The Fossil Human Skull Found at Talgai, Queensland.

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(From the Department of Anatomy, University of Sydney.)

[Plates 12–18.]

Contents.

I. Introductory.

Situated in the Darling Downs of Southern Queensland, in the vicinity of the town of Warwick, are a series of alluvial flats, watered by the tributary creeks of the Condamine River, which is itself a branch of the Darling. One of these creeks, the Dalrymple, winds a tortuous course through the black-soil country, a few miles north of Warwick, and traverses Talgai Station. In the year 1884, after exceptionally heavy rains, the creek came down in strong flood and overflowed the flats to a width of over half a mile. When the floods subsided, it was found that an old water course or "billabong" had been washed out, leaving a channel about ten feet in depth. A fencer who was at work at Talgai at this time, while traversing this freshly washed-out channel, had his attention arrested by what seemed to be a curiously shaped stone in the side of the cut, lying embedded by itself, not at the bottom, but about three feet up the side. It was firmly fixed in the clay, and in dislodging it he formed the opinion that it had not been recently disturbed. When he had freed it, perceiving that it was a skull, he took it to the proprietor of Talgai Station, from whose son it passed into the possession of Mr. E. A. Crawford, of Greenethorpe, New South Wales. This gentleman, in May, 1914, submitted a photograph of it to Prof. Edgeworth David, F.R.S., Professor of Geology in the University of Sydney, who showed it to Prof. J. T. Wilson, F.R.S. He, immediately perceiving the possibilities, expressed a strong desire to have the specimen itself forwarded to Sydney. This having been done, the preliminary investigations were immediately commenced by Profs. DAVID and WILSON, and the results communicated to the British Association for the Advancement of Science in Sydney, in August, 1914 (1).

Shortly after this, Prof. DAVID made a journey to the site of the discovery. He was fortunate enough to find the original discoverer, who, though a very old man, retained a clear recollection of the circumstances of the find. He visited the locality, and, with a memory still clear as to the local conditions, pointed out to Prof. DAVID, to within a few yards, the spot in the gully where the skull was unearthed. His account of the discovery was as just related, and he was able to identify the formation of red-brown clay, interspersed with nodular concretions of carbonate of lime, as identical with that from the upper portion of which the skull was originally removed.

Two strata are present here. The superficial stratum is a pure black soil, 6 or 7 feet deep at Talgai, covering a deeper one of red-brown clay containing numerous whitish lumps, of the size of small potatoes, of carbonate of lime. It was apparently at the upper level of this deeper formation that the skull was found. It had probably been lying here, covered by 7 or 8 feet of black soil, until exposed by the flood waters.

No bones of extinct animals have yet been found at Dalrymple Creek, but large numbers of extinct marsupial bones, namely of *Diptrotodon*, *Notelephas*, *Nototherium*, and *Megalania*, have been unearthed from precisely similar formations in various situations in the Darling Downs, notably in other creeks of the Upper Condamine such as King's Creek (fig. 1), 10 miles distant from Talgai, at Pilton and Ravensthorpe Station. Mr. R. W. FROST, of Toowoomba, has been mainly responsible for these discoveries, and many of the fruits of his labours in this district are now in the Brisbane Museum. The condition of these extinct marsupial bones from King's Creek, etc., and their state of fossilisation, is strikingly similar to that of the Talgai skull, as many competent observers present at the Australian Meeting of the British Association can testify. Mr. FROST states that he "has found fossil bones in this region at depths varying from 3 to 30 feet. Those found in the black soil are invariably quite black, but the extinct marsupial bones are usually to be found in the underlying clay and are much lighter in colour." The incrustation on the Talgai specimen had no trace of blackness about it. Similar formations containing bones of extinct marsupials have been found at intervals along a line running from the Upper Condamine River, across Queensland to Lake Callabonna and Lake Eyre in South Australia.

It is obvious, however, that, under the circumstances of this discovery, no absolutely certain evidence exists as to the exact level at which the skull was located. It is unfortunate that, owing to Prof. DAVID's departure on active service, he has been prevented from supplying as full an account of the geological aspect of the discovery as his investigations would permit. The above remarks have been, however, compiled entirely from his notes.

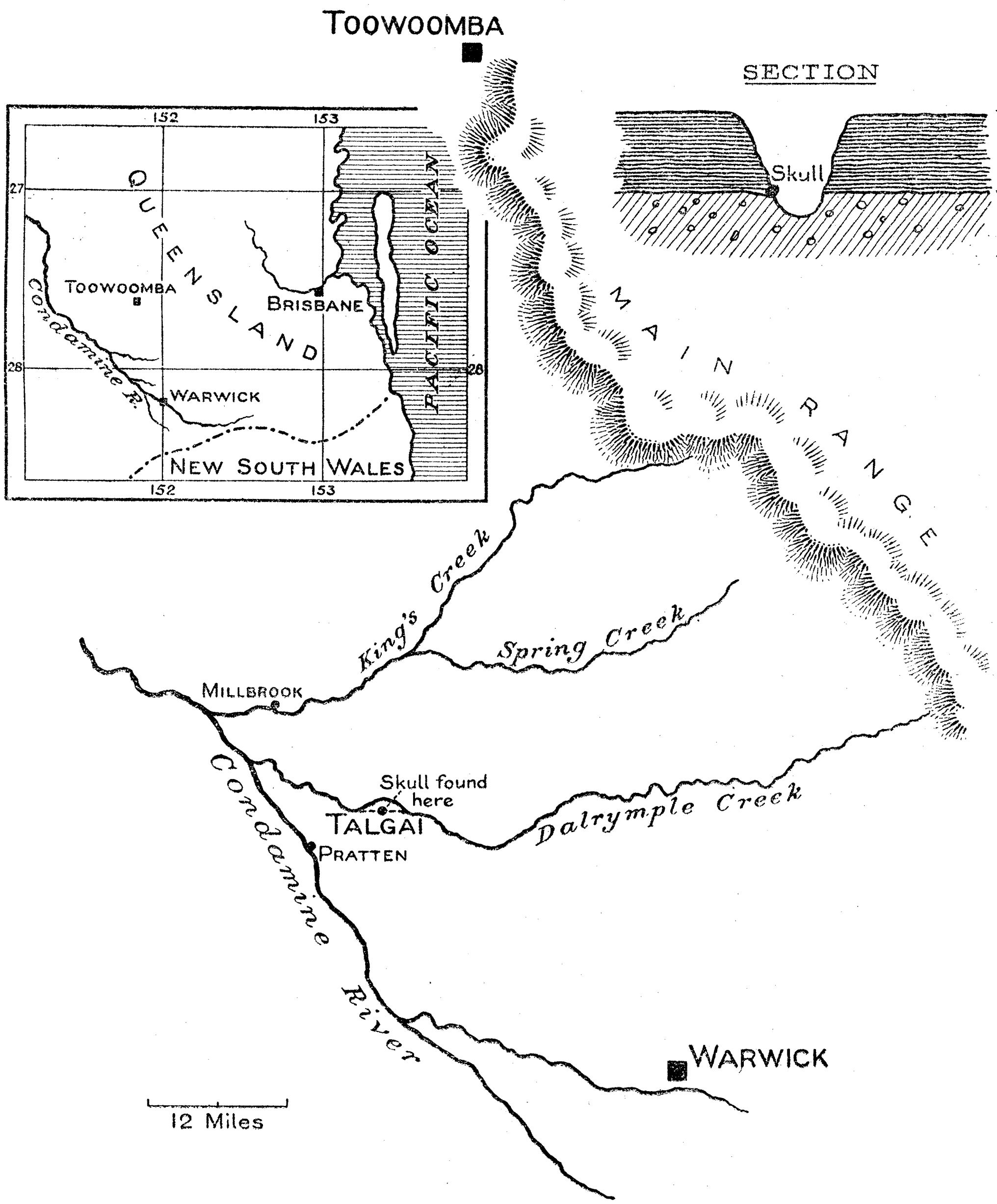

FIG. 1.

In view of the inconclusive nature of the geological evidence, the anatomical investigation of the skull becomes of paramount importance. Prof. J. T. WILSON undertook the preliminary investigations. He subjected the specimen to minute scrutiny and obtained dioptographic tracings of the various normæ of the skull, from which some conclusions were tentatively drawn. Further development of the specimen, which at that stage was not permitted, has revealed that his conclusions, though having to be modified in some details, such as the recognition of certain of the landmarks, notably bregma and inion, were substantially correct.

Before any further and more accurate investigations could be made, it became imperative that the specimen should become the property of some scientific institution, so that no obstacle to its thorough study should arise. Accordingly, with ready generosity, the Hon. JOYNTON SMITH, M.L.C., purchased the skull from Mr. CRAWFORD for a very considerable sum, and presented it to the University of Sydney. Prof. WILSON had, meanwhile, been forced to relinquish his anatomical work temporarily, owing to his absence on military service, and with great unselfishness, handed the skull to the present writer for further study and description, the results of which form the subject of this communication.

I have here to record my gratitude to Prof. WILSON, not only for this opportunity, but also for constant help and advice during the conduct of this work. I wish also to acknowledge the very considerable help which I have received from Mr. R. ETHERIDGE, Junr., Curator of the Australian Museum, and his staff, for courteously placing at my disposal the very fine skull collections under his charge; from Mr. D. M. S. WATSON in the development of the fossil; from Drs. HERSCHELL-HARRIS and SEAR for the extreme care they took in overcoming the difficulties in getting satisfactory radiographs, and from Mr. L. SCHAEFFER, the chief laboratory attendant, for his excellent photographic work.

II. CONDITION AND DEVELOPMENT OF THE FOSSIL SPECIMEN.

In the undeveloped fossil, the cranial and facial portions of the skull were apparently fairly complete, except that the mandible was missing. A hard mineral incrustation, consisting of carbonate of lime coloured with iron salts, covered the specimen almost completely, the actual surface of the bone being revealed at a few points only. This incrustation was not, however, sufficiently thick to mask the general characters of the specimen, the "Australian" facial appearance of which was immediately obvious. The injury which the skull had sustained was only partially revealed at this stage. The cranial cavity was completely filled with an earthy deposit which made the whole specimen extremely heavy. In this condition it was possible to recognise, without doubt, the positions of the glabella, nasion and prosthion, the general shape of the maxillary and palatal regions, and the characters of those elements of the upper dentary arcade which still remained; and it seemed probable that such points as the bregma, inion, lambda, basion and opisthion could be conjectured with some probability (Plate 12, figs. 8, 9 and 10). It was only after the purchase of the skull, however, that further development of the specimen became possible. It was then decided to divide the skull, and a line was accordingly determined which seemed approximately to coincide with the median plane, and along this plane the skull was sawn with a fine lapidary's saw. Unfortunately, this operation was not carried out with complete success. The intention was that the skull should be divided by one straight cut along the determined plane; but owing to a slight fault in technique, some overlapping of the posterior and anterior ends of the cuts resulted in the region of the basi-sphenoid and basi-occipital bones. The effects of this, however, were not serious and were remedied to a large extent in the subsequent development (Plate 14, fig. 14).

After division, the cranial cavity was found to be filled with a mass of earth, which consisted of brown mud interspersed with a few small nodules of lime. When this was removed by scraping, it appeared that the endo-cranial surface of the bones was invested by a hard mineral incrustation similar to that seen on the outer surface. This was carefully and laboriously removed by fine chisels and an electric drill, the skull being supported in plaster of paris so that fractures occurring during these operations could be minimised, and, when occurring, could be repaired with glue without any disturbance to the previously existing relationship of the parts. The incrustation of carbonate of lime varied very considerably in extent, being as thick as 8—10 mm. over some portions of the skull, notably over the more irregular portions of the base. In a few small areas in the frontal region only, the bone surface was bare, the incrustation having been present here probably at some previous time, but having been accidentally chipped off. The matrix was very hard and brittle, but a definite plane of cleavage was easily developed by suitable use of the tools, disclosing the actual surface of the bone.

The process of development was carried out by the writer, with the invaluable help and advice of Mr. D. M. S. WATSON, who, by great good fortune, happened to be in Sydney at this time, and, at some critical times, with the patient assistance of Dr. B. COEN, the Senior Demonstrator in Anatomy. The process occupied some months. Practically no damage resulted to the skull in development; dioptographic tracings of the developed specimen coincide accurately with those taken in the same plane by Prof. WILSON before development, and comparison of photographs of the cut median surface before and after the removal of the matrix reveals no distortion or displacement arising during these manipulations.

After the incrustation had been removed, the skull was found to be very highly fossilised and brittle. The specific gravity of a piece of the right parietal bone, free from earth and powdered, is 2·79 at 20° C./20° C. The amount of organic material remaining in the bone was carefully estimated by Prof. CHAPMAN, of the Department of Physiology, and found to be 3·60 per cent. This investigation will form the subject of a supplementary note to be published shortly.

The X-rays, in a prolonged exposure with a photographic plate, were able to penetrate the thicker parts of the skull to a markedly smaller extent than is usual with modern and many fossil skulls, such as those of Piltdown, Krapina, Shipka, Predmost, Spy (2), etc. A comparison of these radiographs with those of the Talgai skull (Plate 17, figs. 23 and 24) shows that, so mineralised is the latter, an exposure which penetrated the dental tissues to a very high degree was only just sufficient for the bone, a very striking reversal of the usual condition.

III. Description of the Developed Specimen.

The removal of the incrustation revealed at once that one had to deal with the much fractured, highly fossilised skull of a male youth, and it is immediately apparent that, in a skull whose dentition, if it had been that of a modern human being, would have warranted an estimate of 14 to 16 years as the probable age, there are exhibited many of the rugged characters of the adult. The cleaning further revealed the extensive character of the injury the skull had undergone in the course of its history, and rendered it necessary to review those conclusions which had, quite tentatively, been arrived at previously.

The *right side of the cranium* shows a large *post-mortem* fracture extending from the base of the skull to the region of the sagittal suture. This is associated with considerable dislocation of the right temporal and portions of the right parietal bones. The right half of the specimen was divided by this fracture into two separate pieces, which, in the developed specimen, are held in their pre-existing position by a mass of plaster of paris (Plate 14, fig. 12).

The posterior of these two portions is extensively broken, large separate fragments being held in position by the earthy matrix. The anterior half of this right side has been subjected to a considerable shear, which has flattened out the temporal fossa and the lateral part of the frontal region, and disturbed the right orbit and zygomatic bone, but influenced comparatively slightly the right maxilla.

The *left side* has apparently suffered far less gross injury, the most obvious defects being the presence of a hole, approximately 25 × 50 mm. in its main diameters, in the region of the squama temporalis (Plate 15, fig. 15, A), and the loss of the middle part of the left zygomatic arch.

Other injuries upon this side of the cranium which are immediately manifest consist of overlapping of large fragments of bone at the vertex and the comminution of the bones in the posterior and inferior parts of the parietal region.

Further investigation, however, reveals the presence of a severe injury to the occipital region, which is described hereafter. The foramen magnum has, unfortunately, suffered injury, its whole contour having been destroyed, leaving a large irregular orifice, 38 × 45 mm., in its sagittal and coronal diameters (Plate 14, fig. 14).

Over and above these gross injuries, all the cranial bones are extensively brecciated, the condition resembling a coarse mosaic, in which the bony fragments are held in position by thin layers of matrix cementing them together. The general contour of some of the bones, especially upon the left side, appears to have been disturbed comparatively little. The cranium had obviously been subjected to great earth pressure when the cavity was full of a solid substance such as the earth the specimen originally contained. This has resulted in the bones being cracked *in situ*, the whole brain-case "giving way" along certain lines, where one segment had been caused to overlap another.

The *facial skeleton* is, fortunately, better preserved. The main injury, as already mentioned, involves the right frontal and zygomatic bones and the right orbit (Plate 14, fig. 13). This affects the right maxilla, as a whole, but slightly. The left side of the face is in a very good state of preservation, except that the left canine tooth has been driven up into the alveolar border, and the maxilla fractured thereby.

The pyriform aperture of the nose is comparatively well preserved, except along its upper margin. The left zygomatic bone has suffered only slight injury. The palate is deficient in its posterior portion. Eight teeth are present *in situ* and well preserved; the two wisdom teeth, though unerupted, have been partly revealed in the development of the specimen, and the separated crowns of two other teeth accompany the main specimen.

A. *Cranium.*

In embarking upon any detailed study of the brain-case, a few observations only can be made, on a superficial examination, with ease and certainty. The glabella and nasion can be identified without doubt. A close examination of the region of the posterior margin of the foramen magnum shows clear continuity of compact bone from the endocranial to the outer surface, enclosing unbroken diploe, so that probably the opisthion has just been preserved (Plate 15, figs. 15 and 16). More careful study reveals, however, good evidence for identifying other important points and sutures. The left zygomatico-maxillary suture is, indeed, the only undisturbed suture in the skull, but it is important as showing the possibility of the recognition of sutures in any uninjured part of the skull, fossilised, as it is, to such an extent. The most careful scrutiny of the bony surface fails to reveal any other uninjured suture. But, since the brain-case has obviously given way under earth pressure, and some areas have been caused thereby to overlap others, one would anticipate that these conditions would be most obvious in a youth's skull along the sites of the larger sutures. On the left side there are apparent two well marked fractures, running upwards and backwards towards the region of the sagittal suture (C and D, Plate 13, fig. 11, and Plate 16, fig. 17). The posterior of these (C) is the more salient. The overlapping here is greater, and it may be traced down very definitely to join a horizontal fracture at the site of the parieto-squamous suture (*p.s.s.*, fig. 11). The anterior fracture (D) is indistinct in its lower part, where the skull is very broken, but clearly leads down towards the lateral angular process of the frontal bone, and is, therefore, too far forward for the coronal suture. An examination of the bones in this region makes it clear that the coronal suture must be situated either at C or D, and it may be, therefore, definitely allocated to the posterior position (C). This determination is very strikingly confirmed when a dioptographic tracing of the skull is superimposed on similar tracings from recent Australian Aboriginals (fig. 25, p. 384).

At the upper end of the suture the bone has been considerably comminuted, so that the bregma is not accurately determinable, although its site is very obviously limited to a small area (B, figs. 11 and 17).

The coronal suture may be traced downwards to a point (P), where it turns in a rounded angle into the parieto-squamous suture. The parietal bone has possibly been broken away to a slight extent along this bevelled margin, the depression of the squama temporalis below the level of the parietal being thereby made possible. The *frontal bone*, whose limits are thus defined, has escaped injury in its supra-orbital portion, except close to the lateral angular process, where an unimportant fracture runs up from the supra-orbital margin to the median plane (Plate 14, fig. 13). The bone is quite unbroken for a distance of 55 mm. from the nasion, which is itself uninjured, and is depressed in the manner so characteristic of Australian crania. The lateral angular process has been undisturbed, but the bone immediately behind it has been extensively brecciated, so that it is impossible to trace the beginning of the temporal lines. Approaching the bregma, comparatively large portions of the bone have been depressed. This has resulted in producing some prominence at the actual bregmatic region, which is probably artificial. It is clear that the forehead is receding, tubera frontalia are absent, the lateral angular process is slender and not prominent, and no supra-orbital prominence is present. In the median cut surface no frontal sinus is discoverable. The poor supra-orbital development is probably to be explained by the youth of the skull.

The sagittal suture is not distinguishable either on the external or endo-cranial surfaces of the skull, the injuries having been very severe in this region.

The parieto-squamous suture has already been recognised at its anterior end. Posteriorly, the parieto-mastoid suture is clearly distinguishable (Plate 13, fig. 11, *p.s.s.*, *p.m.s.*), the mastoid bone being comparatively uninjured, although the mastoid angle of the parietal has been depressed below the level of the other bones in this region. The identification of the posterior inferior angle of the parietal (asterion) is confirmed by the study of the endocranial surface, the sulcus for the transverse sinus being intact here. Between these two points the parieto-squamous and parieto-mastoid sutures can be traced except in the area near their junction, where the skull is considerably brecciated, but the appearances strongly indicate that the line of the former suture was decidedly curved when traced posteriorly, and formed a marked angle with the latter suture, the condition found in most modern skulls, and contrasted with the straight horizontal course of these sutures seen in some primitive Australian and anthropoid crania.

The left half of the lambdoid suture can be recognised without doubt. The right side of the cranium is so injured in this region as to be valueless for the purpose. On the left side there is no sign of an uninjured suture, but there are two horizontal fractures (Plate 16, fig. 18, L and I) which have to be considered. At both of these there is some loss of substance, but the overlapping is more considerable at the lower one, and its direction and relation to the opisthion is such that no doubt can exist that it represents the true line of the suture. Any attempt to regard the upper fracture (I) as the true site is immediately negatived by the quite abnormally anterior position that the lambda would then assume, and by the abnormally small size of the parietal bone which would result from such a position of the upper margin of the squama occipitalis. Furthermore, the superposition of the tracings, as in fig. 25, again strikingly confirms the recognition of the lower line as the lambdoid suture. The loss of substance of the bone, and the extreme overlapping at this suture, are not surprising when the very dentate character of this suture in most skulls is borne in mind. The division of the skull passes through the lambdoid suture at its highest point, which may justifiably be regarded as the lambda.

The *parietal bone*, thus delimited, has been very extensively damaged, to an extent which may be appreciated by viewing the cut surface (Plate 15, figs. 15 and 16). It is impossible to determine the presence or absence of the tubera parietalia, the position and condition of the temporal lines, and the contour of the cranial vault between them and the sagittal suture. If the recognition of the coronal and lambdoid sutures is correct, the parietal bone would appear to have been of similar size to that found in the majority of recent Australian skulls (fig. 25).

The *temporal bone* upon the right side is very considerably dislocated and fractured. Upon the left side, however, it has escaped injury, except in its squamous portion. Here a large irregular gap extends along the lower part of the temporal fossa, immediately above the root of the zygoma. It is particularly unfortunate that a deficiency should exist here, since this is the portion of the bone which forms the lower part of the middle cranial fossa, and therefore materially affects the endocranial cast in this important region. The remainder of the squama temporalis is somewhat depressed below the level of the parietal, which has evidently been caused to overlap here. The external acoustic meatus and the tympanic region are uninjured on both sides. The meatus is small and oval, its anterior and inferior boundaries being formed by a moderately thin tympanic plate. The bone at the root of the zygoma is seriously injured, but certainly no great development of a post-glenoid process has been present. The characters of the tuberculum articulare are, unfortunately, indistinguishable because of fracture. The mastoid and petrous portions of the bone are in an excellent state of preservation, but the region of the articulation with the occipital is too broken to render possible the determination of any important details of structure at this point. The mastoid process is noticeably small, a well-marked digastric groove (incisura mastoidea) being plainly apparent in a lateral view of the skull. On the endocranial surface the transverse sulcus is uninjured and very deeply impresses the bone. The petrous bone is well preserved, except at its tip. It is of large size, and the impressions of the cerebrum on its surfaces are well marked. Apparently, no foramen lacerum was present. The zygomatic arch has been broken in its central part and at its root, but the appearances suggest that it was extremely large and horizontal in its course.

The *occipital bone* has been so extensively injured by local fractures that the identification of any landmarks in this region is impossible. There exists no sign of the nuchal lines or of a transverse occipital torus, and all attempts to identify the inion are futile. Further, the dislocation *en masse* which this bone has suffered, as will be afterwards shown, renders any hypothetical recognition of this point, and the very probable identification of the opisthion, valueless as datum-points. The groove for the transverse sinus, recognisable in the sigmoid portion of its course, is quite indistinguishable on the endocranial surface of the occipital. The injury to the region of the foramen magnum has already been described (Plate 14, fig. 14). The occipital condyles have disappeared, and the basi-occipital is much fractured. The appearances suggest that this bone has also been displaced and the actual basion lost.

Only a few details of the *sphenoid bone* can be made out. The basi-sphenoid is much broken, as are also the alae parvæ, and fragments only of the upper parts of the pterygoid processes are present. The great wings are brecciated in their upper portions at the region of the pterion, so that it is not possible to describe the sutures here. No marked degree of post-orbital compression is present. The lateral surface of the great wings is directed sharply inwards (medially) when traced downwards.

Since the nasion and the glabella (and also the prosthion) are to be identified beyond all doubt, and since the lambda may be confidently recognised, the median plane may be determined with some degree of accuracy. Although the plane of division of the skull was determined when it was thickly incrusted and when one side was so obviously damaged and distorted, it fortunately coincided with the median plane, passing accurately through the prosthion, foramen incisivum, nasion, glabella, and lambda.

In so far, then, as the important landmarks are concerned, the nasion, glabella and asterion can be identified with certainty, all of them comparatively uninjured. The position of the bregma may be approximately determined. The basion is absent and the basi-occipital region damaged; the opisthion is present, but very definitely displaced. The inion is quite unrecognisable, as also is the pterion. The sites of coronal, sagittal, lambdoid, parieto-squamous and parieto-mastoid sutures are all identifiable. An examination of the regions thus defined reveals at once that the major fracture of the right side, with the attendant dislocation of the temporal and great injury to the occipital, parietal and sphenoid bones, renders this side of little or no value for detailed study, except in the supra-orbital portions of the frontal. Observations must, therefore, be mainly limited to the left side. The measurements in the accompanying Table have been determined mainly by reference to this side.

The cranial capacity was estimated by measuring the actual amount of water displaced by the endocranial cast of the left side and multiplying by two. This gave the figure 1250 c.c. The damage in the occipital region would necessitate the addition to this of at least 50 c.c. Since there are obvious depressions of some parts

TABLE I.—Measurements of the Talgai Skull.

