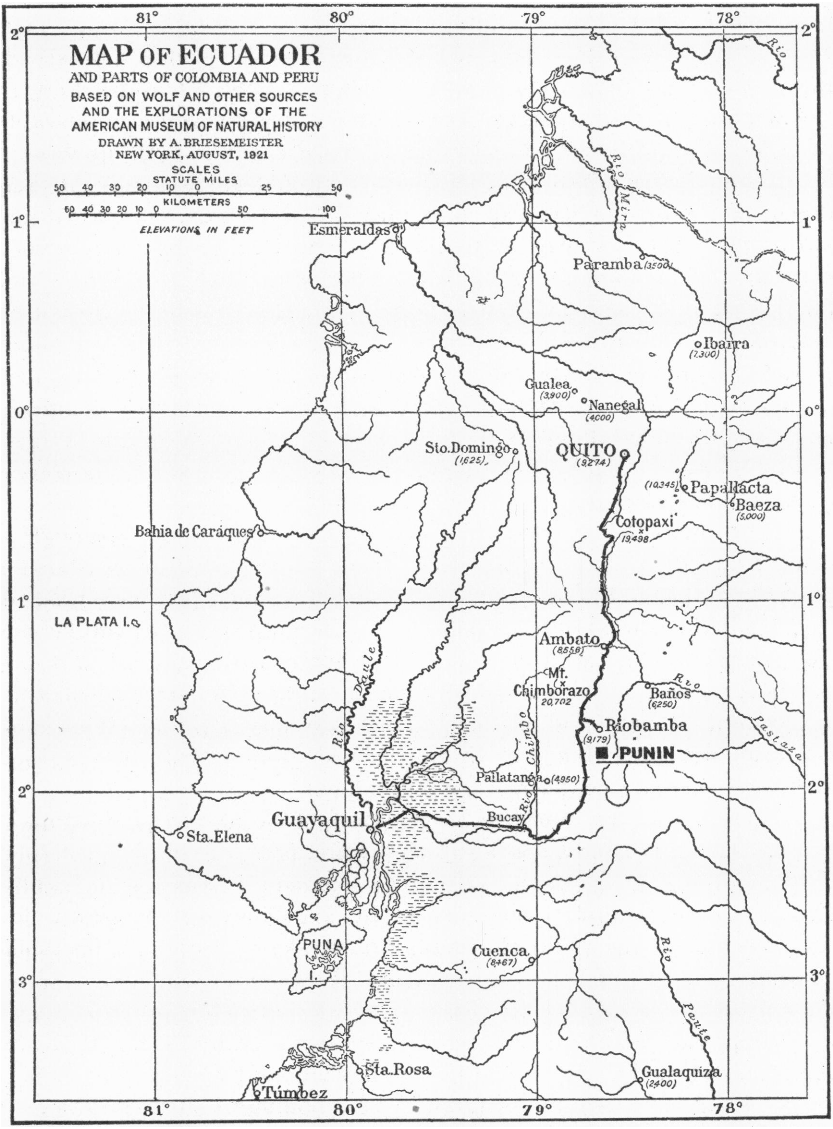
MAP OF ECUADOR
AND PARTS OF COLOMBIA AND PERU
BASED ON WOLF AND OTHER SOURCES
AND THE EXPLORATIONS OF THE
AMERICAN MUSEUM OF NATURAL HISTORY
DRAWN BY A. BRIESEMEISTER
NEW YORK, AUGUST, 1921
SCALES
STATUTE MILES
KILOMETERS
ELEVATIONS IN FEET
81°
80°
79°
78°
2°
1°
0°
3°
Esmeraldas
Paramba (3500)
Ibarra (7,300)
Gualea (3,900)
Nanegal (4000)
Sto.Domingo (1,625)
QUITO (9,274)
Papallacta (10,345)
Baeza (5,000)
Cotopaxi 19,498
Bahia de Caráques
LA PLATA I.
Ambato (8,558)
Mt. Chimborazo 20,702
Baños (6,250)
Riobamba (9,179)
PUNIN
Pallatanga (4950)
Rio Daule
Rio Chimbo
Rio Pastaza
Rio Mira
Guayaquil
Bucay
Sta.Elena
PUNA I.
Cuenca (8,467)
Rio Paute
Sta.Rosa
Gualaquiza (2400)
Túmbez

Fig. 1

where the calvarium was found a slow seepage has prevented this packing down of the ash and the formation is looser as well as quite damp to the touch. The skull was so damp when it was removed that it was exceedingly friable and broke under its own weight. After it had dried out in the air the texture of the bone became fairly dense and quite comparable with the bones of horses, camels, mastodons, etc., found in the quebrada.

