

# 12. On the dermal skulls of *Lyrocephalus*, *Aphaneramma*, and *Benthosaurus*, Labyrinthodonts from the Triassic of Spitsbergen and N. Russia.

By

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### 1. Introduction.

The first description of a Triassic Labyrinthodont from Spitsbergen, defining the new genus and species *Aphaneramma rostratum* A. S. WOODWARD, was published by A. SMITH WOODWARD in 1904. A number of new forms have been discovered by various Swedish expeditions — most of them by Prof. E. STENSIÖ's expeditions in 1912—1918 — and described in a series of interesting papers by C. WIMAN (1910, 1913, 1914, 1916, 1917). The forms described by WIMAN include the new genera and species *Lonchorhynchus öbergi* (1910), *Lyrocephalus euri* (1913), *Platystega depressa* (1914), *Tertrema acuta* (1914), *Capitosaurus polaris* (1914), *Cyclo-tosaurus? spitzbergensis* (1914), and *Peltostega erici* (1916).

The Labyrinthodont fauna of Spitsbergen has recently gained additional interest by the description (SÄVE-SÖDERBERGH 1935) of the closely related, but stratigraphically slightly older fauna from the Eotriassic of East Greenland (Cape Stosch), also shown to be to some extent related to certain faunas in N. Russia (SÄVE-SÖDERBERGH 1935, p. 196). The interesting

relations of the Triassic *Labyrinthodontia* from Spitsbergen and East Greenland to those of Russia have lately been further discussed, on the basis of important new finds in Russia, by A. HARTMANN-WEINBERG and TH. M. KUSMIN (1936 a, b). Finally, in connection with a thorough reinvestigation of certain Spitsbergen *Labyrinthodontia* (SÄVE-SÖDERBERGH 1936), I have been able to add a few further points to the evidence of the close relationship of the Spitsbergen and East Greenland *Labyrinthodontia*, by showing that *Lonchorhynchus öbergi* WIMAN and *Aphaneramma rostratum* A. S. WOODWARD must be referred to the same genus (*Aphaneramma*), closely related, probably even a direct descendant, of the Greenland genus *Stoschiosaurus*. On the other hand, I expressed the opinion (1936, p. 115) that the Russian genus *Benthosaurus*, which formerly was very incompletely known, cannot now, judging by BYSTROW's beautiful new restorations (1935), be considered closely related to the Spitsbergen and East Greenland Trematosaurids, as I thought possible in 1935.

In my previous publications (1935, 1936) I also gave restorations in dorsal and lateral view of the dermal skulls of the Spitsbergen forms *Lyrocephalus euri* (1936, text-figs. 1, 2), *Platystega depressa* (1936, text-figs. 18, 19), and *Aphaneramma* («*Lonchorhynchus öbergi*» — text-figs. 31, 32). These restorations were, however, semidiagrammatical, in so far that the ornamentation of the dermal bones was omitted, and the radiate structure of each dermal bone shown instead.

The external ornamentation was formerly considered of little morphological interest. But in a beautiful recent publication devoted to the structure of the dermal bones, BYSTROW (1935) has put forward a number of interesting points of view, that throw new light on the importance of the external ornamentation. BYSTROW was able to demonstrate the individual development of the dermal bones and their ornamentation in *Benthosaurus*, and from this he drew general conclusions on this structure in other primitive Tetrapods.

The two most important new points brought out by BYSTROW are:

1. The individual development of the ornamentation of each dermal bone proceeding, according to him, from a radiating type (similar to that of the adult *Dvinosaurus*) to a type consisting of rounded pits, and sometimes — in zones of more intense growth — from this to a type consisting of a central, pitted field and a distal part with elongated grooves, and itself finally changing again into one of rounded pits only;

2. The presence in the skull of definite zones of more intense growth, characterized by the elongated groove type of ornamentation.

The presence of definite zones of more intense longitudinal growth than others had already been demonstrated by my analysis (1935, pp. 74—75; cf. also pp. 75—92) of the relative lengths of transverse divisions of the dermal skull in different *Labyrinthodontia* — it was hardly necessary to

point out that different lengths depend upon different degrees of intensity of growth. But BYSTROW was the first to show the connection between these zones of intense growth and the elongated groove type of ornamentation, and in this way made possible a more exact delimitation of the zones of intense growth.

In his important publication (1935) BYSTROW also gave a new restoration of »*Lonchorhynchus öbergi*» (fig. 27), and sketches of certain lateral line canals and dermal bones in *Lyrocephalus euri* and *Aphaneramma* (fig. 18). These illustrations were, however, apparently based upon a study of the literature only, and are to some extent incorrect.

BYSTROW's interesting new points of view on the general evolution of the ornamentation of the dermal bones, on the one hand, and his errors in the interpretation of the Spitsbergen forms on the other, made it seem advisable to give new restorations of the Spitsbergen forms concerned, including the ornamentation of the dermal bones, and based on a study of the actual specimens. At the same time I propose to give some phylogenetical and systematical points of view supplementing BYSTROW's morphological study.

For the loan of specimens I am indebted to the authorities of the Palaeozoological Department of the Swedish Riksmuseum and the Palaeontological Institute of the University of Uppsala.

## 2. *Lyrocephalus*.

Figs. 1 and 2 show the restored dorsal and lateral views of the skull of *Lyrocephalus euri*, based chiefly on specimen U.3, with parts restored in accordance with conditions in specimens U.1, U.2 and U.34. The elongated groove type of ornamentation is found in two areas (cf. fig. 3), one preorbital and circumorbital, and one postorbital. The preorbital and circumorbital area may be considered to be made up of a transverse, preorbital zone of the dermal cranial roof, including important posterior parts of the naso-postrostrals, anterior parts of the frontals, postero-lateral parts of the posterior antorbitals and anterior parts of the jugals, and a pair of lateral and posterior circumorbital zones, including antero-medial parts of the jugals and anterior parts of the postorbitals. The extreme breadth of the lateral line grooves prevents a closer examination of the anterior supraorbitals, the anterior parts of which probably also shared in the formation of the preorbital zone of intense growth. — The postorbital area may be considered to be made up of an unpaired transverse postorbital zone of the dermal cranial roof (and postorbitals) including important anterior parts of the fronto-parietals, the most posterior parts of the frontals and supraorbito-dermosphenotics, anterior parts of the supratemporo-intertemporals, and posterior parts of the postorbitals, and a pair