	Talgai.	Averages of Australian Males (DUCKWORTH).
	mm.	mm.
Maximum length	192 (?)	188
Maximum transverse	141 (bimastoid)	132
Auriculo-bregmatic	105 (?)	
Minimum frontal	99	98
Maximum frontal	110	
Maximum bi-orbital width	—	108
Maximum bi-mastoid	141	
Bi-zygomatic	128+	133
Naso-alveolar	65	68
Nasal width	25	27
Interorbital width	29	25
Orbital width	40	41
Orbital height	32·5	33
Width of superior alveolar border	51	
Height of alveolar curve	69	
Palatal length	67 (?)	59
Palatal breadth	66·5	65
Orbito-alveolar	43	
Cephalic index	73·4 (?)	69·2
Orbital index	81·2	80·5
Palato-maxillary index	99·3 (?)	109·6
Cranial capacity (minimum)	1300 c.c. (water displacement)	1269 c.c. (shot)

of the brain case, it may be safely stated that the cranial capacity of the skull was at least 1300 c.c. (as measured by actual displacement). This is well within the range of modern Australians.

The thickness of the frontal bone in the region of the glabella is 16 mm.; in an area a small distance in front of the bregma 7 mm.; and in the nuchal plane of the occipital 9 mm. In all of these areas the bone measured was quite undamaged and quite free of matrix.

The *endocranial cast* is of comparatively little value for study. The endocranial surfaces of the bones are so irregular, from the multiplicity of fractures, that no recognition of any details of the actual surface relief of the cerebral form is possible, except in a small area where the brain left definite impressions upon the petrous bone. The right side of the cast is of no value, beyond illustrating very graphically the great damage which this side of the cranium had sustained. By a most obvious reconstruction of the deficiency in the left squama temporalis, a complete cast of the left side was obtained. Unfortunately those parts of the parietal and frontal regions which are of such interest in the study of the endocranial casts of prehistoric skulls have been too extensively damaged to warrant any conclusions being drawn from them. The outstanding features of the cast are the large size of that portion of the transverse sinus which has escaped damage (the sigmoid portion) and the shape of the temporal lobe, which is small and curved distinctly inwards towards the median plane. The appearances here are not to be relied upon, however, since the squama temporalis has been in one part broken and, in its remainder, very obviously depressed.

B. *General Estimate of the Results of the Study of the Cranium.*

The state of the cranial bones as set forth in the foregoing description renders it quite obvious that any attempt to reconstruct the details of the cranium must be, except in the case of the frontal bone, largely conjectural. Yet it is possible to take a more general survey of the proportions of the cranium, with some approach to accuracy. A close examination leads to the conclusion that no considerable portion of any bone has actually been lost. Even on the right side, the portions missing in the lateral aspect can be quite definitely identified, displaced inwards and fixed to the endocranial surface (Plate 15, figs. 15 and 16). By roughly elevating the most obviously depressed areas, a more correct idea of the general conformation of the various regions may be obtained. The right side of the cranium, and even (but to a much slighter degree) of the face, has very obviously been distorted. The large lateral fracture on this side, accompanied by actual dislocation of neighbouring fragments of bone and evidence of splintering, is undeniably a *post-mortem* injury, and is clearly the result of direct violence. There is, on this side, no indication of the skull having been very plastic at any time during its mineralisation, and it is highly probable that extreme plasticity played a very minor part in the production of the distortions present. Furthermore, in determining the median plane on the undeveloped skull, a straight plane was marked out. Though the actual process of dividing the skull was technically faulty, as shown by the overlapping of the saw cuts, the straight plane determined upon was adhered to anteriorly and posteriorly and divided the skull accurately in the median plane. Had any marked lateral distortion of the brain-case been present, a plane cut passing through the prosthion, nasion and glabella anteriorly would have passed some distance to one or other side of the median plane posteriorly. These facts suggest that, on the left side, no marked lateral distortion is present. But there is more definite proof available that the injury to the skull has affected it on the left side only locally, except in the regions of the occiput and basis cranii.

The basion, as has been pointed out, is not recognisable, and the fractures in this region make any direct reconstruction fallacious, so that accurate comparisons by orientation with reference to the basi-cranial axis are not possible. The inion also cannot be identified, and therefore comparisons with other crania poised on the glabello-iniac plane cannot be made. This is much to be regretted, since so many data are available for other fossil skulls referred to this horizon. The base line suggested by KEITH (3) is, however, available. This line, drawn from the orbital margin at the fronto-zygomatic suture to the posterior inferior angle of the parietal (asterion), is an admirable one for practical purposes, since these two points are accurately determinable and are comparatively uninjured in the Talgai skull.

From investigations on many crania, including Australians, Melanesians, Europeans, etc., I can support KEITH's statements as to the approximation of this line to the base line of the cerebrum, and its value as a horizon for the determination of differences in cranial form. The results of superposing an orthogonal projection of the left side of the Talgai brain-case on similar projections of modern Australians published by TURNER (4), BERRY and ROBERTSON (5), and KLAATSCH (6), reveal two very important facts. Fig. 25 (p. 384) shows the result of such a superposition of the Talgai tracing on that of Skull 16 in BERRY's collection. In the first place, the nature of the distortion in the occipital region and the basis cranii is rendered very obvious. Together with some loss of substance in the squama occipitalis and much fissuring of this and the nuchal and basal portions, the whole bone has been dislocated into an abnormal position upwards, so that even had the inion been recognisable on the bone it would have had no value in so far as its position in the whole skull is concerned. In the second place, the confirmation of the identification of the sites of the coronal, parieto-temporal, and lambdoid sutures is very striking, and is further evidence that no great distortion exists on this side, except in the regions previously mentioned.

The method of superposing dioptographic tracings which was used in fig. 13 has been applied (figs. 26 and 27) to the norma facialis and norma verticalis of the Australian skull (No. 17) from the collection of BERRY and ROBERTSON, poised, in these instances, on the Frankfurt plane. Study of these three figures shows the very striking similarity in general conformation existing between the Talgai and such a modern Australian cranium. The reconstruction of the Talgai skull has been based upon the left side only. The skull chosen from BERRY's published tracings is not in any way a unique specimen. It is a fair average sample of a truly Australian type, and many other crania in the collections mentioned give similar results on superposition. It is quite reasonable to assume, then, that these tracings afford an approximate indication of the damage sustained in frontal, parietal, and temporal regions, and that the Talgai brain-case is identical in its general outlines and proportions with many of the crania of modern Australians. I feel confident that, had the specimen been discovered without the facial skeleton, it would not have been considered remarkable in any anatomical respect.

It is greatly to be regretted that the preservation of the specimen is not sufficiently good to allow the use of finer methods of form-analysis for comparison with other important prehistoric and Australian skulls; but any such attempt would involve probable errors of such magnitude that the results would be of no value as accurate mathematical expressions. However, it is clear that, even had such investigations been possible, a study of the general proportions of the cranium, the curvatures of frontal and parietal bones, of the height of the calvaria and the position and height of the bregma, would have revealed nothing significantly different from the Australian of to-day.

C. *The Face.*

In the face, the prognathism is very obvious, and is of the total facial type, with a slight degree of alveolar subnasal prominence super-added. It is impossible to express this prognathism by Flower's index, since the basion is absent or displaced, but the comparison shown in fig. 25, with a skull whose gnathic index is 102, would indicate that in the Talgai skull the index would not have been very much higher than this; probably about 105 (the range in Australians being from 96 to 108).

The spheno-maxillary angle also cannot be accurately measured, since the basion is not available, but it is certain that it lay somewhere between 90° and 100°, probably between 92° and 96° (the average of Australians, measured by DUCKWORTH, is 92°, European 75°). The most certain method applicable here is the one suggested by KLAATSCH, following FRAIPONT, namely, by measuring the distance from the glabella on the prolongation of the glabella-lambda line of the foot-point of a perpendicular drawn from the prosthion. The distance in this skull is 22 mm., the range in Australians being from 5 to 25. From these facts, the conclusions may be drawn that the prognathism of the Talgai face is of a very marked but not extraordinary degree.

The *forehead*, sloping in character, with poor supra-orbital development, and no significant increase in the size of the lateral angular processes of the frontal, has been already described. In the facial aspect, these characters are combined with a depressed nasion and wide inter-orbital distance, which are very materially responsible for the characteristic "facies" of the skull.

The *orbit* is large, but is exceeded in size in both diameters by many modern Australian examples. A horizontal line through the nasion cuts the orbital cavity so that more than one-third of its area lies above this line, which is, as KLAATSCH has pointed out, a very common characteristic of Australian, as contrasted with European skulls. The shape of the orbit is quadrangular with very rounded corners, especially in the lower lateral quadrant. The margin here, where formed by the zygomatic bone, is sharply defined and not smooth and everted.

The *zygomatic bone* is well preserved, the zygomatico-maxillary suture being the only uninjured one in the specimen. Both of these bones are large, broad, and rugged, and are somewhat flattened as they are traced posteriorly. This latter condition may possibly have arisen *post-mortem*. The orbital portions of both bones have been lost.

The skeleton of the *nose* is of very considerable interest. From a depressed nasion the upper parts of the two nasal bones are present, running forwards and slightly downwards, so that their external surfaces look strongly upwards. The lower portions of the nasal bones have been broken away, especially upon the left side, so that the upper boundary of the apertura pyriformis nasi is imperfect. Its lateral margins are well preserved, and lie flat and level with the general surface of the maxilla. The bones forming the lower boundary are well preserved, but no clear line of separation exists between the nasal floor and the external surface of the alveolar process of the maxilla. No pre-nasal fossa or crest is present, nor the anterior nasal spine, the floor of the nose continuing by a gradually inclining plane on to the pre-maxillary surface of the maxilla. Even in those Australian crania whose alveolar subnasal prognathism is most extreme, it is not common to see this very primitive arrangement developed to such an extent as it is in this skull. The size of the pyriform aperture of the nose is not noteworthy; its greatest breadth is situated very low, so that the orifice has a somewhat triangular shape.

The *maxillæ* are large and rugged. Posteriorly, they are somewhat immature, since, consistent with the age of the individual, the tuber maxillare has not reached its full development. The infra-orbital fossa, on the comparatively uninjured side, is very shallow, and the surface of the bone here is broad, running medially to the edges of the nasal aperture, which are not raised at all above the level of the surface. The general conformation of this region is of a primitive type, but it has not the full, almost "bulging" character of the Gibraltar maxillary region. The incisive and canine fossæ are very slightly excavated.

The premaxillary region is of great interest. Extremely broad and square, it protrudes in direct continuation forwards and slightly downwards from the nasal floor. The juga alveolaria of the canine teeth are distinguishable, and between them the jaw is extraordinarily broad and flat. The distance between the most prominent points of these canine ridges measured at the alveolar margins is 51 mm. The greatest distance between similar points in the skulls in various collections in Sydney is 46 mm. in an Australian aboriginal, and in a Maori male, the usual measurements in the larger, more rugged type of male adult being about 40 mm. In Dr. SMITH WOODWARD'S reconstruction of the Piltdown face, the distance between these points is presumably of slightly greater size than in the Talgai skull.

These features, reminiscent of the anthropoid condition in the conformation of the maxillæ, its great squareness and breadth, and its continuity with the nasal floor, are mainly responsible for the very primitive appearance which the norma facialis presents, and, in conjunction with even more important characters in the palate and teeth, form the most significant anatomical features of the skull.

The *palate* has sustained some damage, especially in its posterior part, but, fortunately, its main features and outline are beyond doubt (Plate 17, fig. 19). Two fractures run inwards from each canine tooth to meet in the median line about 45 mm. behind the prosthion, and on the left side a fracture runs parallel to this from the first premolar. These have had no more than a purely local effect, and have not resulted in the dislocation of any part, nor in the distortion of the palate as a whole. The posterior part has sustained more damage, being deficient in its median portion. A large irregular gap extends forwards, affecting the right side more than the left. The lateral portions of the posterior border are, however, still present, though fractured, particularly on the right side. An approximate reconstruction of the posterior margin of the palate may, however, be made from the remaining lateral portions. Furthermore, the alveolar margin encircling the first premolar, and to a slighter degree that of the second premolar, has been broken away, involving some slight deformity and loss of substance of the bone.

The shape of the palate reveals a very primitive type. The large incisor teeth are disposed in an almost straight transverse line, the canines jut out prominently at the corners, and the molar-premolar series lie almost parallel, with some slight convergence towards the median plane in the region of the second molar teeth. There are many Australian skulls which present a primitive shape in this region, in contrast with the European type of small palate with the teeth arranged in a gentle curve with diverging posterior limbs. These Australian palates with their more quadrangular shape are reminiscent of the anthropoid condition, but in no present-day skull have I been able to detect this peculiarity developed to such an extent as in the Talgai specimen. Fig. 2, showing the effect of the superposition of the tracing of the Talgai palate on those of the most primitive type of Australian, a reconstruction of the Piltdown (KEITH, 8), and a modern Englishman illustrates these facts graphically. The characteristic shape of the palate is obviously to be connected with the great size of the canine teeth and the broad premaxillary region which has previously been described. This figure and fig. 3 further establish the important fact that the peculiarity of the Talgai palate resides mainly in the anterior portion of the jaw bearing the incisor, canine, and premolar teeth. The "reduction" of this portion of the jaw, which constitutes such an important character in the human, as contrasted with the anthropoid palate, has not been carried so far in the Talgai specimen as it has been in the present-day Australian. The modern Australian palate figured is the largest and most primitive one obtainable in the skull collections in Sydney.

The accompanying Table of measurements and comparisons reveals some further important characters. The palato-maxillary length was measured according to two methods: first, from the most anterior point in the median plane between the two medial incisors to the point where the median plane cuts the tangent to the deepest parts of the notches on the posterior margins of the palate, and, secondly, by the method of the International Convention, in which the anterior point is one in the median plane on the line joining the posterior alveolar margins of the medial incisors. By the first method, comparisons were made possible with TURNER'S and DUCKWORTH'S measurements in the series of Australian crania investigated by them. On the Talgai skull, however, this measurement is only approximate, since the posterior palatal border is injured, although sufficient is left of the left lateral half to warrant a reconstruction. The line thus determined happens to coincide with the line tangent to the posterior borders of the unerupted third molar teeth, orthogonally projected on to the level of the palate. A measurement of length which may be made with absolute accuracy, however, is along a line whose anterior point is the same, but which terminates posteriorly at the level of the posterior margins of the second molar teeth; this has been compared with the maximum measurement between similar points on the Australian skulls in the various collections in Sydney. The Tasmanian palate used is the very large one figured by KEITH, from which source also details of the Gibraltar, Heidelberg and La Chapelle skulls were obtained (9). The Melanesian skull is the large rugged example figured by ADLOFF (10), and specially mentioned by him for its great size.

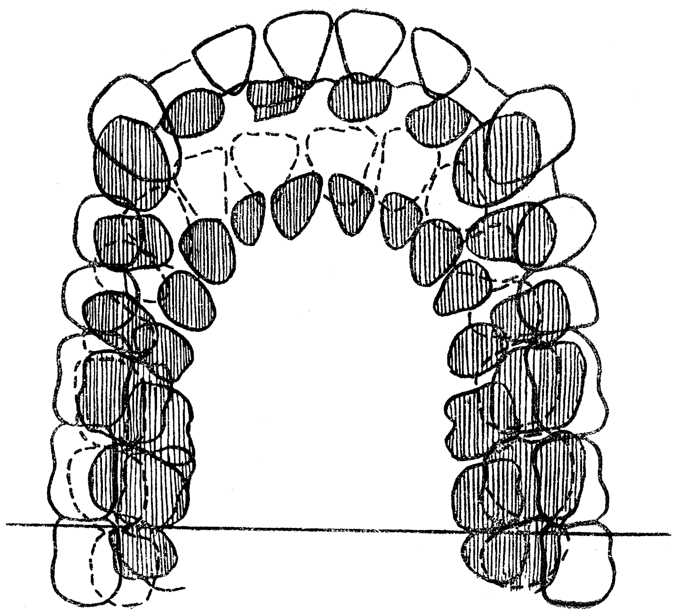

FIG. 2.—Palatal areas of Talgai and (tentatively reconstructed) Piltdown skulls, a very large Australian and a modern Englishman, superposed on a line posterior to the second molar tooth. The reconstructed Piltdown palate (red outline) is the largest. The others in order of size are Talgai (black), Australian (red), and English (black).

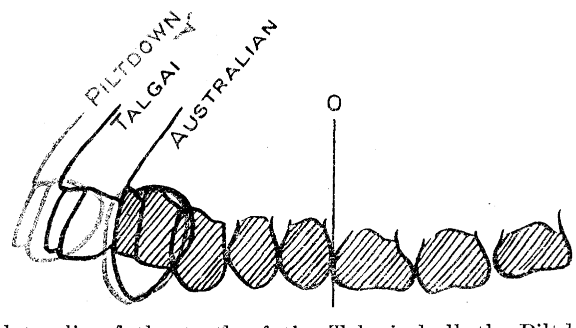

FIG. 3.—Tracing in normal lateralis of the teeth of the Talgai skull, the Piltdown reconstruction, and a large adult Australian, superposed on a line drawn anterior to the first molar tooth. The incisor teeth of the Talgai skull have been reconstructed. The Piltdown tracing is from SMITH-WOODWARD'S reconstruction.

TABLE II.—Measurements of Palate.

	Talgai.	Piltdown.*	Heidelberg.*	La Chapelle.	Gibraltar.	Male maximum Australian.	Large Tasmanian.	New Britain.	Modern English.
Palate maxillary length	67	76	—	—	—	68	—	61	—
Palate maxillary breadth . . .	66·5	73	68	72	71	71	61	68	—
Palate maxillary index	99·3	—	—	125	131	98–128	107	111	—
Length to posterior borders of third molar	67	76	60	60	54	—	62	56	—
Length to posterior border of second molar	58	64	52 (?)	48	44	49	53	49	—
Total area	3900	4420	3670	3500	3160	3600	3670	3565	2260
Area anterior to second molar. .	3430	3620	3000	—	2500	3100	3130	3000	1880
Palate maxillary length (International Convention)	62	70	—	—	—	—	—	—	—
Palate maxillary breadth (International Convention)	42	53	—	—	—	—	—	—	—
Palate maxillary index	—	—	—	—	—	—	—	—	—

* Hypothetical estimates: of neither of these skulls has any part of the palate been recovered; nevertheless the possession of the mandibles makes it possible to estimate the size and form of the palates with a close approximation to accuracy.

The area of the palate was calculated as the space enclosed between the outlines of the outer margins of the crowns of the teeth and a line joining the most posterior parts of the third molars. Since the posterior part of the Talgai palate is imperfect and, in addition to that, immature from the non-eruption of the wisdom teeth, an estimation of the area bounded posteriorly by the line joining the posterior margins of the second molar teeth was made. This may be done with accuracy, and is of value, therefore, as a basis of comparison. Furthermore, in estimating this area, a slight reconstruction is necessary on the Talgai palate on the right side in the region of the premolars, and on the left side in the region of the canine. These minor reconstructions were made in each case by reference to the other side, which was uninjured in the position under consideration; but they involved, however, no significant increase in the area calculated.

The study of these measurements as set forth in Table II reveals further characters of the palate which are of the utmost importance. It must be borne in mind that the most immature parts of the skull of a boy of from 14 to 16 years are the supra-orbital regions and the palate. Apart from the development of the frontal sinuses, the only part of the skull which very appreciably increases in size after the age of 14 to 16 years is the posterior part of the palate, this growth being conditioned by the development of the teeth. That the third molars would have erupted, had the Talgai boy grown to manhood, there is no reason to doubt. These teeth much more regularly appear and are much better developed in such primitive skulls as the Australian, than in the higher types. In this skull, the wisdom teeth are of full molar character and of normal development, in so far as one can judge from direct observation on the labial surfaces of the crowns and from the radiographs. It may, therefore, be assumed that in the adult condition the palate would have been longer, the palato-maxillary index smaller, and the area of the palate greater. Yet, in spite of its immaturity, the specimen presents a very striking picture of a long palate of very primitive form and of a greater area than has been recorded in the representative of any living or extinct race of human beings, except *Eoanthropus*. The total area of the palate as it actually exists,—that is, the space included between the outer margins of the teeth and the line joining the hinder margins of the third molars—is 3850 sq. mm. In this calculation, the first absent right premolar was reconstructed by reference to the other side, where the corresponding tooth is uninjured and the separate second right premolar crown was replaced on its broken neck, but no other departure from the conditions actually present was made. When the left canine tooth, which has been driven upwards and medially, is replaced to a position similar to that on the right side, the area is 3900 mm. In all probability, had the incisor crowns been present, this measure would have been appreciably greater.

That part of the palate lying in front of the line joining the posterior margins of the second molar teeth has an area which may be more accurately calculated and measures 3430 sq. mm. Both of these are considerably larger than the similar areas in the La Chapelle, Gibraltar and Heidelberg crania. The Gibraltar skull is 740 mm. smaller in the total palatal measurement and 930 mm. in the measurement of the area in front of the second molar teeth. The hypothetical palate of Heidelberg man most closely approximates to that of Talgai, but it is smaller by areas of 230 and 430 mm. in the two estimations. Of the palates of recent races, the Tasmanian figured by KEITH (9) is larger than any to which I have had access, although several Australian and New Britain specimens approach it closely. This Tasmanian example is similar in the estimation of both areas to the reconstructed Heidelberg palate.

A study of the calculations of the palatal areas in the various large specimens investigated shows very clearly that the disparity in size between the Talgai specimen and the others is much greater in the area in front of the second molar teeth than in the total palatal area. This further illustrates the fact that the palate is immature in the Talgai skull. Indeed it is safe to assume that had the wisdom teeth erupted, even if comparatively little further development of the jaw had taken place therewith, the palatal area would have been at least 4000 mm. That the area of the palate should be so great with diameters not strikingly in excess of many modern palates is explained by the expanded shape of its anterior portion and the prominence of the canine teeth. In this very primitive shape, there is a very clear contrast to the specialised form of very broad, short palate found in Neanderthal man.

A comparison with the hypothetical Piltdown palate is of the utmost interest. Though no access to any of the actual reconstructions has been possible in this country, SMITH-WOODWARD'S (11) and KEITH'S (8) descriptions and figures render this comparison possible. In shape, and in the prominence of the canine teeth, and the degree of expansion present in the anterior portion, the similarity is marked. In area, the reconstructed palate of the Piltdown skull exceeds that of Talgai by 520 mm. in the total measurement, and by only 190 mm. in the measurement of the area in front of the second molars. Both in shape and area the palate of the Talgai boy approaches that of the reconstructed *Eoanthropus* more closely than any other recorded instance.

D. *The Teeth.*

The teeth, in addition to possessing great interest in themselves, supply sure evidence of the age of the individual. The teeth present include the two canines, the two left premolars, and the first and second molars of both sides. The crowns of the left medial incisor and the first right premolar (Plate 17, fig. 20) are separated from their roots at the neck and accompany the main specimen. The two wisdom teeth have been revealed in the development of the specimen by chiselling away the outer table of the maxilla. They are unerupted, and the occlusal surfaces of their crowns lie 7 mm. above the alveolar margin.

The first molars are the only teeth which are extensively worn, the occlusal surface being quite flat and denuded of enamel in several places. The canines and premolars are much less worn, and the second molars are almost completely unworn, the masticatory surfaces presenting the characteristic crenulated appearance of recently erupted teeth. Judging then by modern standards, the individual was past the 12th year of age, to put it at the lowest limit, and had not yet reached the age of 17. The evidence of age, in so far as the third molars are concerned, is inconclusive, in view of the inconstant characters and time of eruption of these teeth, although, in a primitive skull of the Australian type, these considerations have less weight, since the third molar in these lower races is more constant in form and time of eruption than in the skulls of higher races. However, the extreme degree of wear on the first molars, the very moderate amount on the canines and premolars, and the almost complete absence of wear on the second molars, afford the necessary further evidence to warrant the statement that this individual had, at the time of death, reached an age such as a modern boy would have between the ages of 14 and 16 years. Further, it is clear that the tooth succession in this skull is in no way dissimilar to that of modern man.

The Incisor Teeth.—The crown of the medial left incisor alone is present, and it is preserved separated from its root at the neck (fig. 20). The crown is well incrusted, except at one small area on the labial surface, where the enamel is clearly seen. As this tooth was not included in the purchase of the skull, it was not permitted to clean it, so that this description is necessarily imperfect. It is impossible to say whether the crown has been broken, although the appearances suggest that some of the cutting edge has been lost. Further, the thin layer of incrustation present may possibly make some of the measurements slightly excessive. The mesial surfaces of both canines show a clear interstitial contact facet for the lateral edge of the crowns of the upper lateral incisors. In position and form these facets are quite typical. On the right canine tooth, its lowest point is 7·5 mm. from the alveolar margin. The lateral edge of this lateral incisor tooth, therefore, was at least 7·5 mm. in height.

The lengths of the roots were measured in the skiagram. This was taken with the tube 4 feet away from the skull, the incident rays falling at right angles to the long axis of the teeth under investigation, which were themselves parallel to the photographic plate or film. Distortion was in this way largely obviated, and the errors in measurement arising from this cause are certainly very small, probably less than 1 mm. The measurements in the accompanying Tables give the dimensions of the incisor teeth as far as they could be ascertained.

Comparisons of these dimensions with those given by SCHEFF (12) (quoting MULREITER) and ADLOFF for similar teeth in recent and some prehistoric races show that the incisor teeth in the Talgai skull are within the range of variation in present-day examples, but are extremely large. For example, the minimum and maximum recorded measurements in all living races (including the Australian) for the total length of a central incisor are 19·0 mm. and 29·5 mm. and the probable total length of the right central incisor in Talgai is 28·6.

TABLE III.—Incisor Teeth, Talgai.