While the remains of the Pleistocene mammalia are scattered up and down the Quebrada Chalan for many hundreds of yards, there are intervals where no bones may be found, although these gaps are not very extensive. The human cranium was found in one of these intervals and for this reason its association with horse, camel, and mastodon cannot be asserted as an incontestible inference. It is true, however, that the bones of these mammals can be found within from fifty to one hundred feet from this spot and throughout nearly three quadrants of the compass; and I should judge the bank to be of the same geological origin as these nearby bone-carrying beds, although somewhat disguised in appearance because of the seepage.

No human bones other than the cranium were found although a search, forced by the time available to be somewhat brief, was made deeper into the bank. Any parts of the skeleton which may have washed from the bank could not have remained on account of the stream below. The position of the skull, inverted with the tooth-row upward, was not that of a normal burial, and the absence of other bones strengthens this impression. Weighing all of the evidence carefully, I think serious consideration must be given to the implied contemporaneity of this cranium with the Pleistocene species of the Punin beds.

There can be no doubt as to the Pleistocene nature of the Punin fauna. The commonest species of the region is a true horse, probably *Equus andium.*[1] Teeth of the Andean horse are quite common and skulls with more or less complete skeletons are by no means rare. Probably the most spectacular element in the fauna is the Andean mastodon, *Dibelodon andium.* A tooth of this huge creature was secured and occasionally portions of the large skeletal elements of the mastodon were seen exposed along the quebrada. A good-sized species of ground sloth, *Mylodon sp.?* occurred in this region in Pleistocene time and we found its bones and collected them in numerous spots. Less abundant than the Andean horse, but a characteristic animal of this period is the so-called camel, *Protauchenia,* which is found sparingly in the Quebrada Chalan. Other forms, collected either by the American Museum party or by Reiss and

[1]As soon as the Punin material has been cleaned for examination a report on the fauna will be published and more definite identifications given.

Stübel, include *Arctotherium* sp.?, *Smilodon*, sp.?, a cervid, a canid, and representatives of present day genera such as *Sylvilagus*, *Oryzomys*, etc. As it exists today, the Punin region is poor faunally, compared to the Punin of Pleistocene times.

H. E. Anthony,
Associate Curator, Department of Mammology.

Craniology

When turned over to the Department of Anthropology for craniological and craniometric analysis, the calvarium was broken into many pieces. The fragments, however, were rather large, for the most part, and the calvarium was reconstructed very satisfactorily by Mr. S. Ichikawa, under the supervision of Doctor Milo Hellman. While several portions are still lacking, the calvarium, as restored, is a very satisfactory craniological and a fairly satisfactory craniometric specimen (Fig. 7). It has been catalogued as number 99–8271.

The sex of the calvarium is not clear. We have somewhat hesitatingly designated it as that of a female of mature years. In several features it approaches masculinity, but a majority of its features indicate the opposite sex.

In norma verticalis it is ovoid in form (Fig. 7c). The parietal eminences are moderately prominent. The coronal suture is of medium complexity and beginning to disappear. The sagittal suture is also moderately complex and its ramifications average more than a centimeter in width. About 3 centimeters posterior to the bregma the region of the suture becomes a shallow groove which widens into a conspicuous fossa in the region anterior to the obelion. The occipital portion is very prominent. There are extensive grooves on the right and left sides of the frontal bone.

In lateral view the general lowness of the cranial vault and face are the most noticeable features (Fig. 9). The face is somewhat projecting. The sagittal contour rises in a low arc from the metopion to the vertex which is about midway between the bregma and the obelion.

