THE FOSSIL HUMAN REMAINS FROM THE PALEOLITHIC SITE OF SIDI ABDERRAHMAN (MOROCCO) [1,2]

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NINE FIGURES

INTRODUCTION (P.B.)

In 1954 one of us (P.B.) discovered at the site of Sidi Abderrahman an incomplete human mandible associated with a Middle Acheulean industry and clearly dated to the beginning of the African Third Pluvial stage. Geologists and prehistorians interested in the Moroccan Pleistocene have known since 1941 the particular importance of the Schneider gravel pit at Sidi Abderrahman, southwest of Casablanca (fig. 1). In that year two prehistorians, R. Neuville and A. Ruhlmann ('41) published an account of paleontological and prehistoric discoveries giving to that pit the renown it has today.

Since then the exploitation of the pit has been continued. A new pit, under the aegis of the same company, was begun at Sidi Abderrahman — Extension; some comparable enterprises excavated in the S.T.I.C. pit and the Thomas pit in the immediate vicinity; finally, to facilitate the commercial excavation, a trench to permit locating a new working face ("cunette," in sand pit terminology), was opened in the northeast face of the old workings, along the whole length of a cut 1900 meters long.

[1] Translated from the French by F. Clark Howell.

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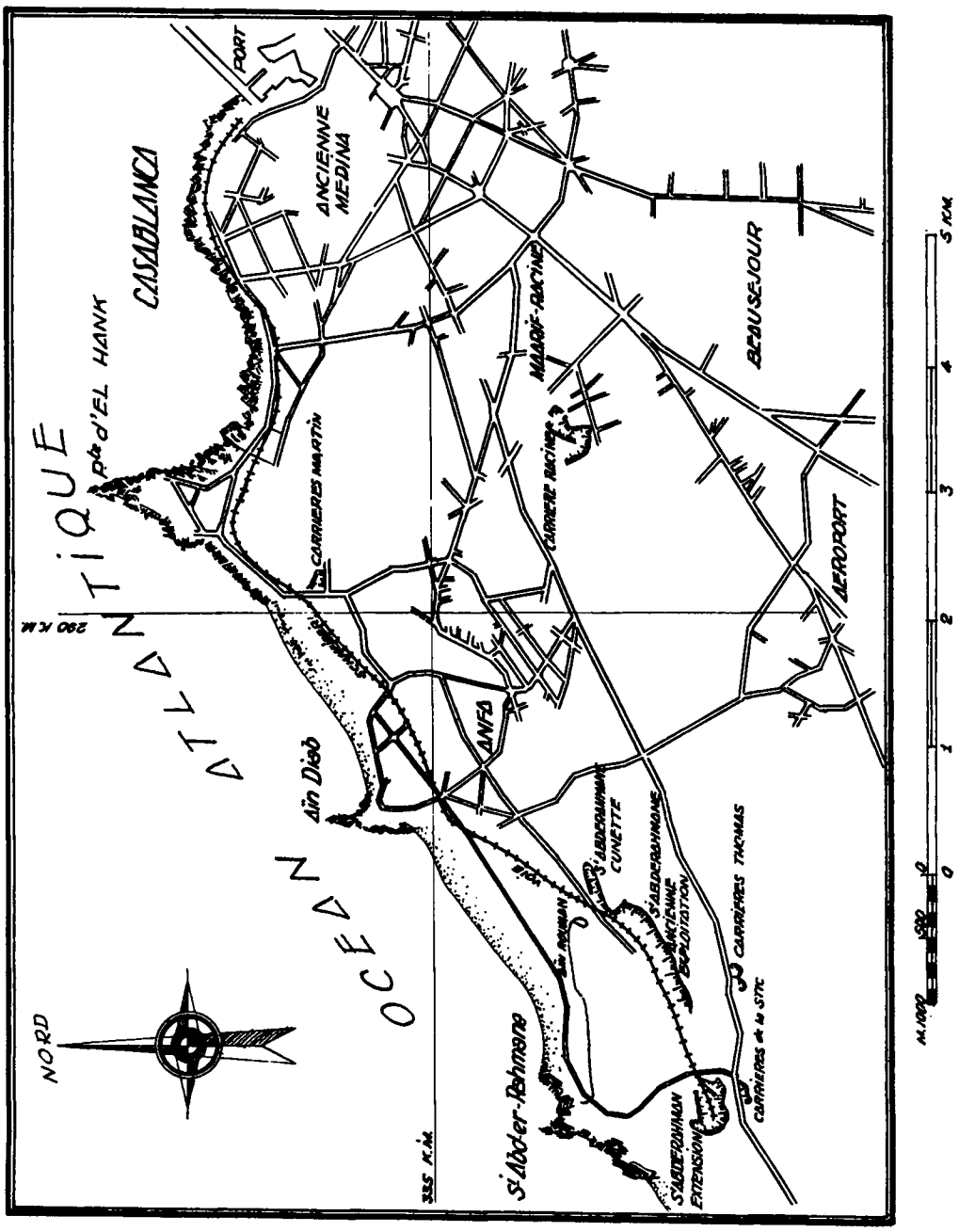


Fig. 1 Map of the region west of Casablanca, Sidi Abderrahman Sector.

Parallel to the development of the pit, archeological and paleontological researches were continued. After the premature death of the earlier workers, new investigators undertook their work, so that today we possess a complete stratigraphic, paleontological and prehistoric series which permit one to control the observations of the earlier workers, and to arrive at new conclusions on the Pleistocene of the Atlantic coast of Morocco (Biberson, '55).

These new results have been fulfilled recently by the discovery of human remains which offer the possibility of identifying the makers of the Paleolithic industries collected. The present paper is an appraisal of present knowledge of this important site and the conclusions which may be drawn from it.

STRATIGRAPHY (P.B.)