	Crown.			Neck.		Root.	Total length.
	Mesio-distal.	Labio-lingual.	Height.	Mesio-distal.	Labio-lingual.	Length.	
Central incisor, R.	10·9	8·6	10·6	8·0	7·0	18	28·6
L.	—	—	—	8·2	7·5	18	—
Lateral incisor, R.	—	—	7·5+	8·0	7·0	18·5	—
L.	—	—	7·5+	7·8	7·0	18·6	—

As previously remarked, the incisor teeth are arranged in a comparatively straight transverse line. The distance between the mid-points on the mesial alveolar margins of the two canine teeth is 40 mm. measured in a straight line. In a special investigation by the writer of over 300 recent crania, mainly of Australians and Melanesians, the maximum distance observed between these points was 37 mm., in the large cranium of an adult male Australian in the Australian Museum (No. 1257). This excessive size is, of course, another manifestation of the great squareness of the premaxillary part of the jaw, of which mention has already been made. In this area of the alveolar margin lie the necks and very small portions of the crowns of the four incisor teeth, but no evidence of any abnormal distance between canine and lateral incisor is discernible. The radiographs (Plate 17, fig. 23) show that this region of the jaw is completely occupied by the alveoli of the teeth and that no greater space is present between the roots of the two incisors than between those of the lateral incisor and canine. This fact, in conjunction with the proof that the crowns of the lateral incisor and canines were in contact, shows that no diastema in the proper sense of the term was present in this region. The presence and size of the root canals are also revealed by the skiagrams, but there is nothing worthy of note in this respect.

TABLE IV.—Upper Incisor Teeth.

	All living races (including Australians).			Talgai.	
	Total length, range.	Length of crown, range.	Length of root, average.	Length of crown.	Length of root.
Central incisors	19·0–29·5	7·5–14·0	12·4	10·6+	18·0
Lateral incisors	17·5–27·5	8·0–11·8	13·0	—	18·5

The Canine Teeth.—The canines are enormous teeth. On the left side the tooth is apparently undisturbed in position, the alveolar margin of the maxilla investing it to the line of the enamel. The bone immediately on either side of it has, unfortunately, been injured. On the left side the canine has been forcibly driven up into the maxilla and pressed somewhat medially, the fractures consequent on this being apparent on the palatal and facial surfaces of the bone (Plate 13, fig. 11, and Plate 14, fig. 14). The tooth itself uninjured. The enamel margin on the labial and lingual surfaces lies 7 mm. higher than the similar margins of the lateral incisor and first premolar, and a well-marked facet, obviously due to the wear of the first lower premolar, is placed high up on the lateral surface of the canine in the narrow interval between it and the first upper premolar, an interval which could not possibly have accommodated any lower premolar tooth, however pointed it may have been. If one reconstructs the maxilla here by lowering the aveolar margin where it has been injured around the root of the tooth, bringing it down about 7 mm. into line with the margin around the incisor and premolars, the canine tooth being brought down with it, this facet of wear on the distal surface of the canine comes to lie in a position where the lower premolar would have worked against it in occlusion of the teeth. A careful examination of the occlusal surface of the upper premolar shows a facet of wear upon that tooth for its lower opponent which is accurately in line with this facet on the canine in the reconstructed position, and makes it quite clear that this accurately reproduces, in this respect, the position this canine tooth must have had in the uninjured mouth (fig. 4).

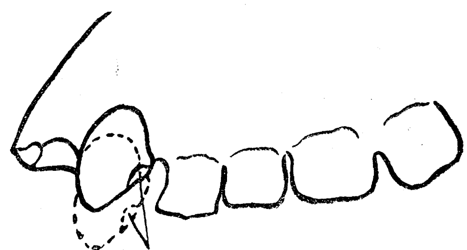

Fig. 4.—Position of canine tooth in actual specimen ——; true position of canine ……; P.F., facet for first lower premolar.

The measurements in millimetres of the crown are shown in the accompanying Table in comparison with similar measurements on the Piltdown, Krapina and Spy teeth, and the maximum single measurements in each diameter recorded on the teeth of living races, including the Australians.

Table V.—Canine Teeth.

	Crown.			Total height.	
	Mesio-distal.	Labio-lingual.	Height.		
Talgai, right . .	9·6	10·8	14·5		
left . .	9·6	10·9	14·0		
Piltdown . . .	10·0	10·5	11·5	29·5	Smith-Woodward.
Krapina . . .	9·2–10·5	11–11·3	10·1		Adloff.
Spy	7·5–8	9–10	7·5–8		Fraipont.
Maximum of all living races	9·3	10·8	13·5	37·0	Adloff and Mulreiter.

From these measurements, it appears that the Talgai tooth is in some respects the largest single human canine yet recorded. In each diameter it exceeds the maximum recorded measurements on the teeth of representatives of all living races. It is exceeded by the Piltdown canine in the mesio-distal direction only, and then by less than $\frac{1}{2}$ mm. The maximum measurements of the Krapina canines are greater mesio-distally and labio-lingually but considerably less (over 4 mm.) in height. Accurate measurements of the total length proved impossible on account of some lack of definition in the radiographs. So densely mineralised is the skull that the most prolonged exposures, under conditions most favourable to extreme penetration, failed to give clearly defined pictures of the deepest portions of the roots, where thicker bone had to be penetrated.

The canine tooth is human in shape, and its large crown has a well-developed pointed apex, which projects several millimetres below the line of the masticatory surfaces of the other teeth, and probably reached to within a comparatively short distance of the alveolar margin of the mandible. The labial surface is markedly convex in both directions, and is covered by enamel, which is stained with iron and quite intact and unworn. This surface is deep, and the greatest mesio-distal diameter is not in the region of the neck, but at a level 5 mm. from the apex. It passes in a rather abrupt curve posteriorly on to the distal surface, and anteriorly on to the mesial surface. In this respect, it is of the normal adult human type. The lingual surface has a well-marked tubercle near the thick neck, below which it is slightly concave. The enamel here is fissured and stained *post-mortem*, but is otherwise quite intact and unworn by any other teeth. The mesial surface, clearly marked off from labial and lingual surfaces as described, bears a broad triangular area in its upper part, from the apex of which a smooth border runs down to the apex of the crown. On the former (triangular) part, at its apex, and situated with its lower border nearly 8 mm. from the enamel margin, is a small facet caused by the contact of the lateral incisor tooth. This is a small, triangular, concave surface with well defined edges, and having the typical form of an interstitial contact facet. On the narrow margin of the mesial surface, there is another facet, a small, shallow, elongated, quadrangular surface, placed on the lingual slope of this border (fig. 6, and Plate 17, figs. 21 and 22), and involving the enamel only. It measures $4 \times 1{\cdot}5$ mm., and has clearly defined edges except towards the apex of the tooth, where it fades away before reaching the extreme tip. It is undoubtedly a surface of wear caused by the lower canine tooth.

The distal (posterior) surface, also marked off from the labial and lingual surfaces by definite borders, shows similarly an upper triangular area and a lower smooth border. The broad triangular area has its base along the cervical line, and its apex is occupied by a large, triangular, gently concave facet, which verges slightly towards the lingual surface of the tooth. This facet, over which the enamel is worn down to extreme thinness, measures (on the left canine) $4{\cdot}5$ mm. in its maximum labio-lingual diameter and 5 mm. in the vertical. It has sharply defined margins, and is beyond question a facet caused by the wear of the first lower premolar tooth. Below this, the lower narrow portion of the distal margin is smooth and unmarked by the opposing tooth of the mandible. This smooth lower portion of the distal margin, which lies between the apex of the triangular facet caused by the premolar and the apex of the tooth, measures 4·5 mm. in length.

The relationship which must have existed between the upper canine and the first lower premolar in the closed position of the jaw is well illustrated on the left side, where the alveolar margin is reconstructed in the manner previously mentioned (fig. 3). The base of the facet on the canine here comes into line with the mesial facet, which is very apparent on the occlusal surface of the first upper premolar. It is therefore clear that the first lower premolar was situated mainly behind the canine of the maxilla, and did not produce a facet upon its lingual surface, as it usually does in regular human dentitions (fig. 5). The facet for the lower canine on the mesial (medial interstitial) surface is placed very definitely on that border of the tooth and not on the lingual surface, and is, furthermore, separated from the facet of the premolar on the distal surface by a very appreciable interval, namely, the breadth (mesio-distal diameter) of the tooth between these mesial and distal facets.

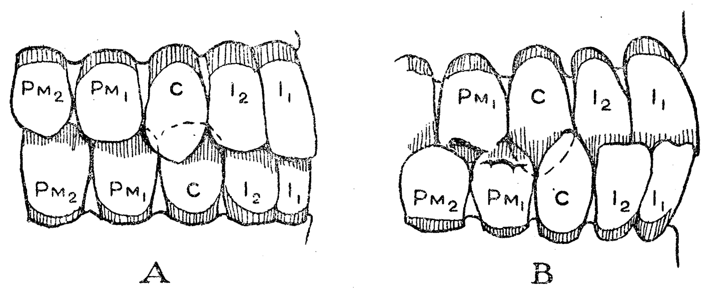

FIG. 5.—Normal human teeth in occlusion. A, labial aspect; B, lingual aspect; I_1, median incisor; I_2, lateral incisor; C, canine; PM_1, first premolar; PM_2, second premolar.

The conclusions to be drawn from these facts are of the utmost importance. Deductions may be made from such facets with especial confidence in considering the teeth of more primitive races and anthropoids, since there is much better agreement between the maxillary and mandibular teeth in these instances than in modern types, such as the European. The condition and position of the facets of wear are identical on both the canine teeth, so that the possibility of some individual abnormality in their mandibular opponents may be excluded as an explanation of these peculiarities. Further, the very curious position of the facet on both canines for the lower premolar placed high up on the distal surfaces cannot be explained by the absence of the upper premolar, since, on the left side, this premolar is present and is a normal tooth. In the normal human dentition, though great variation in the detail of these facets occurs, there are certain characters invariably present. The upper canine tooth usually shuts over and in front of the lower canine and first lower premolar and two facets result, placed side by side or confluent with each other, and extending from the occlusal surface on to the lingual surface of the tooth. Though they occasionally encroach on the mesial and distal borders, they are invariably placed mainly on the lingual surfaces (fig. 5). These may be well seen in adolescents and young adults before the teeth have been ground away to any great extent, as commonly occurs in the skulls of older individuals, especially in such races as the Australian and Melanesian.

In no regular human dentitions, nor indeed in any abnormal specimens which I have been able to investigate, are the relative form and positions of these surfaces, and especially of the premolar facets, similar to those present on the Talgai canine. Those instances in which the facet formed by the lower canine is in a position comparable to that on the Talgai tooth, in being placed on the anterior margin only and not on the lingual surface, are cases in which the canine teeth are comparatively small and do not project beyond the masticatory surfaces of the other teeth, and in which the occlusal surfaces meet accurately and do not override to the usual extent. Such conditions are in marked contrast to those present in the tooth under discussion. In the Anthropoids, however, very different and varying conditions are present. Indeed, a survey of such details shows that "there is a great deal of variability about the articulation of the upper and lower teeth in the higher apes" (TOMES, 13). The three-sided, pyramidal shape of the upper canine tooth of the Chimpanzee makes a comparison with the more definitely four-sided condition in the human Talgai tooth difficult, but in the Orang and the Gorilla, in spite of the enormous size of the canine teeth, more comparable conditions may be observed. In these forms, one not infrequently finds the facets caused by the wear of the mandibular opponents in the form of elongated, sharply defined surfaces on the anterior interstitial and posterior interstitial surfaces. In the skulls of two young Orangs in the Australian Museum (A 11705 and S 1331) a condition of wear is present which is essentially identical with that in the Talgai tooth. In one of these skulls the first permanent molar is present; in the other, the second permanent molar has just erupted. On the upper milk canines are two facets, an elongated narrow surface on the anterior interstitial surface caused by the lower canine and a triangular concave facet on the posterior interstitial surface caused by the pointed lower first milk molar (fig. 6). These facets are absolutely identical in form and position with the similar facets on the Talgai tooth. In the skull of a young Gorilla in the same collection, an analogous condition is also present, though in this case the anterior facet is rather more elongated.

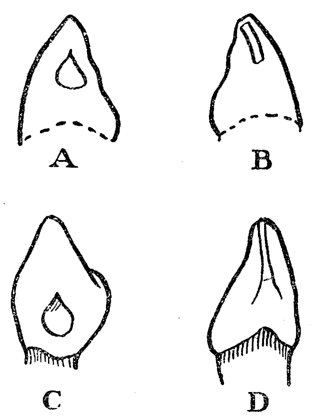

FIG. 6.—Upper canine tooth of Talgai Skull (A and B) and of young Orang (C and D). A and C, posterior interstitial surface showing facet caused by lower premolar; B and D, anterior interstitial surface showing facet caused by lower canine.

Further observations on the position of these facets in the fossil human skull under consideration supply additional evidence as to the method of articulation of the teeth. The relationship of the upper lateral incisor and upper canine teeth is shown by the radiographs of the anterior portion of the palate, which reveals the roots, by the position of the necks of the teeth in the alveolar margin and by the interstitial contact facets on the mesial surfaces of the crowns of the canines. These show that no true diastema existed in this region, and that the crown of the incisor was in contact with the canine tooth, 7 or 8 mm. from its alveolar margin. The relationship of the upper premolar may be appreciated by the reconstruction (fig. 4) carried out on the left side. This reveals the fact that the crown of the upper canine projected below the level of the mesial margin of the upper premolar for a distance of nearly 7 mm. No interstitial facets are present indicating contact between the upper canine and premolar teeth.

The articulation of the lower premolar teeth with the upper canine is deduced from a study of the facet on this latter tooth. It is clear that in the closed position the premolar was situated mainly behind the canine and not against its lingual surface. The relationship of this facet to the facet on the upper surface of the first upper premolar on the left side and the shape of the recess thus formed would indicate that the lower first premolar was probably a pointed tooth. The evidence of the relationship of the lower canine tooth is incomplete since the upper lateral incisor tooth is missing. The upper premolar has a crown 9 mm. in height. The lower premolar crown would probably not have exceeded 10 mm. in height, which is much above the average height of human lower premolars, and approximates to the maximum in living and extinct races. In all probability, therefore, since the manner of articulation of the upper and lower first premolars is clear, the greatest distance between the alveolar margins of maxilla and mandible was about 18 mm. in this region. Such being the case, the tip of the upper canine tooth would have reached probably to within 4 or 5 mm. of the line of the alveolar margin of the mandible. Further, the lower canine tooth must have been positioned mainly in front of the upper canine, since the facet caused by it lies on the anterior interstitial border of the latter tooth, and not on its labial or lingual surface. The apex of the lower canine, therefore, must have been received into a distinct gap between the first premolar and lower canine. This latter tooth was, in all probability, a large tooth. There is no reason whatever to support the view that in a dentition composed of such extremely large teeth with an abnormally large upper canine, there existed an abnormally small lower canine, nor could an originally large lower canine have been reduced in size by wear, considering the age of the skull and the character and position of the facet caused by it on its maxillary opponent.

The only conclusion to be drawn, therefore, from these facts is that, notwithstanding that there is no true diastema in the maxilla to receive the lower canine, the method of articulation present in the Talgai teeth must have been similar to that observed in the young Orang skulls. KLAATSCH (14), in investigating the teeth of Australians, was keenly alive to the possibility of discovering some trace of a diastema in the upper jaw or some modification in the lower premolar in adaptation to a large upper canine, but he very definitely states that he was unable to detect either of these features in all the skulls examined by him. The evidence furnished by the upper canine and first premolar teeth in the Talgai jaw points clearly to the presence of this modification of the lower first premolar and canine, in conjunction with a large upper canine tooth, as in the skulls of young anthropoids. In view of these facts, the reconstruction shown in fig. 7 is the one which is most consistent and portrays a human dentition in which these anthropoid characters are manifested in a manner quite unknown in man, except for the single example of *Eoanthropus*.

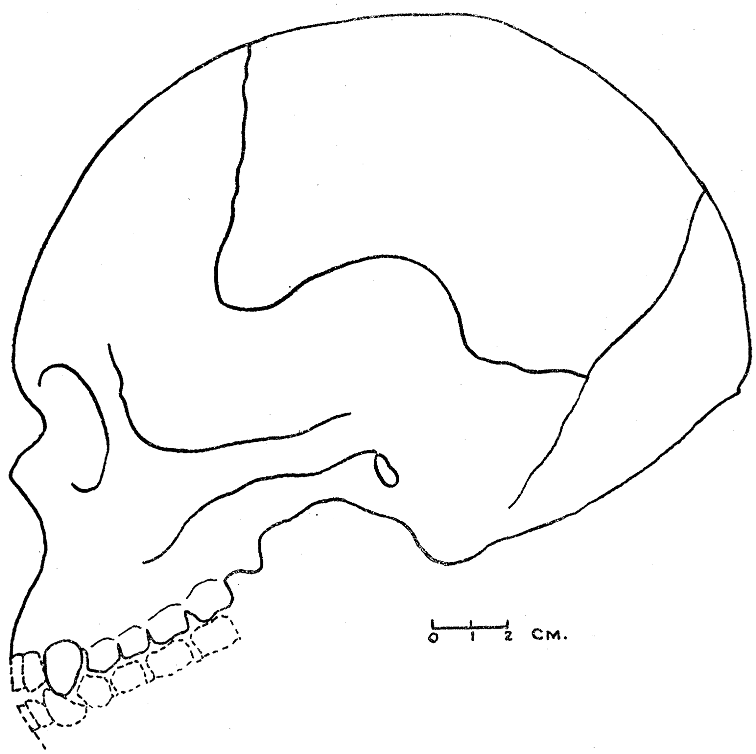

FIG. 7.—Reconstruction of Talgai Skull. The reconstruction of the cranium is very hypothetical, and has been arrived at by comparison with the Australian cranium shown in fig. 25. Teeth absent in specimen shown by dotted lines.

The Premolar Teeth.—The first and second premolar teeth are *in situ* on the left side, the crown of the second premolar on the right side is present, separated from its root. On this side, the two premolar crowns have been broken off at the neck and the alveolar margin immediately above them damaged. The measurements of these teeth are shown in the following Table in comparison with those of Krapina and of living races:—

TABLE VI.—Measurements of Crowns of Premolar Teeth.

	1st premolar.			2nd premolar.	
	Talgai.	Krapina.	All living races.	Talgai.	All living races.
Labio-lingual	12·3	11·4	6·7–12·5	11·0 11·0	8–11·7
Mesio-distal	8·6	8·2	5·5– 8·7	7·9 8·1	5·5–8·2
Height	9·0	8·0–10·0	5·5–10·8	8·9–9·0	5·0–10·0

In the *first premolar* the actual labio-lingual diameter was probably slightly greater than the above figures show, since the lingual cusp is partly broken away, exposing the irregular, darkly stained dentine. The labial cusp is more prominent than the lingual, which, however, is well developed. Neither is very pointed or caniniform. The occlusal surface shows the effect of the wear of the opposing teeth, but the enamel has only been worn away and the dentine exposed in one small spot on the labial cusp of the first left premolar.

The *second premolar* is a slightly smaller tooth than the first and its cusps are more equal in size. There is a slight degree of bulging between the neck and the masticatory surface on the labial and lingual surfaces of each premolar tooth. The skiagrams taken with films closely applied to the alveolar process show well developed roots with a large single pulp cavity. The roots, which reach up to the floor of the sinus maxillare, measure for both first and second premolars 20 mm. in length. This measure is approximate, but the error due to distortion is very slight. Hence, the total length of these teeth is about 29 mm., which is greatly in excess of the average premolars of living races, whose minimum and maximum recorded measurements are 15·7 and 28·2.

The premolar teeth of the Talgai jaw are, therefore, of typical adult human character, but extraordinarily large.

The Molar Teeth.—The first and second molars are present on both sides, and are excellently preserved. The third molars are unerupted. In developing the fossil, the outer table of the maxilla has been chiselled away, and wisdom teeth of large size, with crowns of full molar character, were revealed. Their occlusal surfaces are situated, at their lowest points, 7 mm. above the alveolar margin.

The first molars are large, very well worn teeth. The cusps have been ground flat, and the enamel has been worn right through, the stained dentine being exposed in four places on the left and over the site of three of the cusps on the right side. Elsewhere on this surface, in both teeth, the enamel is very thin. The second molars had erupted quite recently. The lingual border of the crown only just reaches to the level of the masticating surface of the first molar on the left side, and a small facet, caused by the wear of the mandibular opponent tooth, is discernible on the enamel here. The remaining portions of the occlusal surface are quite unworn, and have not yet reached the masticating level. On the right side a slightly greater degree of wear is visible, but even this surface is, on the whole, worn very slightly. The first molar has four well developed cusps, but the oblique enamel ridge is absent. The lingual surface is slightly bulged; the labial surface is flat. The crown of the tooth is markedly cuboidal in form.

The second molar has four cusps, the two labial ones being very clearly separated from each other and from the lingual cusps. The oblique enamel ridge connecting the antero-internal and postero-external cusps usually present in human and anthropoid teeth is suppressed. The lingual cusps, two in number, are not so clearly demarcated as the corresponding labial ones. The anterior of these two is the largest cusp on the tooth; the posterior one is very small. In general form this tooth is similar to the first molar.

The third molar crowns are visible in part only. The two labial cusps are quite apparent, and sufficient of the tooth is visible to indicate that it is a large tooth.

The outstanding characteristic of the molar crowns, however, is their great size. In the following Table are given the sizes of these teeth in comparison with those of other fossil skulls and the molar teeth of present-day races :—

TABLE VII.—Measurements of the Crowns of the Molar Teeth.

	1st molar.			2nd molar.		
	Talgai.	Krapina.	Living races.	Talgai.	Krapina.	All living races.
Labio-lingual . .	13·1 13·1	12·5–13·3	9·2–14·5	13·3 13·5	11·2–14·0	9·0–14·7
Mesio-distal . .	12·6 12·1	11·0–13·3	7·8–12·8	11·3 11·1	10·0–12·0	7·0–11·8
Height	9·0 8·2			9·3 9·2		

Therefore, as in the premolars, the molars are teeth whose crowns are very considerably larger than is usual in living races, and approach in size the largest of the Krapina specimens. The radiographs (Plate 17, figs. 23 and 24) make it possible to observe some of the details of the roots of the molar teeth. The photograph is not sufficiently clear to enable a positive opinion as to the numbers of the roots. The roots are clearly separated right up to the necks of the teeth and the pulp cavities are small. In these respects, they present a clear contrast to the form of tooth present in many of the skulls of Neanderthal man. The roots of the molars are long. The extreme density caused in the photograph by the hard palate obscures a large part of the roots, but the appearances suggest that the apices of the roots lie very near the lower boundary of the sinus maxillare. If this is correct, the total length of the molar teeth is approximately 26 mm. Here again the maximum recorded measurement in living races is approached (range 17–29 mm.).

The unerupted third molar is well shown in the skiagrams. The mesio-distal length of its crown on the left side is 11 mm. and the alveolus (on the right side), measuring 13·5 mm. in height, has its apex situated in such a way as to slightly indent the floor of the maxillary sinus, further proof that the molar teeth in this skull are of exceptional length. The wisdom teeth are directed downwards and backwards towards the alveolar margin.

The first and second molar teeth of the Talgai boy are, therefore, definitely human in type and extremely large. The wisdom is large and, apparently, possesses the normal characters of an unerupted tooth.

The distance between the anterior margin of the first molar and the posterior border of the second molar tooth is 25 mm. on the right and 26 mm. on the left side. Measuring to the posterior margins of the wisdom teeth, projected down to the level of the alveolar margin of the jaw, the distances are 36 and 34 mm. respectively.

It is, therefore, obvious that in the palate and teeth of this fossil are to be found its most striking features. To summarise; there is present in the maxilla a very primitive conformation of its anterior portion in its extreme size, squareness and breadth. The palate, immature as it is, in its oblong shape, parallel molar-premolar series and great area, presents a picture approached, but not equalled, by the most primitive skulls of present day or recently extinct races, and there is no doubt that had the palate gone on to maturity, these similarities to the anthropoid condition would have been heightened. The teeth are of very great size but, with the exception of the canines, lie within the range observed in modern examples. The first and second molars are almost equal in size. All the teeth preserved are of human form, but the canines are similar in some respects to anthropoid canine teeth, namely, in size and in the manner of their articulation with the canine and first premolar of the mandible. Therefore, in the palate, jaw and teeth, there are concentrated the most primitive characters found in human skulls in these regions. The majority of these characters are not, of themselves, of extreme significance, since they may be paralleled individually with similar features in many primitive modern skulls, especially in such races as the Australian or Tasmanian, but rarely, if ever, have they been observed so strikingly exhibited, developed in the one individual. But beyond these, the size of the Talgai palate, especially of its anterior portion, and the size and relations of the canine teeth, are features which are quite outside the range of variation observed in any other human skull, except that of Piltdown.

IV. General Conclusions.

This fossil human skull of a not yet adult Proto-Australian presents, therefore, the general picture of a cranium similar in all respects to the cranium of the Australian of to-day, combined with a facial skeleton of undoubtedly "Australian" type, in the palate and teeth of which there are to be found, in conjunction with the most primitive characters found in modern skulls, certain characters more ape-like than have been observed in any living or extinct race, except that of *Eoanthropus*.

From these facts, certain generalisations may be made. It is of interest to observe that, from the comparison of this fossil with modern and Piltdown men and the Anthropoid apes, there is brought forward further evidence to support the belief held by many anthropologists, that in the evolution of the human form of skull, the assumption of a definitely human type of brain was the primary and fundamental factor by which man was enabled to differentiate himself from the more unenterprising descendants of the common ancestral form. In the fossil from Talgai, one may discern a form of skull in which the cranium has long since become of the definitely human type, but in which the face still preserves the last definite trace of the lower, more brute-like characters.

