ETNOLOGISKA STUDIER

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ANTHROPOLOGICAL INVESTIGATION OF AN ARTIFICIALLY DEFORMED AND TREPANNED CRANIUM FROM NIÑO KORIN, LA PAZ, BOLIVIA

CARL-HERMAN HJORTSJÖ

Department of Anatomy, University of Lund, Sweden

INTRODUCTION

The remarkable findings in the Department of La Paz in the Bolivian Highlands of a medicine-man's drugs and implements, also include a cranium. The discovery was made in June 1970, and the skull is now registered at the Gothenburg Ethnographical Museum as Coll.No. 70.19.48. The age of this cranium has been investigated by the Laboratory for Radioactive Dating, Stockholm, using the C14 determination method, and the result was A.D. 755. The radiocarbon dating is discussed by Wassén (p. 28) and in another article in this volume (Hultin, p. 185). The cranium has been made available to me for an anthropological investigation.

METHODS

The measuring technique used was devised by Martin (1928). Moreover, considering the actual artificial deformation of the cranium, it has proved necessary to make measurements not performed by Martin. The results are given in Table 1. In the diagram construction, fig. 5, the Frankfort plane has been geometrically represented according to a method developed by the present author with co-workers (Edlén, Hjortsjö and Lindh, 1947). The anthropological characteristics have been indicated in accordance with principles previously reported by the author (Hjortsjö 1947a and b).

TABLE 1. MEASUREMENTS AND INDICES

The measurements are given in mm, capacity in ml. The numbering in parentheses agrees with Martin's numbering for anthropological measurements.

Capacity (38)	1320	Transversal dimension (24)	330
Max. length (1)	167	Nasion-bregma arch (26)	129
Glabella-lambda length (3)	167	Bregma-lambda arch (27)	125
Glabella-inion length (2)	162	Lambda-opisthion arch (28)	104
Nasion-inion length (2a)	155	Total longitudinal arch (25)	358
Nasion-bregma length (29)	117		
Bregma-lambda length (30)	108	*Angles*	
Lambda-opisthion length (31)	94	Facial angle (72)	87
Nasion-basion length (5)	96	Angles of the facial triangle:	
Basion-lambda length (—)	116	Basion angle (72.5)	41
Max. breadth (8)	131	Nasion angle (72.5)	68
Ant. frontal width (9)	86	Prosthion angle (72.5)	71
Post. frontal width (10)	108	Central angle (Klaatsch)	94
Auricular width (11)	123	Clivus-horiz. angle (35)	64
Asterion width (12)	106	Clivus-vert. angle (Falkenburger)	14
Mastoid width (13)	105		
Basion-bregma height (17)	145	*Indices*	
Height of ears=EH (20)	129	Length-breadth index (8:1)	78.44
Length of foramen magnum (7)	35	Length-height index (17:1)	86.83
Width of foramen magnum (16)	29	Breadth-height index (17:8)	110.69
Basion-prosthion length (40)	94	Length-EH index (20:1)	77.25
Nasion-prosthion height (48)	67	Breadth-EH index (20:8)	98.47
Frontomal. temp. width (43)	100	Frontal curve index (29:26)	90.70
Frontomal. orb. width (43.1)	91	Parietal curve index (30:27)	86.40
Ectoconchion width (44)	91	Occipital curve index (31:28)	90.38
Post. maxillofront. width (49)	22	Frontal index (9:10)	79.63
Ant. maxillofront. width (50)	19	Parieto-frontal index (9:8)	65.65
Cheek-curve width (45)	133	Upper face length-breadth	
Maxillar width (46)	104	index (45:40)	141.49
Width of nose (54)	22	Upper face length-height	
Height of nose (55)	48	index (48:40)	71.28
Right orbital width (51)	39	Upper face breadth-height	
Left orbital width (51)	39	index (48:45)	50.38
Right orbital height (52)	35	Right and left orb. index (52:51)	89.74
Left orbital height (52)	35	Interorbital index 1a (50:44)	20.88
Length of palate (62)	48	Interorbital index 1b (49:43.1)	24.18
Width of palate (63)	40	Nasal index (54:55)	45.83
Height of palate (64)	18	Width-length I of palate (63:62)	83.33
Horizontal dimension (23)	477	Foramen magnum index (16:7)	82.86