In facial view one is struck by the very low face and low orbits (Fig. 7b). The glabella is moderately well developed and the supraorbital ridges extend slightly beyond the mid point of the superior orbital border. The glabellar and supraorbital development is not marked for a male, but is marked, if the specimen is female. The vault is somewhat scaphoid in frontal view, although the acute arching of the vault is not striking until the vertex is reached. As noted above, the orbits are very low and widely rectangular in shape. The lower border of the nasal aperture is infantile in form. The crista lateralis (Gower) does not fuse with the crista spinalis but divides about 5 millimeters below the floor of the aperture and sends a branch to each of the upper incisors. In this view too will be noted the upper left permanent canine which appears in the

frontal process of the maxilla. The tooth is reversed with the apex of the root near the root of the upper left first premolar and the cusp point on a level with the lower border of the orbit. The lingual surface is turned facially.

A portion of the basal region is lacking, especially the greater part of the basi-occipital and the sphenoid. As remarked in the vertical view the occiput is well developed. There is a well marked occipital torus. The mastoid processes are very small. The tympanic plates are both perforated.

The dental arch is rather diminutive in size and in form. This is not due to the size and form of the teeth constituting it, but rather to the anomalous condition associated with the congenital absence of the third molars and to the malposition of the left canine. Thus, while the lack of the molars shortens the dental arch antero-posteriorly, the absence of the misplaced canine reduces it in width. (Fig. 8.)

The teeth present are of unusually large size. They are considerably longer, though about the same width, as the average Australian teeth, which assume unusually large dimensions. The character of wear of the teeth corresponds closely with that seen in Australian dentitions. In certain Australian skulls the premolars and molars present either planes, convexities, or very slight concavities on the occlusal surfaces when the teeth are considerably worn. These surfaces nevertheless remain at or close to right angles of the long axes of the teeth. In American Indian teeth, on the other hand, the occlusal surfaces after wearing down, are at an acute angle on the buccal and at an obtuse angle on the lingual side to the long axis of the teeth.

Although the calvarium has been partially restored, it lends itself to fairly accurate measurement. The basion is lacking and all measurements from this point are estimates, based on measures taken with the basion restored in clay. Width of face and width of nose were obtained by measuring the distance of the left zygion and the most exterior point of the left border of the nasal aperture from the median sagittal plane and then multiplying these values by two. The angles have been read directly with Mollison's craniophor and Ansteckgoniometer. The measurements were taken independently by Sullivan and Hellman and then checked over together. Where discrepancies and differences appeared the diameter was re-measured by them together and the most probable measure obtained. The measures obtained were:

Cranial capacity, estimated by formula	1275????cc.
Maximum length	186mm.
Maximum breadth	132
Basion-bregmatic height (basion restored)	124????
Ear-bregma height	109
Ear-vertex height	115
Minimum frontal diameter	89
Basion-nasion (basion restored)	93????
Basion-prosthion (basion restored)	97????
Maximum bizygomatic width (X2)	125??
Upper face height	60
Nasal height	42
Nasal width (X2)	25??
Orbital width from maxillo-frontale	41
Orbital width from dacryon	40
Orbital width from lacrimale	39
Orbital height	29
Maxillo-alveolar length	53
Maxillo-alveolar width	58
Angles	
Profile angle—Nasion-prosthion—eye-ear plane	80° to 81°
Alveolar angle—eye-ear plane	66°
Bregma-nasion—eye-ear plane angle	52°
Bregma-glabella—eye-ear plane angle	47°
Indices	
Length-breadth	71.0
Length-height	66.7????
Breadth-height	94.0????
Length-ear height (bregma)	58.6
Length-ear height (vertex)	61.8
Modulus	147.0??
Transverse fronto-parietal	67.5
Alveolar projection	104.3????
Cranio-facial transverse	94.5
Upper facial	48.0?
Nasal	59.6?
Orbital (maxillo-frontale)	69.2
Orbital (dacryon)	72.5
Orbital (lacrimale)	74.4
Maxillo-alveolar	109.3

Our problem, as we see it, is to allocate this calvarium racially. The ideal way to approach such a problem would be to have been given a skull with all data of location withheld. This would eliminate the possibility of prejudice which is sure to exist once the locality of the find is known. In our own case these ideal conditions were not met. The calvarium was turned over to us with the definite information that it was

an American skull from Ecuador. This information, of course, immediately prejudiced us against the possibility of its being other than ordinary American Indian remains. But in spite of this prejudice we could not escape the conclusion that the calvarium was definitely Australoid in appearance. This is suggested very strongly by the cranial vault and the facial region. The glabellar region, the orbits, and even the nasal region suggest this. The form and wear of the teeth also recall Australian teeth.