It is further of interest to note that the Proto-Australian is, in some very important features, to be sharply differentiated from Neanderthal man. This is nowhere more clearly seen than in the palate and teeth. In the Talgai skull the palate is comparatively elongated and oblong—in man of the Neanderthal type, it is short, extremely wide, and well arched. Further, the teeth show no signs of that peculiar specialisation in the form of the roots and pulp cavities which distinguishes the teeth of the Neanderthal race.

The geological evidence of the age of the fossil, though more valuable than was thought at the time the skull first came under notice, is admittedly imperfect, since it depends so largely on an untrained observer's narrative of events and conditions existing over thirty years ago. That there is some support afforded by the condition of the fossil in comparison with bone deposits of undoubted Pleistocene age from similar neighbouring strata, has already been mentioned. Further and more accurate investigations along this line are in progress, the results of which will soon be available. But in the light of the anatomical facts here set forth, the claim to high geological antiquity—the assignation of this fossil to the Pleistocene—is very strongly supported, and may indeed be regarded as established.

The direct evidence of the antiquity of Man in Australia has been very imperfect, or, indeed, non-existent, prior to the discovery of this skull (15). No clear and unimpeachable evidence of the remnants of the human frame or of the work of human hands belonging to the Pleistocene in Australia had hitherto been brought forward.

A possible exception to this general statement is the human molar tooth found in the Wellington Caves in New South Wales. The exact origin of this undoubtedly human molar crown has long been a matter of uncertainty, but lately, Mr. R. ETHERIDGE, Junr., Curator of the Australian Museum (16), has collected certain data which point to the fact that this tooth was "taken from the solid breccia of Wellington Cave," and, further, that other parts of a human skeleton were found under similar circumstances by KREFFT. The evidence of this tooth, should it be accepted, is clear proof of the existence of Man in Australia in Pleistocene times, and there is no question as to the authenticity of the document upon which the validity of this statement now rests.

However, in addition to the tooth from Wellington Caves and the Talgai fossil, other evidence of a very important character has been submitted by Mr. ETHERIDGE (17). He has demonstrated beyond all doubt, from an examination of the Post-Tertiary deposits of the same cave in New South Wales, that the Dog (probably *Canis dingo*) existed on this continent, contemporaneous with the extinct Pleistocene Thylacine and Diprotodon, and has confirmed the results of earlier observers around whose opinions certain doubts still hovered. The zoologist needs to bring little argument to demonstrate that the Dog made his way to Australia with Man, that he was not indigenous, and that his introduction was not by means of a simple "walk overland" from Asia. ETHERIDGE'S work, in definitely establishing the presence of the Dog on the Australian mainland in Pleistocene times, is therefore strong indirect evidence of the presence of Man at that epoch.

Furthermore, since the zoological evidence is so clear that the advent of Man and Dog was not by a "walk overland," the discovery of the Talgai skull and the establishment of its antiquity dates back the history of navigation to these early times.

In this connection, it is further of importance to determine if any clear affinity exists with the definitely "Tasmanian" type of skull. This task is, in the most favourable case, fraught with some difficulty and uncertainty. The most important criteria, on which one must mainly depend in such a diagnosis, are the characters of the face and the shape of the cranial vault. In the face, no "Tasmanian" traits are present; unfortunately, the cranial vault has been so injured as to render any positive statement impossible, but if the general conclusions drawn from the study of the cranium and of such superpositions as are illustrated in figs. 25, 26, and 27 hold good, what evidence we possess from the cranium also fails to reveal any Tasmanian affinities.

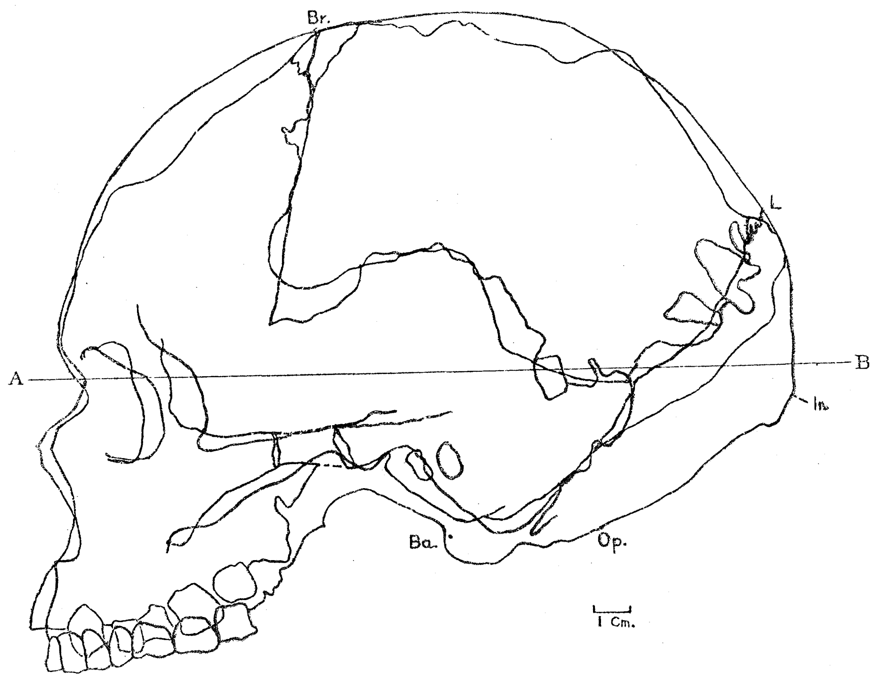

FIG. 25.—Norma lateralis. Skulls superimposed on KEITH'S base-line AB.

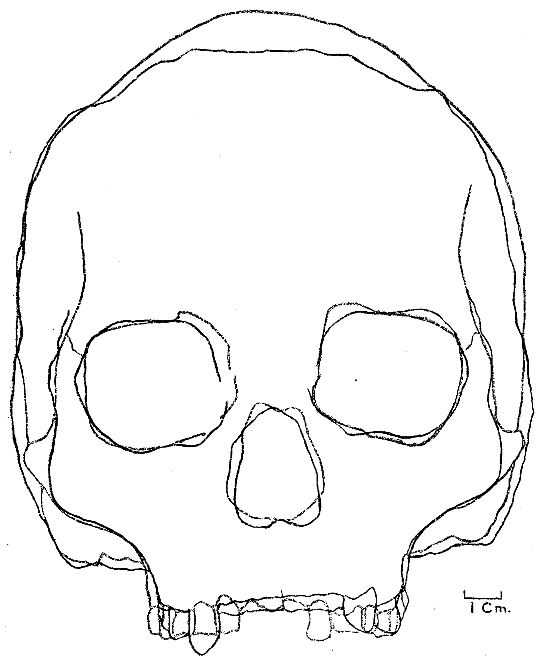

FIG. 26.—Norma facialis. Posed on the Frankfurt plane.

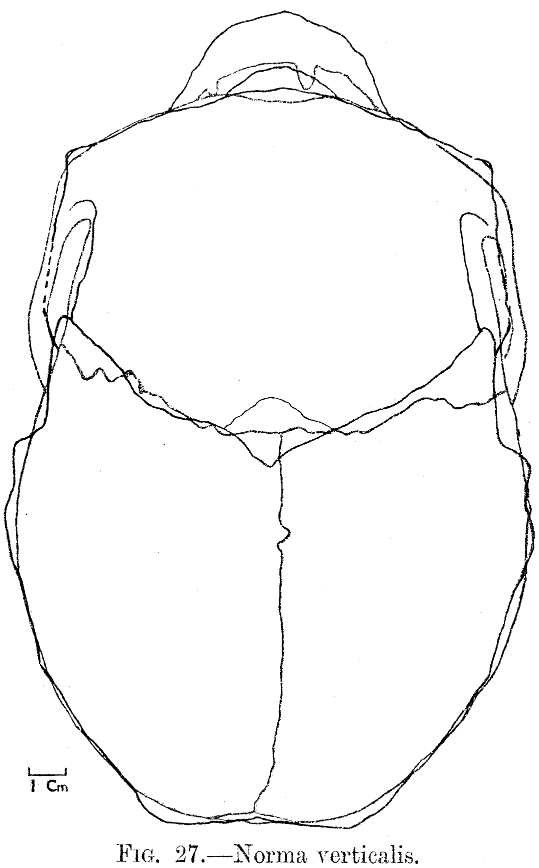

FIG. 27.—Norma verticalis.

FIGS. 25–27.—Dioptographic Tracings of Talgai Skull (black), and Modern Australian (red).

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DESCRIPTION OF PLATES.

The photographs used for illustrations are, in every instance, quite untouched, except in fig. 19, where, however, the palate itself has not been touched. Figs. 8–18 are uniformly half-scale.

Plate 12.

Fig. 8.—Norma lateralis of undeveloped fossil.

Fig. 9.—Norma basalis of undeveloped fossil.

Fig. 10.—Norma verticalis of undeveloped fossil.

Plate 13.

Fig. 11.—Norma lateralis (left side) of the skull after development.

A, deficiency in squama temporalis; *B*, region of the bregma; *C*, fracture at the site of the coronal suture; *D*, fracture of frontal bone; *I*, fracture of parietal bone; *L*, lambda; *p.s.s.*, parieto-squamous suture; *p.m.s.*, parieto-mastoid suture; *E.A.M.*, external acoustic meatus; *M*, fractures in maxilla in connection with the displaced canine tooth; *As*, the asterion; *W*, wisdom tooth; *ZY*, portions of zygoma.

Fig. 12.—Norma lateralis (right side) of the skull after development.

P.P., splints of plaster holding the specimen together.

Plate 14.

Fig. 13.—Norma facialis of the skull after development.

A piece of cardboard of measured thickness has been placed between the two halves of the skull to represent the amount of bone substance lost in the process of sawing.

Fig. 14.—Norma basilaris of the skull after development.

Plate 15.

Figs. 15 and 16.—The endocranial surfaces of the left and right sides, after development.

P.P., plaster of Paris; *X*, pieces of bone, fractured and displaced, being attached to the endocranial surface of the skull. The sulcus for the transverse sinus is visible.

Plate 16.

Fig. 17.—Norma verticalis of the skull after development.

B, the bregma; *C*, the coronal suture; *D*, fracture of frontal bone.

Fig. 18.—Norma occipitalis of the skull after development.

L, lambdoid suture; *I*, fracture of parietal bone.

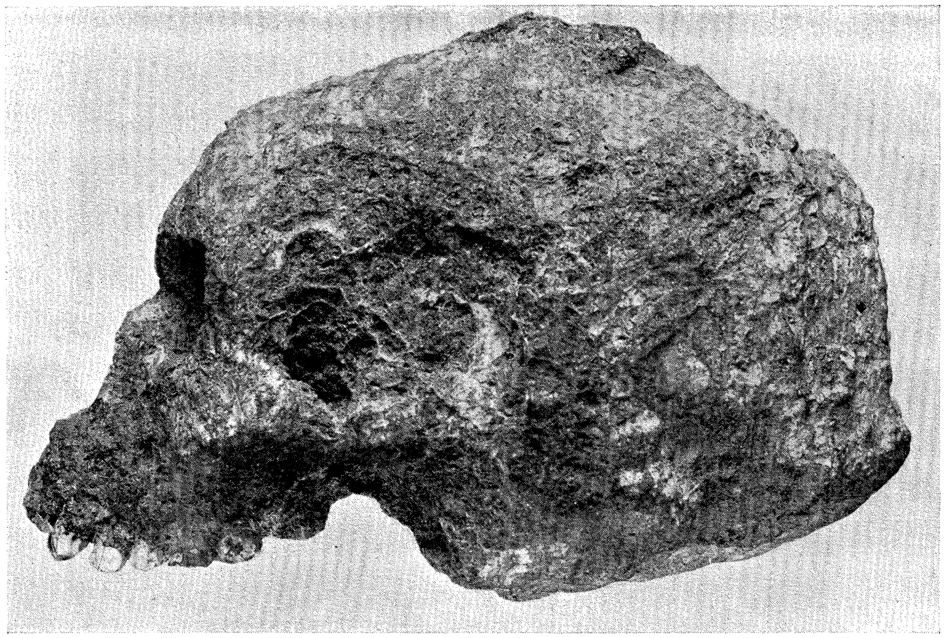


FIG. 8.

FIG. 9.

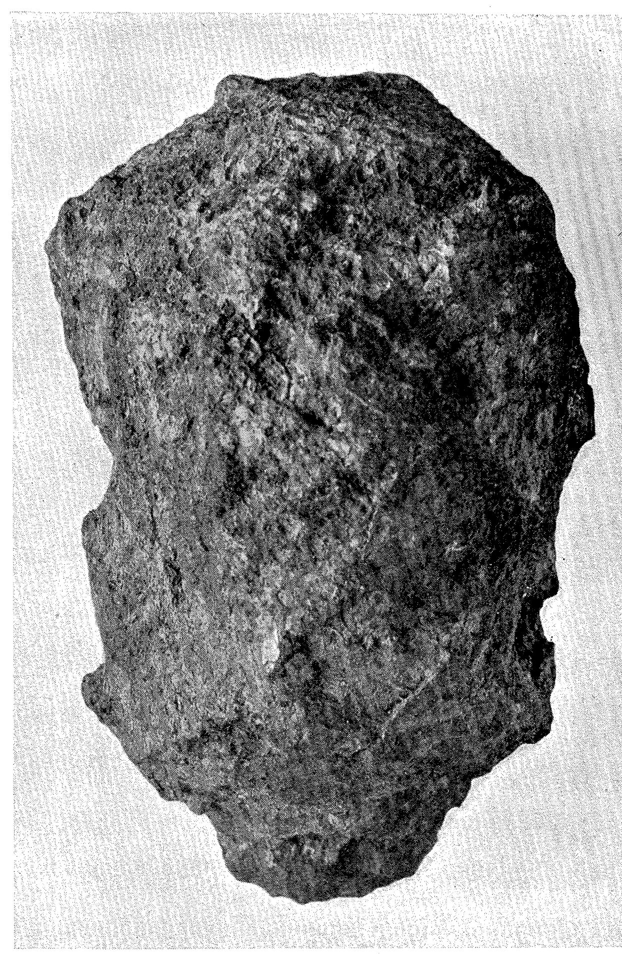
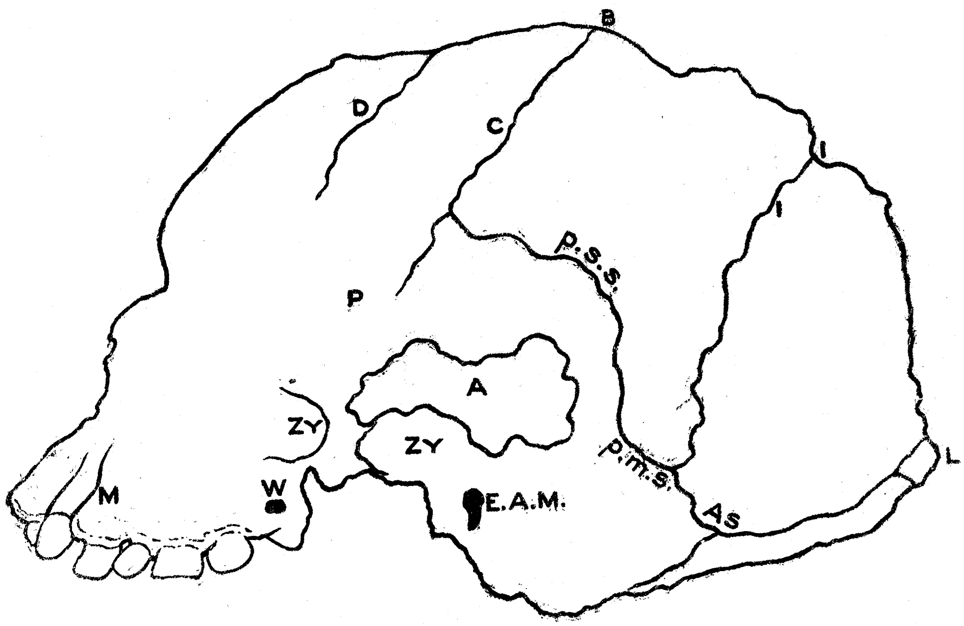


FIG. 10.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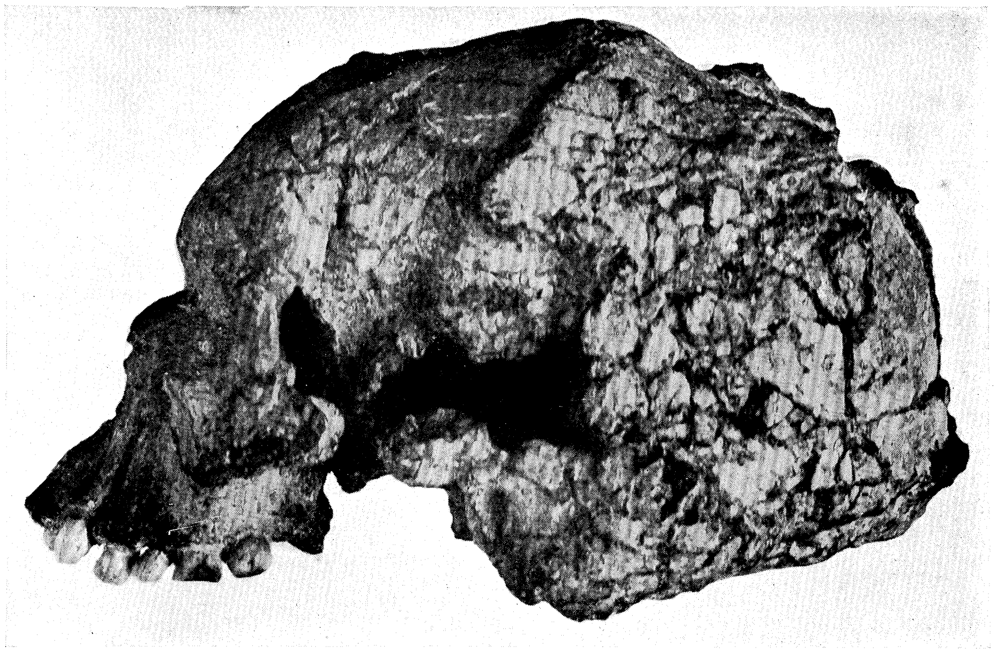


Fig. 11.

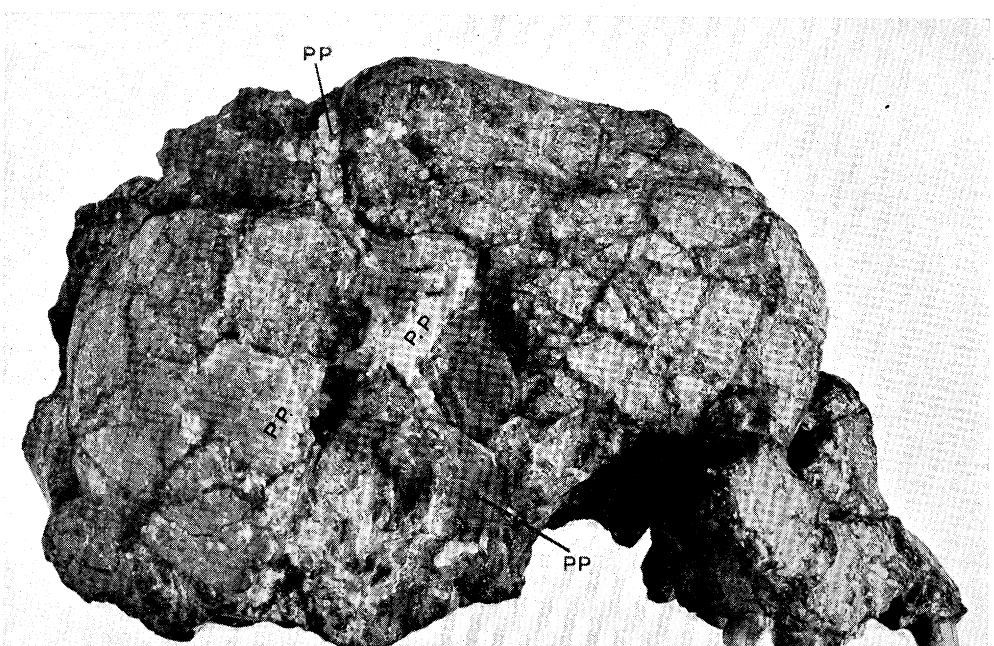


Fig. 12.

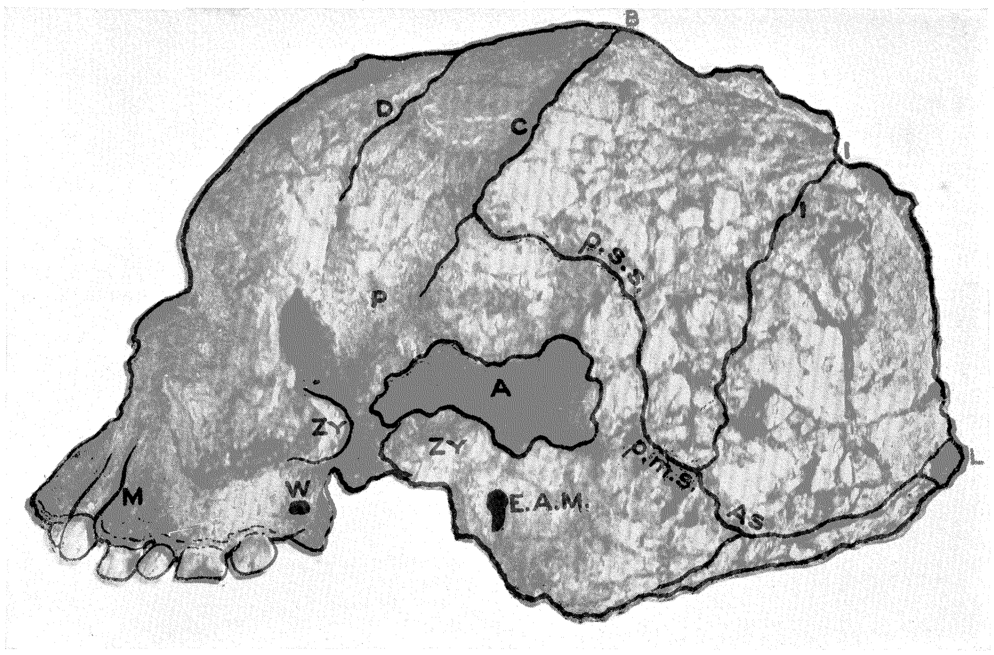


FIG. 11.

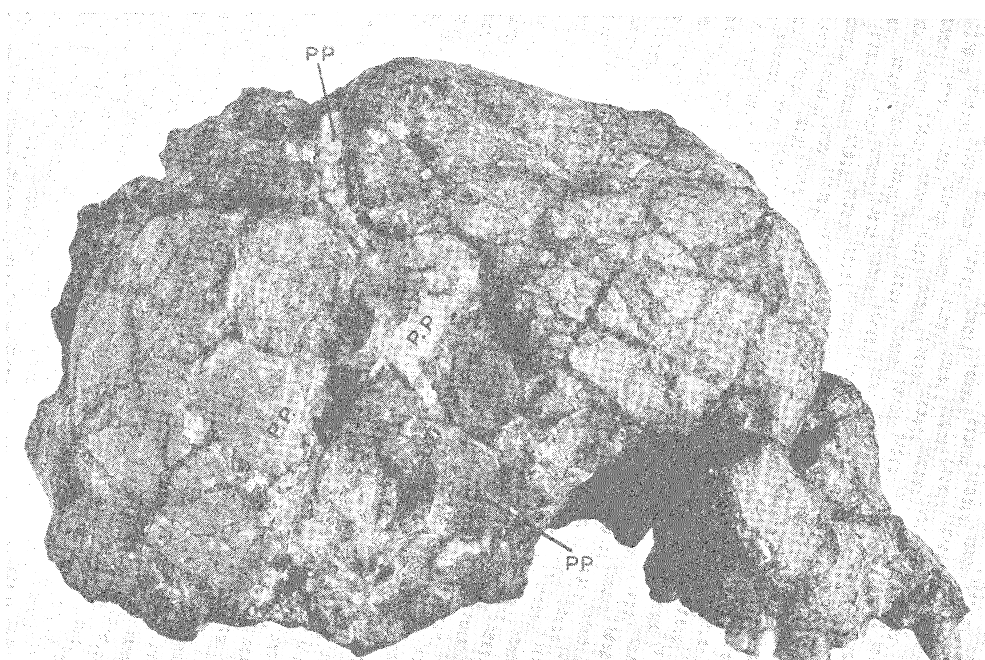


FIG. 12.