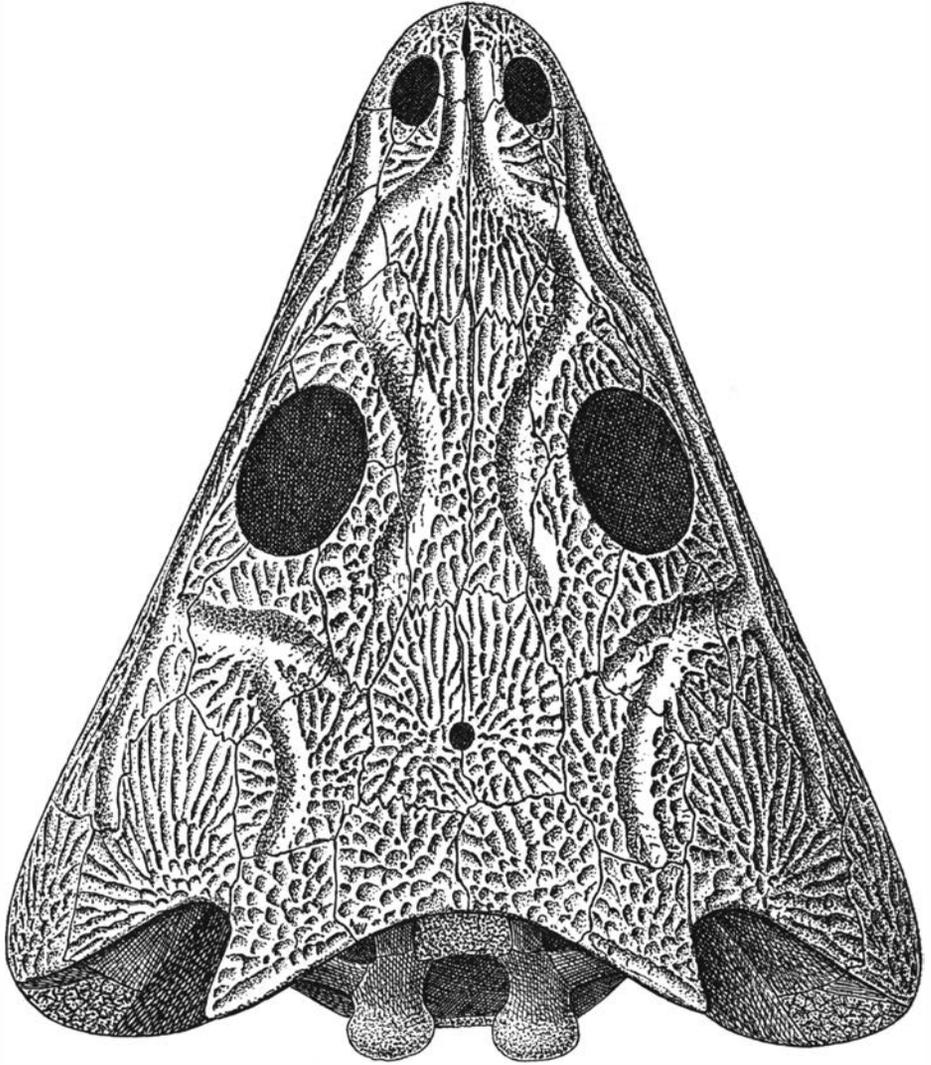


Fig. 1. *Lyrocephalus euri*. Dorsal aspect of the skull, based upon specimens U.3 (chiefly), U.1, U.2, and U.34.  $\frac{4}{5}$  natural size of specimen U.3.

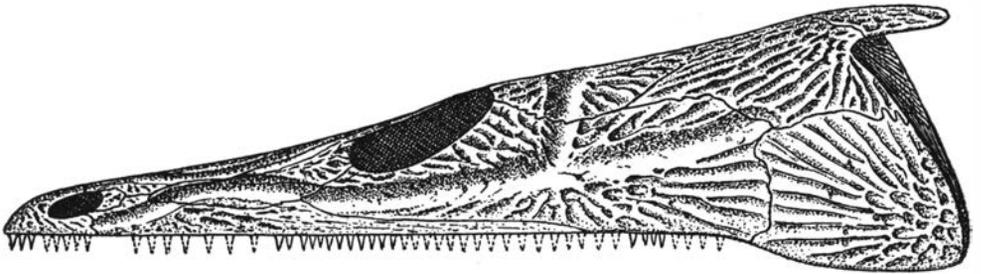


Fig. 2. *Lyrocephalus euri*. Lateral aspect of the skull, based upon specimens U.34, U.1, U.2, and U.3. About  $\frac{3}{4}$  natural size of specimen U.34.

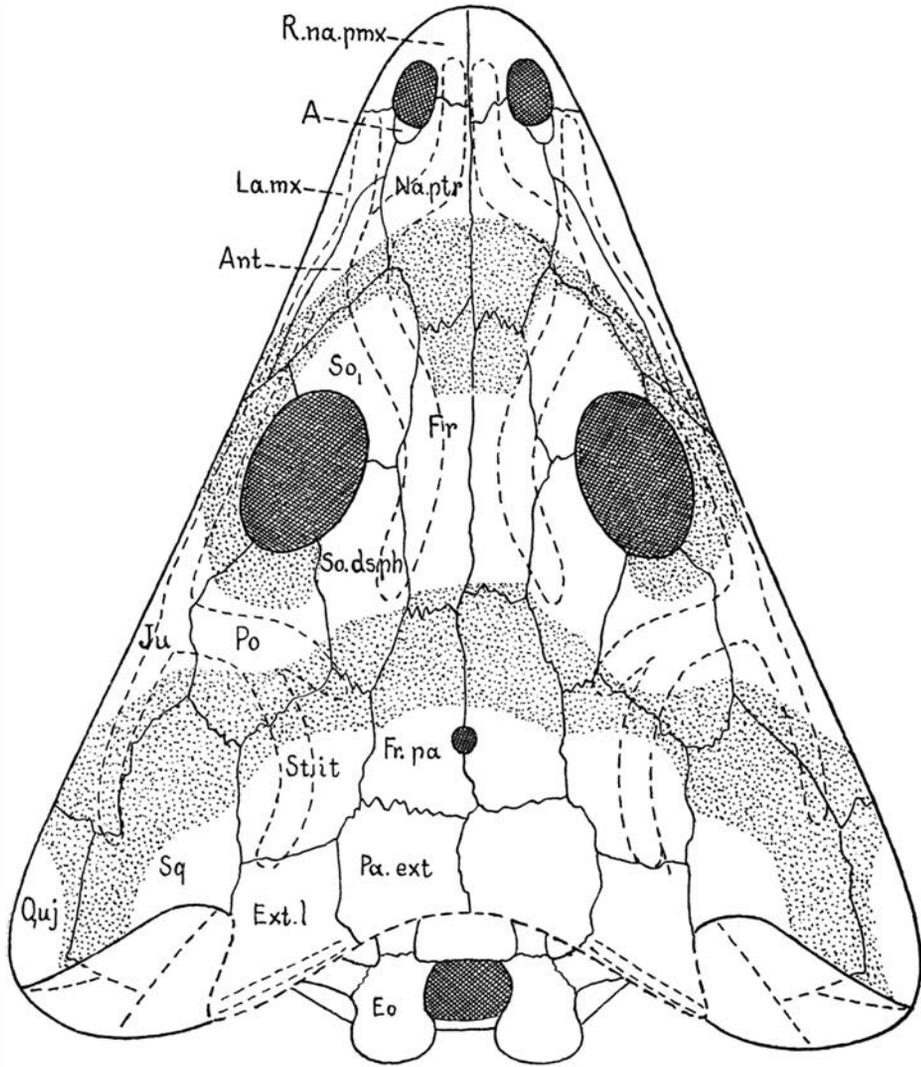


Fig. 3. *Lyrocephalus euri*. Dorsal aspect of the skull, with zones of intense growth (dotted).