We realized that superficial resemblances are often misleading and that detailed analysis sometimes reveals marked differences which have been overlooked. But in this instance at least the metric analysis bears out our first impressions. Practically every index points to the Australoid norm. If we select a dozen of the most definitive indices and measures (cranial capacity, length-breadth, length-height, breadth-height, fronto-parietal, gnathic [alveolar-projection], transverse cranio-facial, upper facial, nasal, orbital, maxillo-alveolar indices and facial angle) and plot their distribution in different cranial series in the form of curves, we find that the calvarium in question best fits the norms of cranial series from Tasmania, Australia, and New Guinea. In America crania of this type are rare, but it most closely approaches the norms of the Pericue (Lower California), Lagoa-Santa (Brazil), and Paltacalo (Ecuador) material. It approaches much less closely the Santa Catalina, California mainland, Virginia, and New York State Indian series. It is most reasonable, of course, to say that it probably belongs to what has been quite widely described as the Lagoa-Santa type (Lagoa-Santa, Pericue, and Paltacalo material). However, it differs very markedly from the average of this type in the low cranial vault and the low orbits. The low face and nose also approach the extreme limits of this type. In these very characters, of course, it approximates most closely the Tasmanian and Australoid norms.

We believe that if the calvarium in question were presented to physical anthropologists, with no data or hints as to its origin, a majority of them would say that it was Australoid or at least that the chances of duplicating it were infinitely greater in Australia and Melanesia than in any other part of the world. This was our reaction to it, and a physical anthropologist of experience upon whom we were able to try the experiment outlined above, said, without hesitation, that the skull was Australian. We have also been able to duplicate it more closely in our collection of Australian and Melanesian crania than among our American crania. While it undoubtedly is American in the sense that the Lagoa-Santa,

Pericue, and Paltacalo material is American, it is not a common American calvarium. After all, the Lagoa-Santa type is not common in America. It has been found very sporadically.

If we accept the statement that the Punin calvarium under discussion is very probably of the Lagoa-Santa type, we have simply pushed the problem back one step further, for there are very decided differences of opinion as to the racial affiliations of the Lagoa-Santa type.

The whole problem hinges on the conception of the racial affiliations of the American aborigines as a group. Hrdlicka, who has had greater opportunities and more experience than any one else with American somatic and osteological material, has repeatedly asserted that the American Indians, both living and dead, are fundamentally of one racial type. A typical statement of this author is that found in his *Early Man in South America*:[1]

> . . . The fact is that the American stem or homotype is not homogeneous; it presents in different tribes and localities the extremes of head form and also numerous other pronounced differences. Yet, the living Indian, as well as his skeletal remains, are characterized throughout America, from Canada to the limits of Tierra del Fuego, by certain fundamental traits that indicate unity in a more general sense of the word. This is not the place, however, to go into detailed enumeration and discussion of these traits. (Reference is here made to an earlier but not much more detailed discussion of this question). It may suffice to say that they apply especially to the facial features, the nasal aperture, the malar bones, the maxillæ, the base of the skull, the teeth; but they extend also to certain characteristics of the vault itself and beyond that to the forms and relative dimensions of numerous parts of the skeleton. This general American type is more or less related to that of the yellow-brown peoples, wherever these are found without decided admixture with other strains. These yellow-brown people, including the American, represent one great stream of humanity. In this way it is explainable how the crania from Brazil, and again those of southern California, with still others, have been found to present resemblances to the Polynesians, or even to some of the less negroid Melanesians; it is a basal or *souche* relation, and the Americans may well be wholly free of any connection, except the ancient parental contact with these branches.

This opinion, coming as it does from a leading American physical anthropologist, is widely accepted in America, especially in so far as it applies to the well-known tribes of living American Indians. It must be admitted by all who have studied American Indians in any detail that a majority of them are more or less completely mongoloid in their appearance. However, several non-American anthropologists have questioned this homogeneity of the living Indians. A large number have also questioned the homogeneity of the American stock as represented by skeletal material. Without going into detail and recounting all of these opinions

[1] *Bulletin 52, Bureau of American Ethnology* (Washington, 1912), 183.

it will be to the point to mention the opinions of a few of the leading anthropologists who have had doubts as to the homogeneity of American skeletal material, in general, and who particularly have claimed that the type under discussion (Lagoa-Santa) is not ordinary American Indian material.