DESCRIPTION OF THE CRANIUM

General characteristics: The cranium has a yellowish-brown colour with unevenly spread dirty brown blotches. On the skull roof there are 3 foramina arisen in connection with trepanations performed *intra vitam*. Furthermore, the cranium has been exposed to artificial deformation. Here and there, remainders of some preserved soft parts, particularly in the zygomatic regions, can be observed. The cranium is exceedingly well preserved, and no traces whatsoever of posthumous damage are to be found. The lower jaw is missing.

The cranium is of average size and rather solidly built. This fact in conjunction with the good sculpturing of the bone surfaces as well as the finely developed cristae and facies musculares suggest with certainty the sex to be male.

The sutures between the skull top bones are everywhere open which suggests an age under 30 years. The synchondrosis sphenooccipitalis on the skull base, which is so important for determining the age, is, on the contrary, just ossified which, in its turn, indicates that the dead person had reached the age of 25. In his lifetime he has had a complete set of teeth in the upper jaw, *i.e.* also molares III (wisdom teeth) have been fully developed. *Post mortem,* all the incisors and the two hindmost premolares have been lost. Only the two front molares show a distinct abrasion. There are no caries defects. With the guidance of the teeth and the suture condition, the age of the person may consequently be estimated at between 25–30 years.

Norma verticalis (fig. 1f): The skull contour is regular, symmetrical and almost sphenoidal. Neither tubera frontalia nor tubera parietalia are well developed. On the other hand, the glabellar region is distinctly prominent.

Norma occipitalis (fig. 1d): From this view the cranium is high and narrow and has an evenly curved upper contour combining the high, in principle vertically placed, side contours. These run down in ordinarily developed processus mastoidei. The side contours are, however, not quite straight but each one shows a slight curving inwards corresponding to a small impression in the lower, hind part of os parietale. This impression is most prominent when the cranium is viewed sideways from behind (see the special picture in fig. 2) and may undoubtedly be interpreted as a straight furrow arisen in connection with an artificial deformation through fillets. Protuberantia occipitalis externa is broadways strongly increased