Neuville and Ruhlmann's ('41) study was based primarily on two sections which have been protected by an "Arrete de Classement." An unfortunate circumstance, due to overlong exposure, led to the disappearance of Site B where their 'Clacto-Abbevillean' industry was discovered. The advance of the working face has permitted confirmation of the fact that the stratigraphy they described was especially localized, as Bourcart ('43) thought, and repeated soundings in the pit have confirmed these conclusions. This stratigraphy can not be generalized for the whole of Sidi Abderrahman and, obviously, even less so for the entire Pleistocene of this Atlantic coast.

Site A, on the other hand, was safeguarded and the northeast trench has cut through all the levels described by Neuville and Ruhlmann. Over a distance of 620 meters it has been possible to study a series of transverse sections 12 meters wide, and, due to the new working face, some 4×4 meter longitudinal sections.

The new observations confirm in great part those of the earlier workers; however, some subdivisions have been established, both in the marine and in the continental deposits

previously identified, in order to take into consideration various isolated horizons. The accompanying section (fig. 2) illustrates these observations in a schematic way. It uses the nomenclature of levels of Neuville and Ruhlmann ('41)

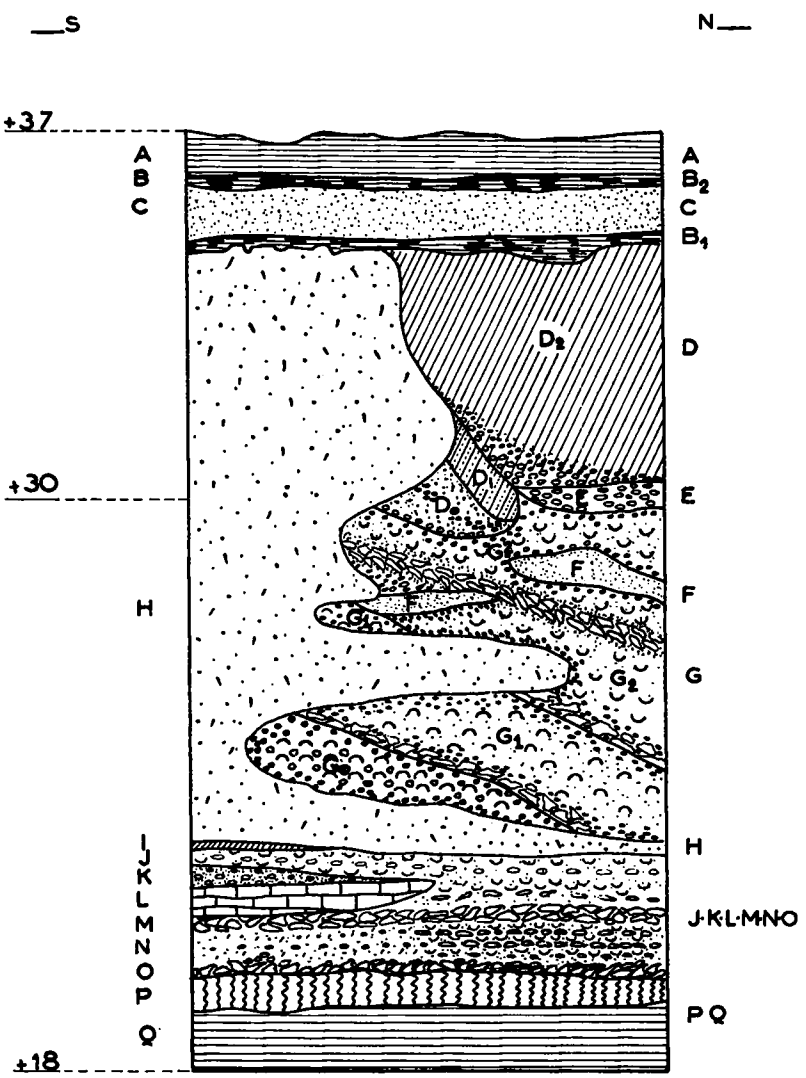


Fig. 2 Schematic section of the Sid Abderrahman "Cunette', with Neuville and Ruhlmann's nomenclature (left) and the revised nomenclature used in the text (right).

with the addition of supplementary designations when such subdivisions have been necessary.

There are two distinct marine cycles. The oldest basal formations rest on a pre-Pleistocene substratum of Cambrian quartzites and Cretaceous marls (symbols P–Q). The base complex, formed essentially of a conglomerate of more or less coarse elements and beach sand, is cut into this substratum; it comprises levels J–M–N–O, separated at Site B by Neuville and Ruhlmann ('41). There is no trace of levels I–K–L in the 620 meters of the trench.

Above, is the consolidated dune H (called the "Great Dune") which begins with beach sands and passes insensibly into blown sand. After the consolidation into sandstone of these strongly calcareous sands, this dune H was attacked as a cliff by a transgressive sea, belonging to a cycle more recent than the preceding formation. In this way, a tortuous littoral was created the coastline of which, hidden until recently under some fairly large landslides, has now been accurately revealed. Some karstic caves were developed in the mass of calcareous sandstone of the old consolidated dune. Certain of these, opening to the outside, were retreats for cave-dwelling animals and habitations of man.

When the transgressive sea reached these caves it disturbed the continental deposits which it encountered and threw them pêle-mêle with its own sediments at the bottom of the caves where they are found today under purely marine beds. This transgression must have reached an altitude of + 28–30 meters, since very characteristic beach formations are found at + 28 meters. The marine deposits were accumulated in places to a depth of 7 meters. In places too, they are constituted of a mass of marine shells forming very beautiful shell-marbles.