Quatrefages,[1] Ten Kate,[2] Rivet,[3] and Soren Hansen[4] have expressed the belief that the Lagoa-Santa type is related to the Papuans and Melanesians. The opinions of such men as these must also carry weight. In so far as craniometric results testify, they bear out the contentions of these non-American authorities.

Only two conclusions are possible. Either we have, in certain parts of America, skeletal remains of a type basically related to those found also in Australia and Melanesia and fundamentally different racially from the prevailing mongoloid American Indian types, or we have a remarkable case of parallelism—parallelism sufficiently detailed to deceive physical anthropologists of very wide experience. At present it is not possible to decide which of these conclusions is closer to the truth. We need much more detailed studies not only of the skull, but of the other parts of the skeleton.

In so far as the calvarium under discussion is concerned, we can only say that there is absolutely no basis for excluding it from a series of Australian or Tasmanian crania and every reason for including it. It is quite possible that if we had the mandible and other parts of the skeleton our decision might be different. We wish to emphasize particularly the point that in claiming that this calvarium is Australoid we have in mind a basic racial relationship and do not believe that it necessarily represents migration from Australia or Melanesia. We feel that unless this is indeed a very remarkable case of parallelism, this type in America and the similar type in Australia and Melanesia are derivations of the same basal racial stock.

How largely this type is represented in the living Indians of today is not at all clear, nor are the tribes usually identified as its representatives entirely satisfactory as such.

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[1]Quoted by Soren Hansen in Footnote 4, below.

[2]Ten Kate, H., "Materiaux pour servir à l'Anthropologie de la presq'île Californienne" (*Bulletin Société d'Anthropologie de Paris*, 3rd series, vol. 7, Paris, 1884); Ten Kate, H., "Sur les Crânes de Lagoa-Santa" (*Bulletin, Société d'Anthropologie de Paris*, 3rd series, vol. 8, 240–244, Paris, 1885).

[3]Rivet, P., "La Race de Lagoa Santa chez les Populations Précolombiennes de l'Equator (*Bulletin et Memoires, Société d'Anthropologie de Paris*, 5th series, vol 9, 209–274; also 314–430 with R. Anthony, Paris, 1908); Rivet P., "Recherches Anthropologiques sur la Basse-Californie" (*Journal de la Société des Americanistes de Paris*, new series, vol. 6, 147–253, Paris, 1909).

[4]Hansen, Soren, "Lagoa Santa Racen" (*Samling af Afhandlinger, Museo Lundii*, vol. 1, part 5, 1–37, Copenhagen, 1888).

We have not touched upon the age of the calvarium in question because we feel that this is not within our province. The day of anatomical determination of age is passing, particularly in America. Age is a matter to be settled by the geologist and archæologist. We can only say that this specimen is quite clearly *Homo sapiens* and no more closely related to *Homo primigenius* than many other modern races.

The interesting points, as we see them, are the racial affiliations of the type and the fact that in several instances this type has been found under the suspicion of being old, archæologically at least.