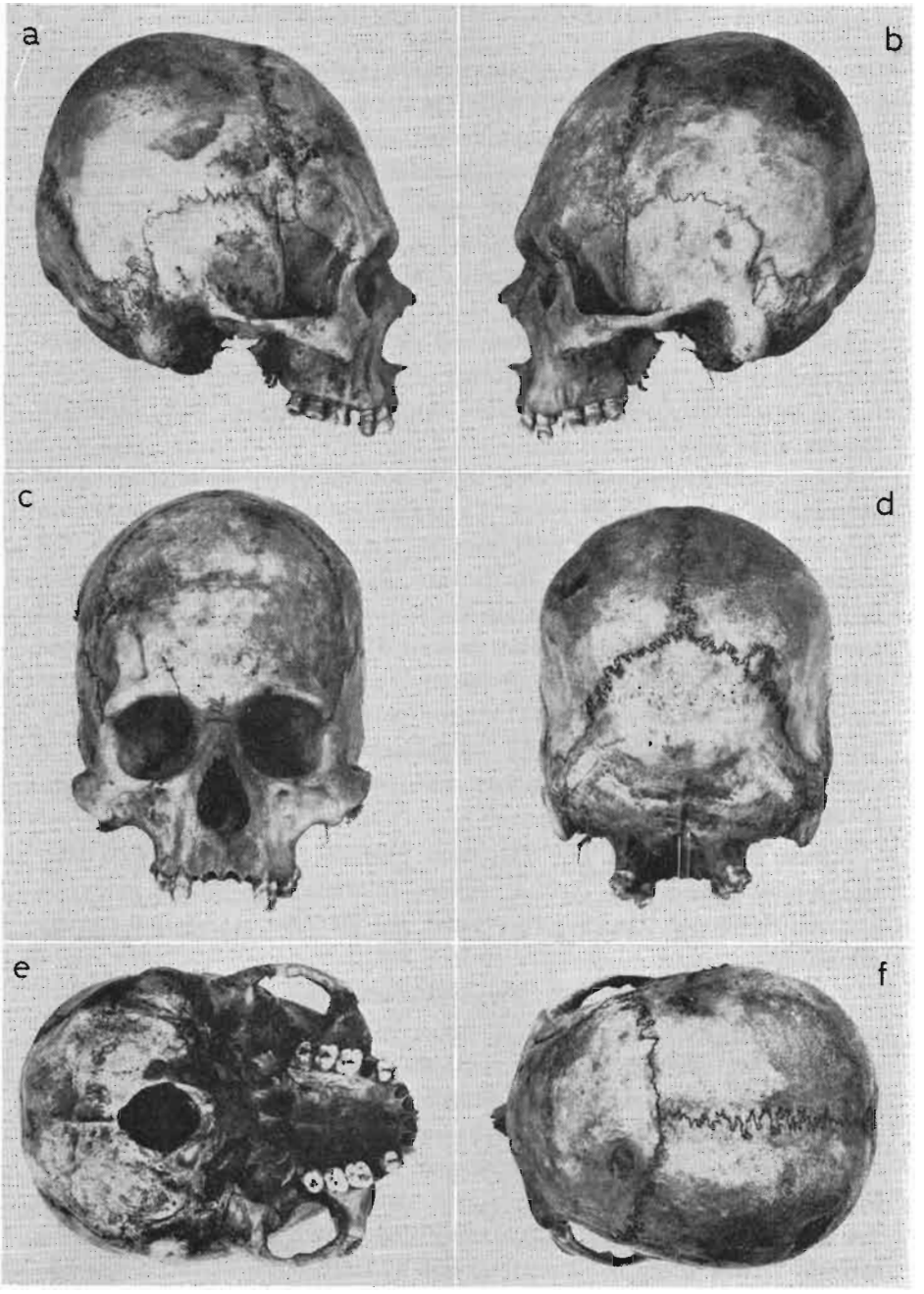
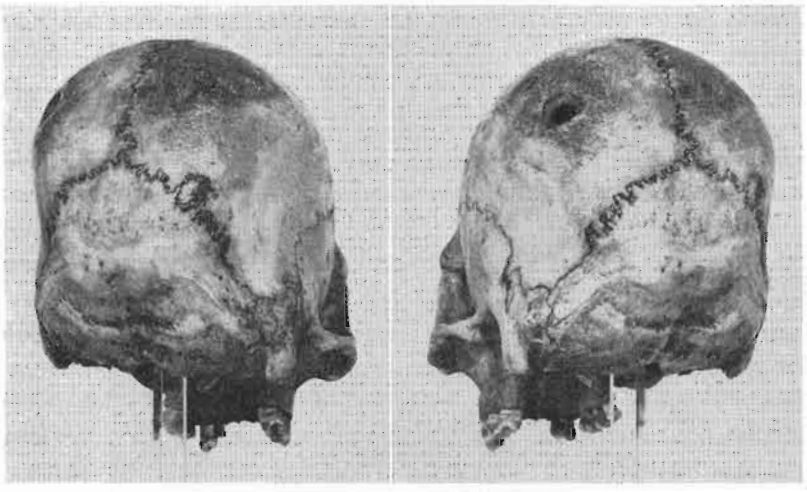


Fig. 1. The skull in different normas. Scale 1: 3.5.

a. Norma lateralis dxt. b. Norma lateralis sin.
c. Norma facialis. d. Norma occipitalis.
e. Norma basalis. f. Norma verticalis.



a b

Fig. 2. The skull photographed sideways from the back and from the right (a) and from the left (b) to demonstrate the impression in the lower back part of os parietale.

but otherwise not particularly well marked. The sculpturing of planum nuchale is, on the other hand, rather conspicuous. The right alveolar arcade stands very much higher than the left one and seems pushed upwards (see below).