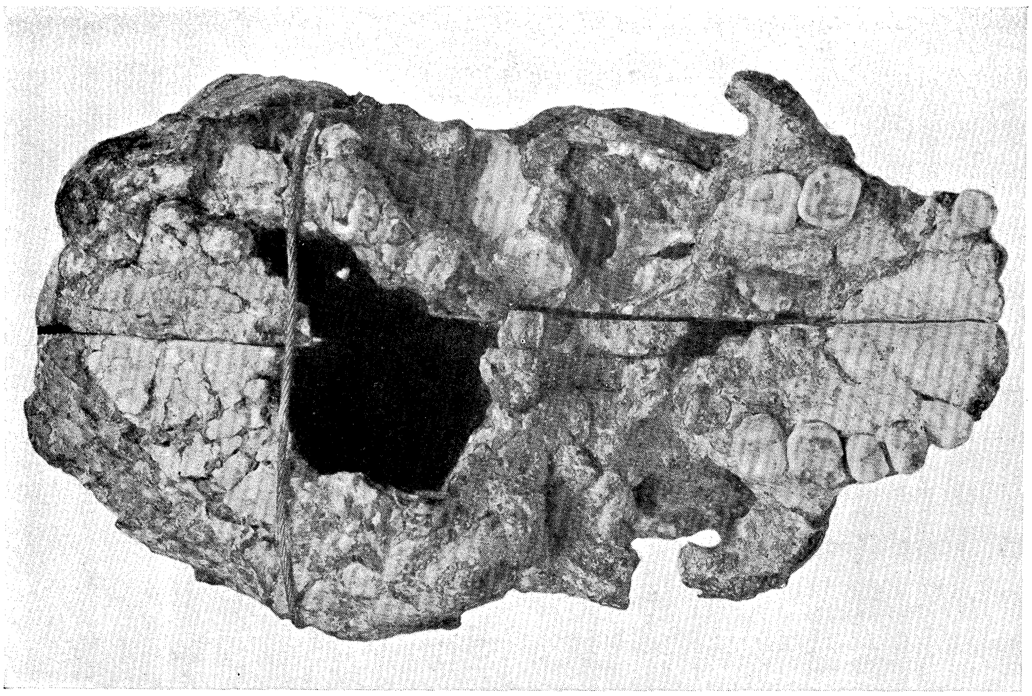


Fig. 14.

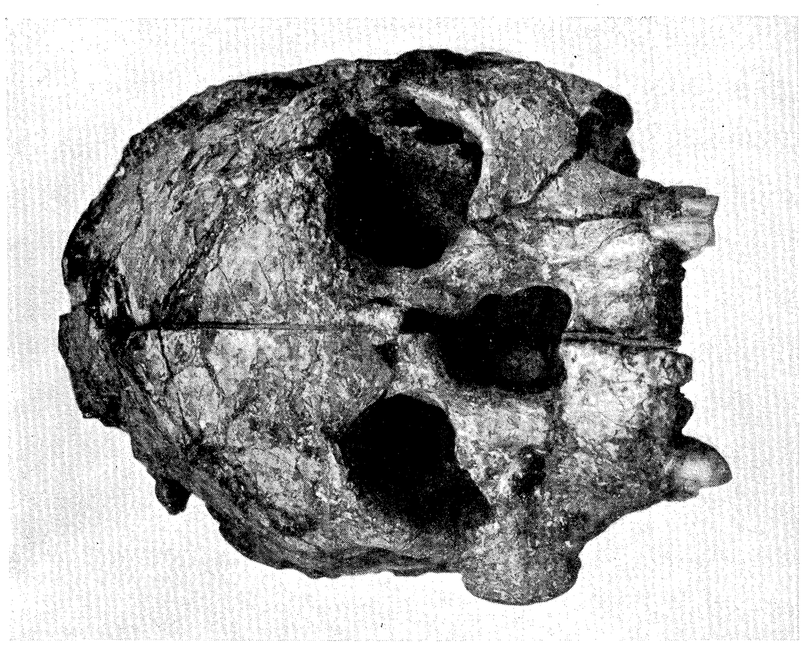


Fig. 13.

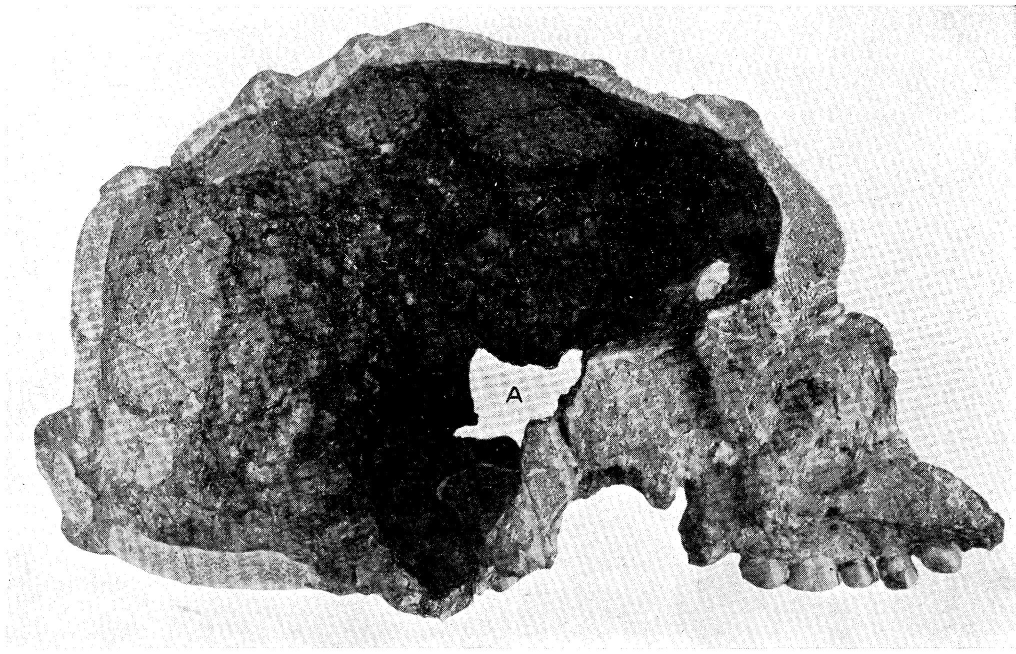


Fig. 15.

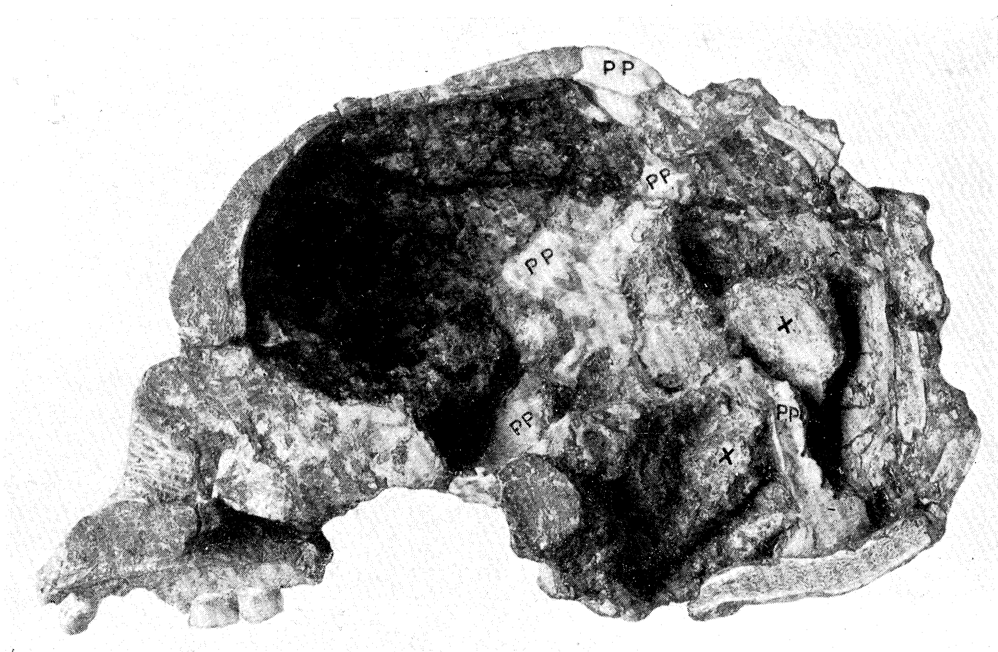


Fig. 16.

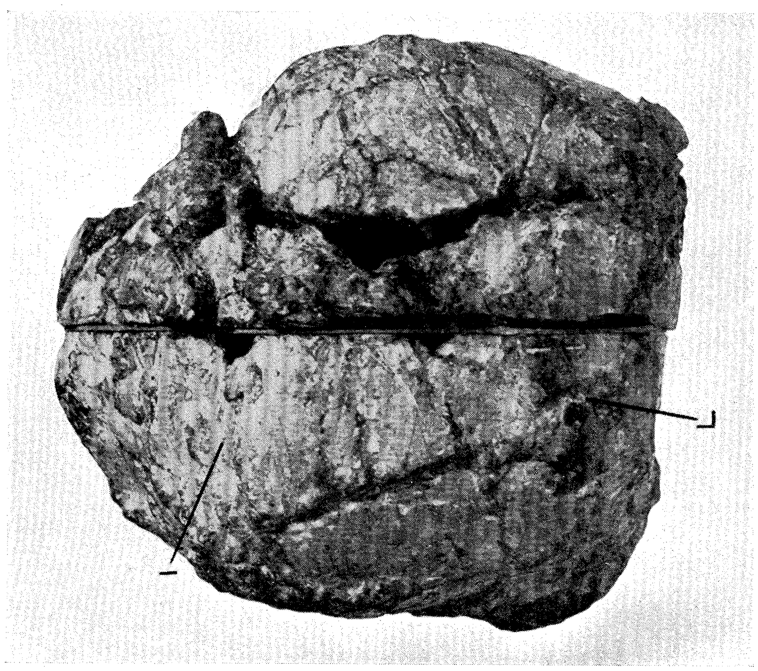


FIG. 18.

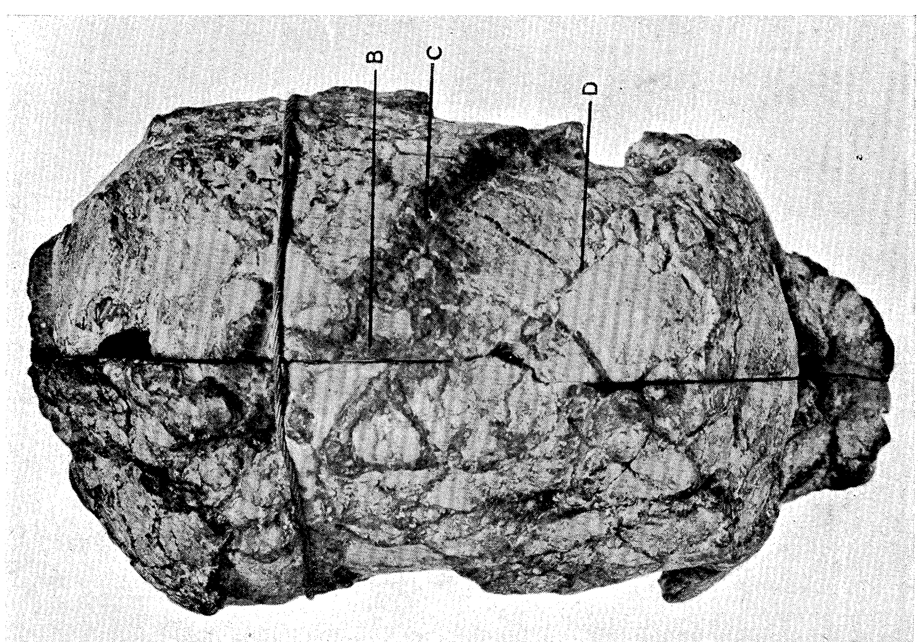


FIG. 17.

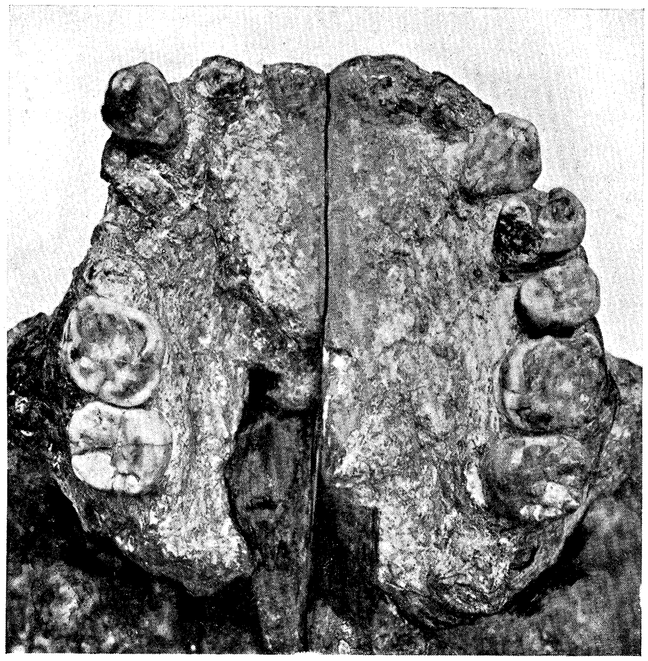


Fig. 19.

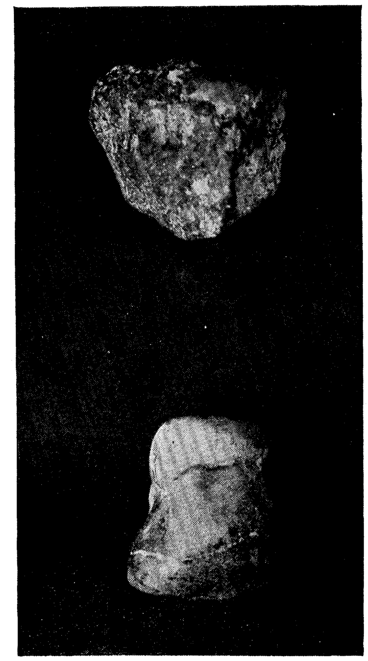


Fig. 20.

Fig. 21.

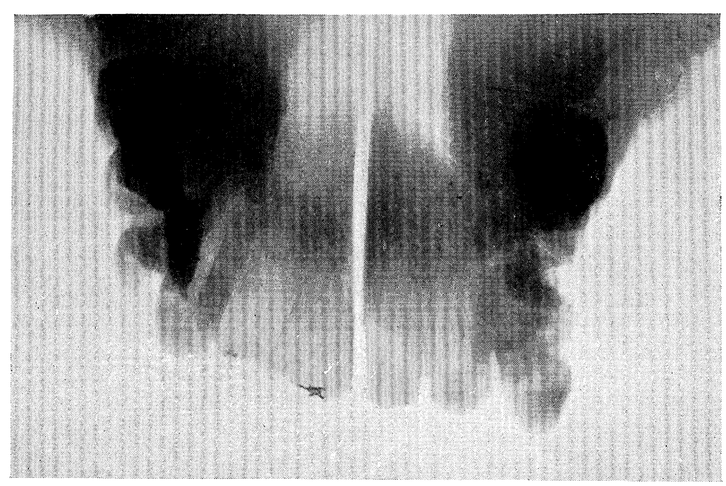


Fig. 23.

Fig. 22.

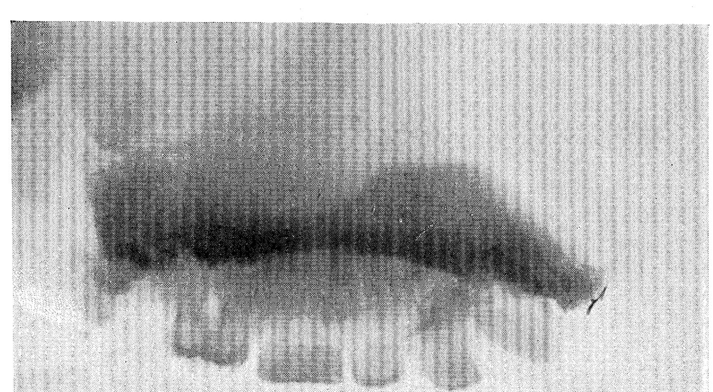


Fig. 24.

FIG. 28.

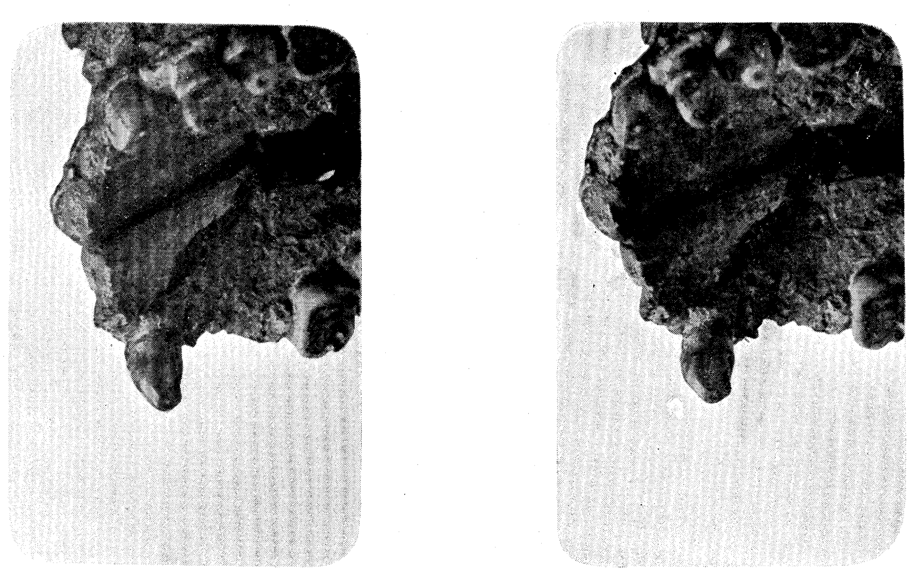


FIG. 29.

PLATE 17.

Fig. 19.—The palate (natural size).

Fig. 20.—The crowns of the left median upper incisor and the second right upper premolar teeth.

Fig. 21.—Distal (posterior-interstitial) surface of the crown of the right upper canine tooth, showing the facet caused by the first lower premolar.

Fig. 22.—Right upper canine tooth ; the facet caused by the lower canine on the mesial (anterior-interstitial) border.

(Figs. 20–22 are enlarged.)

Figs. 23 and 24.—Radiographs of the teeth of the maxilla.

PLATE 18.

Figs. 28 and 29.—Stereoscopic photographs of the right upper canine tooth, from the same aspects as in figs. 21 and 22. The wisdom tooth is visible in fig. 28.

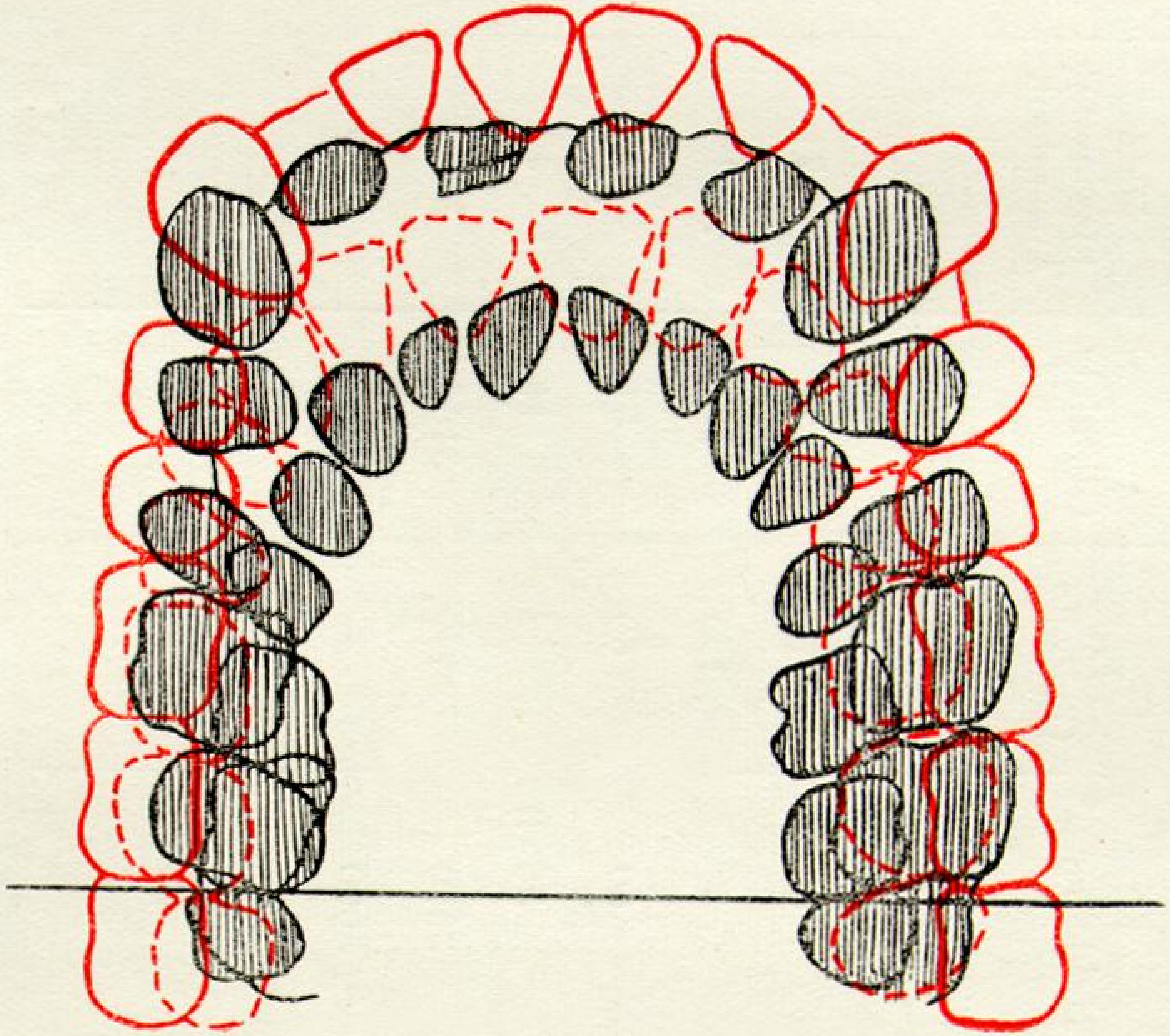


FIG. 2.—Palatal areas of Talgai and (tentatively reconstructed) Piltdown skulls, a very large Australian and a modern Englishman, superposed on a line posterior to the second molar tooth. The reconstructed Piltdown palate (red outline) is the largest. The others in order of size are Talgai (black), Australian (red), and English (black).

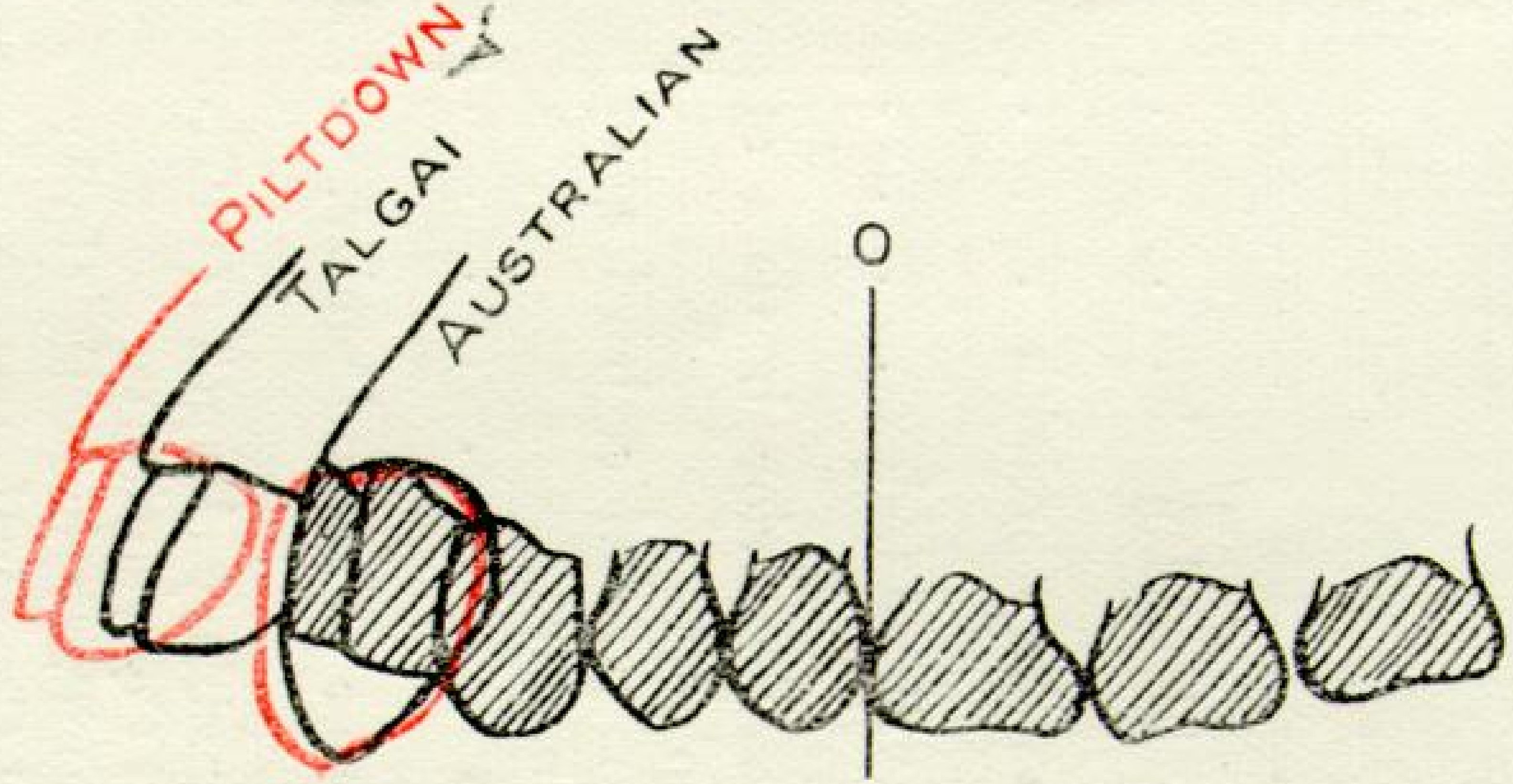


FIG. 3.—Tracing in normal lateralis of the teeth of the Talgai skull, the Piltdown reconstruction, and a large adult Australian, superposed on a line drawn anterior to the first molar tooth. The incisor teeth of the Talgai skull have been reconstructed. The Piltdown tracing is from SMITH-WOODWARD's reconstruction.