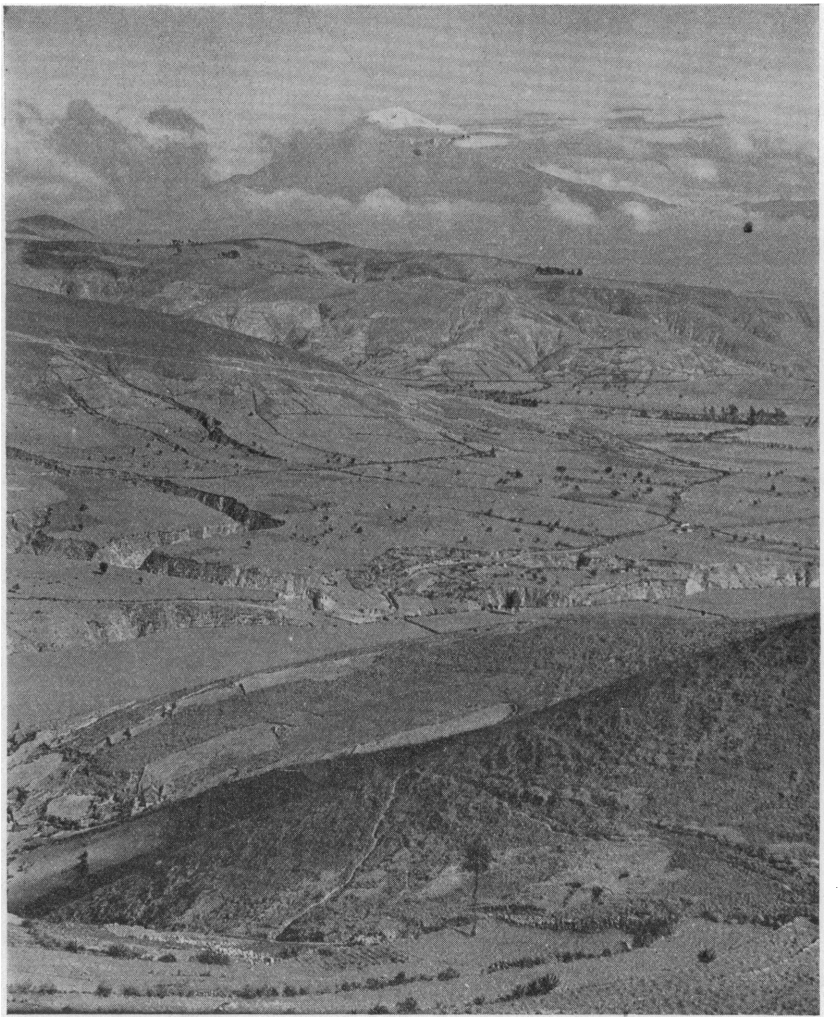

Fig. 2. General Topography of the Punin Region. The village of Punin lies just beyond the left-hand margin of the picture, in the valley. The mountain in the background is Chimborazo.

Fig. 3. Ash-Beds of the Quebrada Chalan showing Erosion. Fossils occur in this type of formation.

Fig. 4. Water Hole in the Quebrada Chalan. The human cranium was in the low bank which enters the picture at the left.

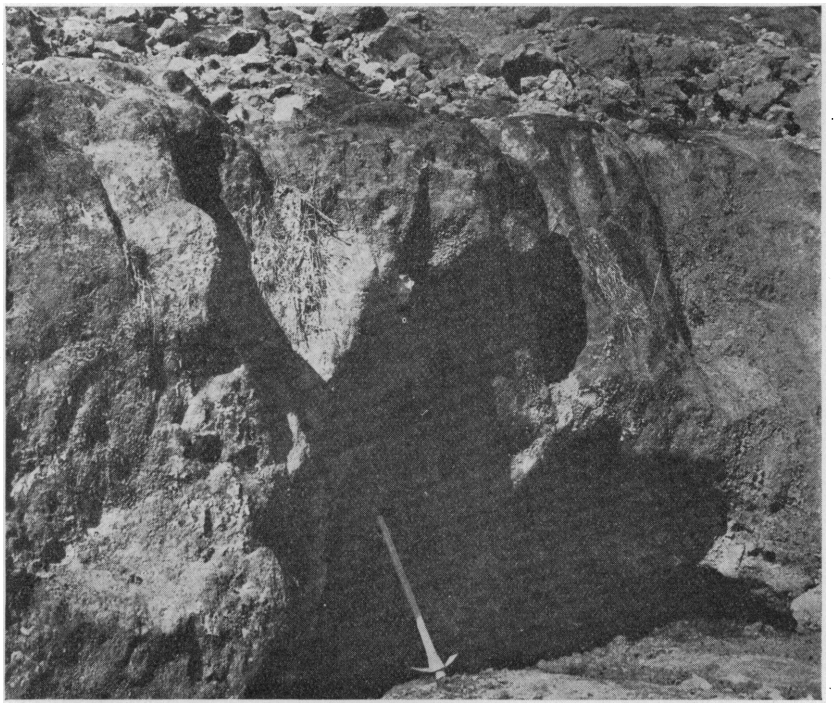

Fig. 5. The White Object, above the Pick Handle, is the Human Calvarium in situ, before the Bank was disturbed.