Norma lateralis (fig. 1 a and b): The cranium is strikingly high in proportion to its length. From a strongly pronounced nasal root dented beneath a very prominent glabella, curva sagittalis rises upwards over a strongly retiring and flattened forehead. Sulcus supraglabellaris is merely suggested. There is a distinct retrocoronal clinocephaly which reaches rather far down the sides. Thereafter, curva sagittalis continues fairly regularly down to opisthion. Consequently, there is no tendency to bathrocephaly and neither is occiput conversely flattened. Vertex is reached approx. 4 cm behind bregma. Protuberantia occipitalis externa is scarcely marked. Linea temporalis is on both sides fairly well pronounced except in its back parts located in the lower parietal region, *i.e.* at the place of the above-mentioned slight impression. Meatus acustici have normal width and are free from exostoses. Processus mastoidei are of ordinary size but remarkably broad and blunt in their lower parts. The facial skeleton is powerfully formed. It is not prominent and has an insignificant depth in relation to its height. The nasal root has a slight S-form, and spina nasalis anterior is protracted forwards to a sharp tip.

Norma facialis (fig. 1 c): Considering its width the cranium has a comparatively great height. The brain crane, however, is accountable for this, since the facial skeleton is rather low in relation to the cheek curve width. If one disregards the bulging glabella and the arcus superciliares in their medial parts clearly marked out, the whole of the frontal region appears to be flattened. In the glabellar region there is a small rest of sutura frontalis media. Of the two foramina or incisures in margo supraorbitalis there is on the left side only one represented, incisura frontalis medialis (for ramus medialis of nervus frontalis, and corresponding artery). This must be considered as a normal anatomical variation. On the right side, however, there is a variation in the anatomical structure which the author has never previously observed or found described. There is an incisura frontalis medialis of the same kind as on the left side although less well developed. From this incisura a fine bone canal runs sideways upwards passing to approx. 15 mm above margo supraorbitalis. The anterior wall of the canal is partly defect, and on the front side of the bone, a fine, for the most part not obliterated, suture indicates the course of the canal (see the special picture in fig. 3; a fine straw has been brought through the canal). On the right side there is also a foramen frontale laterale (for ramus lateralis of nervus frontalis, and corresponding artery). It is, however, located not less than 10 mm above margo supraorbitalis, and from the foramen a 2 mm wide and 35 mm long, sharply demarcated furrow rises upwards-backwards on the lateral lower part of squama ossis frontalis. Ramus lateralis of nervus frontalis (or corresponding artery) has thus continued its ascending course in this furrow (see the special picture in fig. 3; a piece of wire has been passed through the canal). It can not be but assumed that both ramus medialis and ramus lateralis of nervus frontalis (and corresponding arteries) have brought about deep canals in the bone tissue, which thereafter have partially been transformed into bone canals. The manifestation described above can of course be a unique phenomenon in the asymmetrical structure of many of the skull details. But a purely hypothetical explanation of the find may also be that the pressure of a fillet in connection with an artificial deformation can be the cause. Processus zygomatici ossis frontalis shoot beak-like downwards-outwards, and the difference between the smallest anterior frontal width and the width between the two frontomalaria temporalia—14 mm—is therefore considerable. It appears not improbable, though, that also the smallest anterior frontal width has been reduced through artificial deformation. The zygomatic arches are bending outwards, contributing to the large facial width.