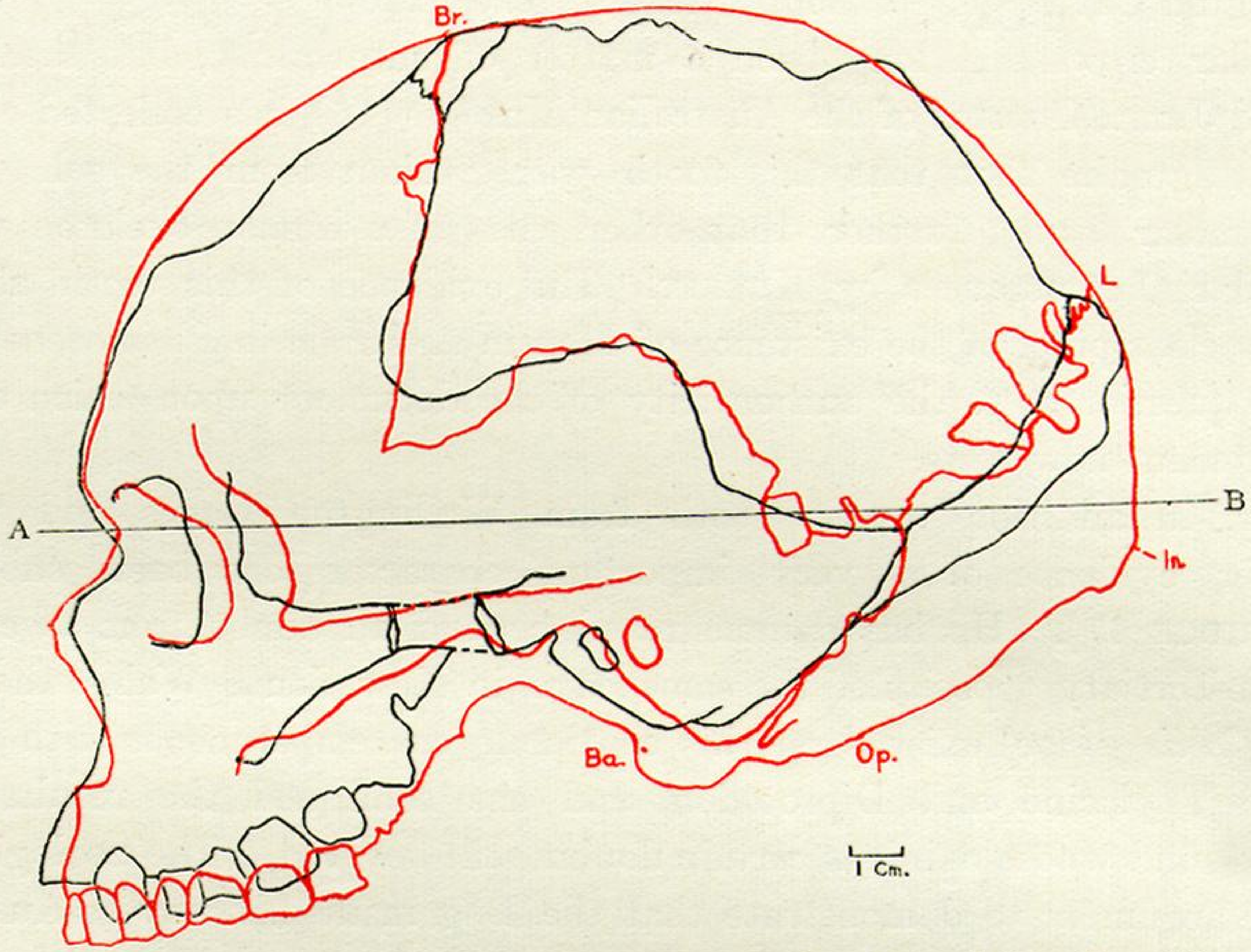


FIG. 25.—Norma lateralis. Skulls superimposed on KEITH'S base-line AB.

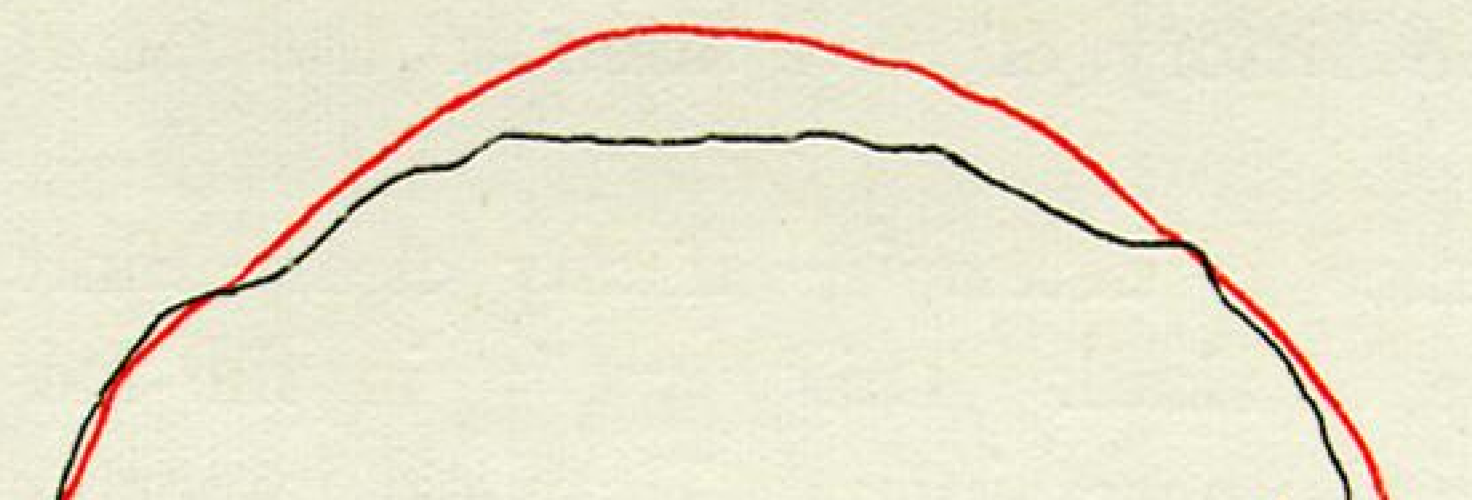


FIG. 26.—Norma facialis. Posed on the Frankfurt plane.

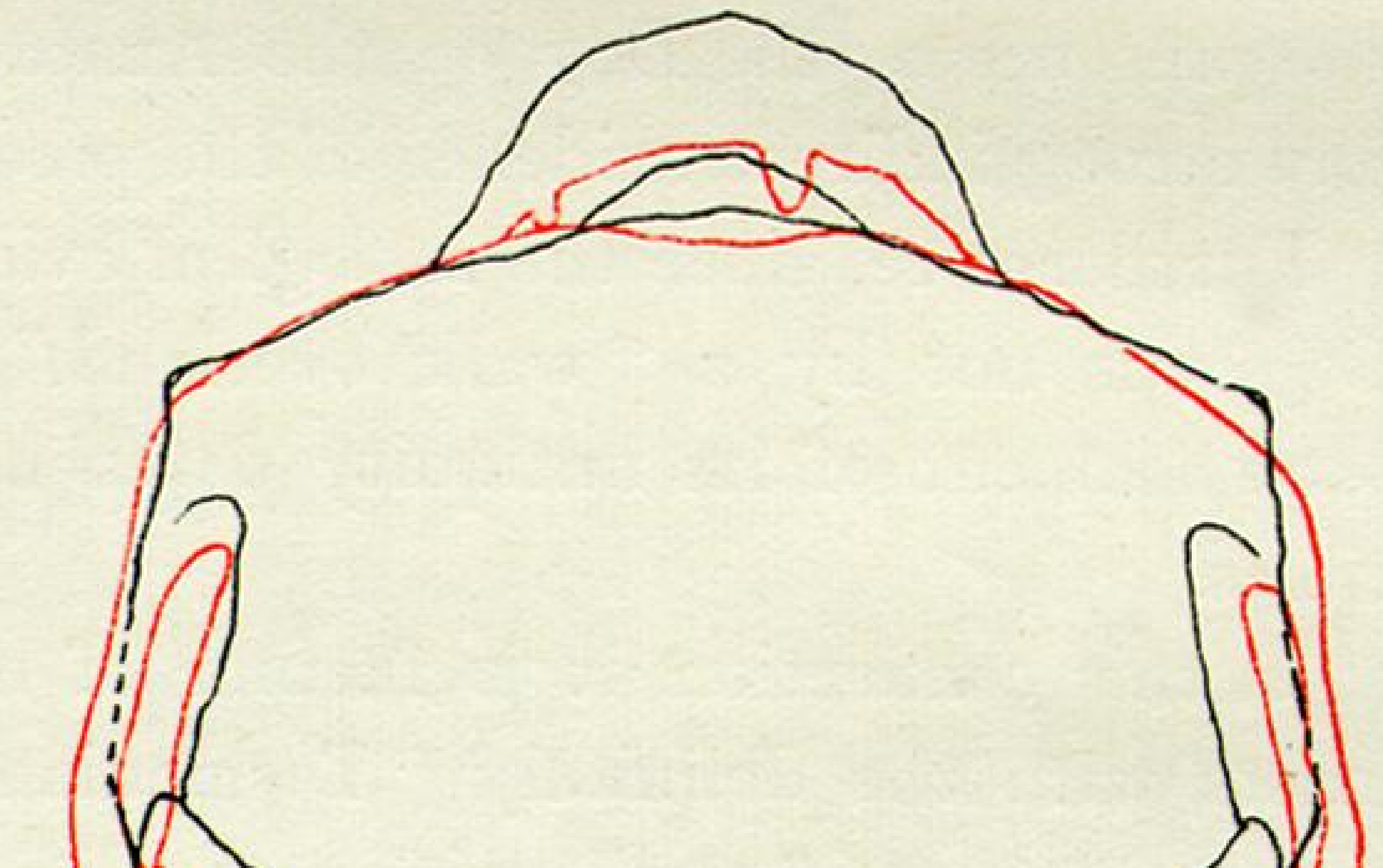


FIG. 27.—Norma verticalis.

FIGS. 25–27.—Dioptographic Tracings of Talgai Skull (black), and Modern Australian (red).

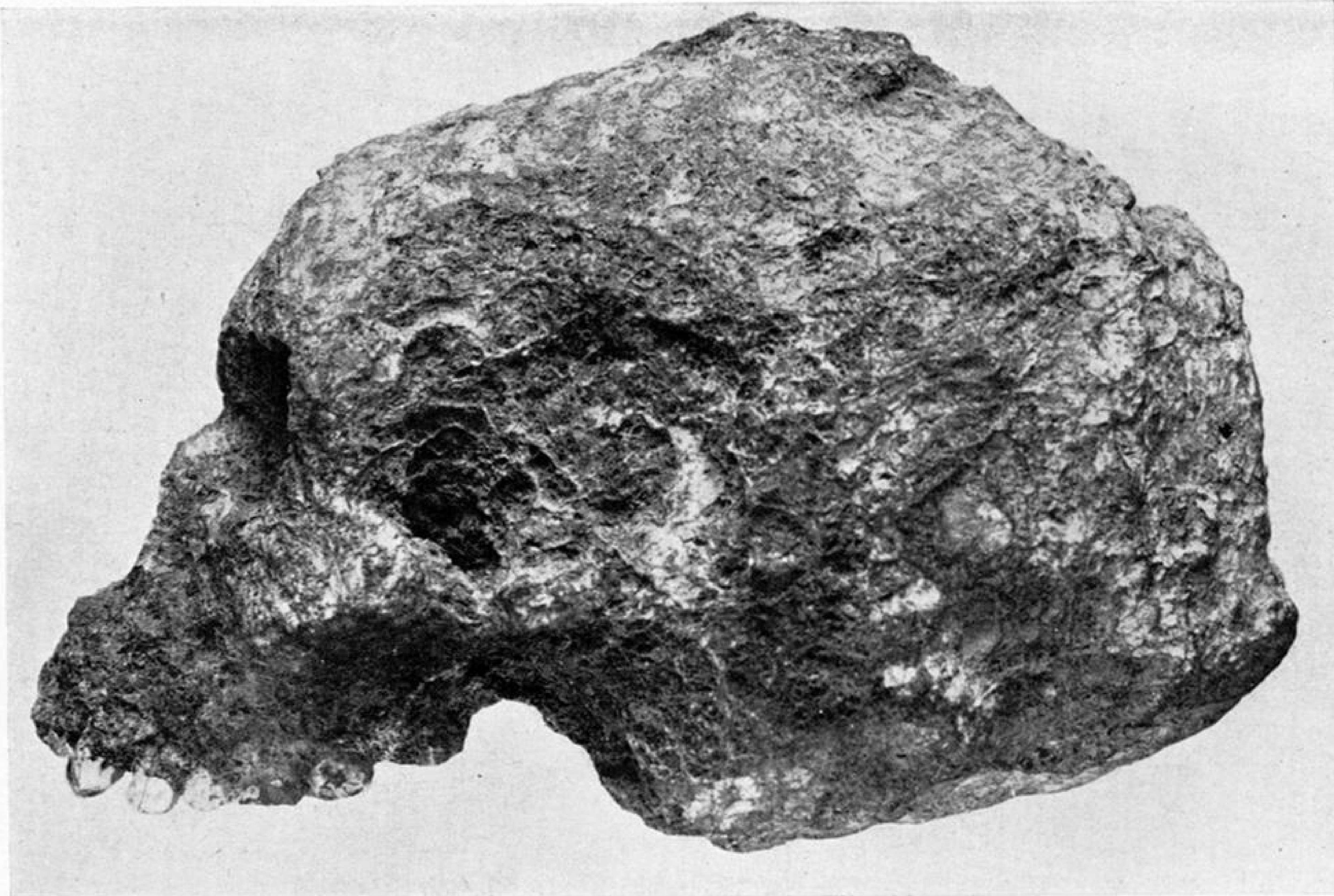


Fig. 8.

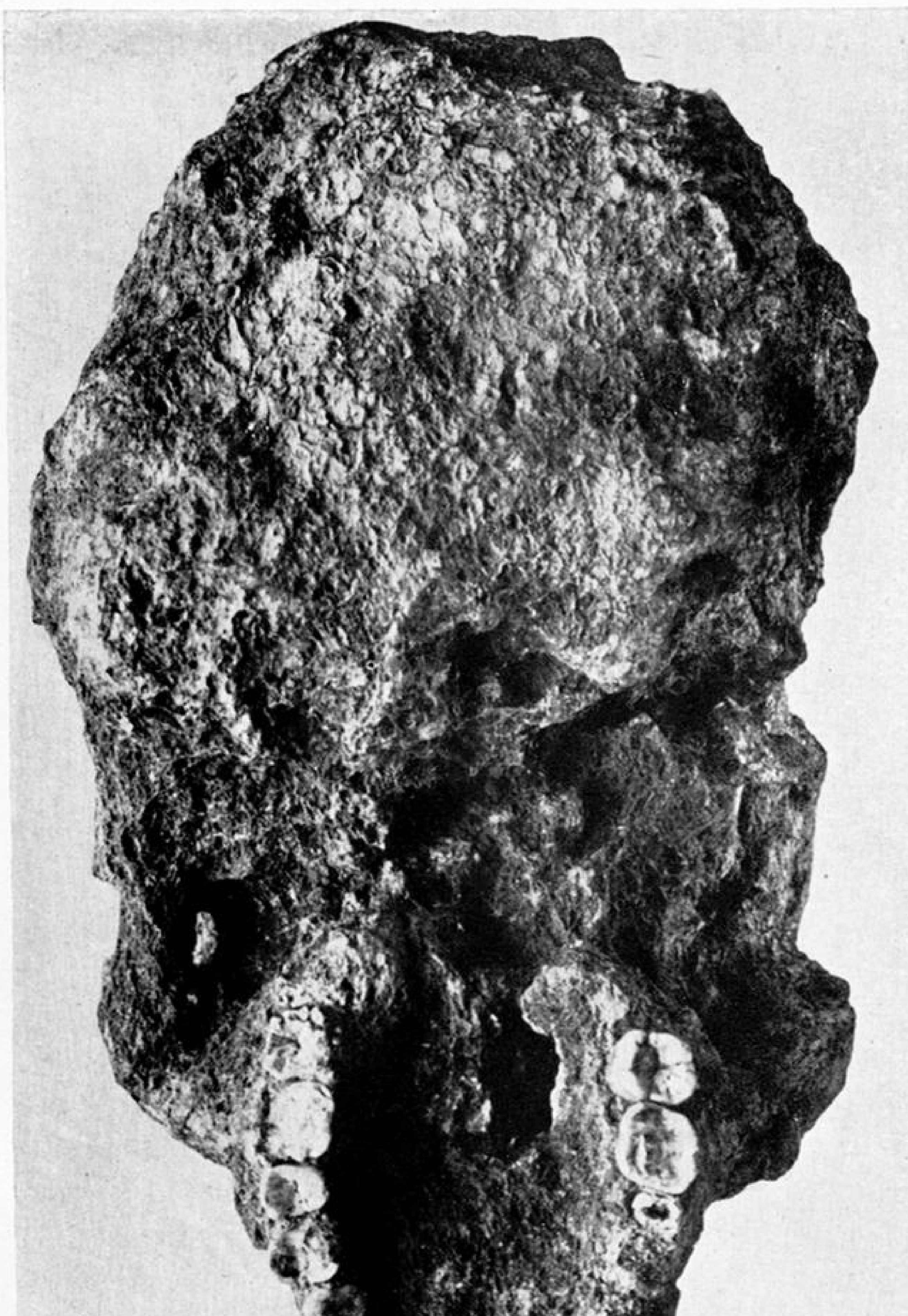


Fig. 9.

Fig. 10.

Plate 12.

Fig. 8.—Norma lateralis of undeveloped fossil.
Fig. 9.—Norma basalis of undeveloped fossil.
Fig. 10.—Norma verticalis of undeveloped fossil.

FIG. 11.

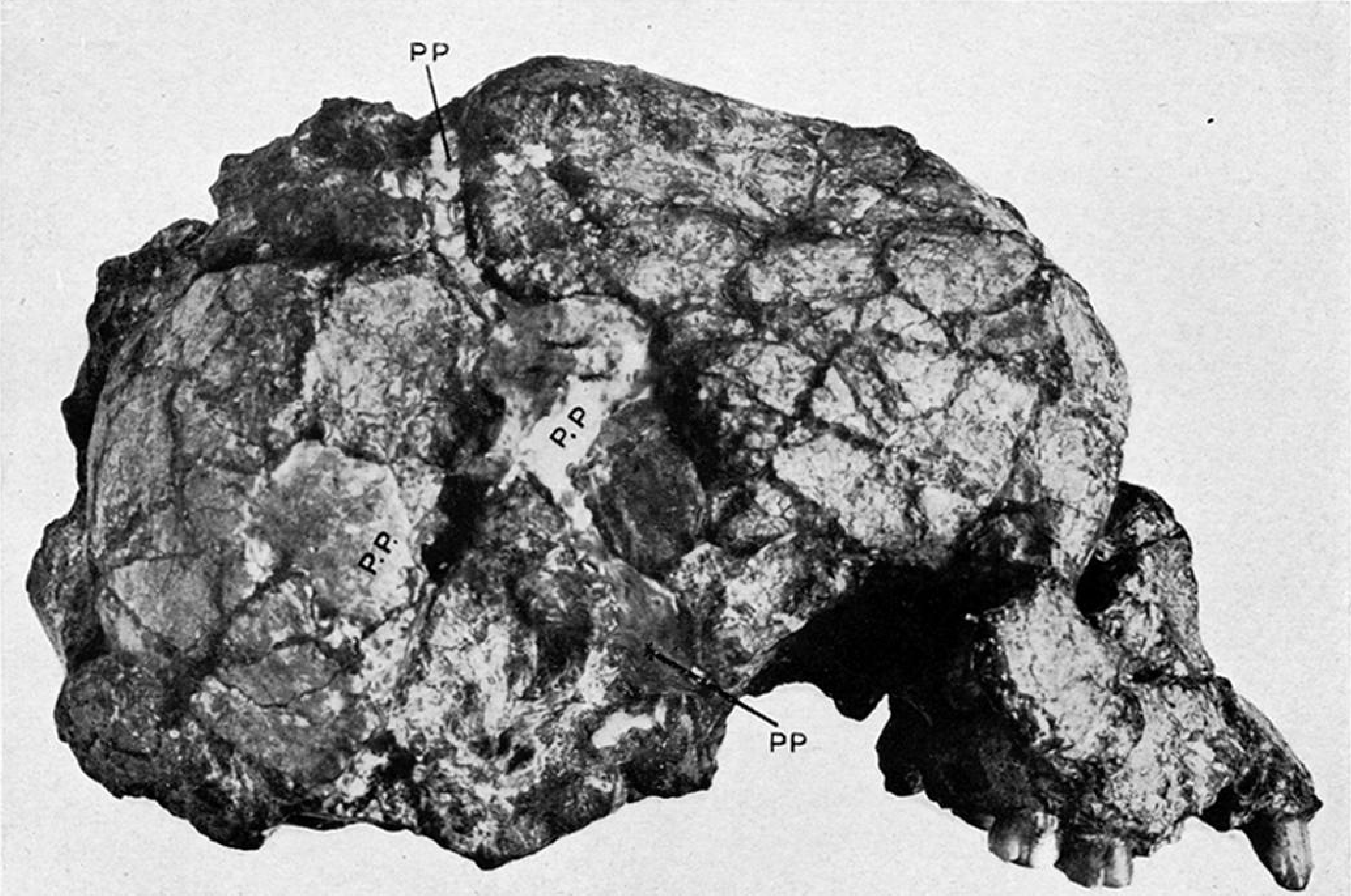


FIG. 12.

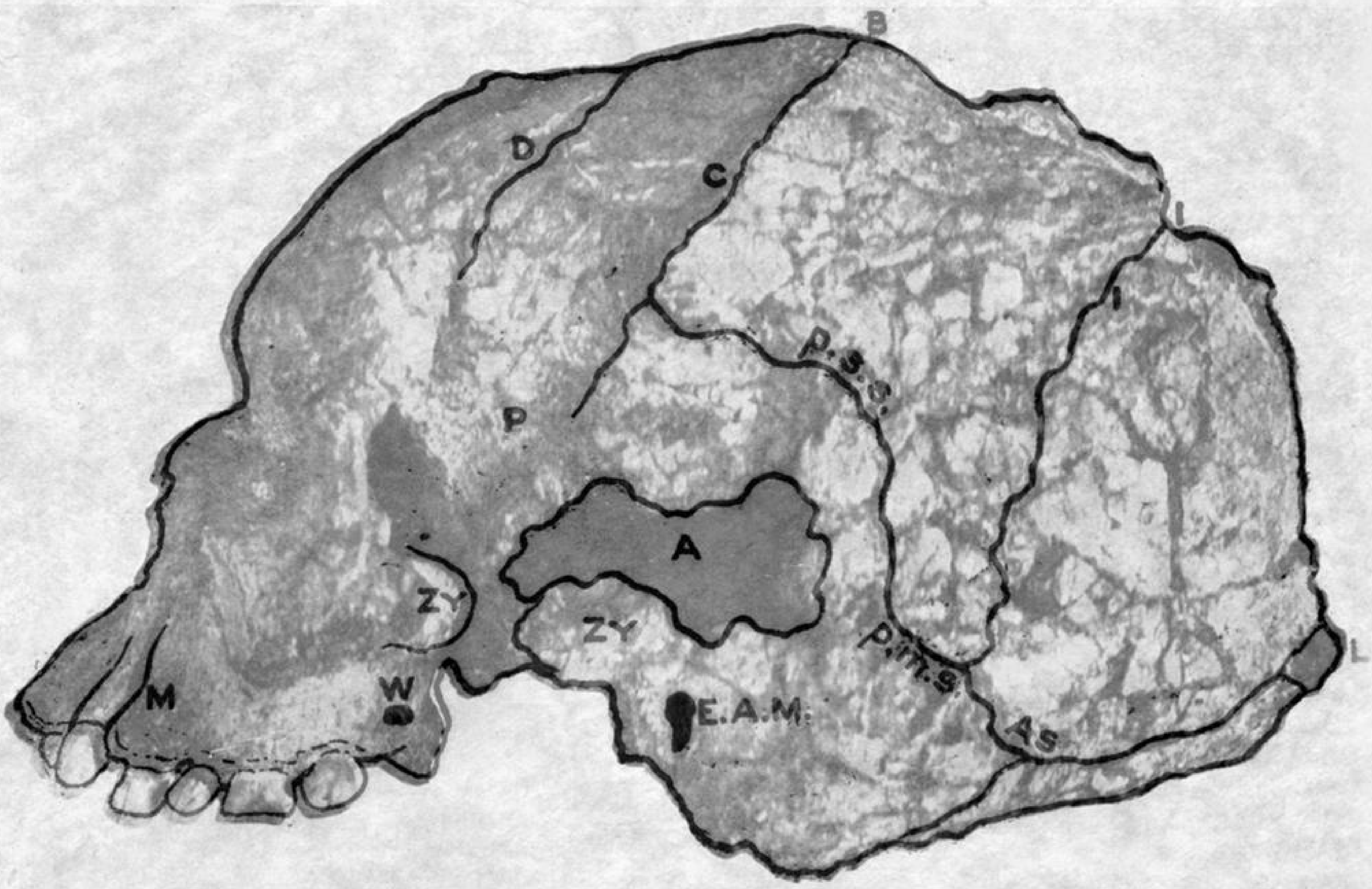


Fig. 11.