*A*, anterior antorbital (septomaxillary); *Ant*, posterior antorbital; *Eo*, exoccipital; *Ext.l*, lateral extrascapular; *Fr*, frontal; *Fr.pa*, fronto-parietal; *Ju*, jugal; *La.mx*, lachrymo-maxillary; *Na.ptr*, naso-postrostral; *Pa.ext*, parieto-extrascapular; *Po*, postorbital; *Qu*, quadrate; *Quj*, quadratojugal; *R.na.pmx*, naso-rostro-premaxillary; *So*, anterior supra-orbital; *So.dsph*, supraorbito-dermosphenotic; *Sq*, squamosal; *St.it*, supratemporo-inter-temporal.

of cheek zones, including postero-medial parts of the jugals, very large antero-lateral parts of the squamosals, and antero-dorsal parts of the quadratojugals. The position of the zones of intense growth is illustrated in fig. 3.

It may be noted that the two zones of intense growth of the dermal cranial roof, though quite distinct are not very strongly marked. This agrees with the fact that *Lyrocephalus euri* has a fairly normal shape of the skull without extreme lengthening of any part. It may be characterized as a primitive type (in this respect!) of a line developing two zones of intense growth of the dermal cranial roof, one pre-orbital, the other postorbital. A much more advanced type of the same line is represented by *Trematosaurus* (fig. 4), which shows beautifully the same zones of intense growth as *Lyrocephalus*, though much more sharply marked, both by the ornamentation and by the proportions of the skull.<sup>1</sup>

In a previous publication (1936, p. 46) I have already pointed out that BYSTROW'S sketch (1935, fig. 18 A) of the arrangement of the lateral line canal grooves in a specimen (U.2) of *Lyrocephalus euri* is partly incorrect, owing to a misinterpretation of WIMAN'S figure (1914, pl. I, fig. 2).

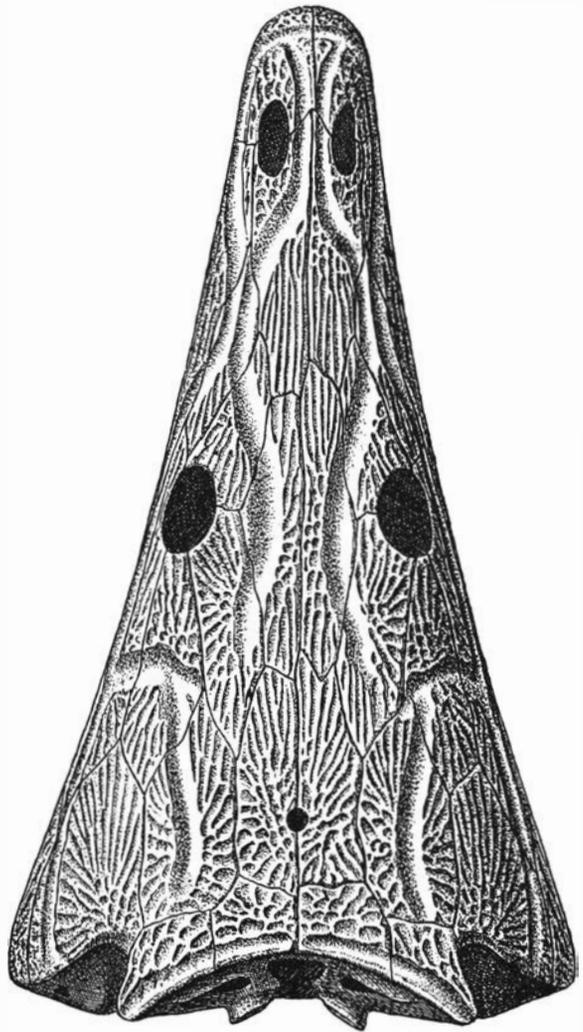


Fig. 4 A.

*Trematosaurus brauni*. Dorsal aspect of the skull, Fig. 4 B. After a cast in the *Ant*, posterior antorbital; *Ext.l*, lateral extrascapular; lachrymo-maxillary; *Na.ptr*, naso-postrostral; *Pa.ext*, jugal; *R.na.pmx*, naso-rostro-premaxillary; *So.*, anterior squamosal; *St.it*, supra-

<sup>1</sup> My restoration of *Trematosaurus brauni* (fig. 4) is made after a cast (in the possession of the Swedish Riksmuseum) of a specimen from Bernburg. It differs in certain respects from BURMEISTER'S classical restoration (1849), and also from BYSTROW'S figure (1935, fig. 25) which is largely based on a possibly somewhat different Russian species.

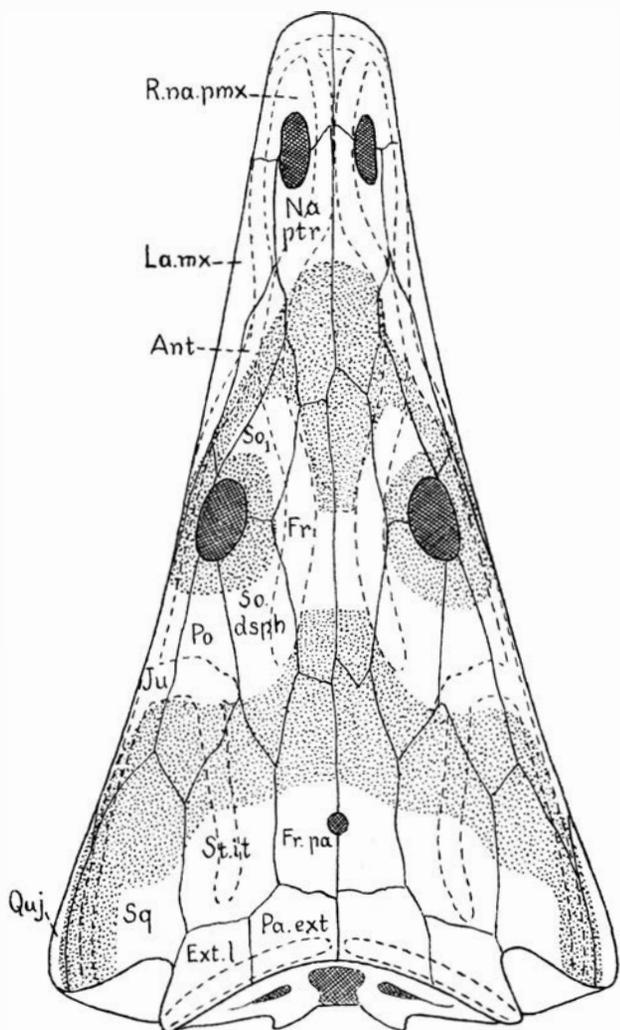


Fig. 4 B.

with zones of intense growth denoted by dotting in Swedish Riksmuseum.  $\frac{1}{2}$  natural size.