This molluscan fauna permits three superimposed horizons to be discerned: (1) horizon G_0 characterized by a gastropod, *Acanthina crassilabrum,* typical of the old warm Pleistocene, known today only in Chile and Peru; (2) horizon G_1 where the preceding warm fauna disappears, and a so-

called northern fauna with *Littorina littorea* increased; it is abundant today in the English Channel but does not seem, in the Atlantic, to pass south of the peninsula of Portugal; (3) horizon G_2 where the northern fauna is replaced by a new warm fauna with *Purpura haemastoma* which will very rapidly eliminate the old warm fauna of Chileo-Peruvian type which is on the way to extinction. With G_2 the marine series is ended.

Neuville and Ruhlmann ('41) believed they were able to isolate a level F, a dull brown sandstone containing sandworms. No one has found this bed in the form so described; on the other hand, lenses of sandstones, intrusive in various horizons of level G, are frequent. These are derived from marine sands, and redistributed by slope-wash. Undoubtedly, here is an example of dissolution pockets filled up by sand brought down by running waters. In other places these lenses are related to the base of the overlying continental levels and logically should be compared with them. Neuville and Ruhlmann's level E, which they said still contained numerous marine shells, is really the superficial part of Level G, weathered and partially redistributed by water action at the beginning of the subsequent regression.

The frankly continental formations consist of various horizons of level D. If subdivisions have seemed necessary, it is due to lithological differences, confirmed by the variety of prehistoric industries collected, although the paleontological evidence is not determinative. It is possible to isolate: (1) horizon D_0 consisting of yellowish-brown sandy sediments, slightly clayey at the base, which are in close relation with the sandy lenses F; (2) horizon D_1, which follows insensibly the lower horizon, composed of finer elements of clear yellow color becoming more and more clayey; (3) horizon D_2 very calcareous, of reddish color, and strongly brecciated in places. This latter horizon is the most developed and corresponds to Neuville and Ruhlmann's ('41) determination of a "red calcareous breccia." Its industry, as will be seen, is a great deal more evolved than that of the lower horizons, although

the mammalian fauna is scarcely different. Above is a calcareous crust (B_1) sometimes diffuse and penetrating the mass as concretionary nodules (*"en poupees"*), but perfectly bedded at the top.

On this crust a new dune (C) often rests. It is not greatly developed in the trench since it was in the way of the dead cliff, but is magnificently represented in the same sector, for example, at the S.T.I.C. pit and at the Thomas pit. This dune is sealed by a new crust, B_2, which is perfectly fossilized. Finally, at the very top of the section, are found superficial formations (A) consisting most often of "red subaerial deposits," and characteristic of a new cycle.

Recent geological studies in the region of Casablanca have permitted identification of a series of post-Pliocene transgressions (Biberson, '55). The oldest, attributable to the Calabrian, seems to have had its shore line at an altitude approaching + 100 meters. It was followed by a first pluvial which left its traces in the form of rubified deposits. The maximum transgression of the second is not so clear; it seems to be located towards + 55–60 meters, where traces of it have been found. It is this cycle, and more precisely its regressive or final part to which the conglomerate at the base of Sidi Abderrahman belongs. Logically, it ought to be included in the Mediterranean Sicilian. The dune (H) is contemporary with the following so-called Romanian regression and with the second Pluvial *sensu lato.*

The following transgression which attacked the cliff of this petrified dune to reach a height of + 28–30 meters is accordingly the homologue of the Mediterranean Tyrrhenian I. The continental deposits surmounting this transgressive marine level belong to the Third Pluvial. Dune C is very likely contemporary with the post-Ouljian (Tyrrhenian II) regression. As for the "red subaerial deposits," geologists unanimously agree in dating them to the North African Fourth Pluvial (Grimaldian-Würmian).

The remains of Sidi Abderrahman man were collected in the sandstone F (D_0) at the base of the continental formations

infilling the dead cliff (Arambourg and Biberson, '55). This fossil is thus perfectly dated to the end of the maximum transgression of Tyrrhenian I, corresponding to the beginning of the North African Third Pluvial.

ARCHEOLOGY (P.B.)

If the stratigraphic and paleontological facts permit accurate relative dating of the fossil remains of Sidi Abderrahman man, the series of prehistoric tools which have been collected, either closely asociated with this fossil or in the adjoining levels, testify perfectly to the industrial stage which this form had attained in the developmental succession of Moroccan prehistoric cultures. In practice, each of the geological levels isolated stratigraphically is also an archeological level. Naturally, the marine formations of Sidi Abderrahman, which are largely beach deposits, frequently provide a mixture of industries. In general, the physical condition of the pieces makes possible a classification; but, it is evident that this method can only be employed if numerous series are combined, permitting maximum elimination of chances of error. Besides, the abundance of implements in this sector proves that prehistoric man came onto the beach to obtain the primary material needed for manufacture of his tools. He left those which were badly made or those which were roughed out and of no immediate interest; therefore one is often struck by the coarseness shown by the assemblages collected. It would then seem advisable not to be misled by this archaic character and to reach judgments on the basis of the best pieces which only truly characterize a culture. Similarly, the technique of workmanship tends to be deceptive. The simplest, on a beach where there are large blocks, is the so-called *anvil technique* which permits large flakes to be obtained which could be retouched later as bifaces with a wood or bone billet. This technique is common everywhere in the whole African Paleolithic and does not serve to date the industry. These various considerations lead one to revise certain earlier determinations.

The conglomerate at the base of the Great Dune (H) contains some rolled tools: choppers and chopping/tools of the Pebble-culture type and some bifaces which are typologically attributable to the African Chellean. At the surface of the conglomerate, on the other hand, Neuville and Ruhlmann ('41) collected an unrolled industry the workmanship of which was essentially by the anvil technique, but where retouch by a stone hammerstone gave very regular pieces; some of the best made of these bear traces of a wood or bone billet. The first cleavers known in Morocco are to be noted also.

It appears that the essential characteristics of the Acheulean technique are present here. Thus, the "clacto-Abbevillean" of Neuville and Ruhlmann ('41) ought to be referred to the period of transition between the African Chellean and the Acheulean. The resemblances with the industries of stages 4–5 of Olduvai Gorge (Leakey, '51) are significant in this regard; it is for this reason that the author places it in the oldest Acheulean.