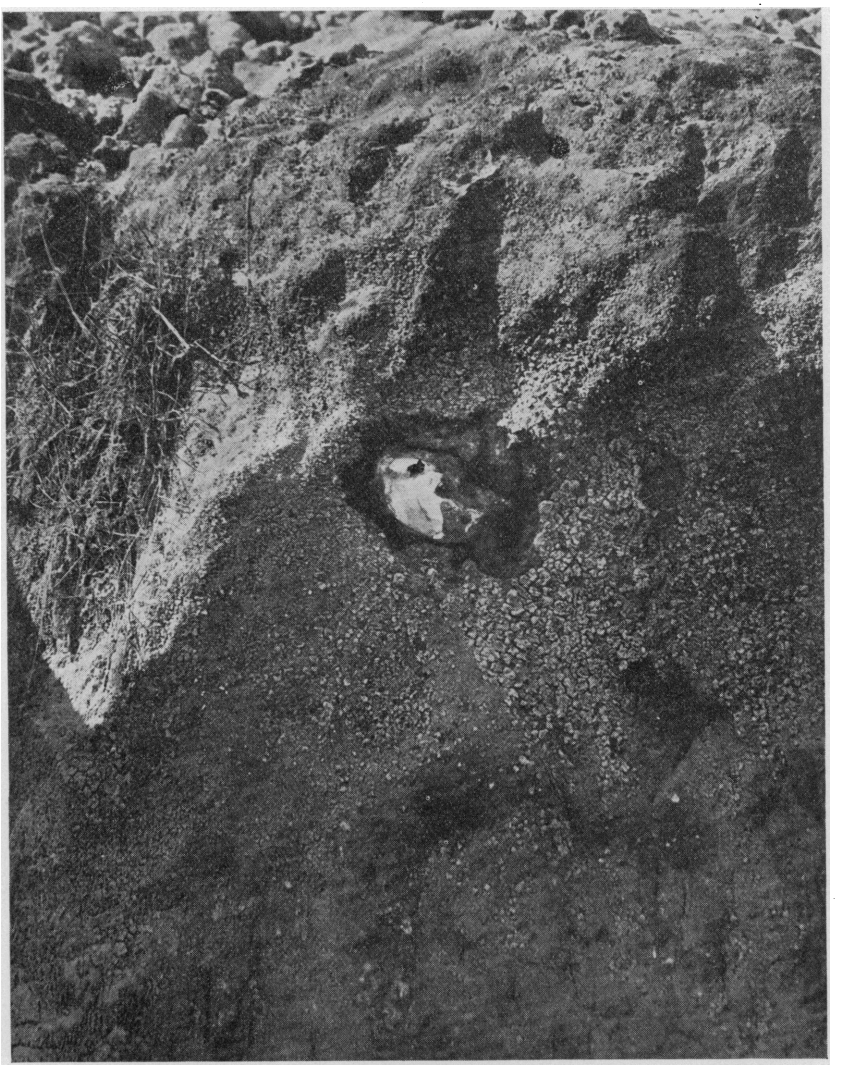

Fig. 6. Skull as it appeared before Excavation had gone very far. The white surface is the original exposure.