*Fr.*, frontal; *Fr.pa*, fronto-parietal; *Ju*, jugal; *La.mx*, parieto-extrascapular; *Po*, postorbital; *Quj*, quadrato-supraorbital; *So.dsph*, supraorbital-dermosphenotic; *Sq*, temporo-intertemporal.

A recently cleaned impression of the external surface of the skull in *Lyrocephalus euri* (specimen U.34) shows part of the prenarial region, which was very incompletely known before, and reveals the presence of a slit-like »foramen interpraemaxillare» (cf. BYSTROW 1935, figs. 12, 15, 16; SÄVE-SÖDERBERGH 1935, pp. 29, 32; text-fig. 10; HAUGTON 1915), but unfortunately does not yet allow any definite statement regarding the presence or absence of a groove for the ethmoidal commissure of the infraorbital lateral line canals.

A short medial branch of the groove on each side for the vertical portion of the suborbital part of the infraorbital canal, and a pair of grooves for the supratemporal commissural canal, are very clearly shown in the cast of *Trematosaurus brauni* (fig. 4).

### 3. *Aphaneramma*.

It is at present impossible to define the different existing species of the genus *Aphaneramma* (cf. SÄVE-SÖDERBERGH 1936, pp. 58—63). In the present study I shall therefore deal with the different specimens separately, without trying to connect one to the other to show the evolution of one species. The specimens studied are:

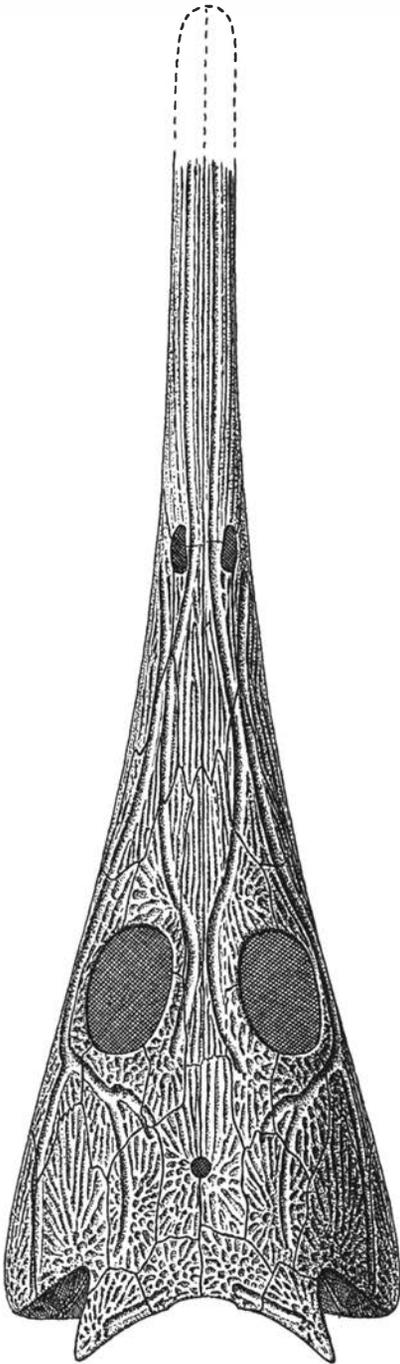


Fig. 5. *Aphaneramma* («*Lonchorhynchus übergi*»). Dorsal aspect of the skull, based on specimens B.1 (chiefly), and U.28. Natural size of specimen B.1.

1. The small holotype (specimen B.1 of the Swedish Riksmuseum) of »*Lonchorhynchus übergi*», combined with specimen U.28 to a restoration of the whole skull, except for the anterior end of the snout, which is still unknown;

2. Specimens U.9 and U.12, showing parts of the dorsal surface of the skull and illustrating certain stages of the individual development of the ornamentation of the dermal bones;

3. Specimen U.15, showing the type of ornamentation in an old individual.

The restoration (figs. 5, 6) of the skull in the holotype of »*Lonchorhynchus übergi*» clearly shows (as BYSTROW has pointed out) three transverse zones of more intense growth of the dermal cranial roof: a postorbital and a preorbital, identical with those of *Lyrocephalus*, though more strongly marked, and a prenarial zone, evidently comprising the posterior and by far larger parts of the naso-rostromaxillaries. Of the two zones present also in *Lyrocephalus* and *Trematosaurus*, the preorbital is in the present specimen of *Aphaneramma* developed much more strongly than the postorbital. Laterally, the postorbital zone is continuous with the cheek zone on each side, as in *Lyrocephalus*. In respect of zones of growth and type of ornamentation, *Aphaneramma* may be characterized as a fairly advanced form of the same general type as *Lyrocephalus euri* and *Trematosaurus brauni*, showing in addition, as a specialization of its own, an extremely pronounced prenarial zone of intense growth.

Specimen U.9 (fig. 7 A, B) was also figured by BYSTROW (1935, fig. 18 C), who shows correctly the unusual arrangement of the lateral line canal grooves on the left side of this interesting specimen.

On the right side, however, the medial branch of the groove for the vertical portion of the suborbital part of the infraorbital canal can be followed a little farther back than shown in BYSTROW's figure, and actually crosses the suture between the supra-orbito-dermosphenotic and the supratemporo-inter-temporal, ending in the most anterior part of the latter bone.

The external ornamentation of certain dermal bones in specimen U.9 are of special interest, as they show that the »central field» — with pitted ornamentation — was apparently here acquired very late. In the fronto-parietals of this specimen (especially in the right one) there is thus hardly any »central field» at all, and in the frontals, medially to the grooves for the supraorbital canals, the elongated grooves anterior to the centre of the bone (diverging anteriorly) meet those posterior to the centre (diverging posteriorly) without the intercalation of any pitted field. Only laterally to the grooves for the supraorbital canals are there two pits on the right and one on the left frontal. The ornamentation of the frontals and fronto-parietals shows a regular radiating arrangement of bifurcating ridges, which is markedly similar to the arrangement of the ridges in *Dvinosaurus tertius* (BYSTROW 1935, fig. 30). The ornamentation of these bones in *Aphaneramma* differs, however, from that in *Dvinosaurus tertius*, in that the grooves between the radiating ridges are constricted at regular intervals by the beginning development of transverse septa. The further development of such septa evidently leads to a subdivision of the elongated grooves into rows of pits — just as postulated by BYSTROW in the final stages (1935, fig. 11, g—h) — and different stages of this process are found in the different other bones of specimen U.9, and in the bones of the larger, apparently somewhat older, specimen U.12 (fig. 7 C). The specimens discussed also show that the development of the septa begins at the centre of a bone and proceeds successively in a centrifugal direction, which is the way in which the »central