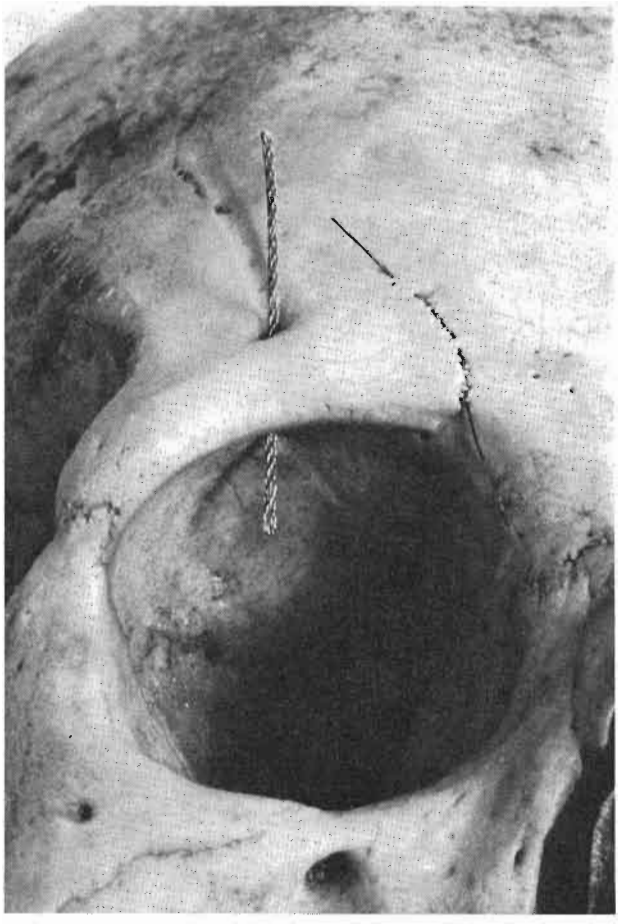


Fig. 3. Margo supraorbitalis dxt with canals for ramus medialis and ramus lateralis of nervus frontalis (and corresponding arteries).

The orbital openings are symmetrical, distinctly demarcated, nearly square-shaped with rounded corners and slightly oblique—placed in such a way that their medially drawn out X-axes form a downwards open angle. The nasal root is of ordinary width while the sharply demarcated nasal opening is high and narrow. The floor of the nasal cavity stands much higher on the right side than on the left. To judge by the appearance and the position of crista nasalis there has been a considerable deviation to the left of septum nasi. The powerful, pointed spina nasalis anterior has,

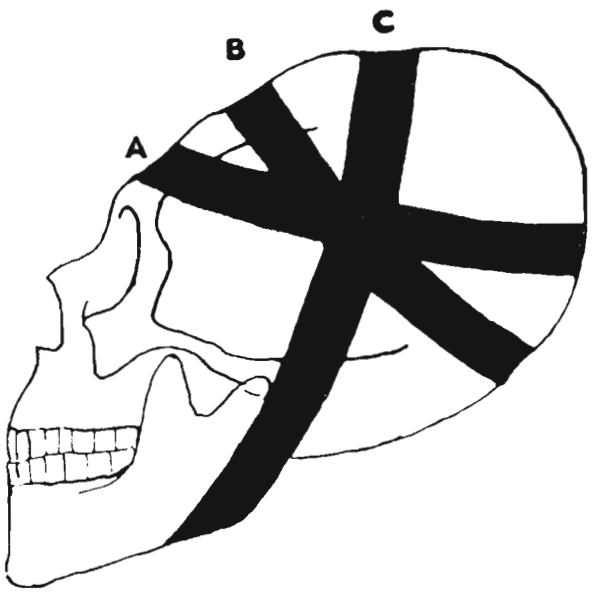


Fig. 4. A schematic figure showing the hypothetic application of the deforming fillets. (According to Backman, 1919.)

however, not been affected by it. The ossa nasalia resemble the form of a sand-glass and are connected arcade-like to a nasal bridge which in its upper section is concave, in its lower, convex. The jaw parts are fairly vigorous with well-marked juga alveolaria, particularly for the canini and the anterior molares. Foramina infraorbitalia are of normal size and somewhat asymmetrical. No fossae caninae are developed. The right alveolar arcade stands higher than the left.