The base of the Tyrrhenian deposits of Sidi Abderrahman have furnished an abundant industry, notably in the "Cave of the Bears." Here is a still rather simple, but very characteristic Acheulean; the author has termed it Middle Acheulean I. The very special workmanship of very large flakes approaches that of the African Proto-Levallois (called "Victoria West"). The stone hammerstone is always most often employed, but there is increased retouch by wood or bone billet and cleavers are diversified. The top of the Tyrrhenian shows a refinement of this Middle Acheulean expressed in a tendency toward thinner bifaces.

The base of the continental deposits of the Third Pluvial, where the human fossil remains were collected, testifies to still further development (fig. 3). Although the stone hammerstone is still employed, there is general use of the wood or bone billet. Also, the bifaces become flatter, the edges more straight, and the forms more regular. With bifaces are associated unifacial tools on large flakes whose workmanship

testifies to the abandonment of the Proto-Levallois technique for the Tachenghit method, with smooth striking platform and nearly orthogonal flaking-angle. Cleavers become rarer when specialized tools like the side-scraper (still often bificial) make their appearance. One finds here a Middle Acheulean still little refined, but which becomes perfected in the upper

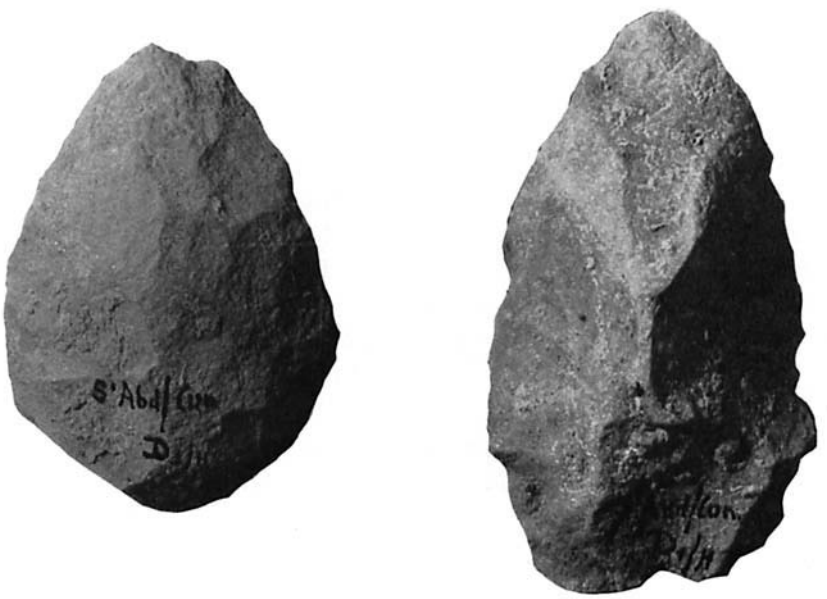


Fig. 3 Two bifaces of Middle Acheulean II (Littorina Cave, Level D_o of the cave entrance in continuity with the sandy lens F containing the human fossil bones). ($\frac{1}{2}$ natural size.)

levels, to terminate in an evolved Acheulean in horizon D_2, the "red calcareous breccia" (fig. 4).

From this quick survey it is evident that Sidi Abderrahman man is perfectly dated, as much by his stratigraphic place at the base of the deposits of the North African Third Pluvial, as by his stone industry which, in the developmental series of the Moroccan Paleolithic, falls within the still rather rough Middle Acheulean, corresponding approximately to Chelles-Acheul stage 8 at Olduvai Gorge (Leakey, '51).