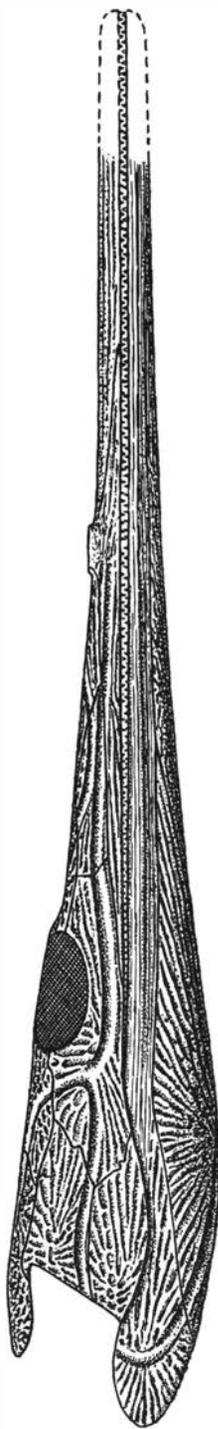


Fig. 6. *Aphaneramma* (*Lonchorhynchus obergi*). Lateral aspect of the skull, with the lower jaw. Based on specimens B.1 (chiefly), and U.28. Natural size of specimen B.1.

field» has been formed and successively enlarged in *Aphaneramma*. This evolution differs from the scheme postulated by BYSTROW (1935, fig. 11), in that the whole process is one single evolution from elongated grooves

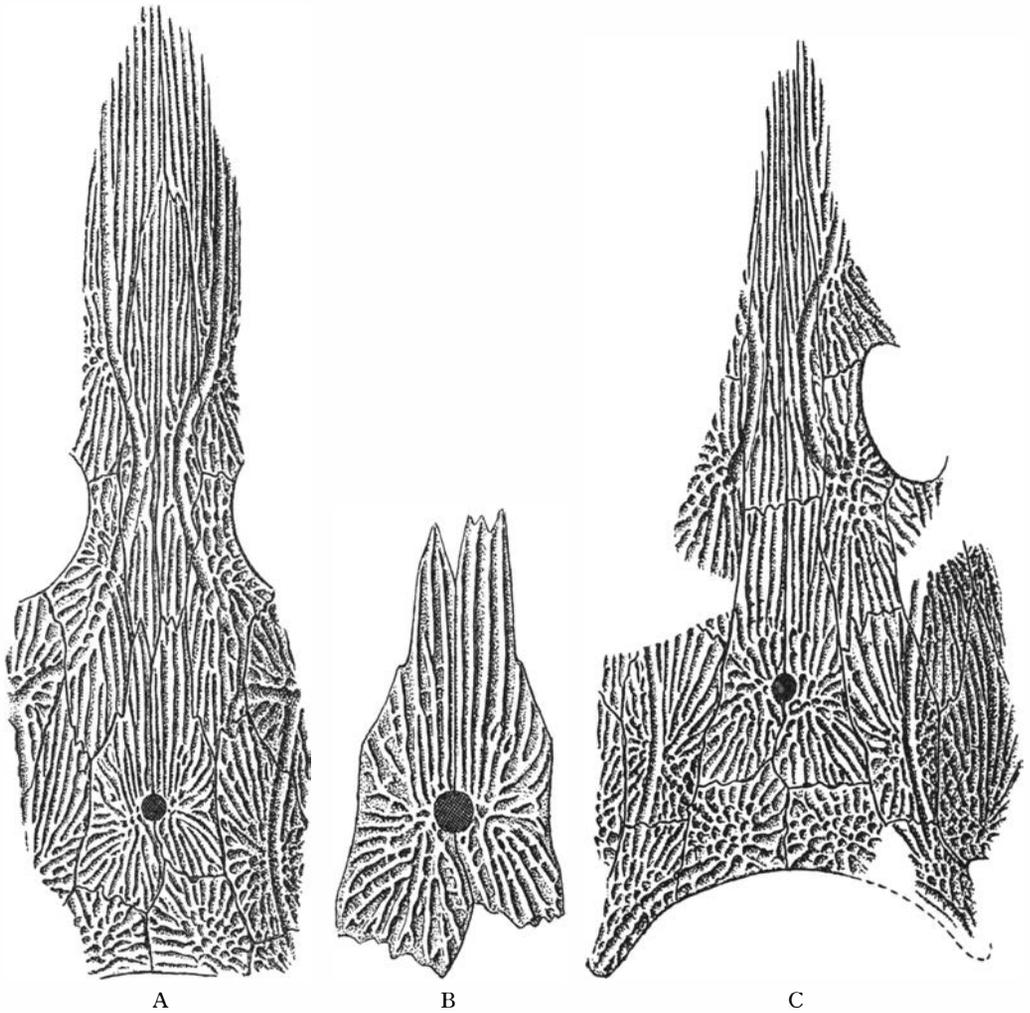


Fig. 7. *Aphaneramma*. Parts of dermal skulls, specimens U.9 and U.12. A, specimen U.9,  $\frac{2}{3}$  natural size; B, fronto-parietals of specimen U.9, natural size; C, specimen U.12,  $\frac{2}{3}$  natural size.

and ridges to pits, without intercalation of any stage corresponding to that denoted *e* by BYSTROW.

The final result of the individual evolution of the ornamentation of the dermal bones is shown in the very large specimen U.15 (fig. 8). In this the entire surface of several dermal bones, and most of the surface of the other is ornamented by rounded pits, arranged in more or less distinct radiating rows.