Norma basalis (fig. 1e): The sphenoidal form mentioned in norma verticalis recurs, of course, also in this view. In relation to its width, the facial skeleton is of very insignificant depth. The palate, surrounded by a paraboloid alveolar arcade, is highly asymmetrical. Particularly in its back sections the palate roof stands considerably higher on the right side than on the left, and the right lamina medialis of processus pterygoideus is 6–7 mm shorter than the left. The author cannot, however, take any standpoint as to whether the abovementioned striking palate asymmetry may be the result of an uneven pressure from below in connection with an artificial deformation (see fig. 4, fillet c. under the angulus mandibulae)—particularly as the lower jaw has not been available for investigation whether

a simultaneous deformation of it has occurred. Foramina palatina and foramen incisivum are all large, and spinae et ruga in the palate roof are well developed. The general proportions of the palate are ordinary. The angle between clivus and planum nuchale is, on the other hand, clearly reduced on account of the artificial deformation. Foramen magnum is long and narrow and the occipital condyles are well developed. The venous emissary behind the right occipital condyle is large but hardly noticeable on the left side whereas foramina jugularia are congruent.

Anthropological characteristics (*ad modum* Hjortsjö, 1947a and b): euencephalic, mesocephalic, strongly brachyhypsicephalic (L-H I), strongly stenohypsicephalic (B-H I), strongly brachyhypsicephalic (L-EH I), strongly stenohypsicephalic (B-EH I), spherometopic, stenometopic, strongly brachyeuryfacial, orthofacial, eurychamaefacial, hypsiorbital, hypsistenorrhine, mesostaphyline, orthognathous and having retrocoronal clinocephaly. The cranium has been exposed to artificial deformation and 3 trepanation openings in the skull roof can be observed.

ARTIFICIAL DEFORMATION

The cranium described above is anthropologically-ethnologically in close conformity to the group of 13 skulls, previously brought home by Dr Stig Rydén from various places in the Bolivian Highlands around the Titicaca lake. These regions are thus in close neighbourhood with the now actual locality, Niño Korin, but their archaeological age is much younger. In connection with the anthropological investigation of the aforementioned 13 skulls (Hjortsjö and Lindh, 1947) the artificial deformation has been, in principle, discussed against the background of observations made by, *i.a.* Gosse (1855), Topinard (1879, Hrdlička (1912), Backman (1919), Imbelloni (1930), Aichel (1933) and Falkenburger (1938). Furthermore, a theoretical analysis has been made in order to prove in what way artificial cranial deformations of different kinds affect the cranial dimensions and, above all, certain anthropological angles. Reference is therefore made to this original work and the author will here confine himself to state that the cranium now investigated shows a typical deformation fronto-sincipito-parietalis, *i.e.* an artificial deformation caused by fillets applied around the head. It is possible that this has been done in the way hypothetically suggested by Backman (see fig. 4). Other names for this type of deformation is "*Aymara*" (Hrdlička), "*deformación circumferencial*" (Imbelloni) and

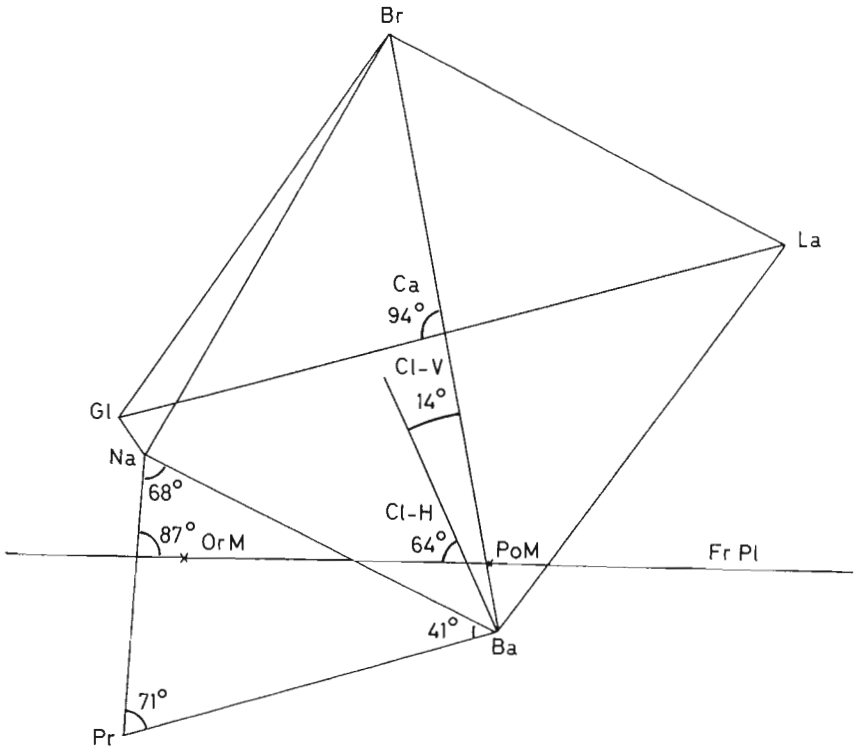


Fig. 5. Median diagram of the skull.