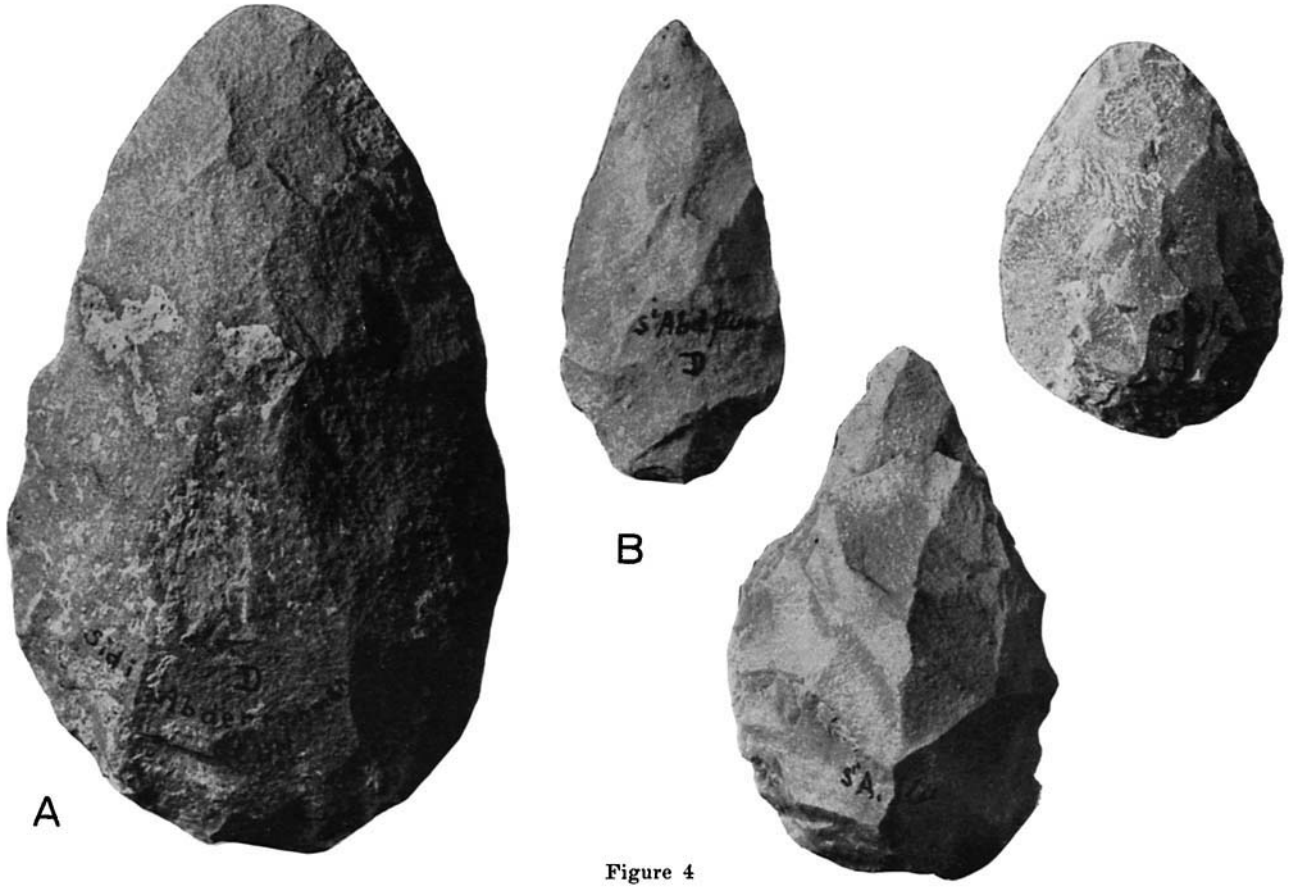


Figure 4

A Large biface of the evolved Acheulean (Littorina Cave, Level D_2). ($\frac{1}{2}$ Natural size.)

B Three bifaces of the evolved Acheulean (Littorina Cave, Level D_2). ($\frac{1}{2}$ Natural size.)

THE HUMAN REMAINS (C.A.)

The various fragments of fossil human bone collected by P. Biberson in "Littorina Cave" permit reconstruction of a portion of mandible. This piece comprises two parts, which do not articulate unfortunately, but manifestly belong to the same individual. The main fragment forms the posterior part of the right body with the last three molars in place; this piece is broken just behind M_3, of which the roots are apparent, and at the middle of the alveolus of P_4; the inferior border is intact. The second fragment is a part of the left postsymphysial region, with P_3 in place, and is broken just behind this tooth, as well as at the level of the mesial border of the alveolus of I_2; the latter tooth and the canine are missing.

Left postsymphysial fragment

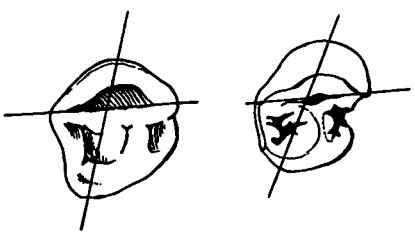
This fragment is 20 mm long and 27 mm high (measured from the alveolar margin). Its inferior border is broken. In spite of this fragmentary state it is evident from the orientation of the external face of the bone with reference to the plane of wear of the premolar, as well as the slightly convex form of the buccal face of the root of this tooth, that the symphysial region sloped slightly backwards, following an angle of which the size order is comparable to that of the *Atlanthropus* II mandible. On the lingual surface, at the level of the canine alveolus, the bony surface below the alveolar border is flat, without a torus, and forms an angle with the buccal face comparable to that which is found in the same way in *Atlanthropus;* this disposition corresponds to an oblique, posteriorly sloping alveolar plane, such as is present in the pithecanthropines, including Heidelberg man.

The lateral incisor and canine are represented only by their alveoli. Their dimensions (in millimeters) are 5.5×9.2 and 8×10, respectively. The buccal alveolar wall of the canine forms a slight ridge above the plane of the mandibular body.

The first premolar is single-rooted. The root length is a bit more than twice the bucco-lingual diameter at the level

of the neck; on its distal face there is a slight longitudinal depression. In *Sinanthropus,* as in *Atlanthropus* I, the root of P_1 is sometimes bifid, but with the two parts fused for the greater part of their length (cf. Weidenreich, '37, figs. 82, 85); however, certain specimens of *Sinanthropus* (*ibid,* fig. 87) are single-rooted, with a single longitudinal depression on their distal and mesial margins, as in the Casablanca fossil.

The crown (fig. 5) is heavily worn and its height measures only 3.8 mm on the lingual face compared to 7.6 mm on the buccal face. Above the neck the buccal face forms a very slight projecting swelling, but without being a true cingulum.



A B

Figure 5

A First left lower premolar of the Casablanca fossil man (× 2), and B of *Sinanthropus* (after Weidenreich).

Nevertheless, at the distal and mesial borders, a trace of vertical cingular folds are clearly distinguishable, like those characteristic of the premolars of *Meganthropus, Sinanthropus* and *Atlanthropus.* It should be noted that the same folds are found attenuated in the Rabat fossil man.

In profile from behind, P_1 is notable in the obliquity and the curvature of the line which, at the neck, separates the crown from the root, so that the former slants much lower toward the buccal than the lingual. This is equally one of the characters presented by *Sinanthropus* (Weidenreich, '37, figs. 79, 82, 86, 87, 89) and which is found also in *Atlanthropus* I and II.

The contour of the worn surface of the P_1 crown is asymmetrical, the bucco-lingual axis being oblique to the mesio-distal axis. In spite of the wear on the crown, it is evident

that this tooth is formed of a main cusp compressed bucco-lingually which forms the whole external (buccal) wall of the tooth. A second, lower cusp is situated lingually and displaced slightly distally with reference to a perpendicular to the mesio-distal axis of the tooth. There are traces of a large posterior fovea and a more reduced anterior fovea. These various characters, very different from those which are present in the homologous premolars of *Homo sapiens* are, on the other hand, wholly comparable to those of *Sinanthropus* (cf. Weidenreich, '37, figs. 86_0, 87_0, 82_0, 84), *Meganthropus,* as well as *Atlanthropus* I, II, III.