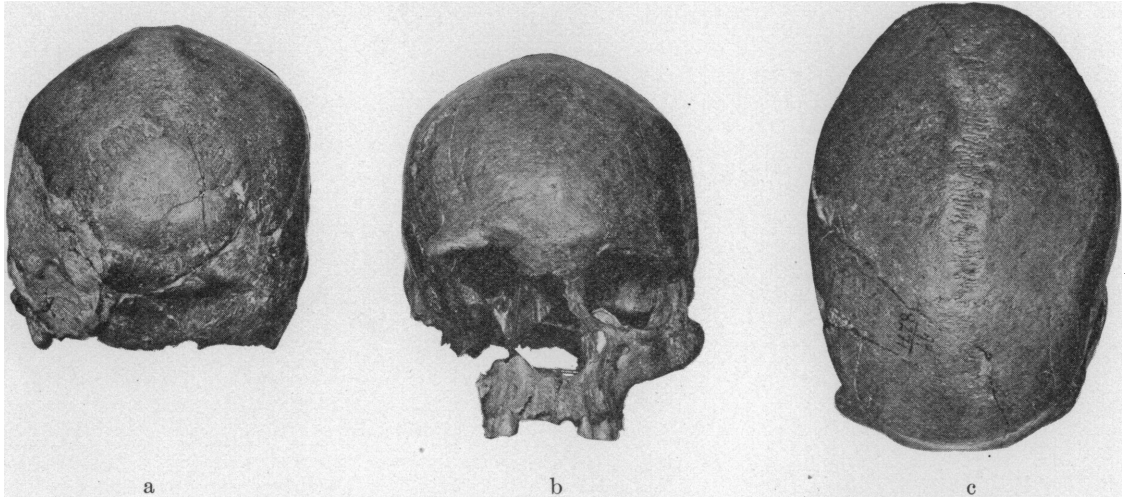

Fig. 7. The Calvarium: a, Norma Occipitalis; b, Norma Frontalis; c, Norma Verticalis

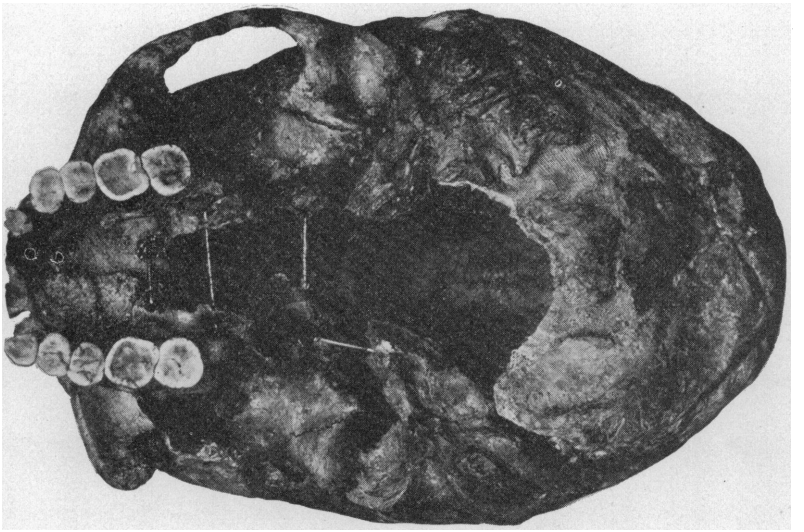

Fig. 8. The Teeth and the Palate.

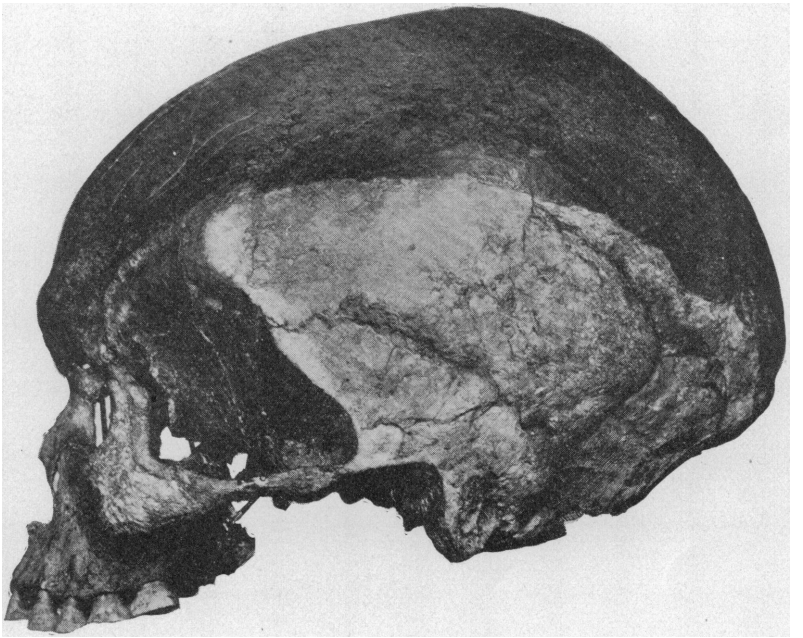

Fig. 9. The Calvarium, Left Side. The light colored area discolored by exposure.

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