Gl	= Glabella	OrM	= Orbitale medianum
Br	= Bregma	PoM	= Porion medianum
La	= Lambda	Fr Pl	= Frankfort plane
Ba	= Basion	Ca	= Central angle
Pr	= Prosthion	Cl-V	= Clivus-vertical angle
Na	= Nasion	Cl-H	= Clivus-horizontal angle

"*deformatio circularis*" (Aichel, Falkenburger). Two important subgroups are, nevertheless, to be noted:

a) the lambda type, also called "*dressée*" (Topinard), "*erecta*" (Imbelloni) and "*droite*" (Falkenburger);

b) the inion type, also called "*couchée*" (Topinard), "*oblicua*" (Imbelloni) and "*oblique*" (Falkenburger).

The high value of the length-height index of the present cranium suggests *a priori* that the deformation is of the lambda type. That this is the case can, however, also be proved in another way. As has already been shown by

Falkenburger, the central angle, the clivus-vertical angle and the clivus-horizontal angle are in different ways affected by the two types. The angles mentioned can be seen in the diagram constructed for our cranium (fig. 5). Falkenburger found thus,

that the central angle in 92% of the lambda type varied between 87–95° and in 91% of the inion type between 95–102°; in the present case the value is 94°;

that the clivus-vertical angle in 100% of the lambda type varied between 16–29° and in 100% of the inion type between 29–44°; in the present case the value is only 14°;

that the clivus-horizontal angle in 98% of the lambda type varied between 57–66° and in 92% of the inion type between 50–56°; in the present case the value is 64°.

TREPANATIONS

As previously stated, the cranium shows 3 trepanation openings, all of them on the left side of the skull roof. The openings can be seen in norma verticalis (fig. 1f) but also in special pictures (fig. 6). The frontal trepanation opening, here called trepanatio frontalis, is located in the upper part of squama ossis frontalis, approx. 1 cm in front of sutura coronalis and approx. 2 cm to the left of the median line. The two other openings, here called trepanatio parietalis ant. and post., respectively, are located within the central section of os parietale sin., approx. 6 cm from the median line and approx. 2.5 cm from each other. In their great material of trepanated skulls, Graña, Rocca and Graña (1954) found likewise that most trepanation openings were located within the left *os parietale*.

Trepanatio parietalis post.: The opening is circle round and crater-like with a diameter in the tabula externa (the outer diameter) being approx. 17–18 mm and in the tabula interna (the inner diameter) being approx. 10 mm. The rim around the exterior opening is partly rather sharp but in other sections somewhat rounded on account of a commencing bone healing or bone reaction. In a zone up to 1 cm wide around the opening, the tabula externa is without any doubt scraped with a sharp-edged object which has been moved tangentially against the skull wall since remainders of marks from scratching or cutting can be noticed here. Probably due to a bone reaction this zone has been slightly elevated. Consequently, various signs indicate that this trepanation was made a short or a long time before the