TABLE 1

Dimensions of the mandibular body of the Sidi Abderrahman fossil compared with some other fossil men

	SIDI ABDER-RAHMAN	SINANTHROPUS		ATLANTHROPUS		MAUER	H. SAPIENS
		G_1	H_1	II	I		
Height below M_2	34.5	34	26	34	35	35	31.2–32.9 [1]
Thickness	17	19.3	15.4	16	19	20.4	12.7–13.8 [1]
Length of molar series	39.3	38.8	33 (alv.)	42	39	36.7	32.6–36.4

[1] After P. Topinard (1866); measured at the level of the mental foramen.

Right mandibular fragment

The total length of this fragment is 50 mm. The body is robust and its proportions recall those of comparable parts of the male *Sinanthropus* G_1 mandible (table 1).

The ventral border is regularly rounded and thick, but without forming a torus as clearly defined as those of the individuals already cited. The alveolar border is smooth, without a torus, and without tubercles or wrinkles, just as in *Atlanthropus* I and II. The alveolar border and the ventral border are parallel, indicating as in *Sinanthropus* and *Atlanthropus,* that the height of the mandibular body was constant as far as the symphysial region. It is known that in numerous living races this part undergoes a notable increase

in height as a result of the development of a projecting chin. On the lateral surface, the *prominentia lateralis* is not very prominent; similarly, on the lingual face, the bone is not much thickened below M_3 and the mylohyoid line is hardly marked in its anterior part.

The molars are very large, and although their crowns are heavily worn it is evident that these teeth were more brachydont than those of living races, resembling in this respect those of *Sinanthropus* or *Atlanthropus*. This character is seen well on M_3 where wear has hardly reached the cusps of the lingual border, and in which the crown height, at the level of the metaconid, does not attain half the length of the tooth; in living individuals by comparison this height sometimes notably exceeds the length (table 2).

TABLE 2

Index of brachydonty in the Sidi Abderrahman mandible, in the Ternifine II jaw, and in some recent human individuals

M_3	SIDI ABDERRAHMAN	ATLANTHROPUS II	LIVING MEN			
Metaconid height	5.5	6	5	6	6.2	5.6
Tooth length	12.3	13.1	10	10	10.6	10.7
Index	44.7	45.8	50	60	58.4	52.3

The separation of the crown and the root is very distinctly marked at the level of the neck where the crown bulges over slightly; there is the same rather rough trace there of a cingular ridge, particularly at the base of the buccal face of M_2. The enamel of the buccal face is smooth, but presents some fine undulations, especially visible near the occlusal border.

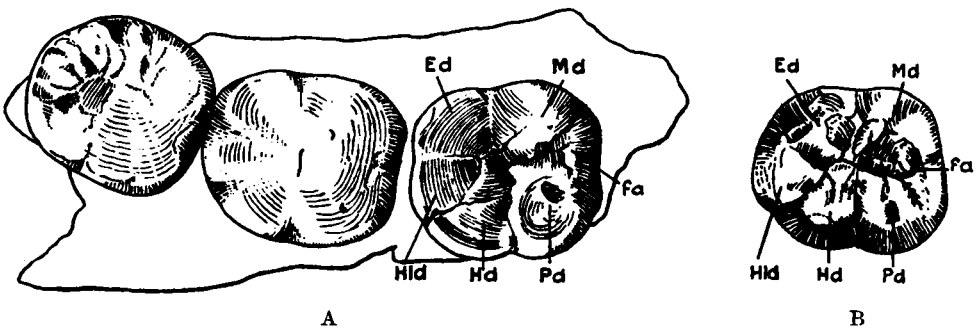
The three molars form a series in which the third is reduced with reference to the first and second (as in *Homo sapiens*), but, where M_2 is larger than M_1 (fig. 6).

The crown of M_1 is subrectangular. Some of its dimensions are: length = 13 mm; protoconid-metaconid breadth = 11.6 mm; hypoconid-entoconid breadth = 11.2 mm. Although the cusps of this tooth are strongly worn and the fissures which delimit them on the occlusal surface partly effaced, the hori-

zontal contour of the crown presents some more or less marked indentations which correspond to their separation. On the buccal side, one such indentation marks the limit between the protoconid and the hypoconid; it corresponds to a deep vertical groove of the buccal face, marking the separation of the two cusps. The protoconid is deeply worn and a small island of dentine appears at the center where the enamel has been completely removed.

The metaconid and the entoconid are equally separated by an indentation of the occlusal face, but the vertical groove of the lingual face which separates the two cusps is less deep than that of the buccal face. The tip of the metaconid is less worn than that of the protoconid and is still discernible; on its mesial face it has an oblique wear facet which extends to the margin of the tooth.

The metaconid is 7 mm long, or 53.8% of the length of the tooth; the smaller protoconid is 5.8 mm long or 44.6% of the tooth length. The predominance of the metaconid — with the resulting asymmetry in the pattern of grooves on the occlusal face — is a primitive character constant in the australopithecines, and which is also to be observed in *Sinanthropus* (Weidenreich, '37, p. 78) and in *Pithecanthropus*.



A B

Figure 6

A — Molar series of the Casablanca fossil man (× 2), and
B — an M_2 of *Sinanthropus* (after Weidenreich).

Ed, entoconid; Hd, hypoconid; Hld, hypoconulid; Md, metaconid; Pd, protoconid; fa, anterior fovea.

As as result of his structure, the metaconid is in contact with the hypoconid over a small distance on its disto-lingual border, and the pattern of the grooves has consequently the so-called dryopithecine Y arrangement.