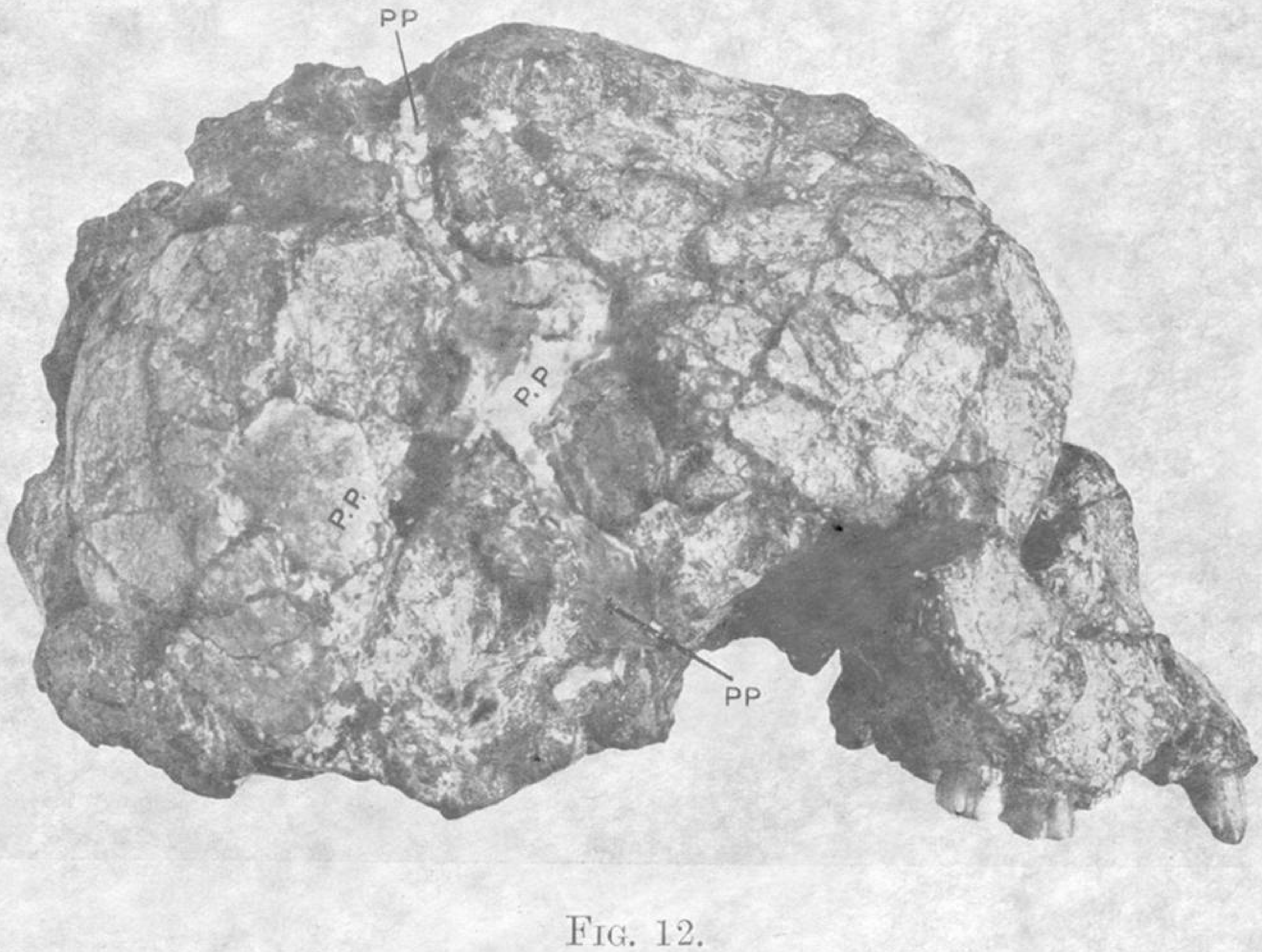


Fig. 12.

PLATE 13.

Fig. 11.—Norma lateralis (left side) of the skull after development.

A, deficiency in squama temporalis; *B*, region of the bregma; *C*, fracture at the site of the coronal suture; *D*, fracture of frontal bone; *I*, fracture of parietal bone; *L*, lambda; *p.s.s.*, parieto-squamous suture; *p.m.s.*, parieto-mastoid suture; *E.A.M.*, external acoustic meatus; *M*, fractures in maxilla in connection with the displaced canine tooth; *As*, the asterion; *W*, wisdom tooth; *ZY*, portions of zygoma.

Fig. 12.—Norma lateralis (right side) of the skull after development.

P.P., splints of plaster holding the specimen together.

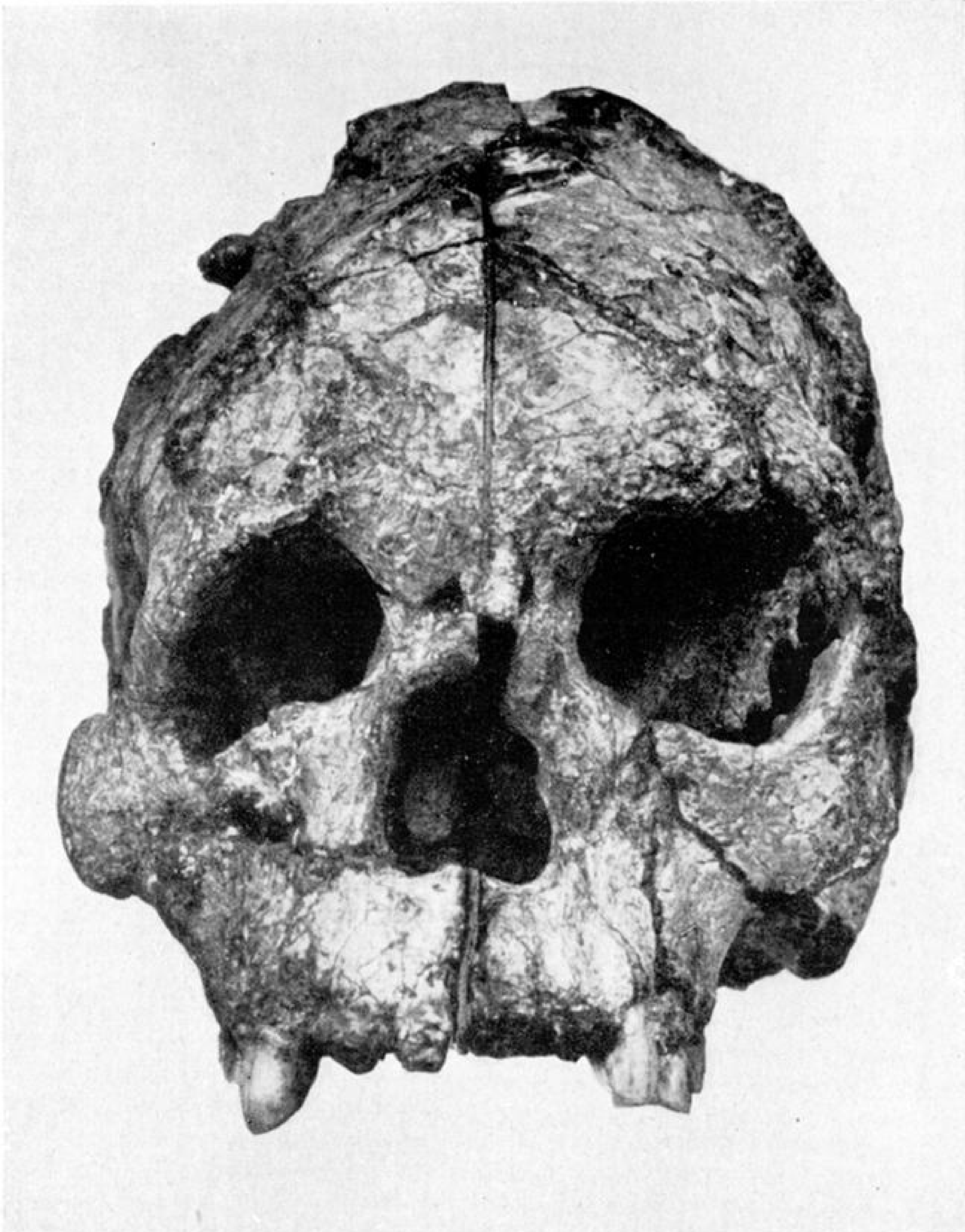


Fig. 13.

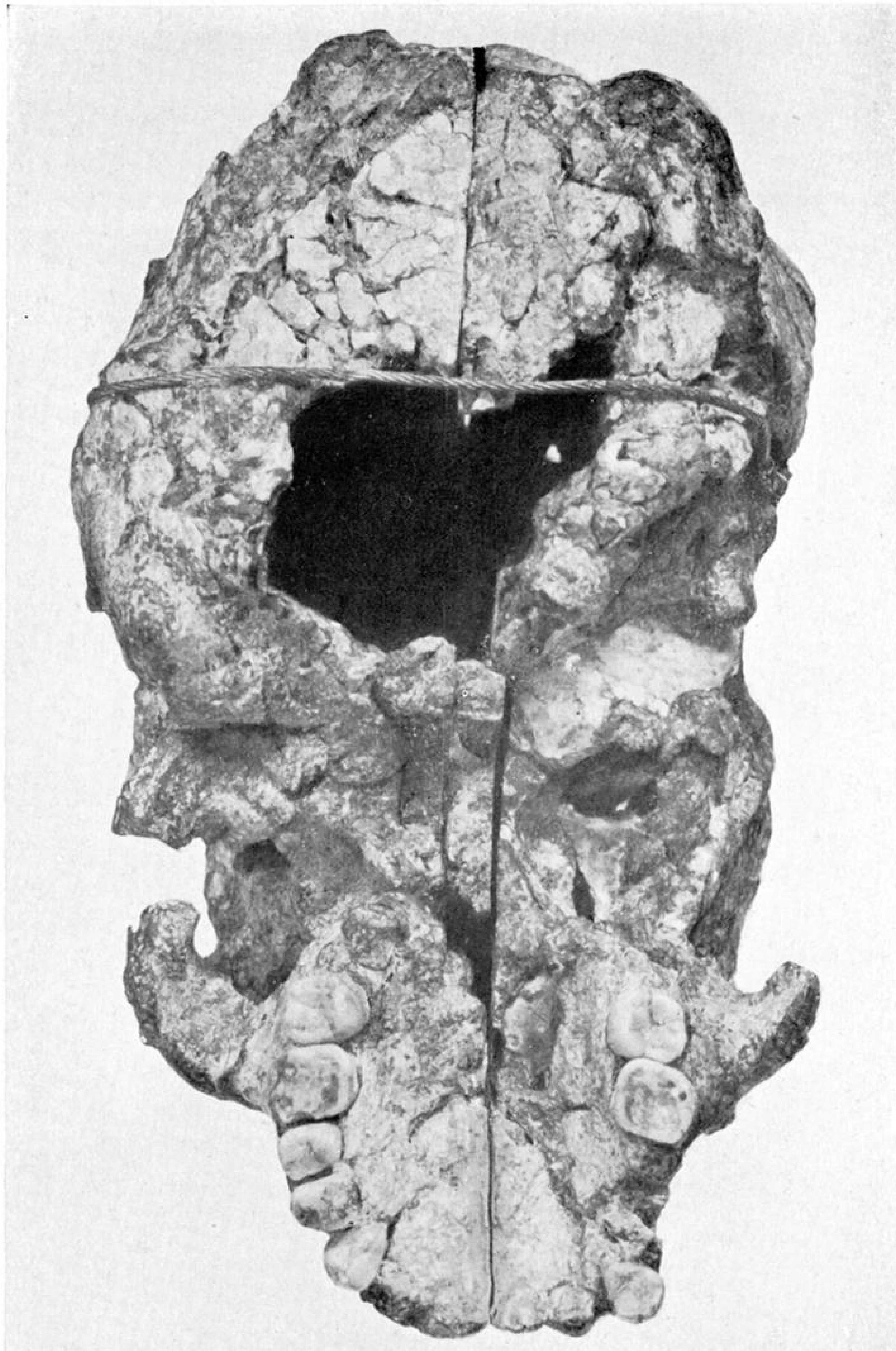


Fig. 14.

Plate 14.

Fig. 13.—Norma facialis of the skull after development.

A piece of cardboard of measured thickness has been placed between the two halves of the skull to represent the amount of bone substance lost in the process of sawing.

Fig. 14.—Norma basilaris of the skull after development.

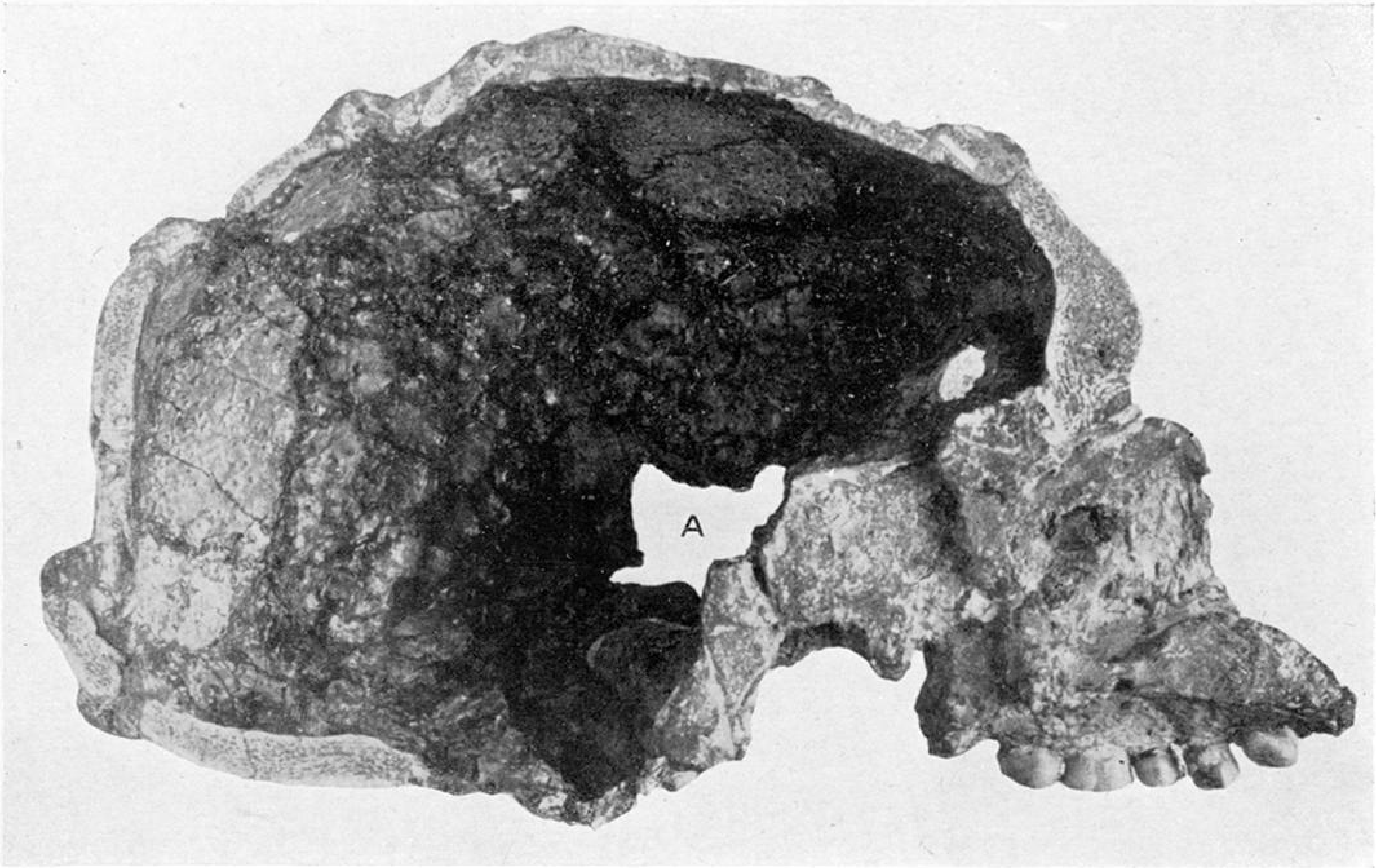


Fig. 15.

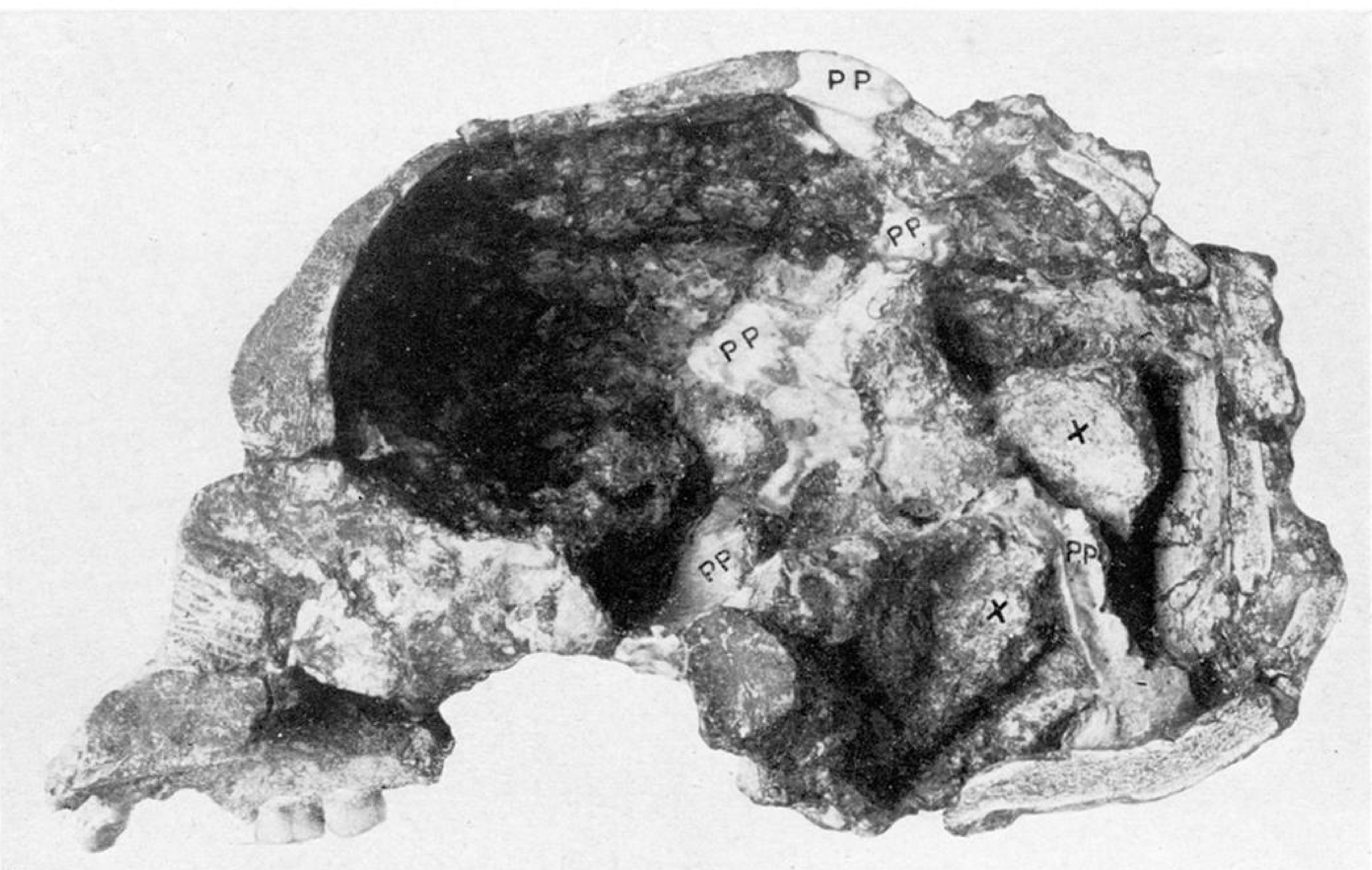


Fig. 16.

Plate 15.

Figs. 15 and 16.—The endocranial surfaces of the left and right sides, after development.

P.P., plaster of Paris ; *X*, pieces of bone, fractured and displaced, being attached to the endocranial surface of the skull. The sulcus for the transverse sinus is visible.

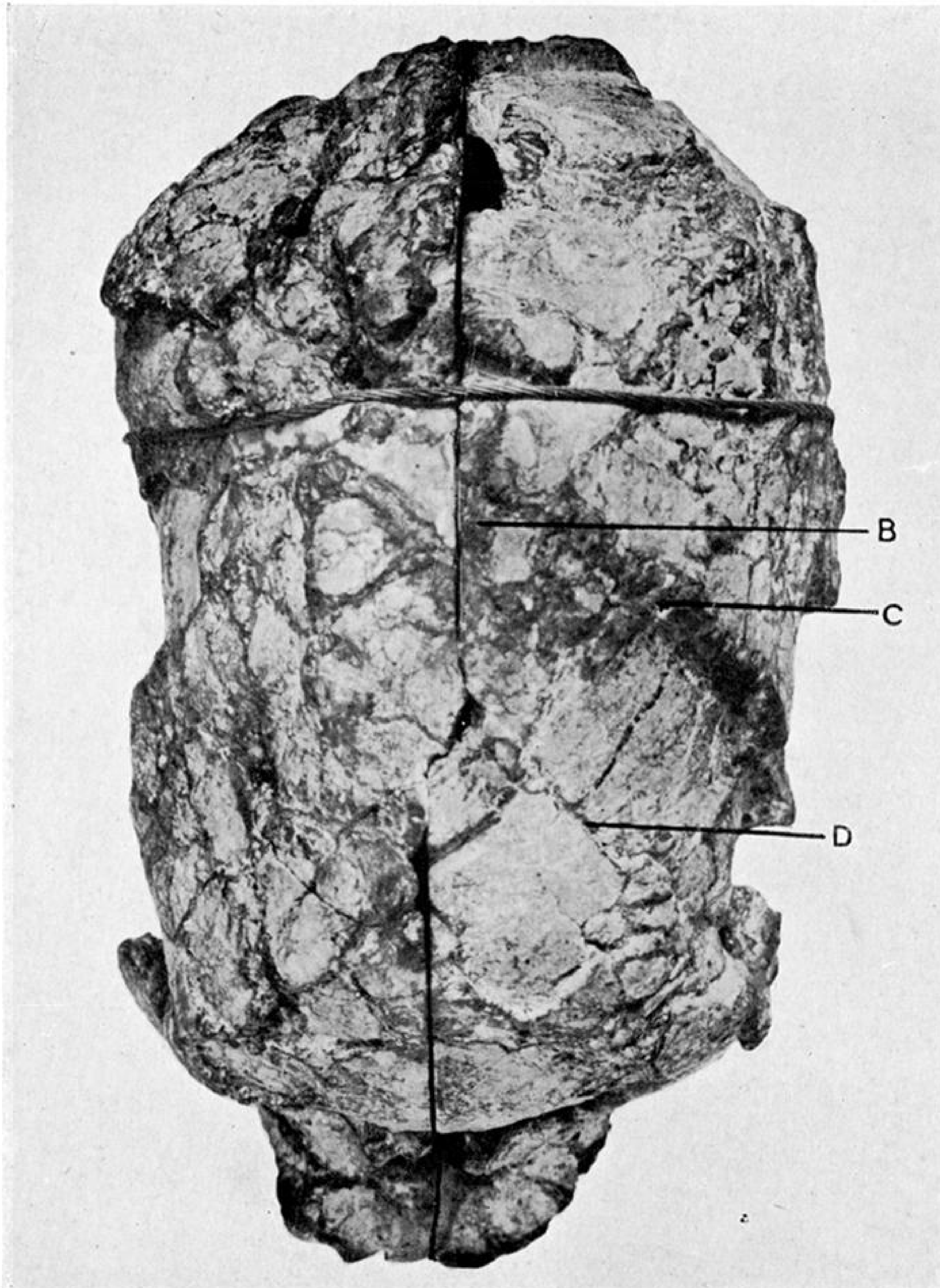


FIG. 17.