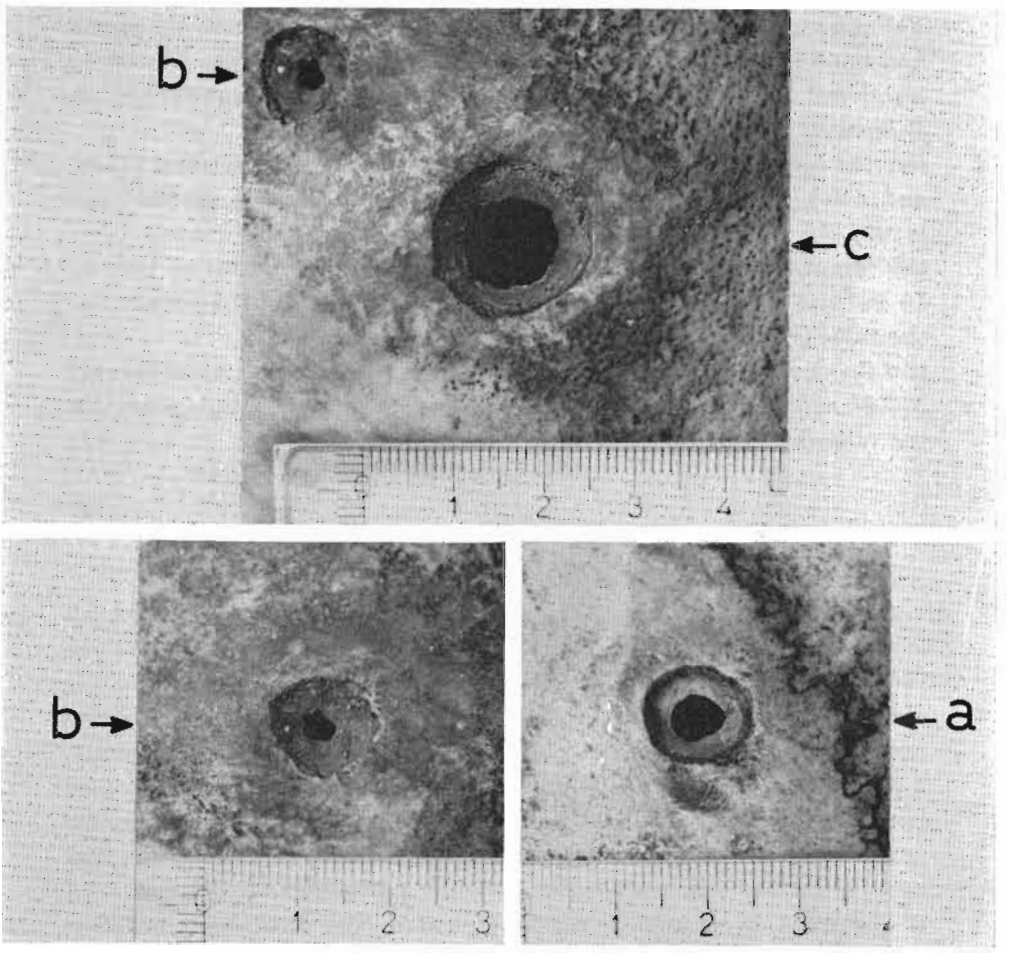


Fig. 6. The trepanations.

a. Trepanatio frontalis

b. Trepanatio parietalis ant.

c. Trepanatio parietalis post.

person's death. Only after the zone was scraped (to make the skull wall thinner? to remove the soft parts?) the trepanation was completed, probably through drilling.

Trepanatio parietalis ant.: As is the case with the above trepanation, this second one is also crater-like but the circle is not so handsomely performed. It is also much smaller. Its outer diameter is hence only approx. 12 mm, its inner approx. 4 mm. The rim is somewhat uneven and shows signs of commencing bone healing or bone reaction. Thus, this trepanation has also been made a short or a long time before death. Here also, as in the first case, signs of scraping can be seen around the trepanation. The scraping seems, however, to have been more intense here, resulting in a slight depression of the zone nearest the opening and obviously making the skull wall thinner. After the scraping the trepanation was completed, no doubt through drilling.

Trepanatio frontalis: The view of this trepanation shows a handsomely drilled crater-like opening made before death in a fairly thick skull wall. Its outer diameter is appr. 11–12 mm, its inner appr. 5–6 mm. The rims are only a trifle rounded but a commencing bone healing or bone reaction seems nevertheless to have taken place. Also in this case numerous cutting or scraping marks can be seen in the zone nearest to the opening. These marks are all superficial and have not made the skull wall thinner.

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