The hypoconid is voluminous. On the lingual face of the crown the attenuated vertical groove which limits the hypoconulid is visible (a fracture of the crown masks this groove slightly, but it is nonetheless already discernible). The hypoconulid is separated from the entoconid on the occlusal surface by a slight groove which ends on the bucco-distal border of the crown at a very slight indentation, a trace of a groove which probably existed at this point on the vertical face of the crown. On the mesial part of the crown there is a slight groove which limits an anterior fovea between the protoconid and the metaconid like that in *Pithecanthropus* or *Sinanthropus.*

TABLE 3

Dimensions of the molar teeth of the Casablanca human fossil

	M_1	M_2	M_3
	mm	*mm*	*mm*
Length	13	14.4	12.2
Max. breadth	11.6	11.4	11.2

The roots of this tooth are visible. They number two, and are broad, compressed disto-mesially, subparallel and deeply set in the mandibular body where they almost attain the center of the height of the bone. They each seem to have two paired pulp cavities.

The second molar is distinguished from the first by its more elongated (mesio-distally) form. The contour is elliptical. The deeply worn occlusal surface is almost smooth; there is merely a trace of the metaconid which forms a small eminence toward the bucco-mesial angle and which bears on its mesial face an oblique wear facet corresponding to the contact of the opposite maxillary molar.

The contour of the occlusal face presents some indentations which correspond to the grooves separating the cusps; these

grooves, 6 in number, correspond to the cusps of M_1, but there is moreover an indication of a 6th cusp between the hypoconulid and the entoconid, in the buccal half of the crown. The corresponding grooves on the vertical faces of the tooth are very attenuated, except for that separating the protoconid from the hypoconid which ends abruptly towards the base above the previously noted vestige of a cingular ridge. This tooth has two roots, equally well separated and each bearing two pulp cavities.

The third molar is smaller than the preceding two and is somewhat less worn. The protoconid and the metaconid are the largest cusps. Since numerous secondary wrinkles cover the other cusps, their delimitation is difficult; nevertheless, the grooves of the vertical faces permit at least 5 cusps to be recognized; the presence of a 6th cusp is not certain.

There are two roots. The first, which corresponds to the first (= protoconid-metaconid) lobe, is compressed mesiodistally and has two pulp cavities. The second is simple, conical, with only one pulp cavity, and diverges from the anterior root by curving posteriorly.

The specimens examined here are distinguished essentially from those of *Homo sapiens* by their absolute dimensions, their massiveness and their macrodonty, as shown by the figures in table 1. Comparing the homologous dentitions of Neandertals (Patte, '55) their dimensions also separate them, but to a lesser degree. Thus, if one compares the figures in table 1 with those collected by Patte ('55) for various Neandertals it is evident that in the latter, at the level of the mental foramen (where the body is generally higher than at the level of M_2), the height in various specimens varies from 24–37 mm (mean = 30.3) and the thickness from 13–18 mm (mean = 15 mm). Similarly, the length of the molar series varies in the Neandertals from 33–39.5 mm (mean = 36.05 mm). Contrariwise, these various dimensions in the Sidi Abderrahman fossil are of the same order as those of *Pithecanthropus, Sinanthropus* G_1, and *Atlanthropus* I and II.

Morphologically, the teeth of this fossil show, in spite of their advanced wear, the essential characteristics of the pithecanthropines: trace of a cingulum on M_2, and distal and mesial cingular ridges on P_3; predominance on the molars of the protoconid over the metaconid, and dryopithecine disposition of the 5 main cusps; traces of a *tuberculum sextum* on M_2.

Nevertheless, if the length of the molar series is almost the same as that of *Atlanthropus* I, *Sinanthropus* G_1, or *Pithecanthropus,* the proportions of the teeth are somewhat different. Those of the Moroccan fossil are relatively more narrow; M_2 especially has a noticeably elliptical contour, whereas in the other fossils this tooth is subrectangular like M_1, or even, broader than long in *Sinanthropus* G_1. Finally, the third molar is proportionally more reduced than is that of *Pithecanthropus,* but recalls in this respect that of *Atlanthropus* I and II.

CONCLUSIONS (C.A.)

It appears evident that the mandibular fragment from Casablanca belongs to an early man more primitive than the Neandertals and still very close to the pithecanthropines; notably, *Atlanthropus* of Ternifine (Arambourg, '55), from which it is distinguished only by some characters which could be considered, judging from the three mandibles known of this fossil, as falling within the range of possible individual variation of this type.

Furthermore, it is important to affirm that the human remains, rigorously dated stratigraphically to the next to the last great marine regression contemporary with the Riss glaciation, furnish a second anthropological landmark in the history of African Middle Pleistocene men. The first was provided by the Ternifine fossils, of which the age is the beginning of the Middle Pleistocene, which corresponds approximately in the stratigraphic series of Sidi Abderraham, to the basel levels J–O, or to the base of level H.

It also seems that the fragment of "Rabat Man" ought to be attached to the same type. In fact a certain dental sim-

ilarity exists between these two fossils; in particular the development of a cingulum on the premolars and on M_1, as well as the morphology of P_3, of M_1 and M_3 (the latter, in the Rabat fossil having a *tuberculum sextum*), seems to be of the same order. The most notable differences between these two fossils lie in the weak height of the Rabat mandible, its great thickness, its almost vertical symphysis (on the buccal face), and the indication of a *trigonum mentale*. It should be noted, however, that this is a non-adult subject, with teeth scarcely worn and in which the last molar has just begun to emerge from its alveolus. In *Sinanthropus* some differences of the same order have been observed between adult mandibles and those of young individuals, although the symphysis of the later are more inclined than those of the Casablanca fossil; but, the presence of a *trigonum mentale* is also very well marked. Chronologically, the Rabat man belongs to a time almost contemporary with that of the Casablanca fossil, for it comes from levels of the "Great Dune," which after the most recent observations, can be attributed to a phase of post-Tyrrhenian regression, i.e., Third African Pluvial.