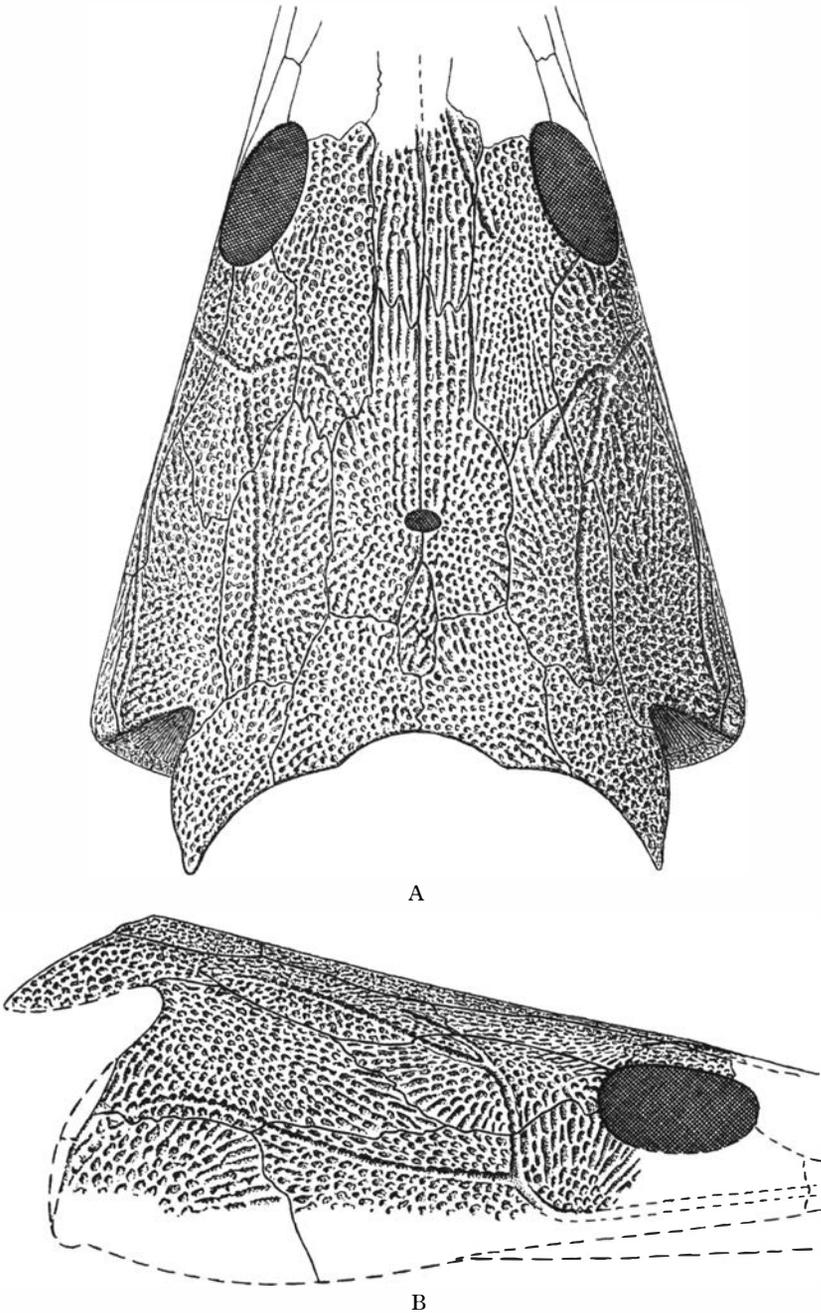


Fig. 8. *Aphaneramma*. Parts of the dermal skull, specimen U.15. A, dorsal aspect; B, lateral aspect. About  $\frac{3}{5}$  natural size.

The arrangement of the grooves for the lateral line canals in specimen U.15 (partly different from that shown in BYSTROW's figure 18 B) has already been described in my earlier paper (1936, pp. 77—78).

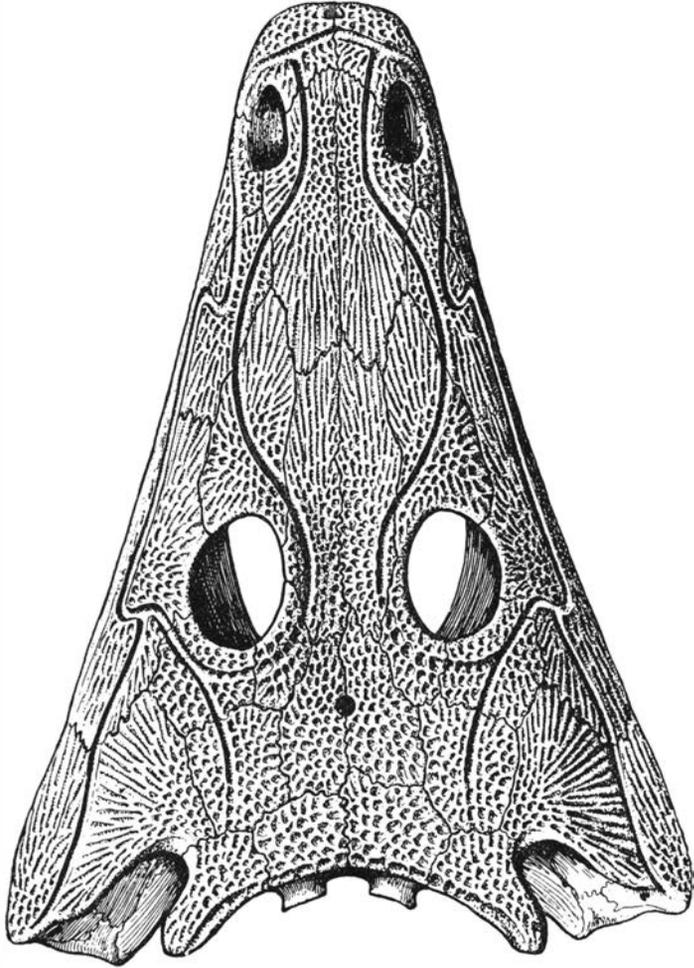


Fig. 9 A.

*Benthosaurus sushkini*. A, dorsal aspect of the skull, from BYSTROW (1935, *Ant*, posterior antorbital; *Ext.l.*, lateral extrascapular; *Fr*, frontal; *Fr.pa*, fronto-parietal; *Po*, postorbital; *Quj*, quadratojugal; *R.na.pmx*, naso-rostro-premaxillary; *So.*, anterior inter-

#### 4. *Benthosaurus*.

The Russian Labyrinthodont *Benthosaurus* was first described and figured by EFREMOW (1929), but our present knowledge of this genus rests chiefly on the very clear and beautiful figures published by BYSTROW (1935) and his description of the skull in different stages of individual development.

In addition to the cheek zones and feebly developed lateral circum-orbital zones *Benthosaurus* (fig. 9) shows, as BYSTROW has pointed out, a single, preorbital, transverse zone of intense growth of the dermal cranial roof, and in this it agrees with *Wetlugasaurus*, *Capitosaurus*, *Cyclotosaurus*

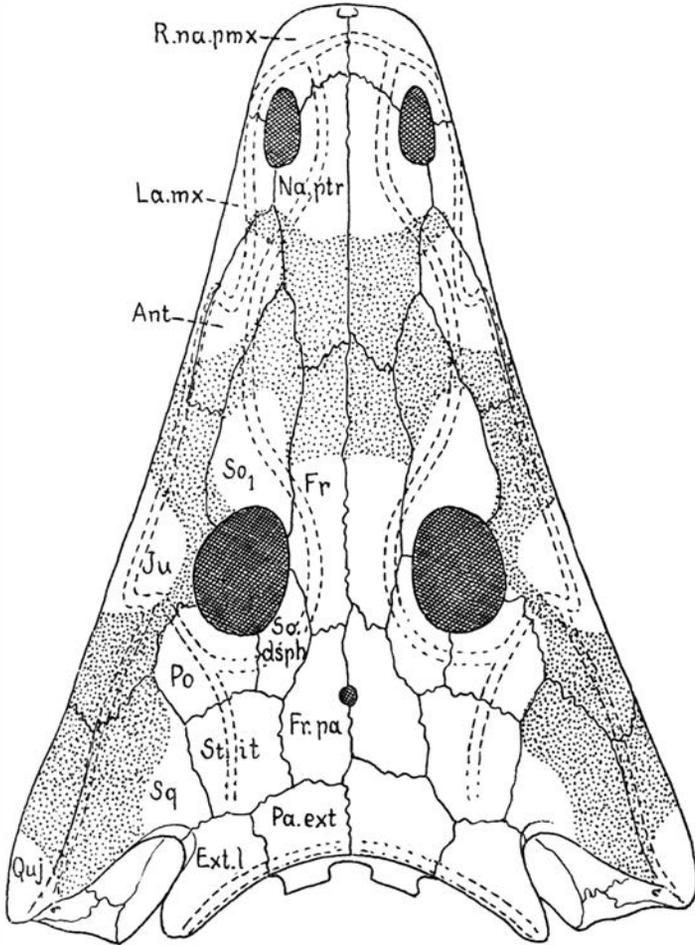


Fig. 9 B.