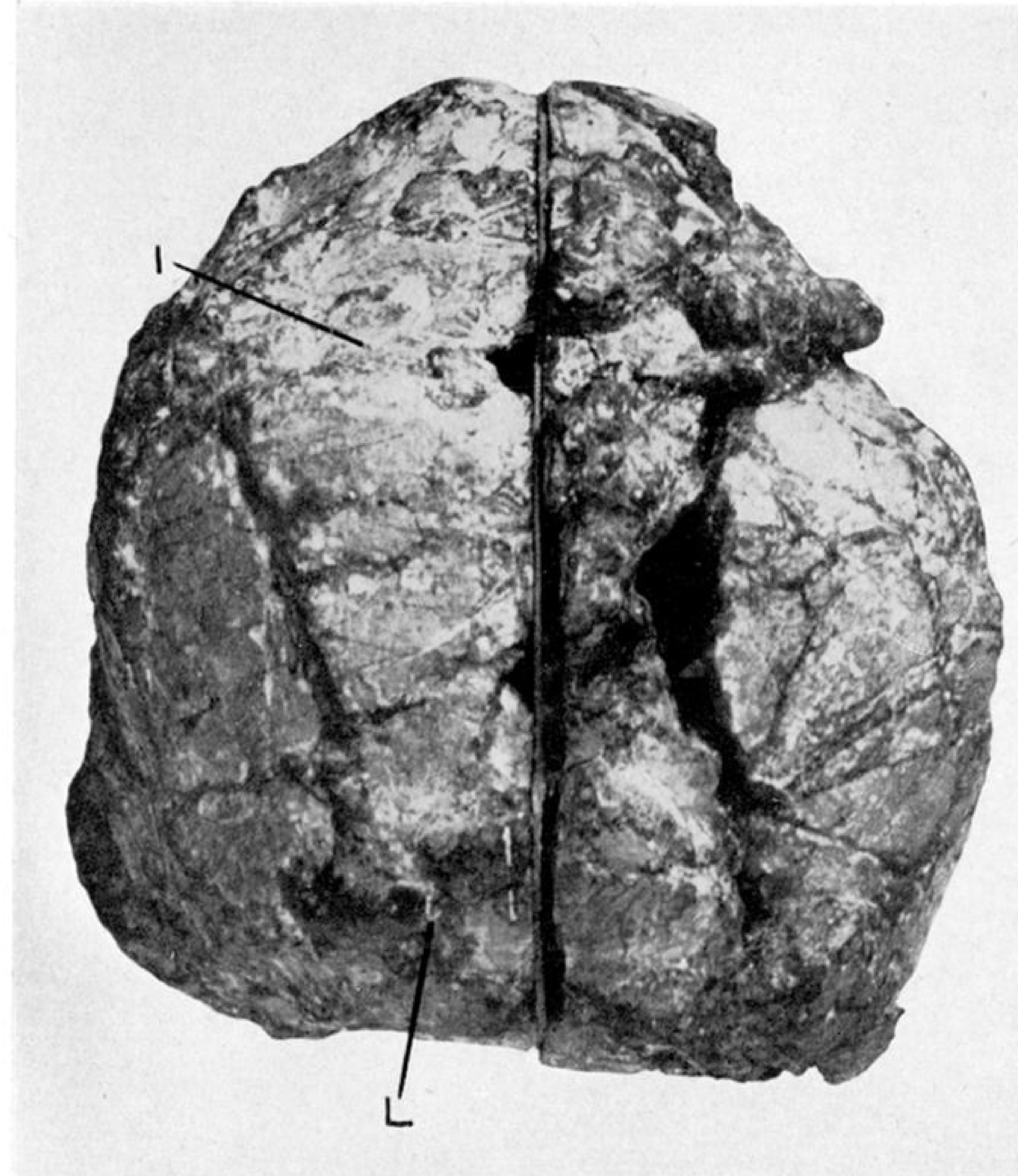


FIG. 18.

PLATE 16.

Fig. 17.—Norma verticalis of the skull after development.
B, the bregma ; *C*, the coronal suture ; *D*, fracture of frontal bone.

Fig. 18.—Norma occipitalis of the skull after development.
L, lambdoid suture ; *I*, fracture of parietal bone.

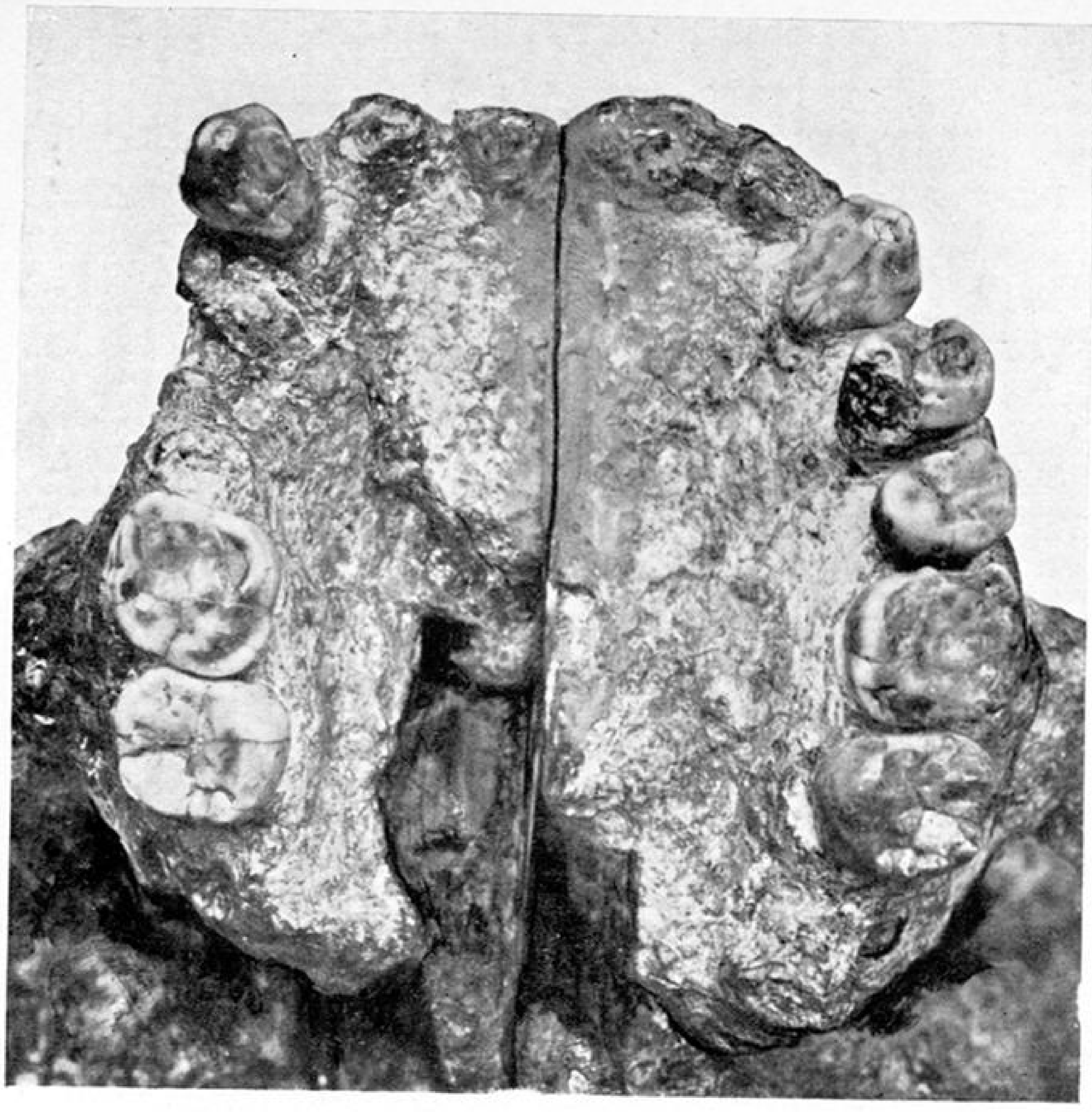


Fig. 19.

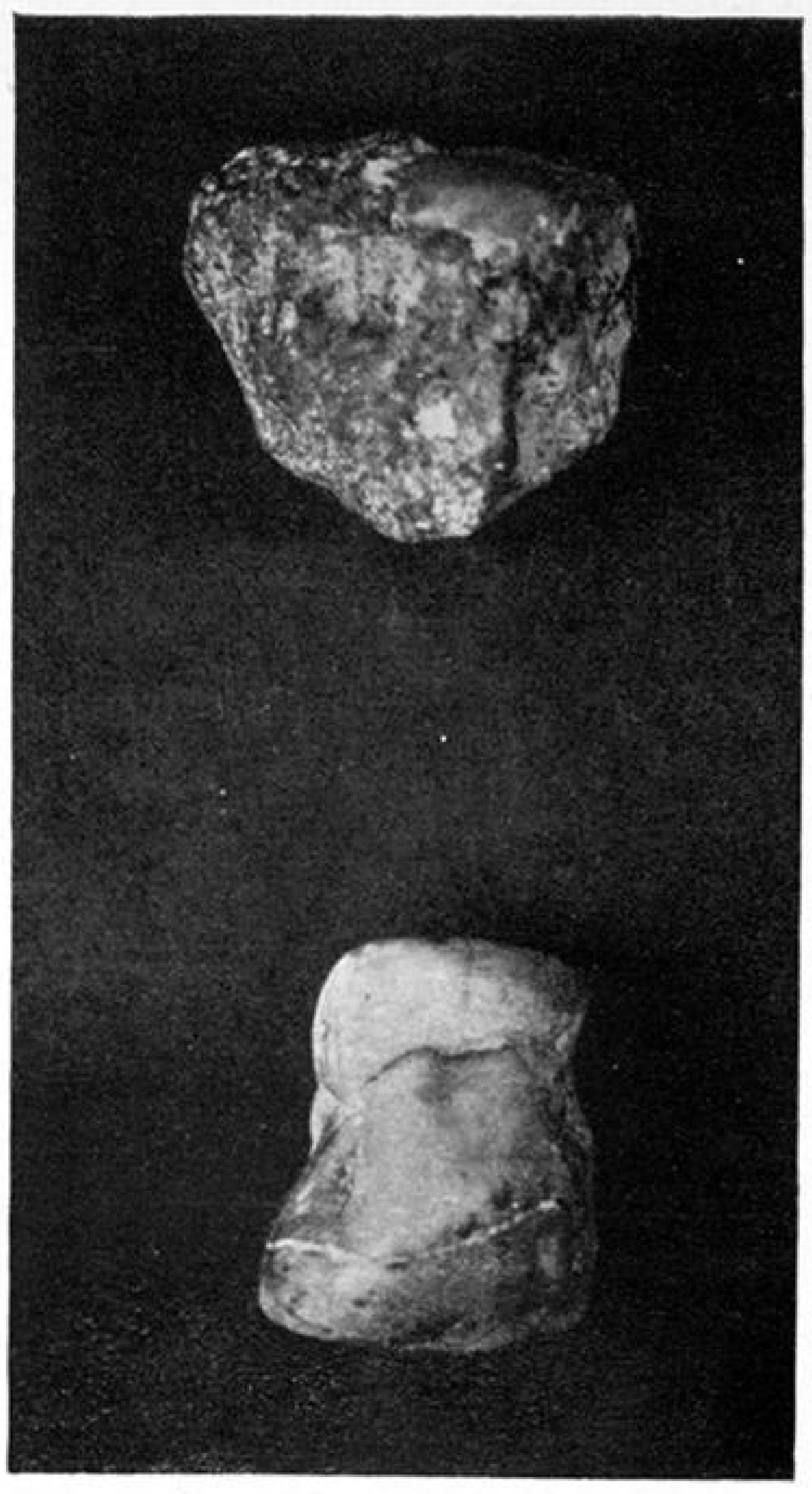


Fig. 20.

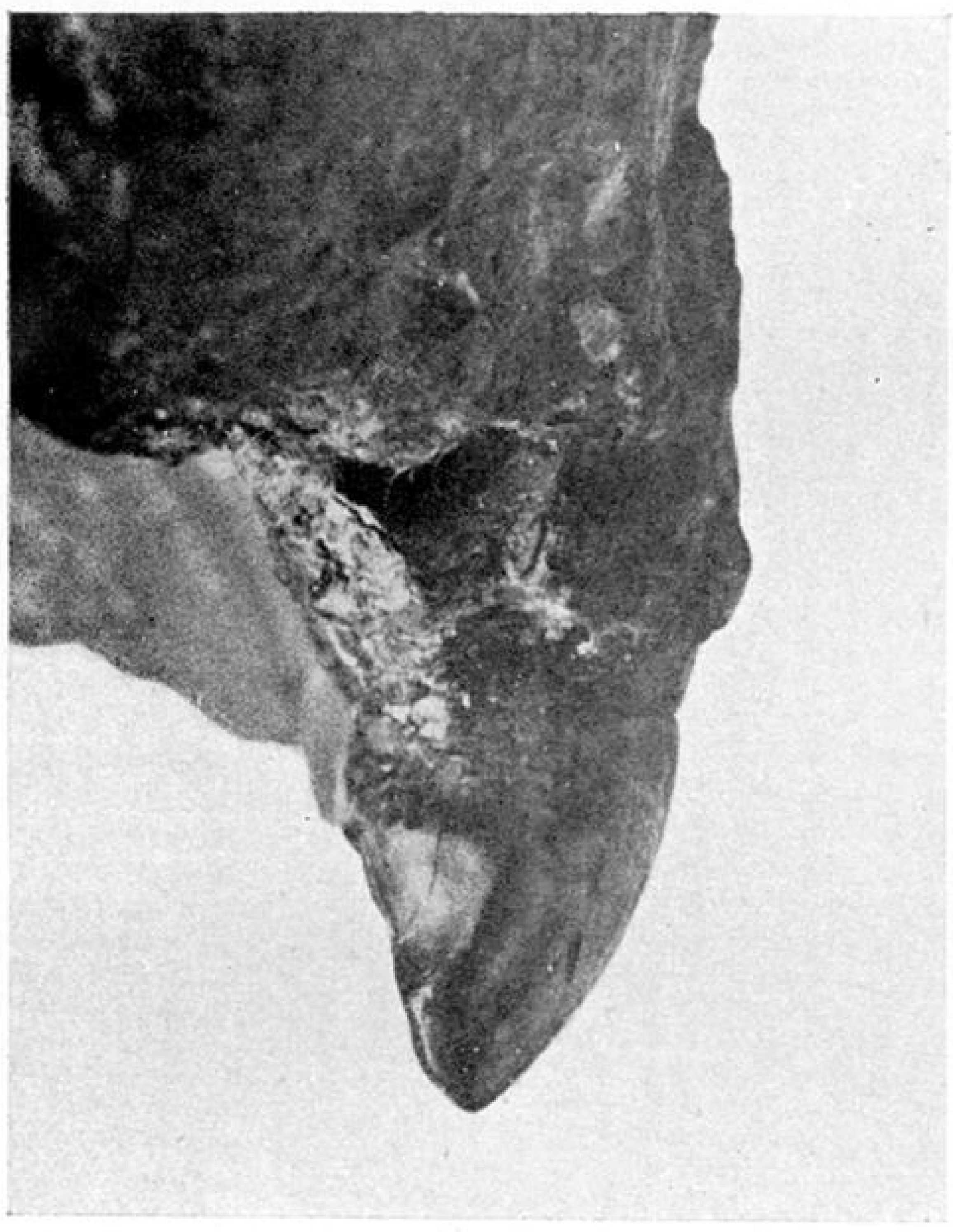


Fig. 21.

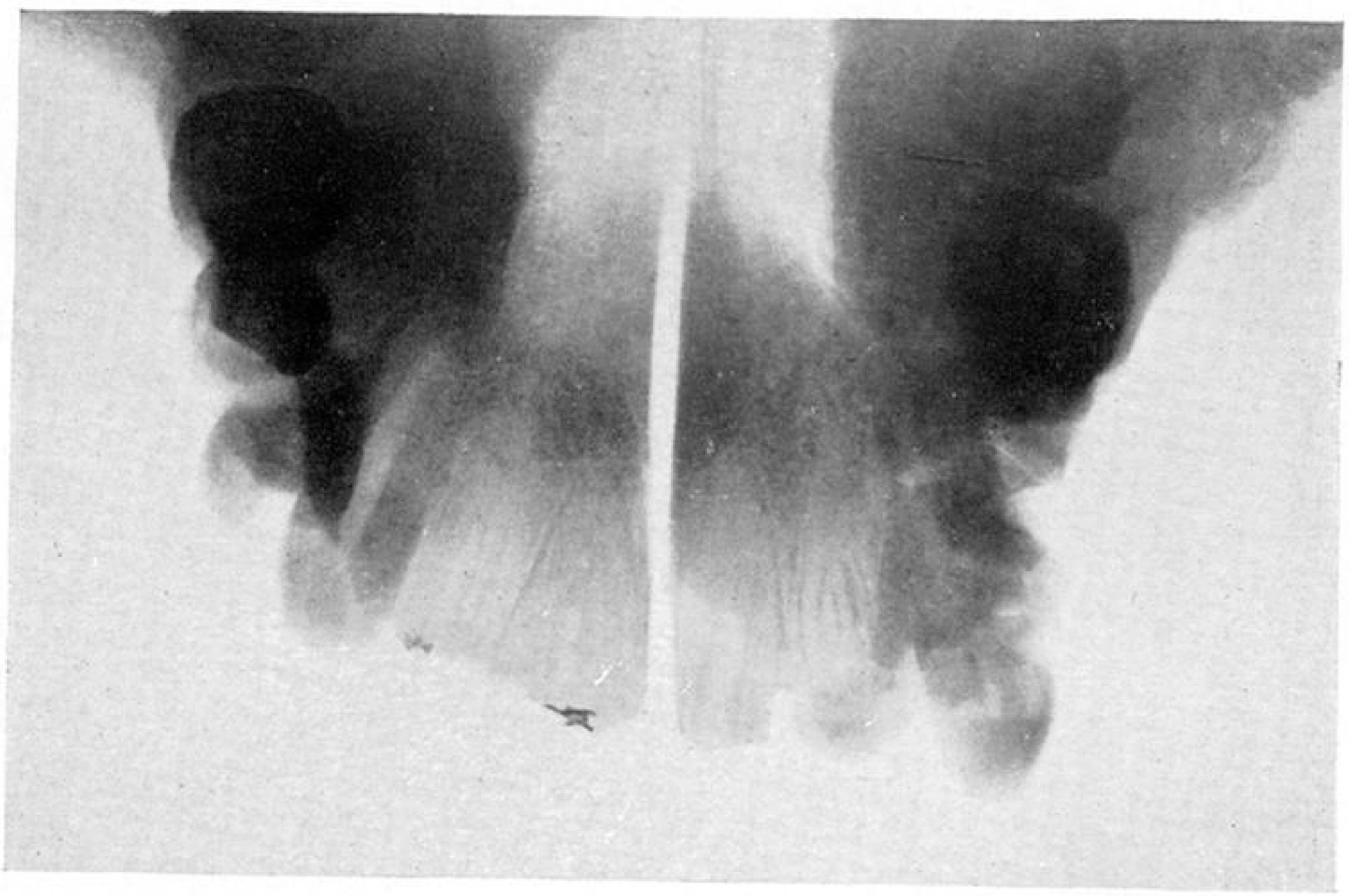


Fig. 23.

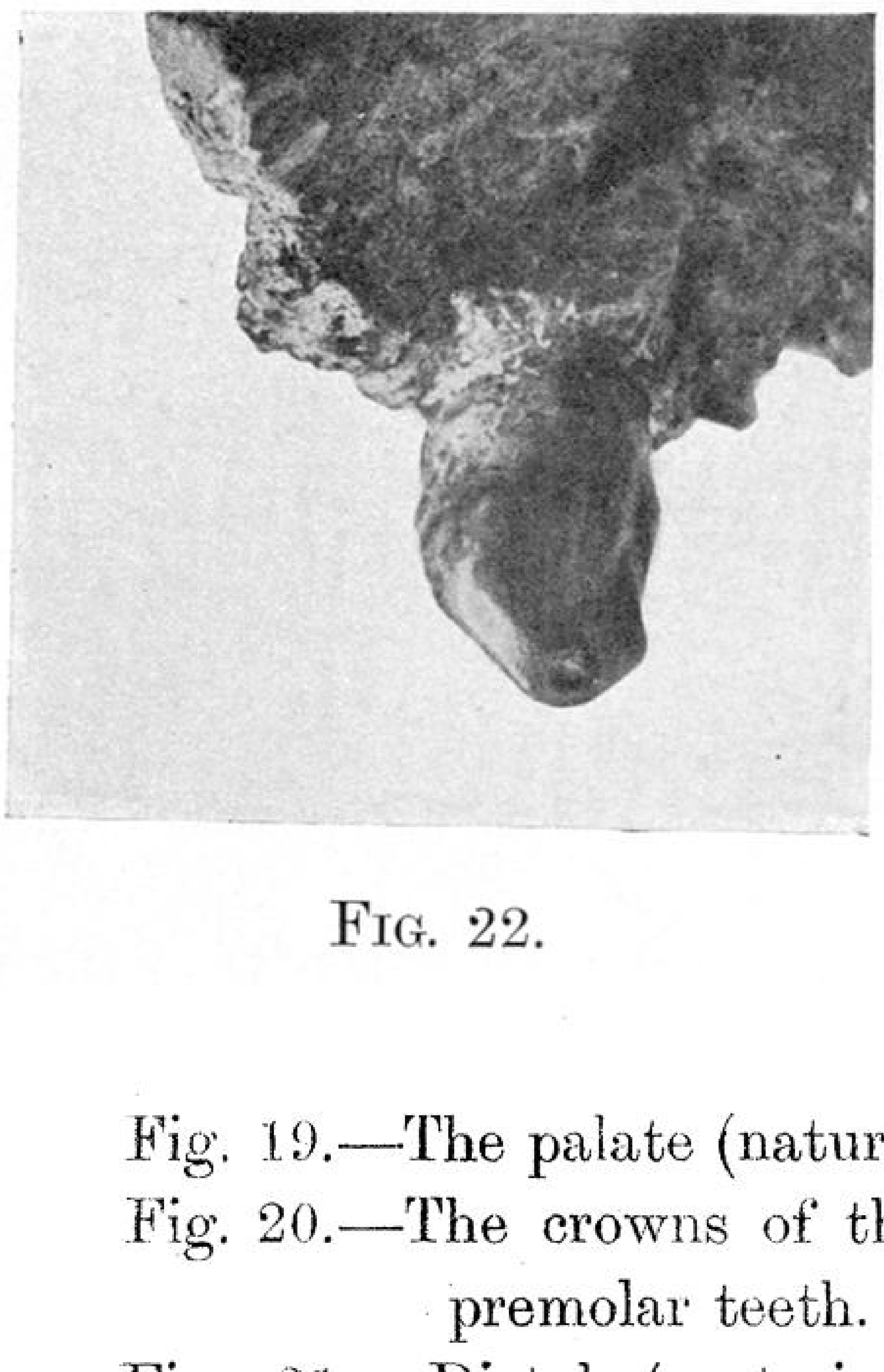
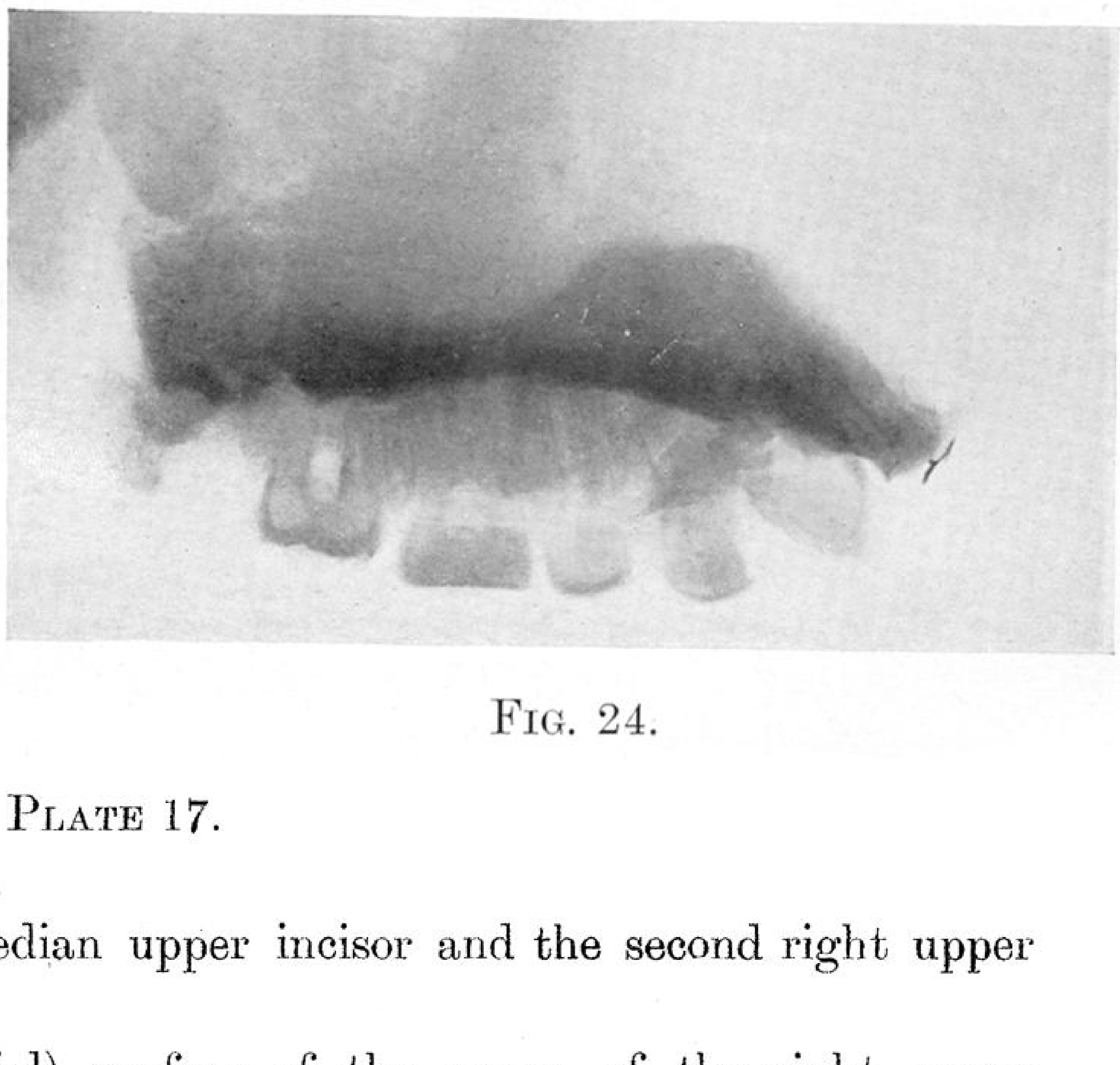


Fig. 22.



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