The association at Casablanca of a pithecanthropine and an evolved Acheulean industry confirms the idea, which the author has already expressed at various times, according to which each evolutionary stage of the human phylum corresponds to limited psychic possibilities which are expressed by the very nature of the industries accompanying the fossil human remains. It is known today, from the recent discoveries by Dart and his co-workers at Makapansgat that the Pebble-Culture is the work of the australopithecines; the discovery of *Atlanthropus* has shown that the pithecanthropines manufactured the first Acheulean bifaces. The Casablanca discoveries corroborate the earlier finds and prove that the "pithecanthropine" type is responsible for the bifacial industries in general, and that his existence extended over the greatest part of the Middle Pleistocene, up to and including the next to last pluvial. Finally, the Neandertals

are the workers of the Levalloiso-Mousterioid industries, and *Homo sapiens fossilis* those of the Upper Paleolithic. One cannot insist too much on this correspondence between the human forms and the successive industries, and on the generality of this fact throughout the Old World; and, also, on the fact that these industries succeed one another in a discontinuous fashion, gradually, without the most recent being directly derived by slow modifications, from those which immediately preceded them.

Each human industry is the psychic reflection of its makers; each corresponds to a mode of life and certain needs, in a word to a determined "vital standing." It is remarkable to note that the progressive complication of this "psychism" accompanies that of the cerebral mechanism, of which the quantitative and qualitative growth is characteristic of the human specialization. It is also remarkable that these phenomena have occurred gradually and discontinuously, so that one could almost employ the term "cerebralization quanta" to characterize them.

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PLATE 1

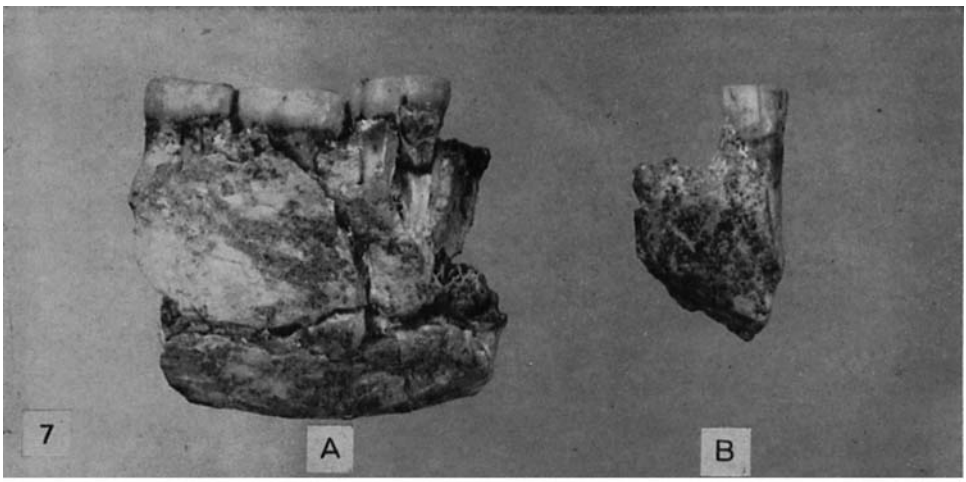
EXPLANATION OF FIGURES

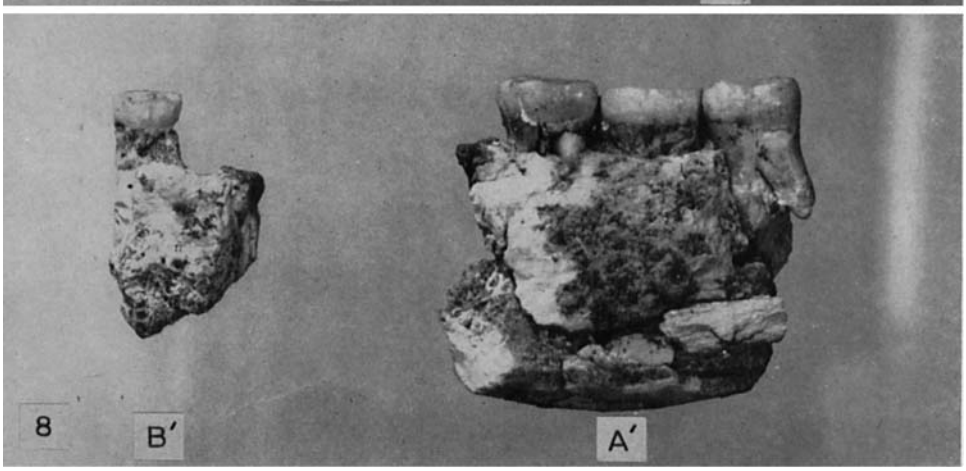
Mandibular fragments of the Casablanca fossil man.

7 A — Lateral view of right posterior fragment (natural size).
A′ — Lingual view of right posterior fragment (natural size).

8 B — Lateral view of left postsymphysial fragment (natural size).
B′ — Lingual view of left postsymphysial fragment (natural size).
C — Occlusal view of left P_1 (× 2).

9 D — Occlusal view of molar series of right posterior fragment. (× 2.)


7
A
B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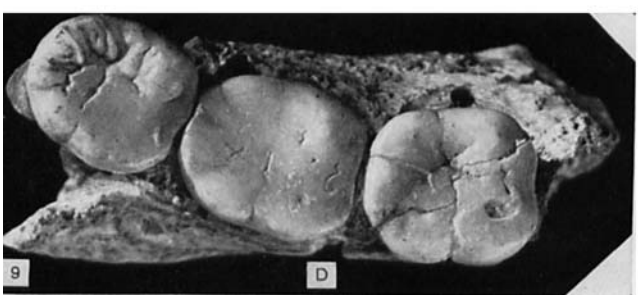
B′
A′


9
D


C