fig. 12); B, schematic figure, showing the zones of intense growth (dotted).  
*Ju*, jugal; *La.mx*, lachrymo-maxillary; *Na.ptr*, naso-postrostral; *Pa.ext*, parieto-extrascapular; supraorbital; *So.dsph*, supraorbito-dermosphenotic; *Sq*, squamosal; *St.it*, supratemporal.

and *Mastodonsaurus*. The presence of this single transverse, preorbital, zone of intense growth of the dermal cranial roof is in fact a characteristic feature of the whole Suborder *Capitosauroides* (SÄVE-SÖDERBERGH 1935, pp. 199—200; cf. pp. 75—84, 88—90), whereas the presence of a post-orbital transverse zone of intense growth of the dermal cranial roof (together with a more or less marked preorbital zone) is equally characteristic of the Suborder *Trematosauroides* (SÄVE-SÖDERBERGH 1935, pp. 199—200; cf. pp. 84—88, 90—91), as demonstrated above in *Lyrocephalus*, *Aphaneramma*, and *Trematosaurus*. Accordingly, it seems very improbable that *Benthosaurus* should be closely related to the Trematosaurids, as HART-

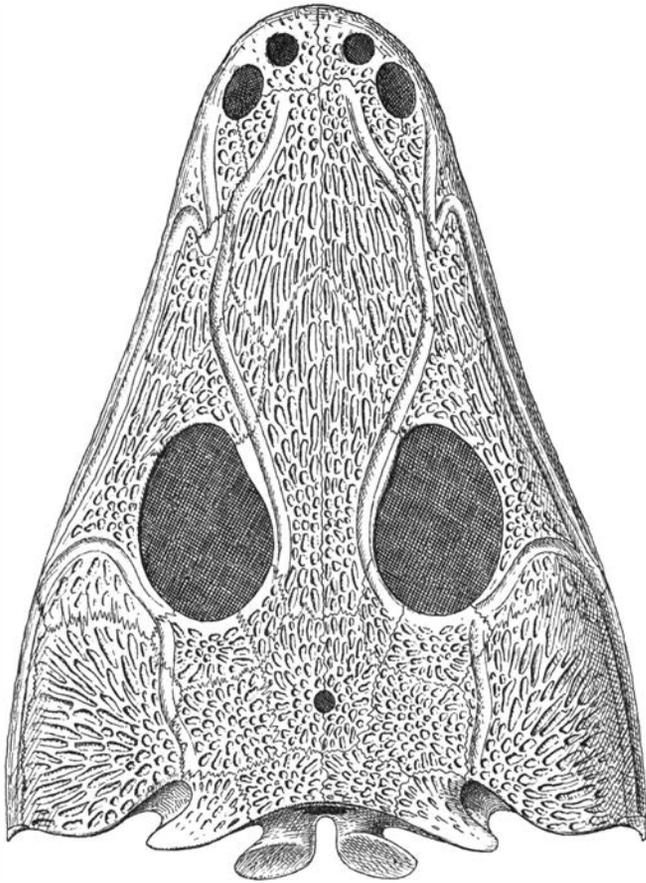


Fig. 10 A.

*Mastodonsaurus giganteus*. A, dorsal aspect of the skull, after FRAAS  
*Ant*, posterior antorbital; *Ext.l.*, lateral extrascapular; *Fr*, frontal; *Fr.pa*, fronto-parietal;  
*Po*, postorbital; *Quj*, quadratojugal; *R.na.pmx*, naso-rostro-premaxillary; *So.*, anterior  
 mosal; *St.it*, supra-

MANN-WEINBERG and KUSMIN (1936 a, p. 55) seem to think, and as I thought possible in 1935 (p. 196), before the skull of *Benthosaurus* was sufficiently well known. The single, preorbital, transverse zone of intense growth, and the striking shortness of the postorbital division of the dermal cranial roof, are clearly Capitosauroid characters of *Benthosaurus*. It apparently differs from the contemporaneous genus *Wetlugasaurus* in the greater breadth of the most posterior part of the skull, and the slightly concave lateral margins, which give the skull of *Benthosaurus* a more triangular shape, somewhat reminiscent of that of *Mastodonsaurus* (fig. 10). On the other hand, *Benthosaurus* agrees with *Wetlugasaurus* in the proportions of the skull and its different regions, and also in the characteristic angular shape of the suture between the postorbital and the jugal, in the

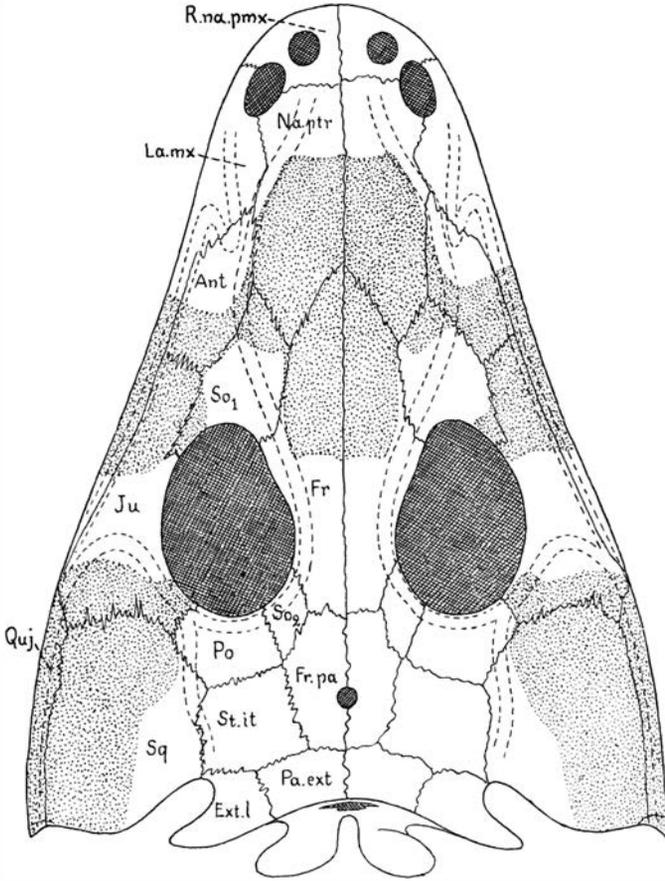


Fig. 10 B.

(1889); B, schematic figure showing the zones of intense growth (dotted). *Ju*, jugal; *La.mx*, lachrymo-maxillary; *Na.ptr*, naso-postrostral; *Pa.ext*, parieto-extrascapular; supraorbital; *So2*, posterior supraorbital or reduced supraorbito-dermosphenotic; *Sq*, squamoso-temporal.

shape of the postorbitals and the supraorbito-dermosphenotics, and in the shape of several other bones.

Several characters in *Benthosaurus* suggest the possibility of a real relationship also with *Mastodonsaurus* (cf. figs. 9, 10). The triangular general shape of the skull, with concave lateral margins, has already been mentioned. The arrangement of the lateral line grooves presents certain similarities. The supraorbital canals form a wide lyre, and then curve laterally round the posterior margins of the orbits, to meet the infraorbital canals unusually far laterally, and at sharp angles, pointing forward; the horizontal portion of the suborbital part of each infraorbital canal has a somewhat similar posteriorly directed loop on the posterior antorbital; and the most lateral part of its vertical portion has a convexity, directed forward.

After all, *Benthosaurus* may in reality be an early representative of the branch of the *Capitosauroidei* culminating in *Mastodonsaurus*. However, this is as yet only an interesting possibility, and a much closer study will be needed to establish with certainty the phylogenetic relations of *Benthosaurus*. At present, we can anyway say that *Benthosaurus* is a fairly primitive Capitosauroid. Provisionally, it may be placed in the superfamily *Capitosauroideae* and in a family of its own, the *Benthosauridae*.

### 5. Concluding remarks.

The general scheme of evolution of the ornamentation of each dermal bone arrived at by BYSTROW (1935, fig. 11) may be correct as far as *Benthosaurus* is concerned (and then very probably also for other Capitosauroid forms), but does not seem applicable to *Aphaneramma*. In this genus (and probably also in other members of the family *Trematosauridae*) the ornamentation proceeds, very simply, from a stage with radiating, bifurcating ridges and grooves, by the development of transverse septa dividing the long grooves into short, and finally into rounded pits, to the stage with rounded pits in radiating rows. None the less, BYSTROW's rule, that the elongated groove type of ornamentation is typical of the zones of more intense growth in older stages (if not in the oldest), clearly holds good also for the Trematosaurids, and thus enables us to make interesting comparisons regarding the arrangement of these zones in different *Labyrinthodontia*.

The chief zones of more intense growth observed in the *Labyrinthodontia* may be grouped as follows:

A. Transverse zones of the dermal cranial roof (connected with the lengthening of different divisions of the roof):

1. The prenarial zone, formed by the posterior parts of the nasorostror-premaxillaries;

2. The preorbital zone, formed by the posterior parts of the nasopostrostrals, the anterior parts of the frontals — in most cases also by the anterior parts of the anterior supraorbitals and the jugals and the posterior parts of the posterior antorbitals, sometimes also by the anterior parts of the posterior antorbitals;

3. The postorbital zone, formed by the anterior parts of the frontoparietals and supratemporo-intertemporals, and by the posterior parts of the frontals, supraorbito-dermosphenotics, and postorbitals.

B. Circumorbital zones (connected chiefly with the narrowing of the orbital openings), mainly lateral to the orbital openings, mainly posterior and lateral to them, or entirely surrounding them.

C. The cheek zones (connected with the growth in posterior and lateral directions of the postero-lateral parts of the cheeks), comprising

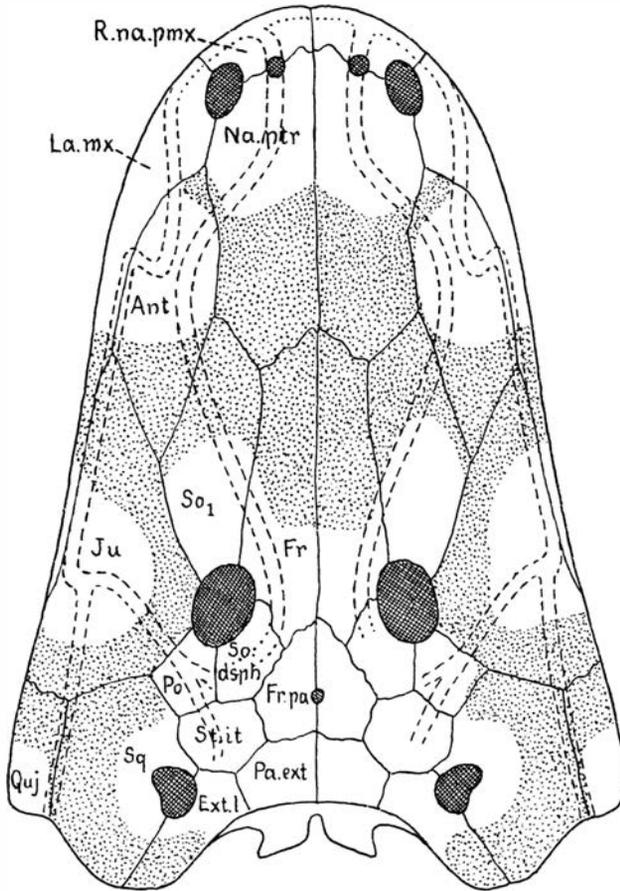


Fig. 11. *Cyclotosaurus robustus*. Schematic figure, showing the dorsal aspect of the skull with the zones of intense growth (dotted). Based on BYSTROW'S restoration (1935, fig. 23).

*Ant.*, posterior antorbital; *Ext.l.*, lateral extrascapular; *Fr.*, frontal; *Fr.pa.*, fronto-parietal; *Ju.*, jugal; *La.mx.*, lachrymo-maxillary; *Na.ptr.*, naso-postrostral; *Pa.ext.*, parieto-extrascapular; *Po.*, postorbital; *Quj.*, quadratojugal; *R.na.pmx.*, naso-rostro-premaxillary; *So<sub>1</sub>*, anterior supraorbital; *So<sub>2</sub>*, supraorbito-dermosphenotic; *Sq.*, squamosal; *St.it.*, supratemporo-intertemporal.

antero-dorsal parts of the quadratojugals, antero-ventral parts of the squamosals, and postero-dorsal parts of the jugals.

D. Special longitudinal zones (connected with the broadening of certain parts of the skull):

1. The supratemporal zone, formed by the lateral parts of the supratemporo-intertemporals; and other special zones connected with the extreme broadening of the skull in the *Brachyopoideae*;

2. The zones of the lateral extrascapulars, connected with the closing of the otic notches in *Cyclotosaurus*.

Now it is interesting to find that the development of these different

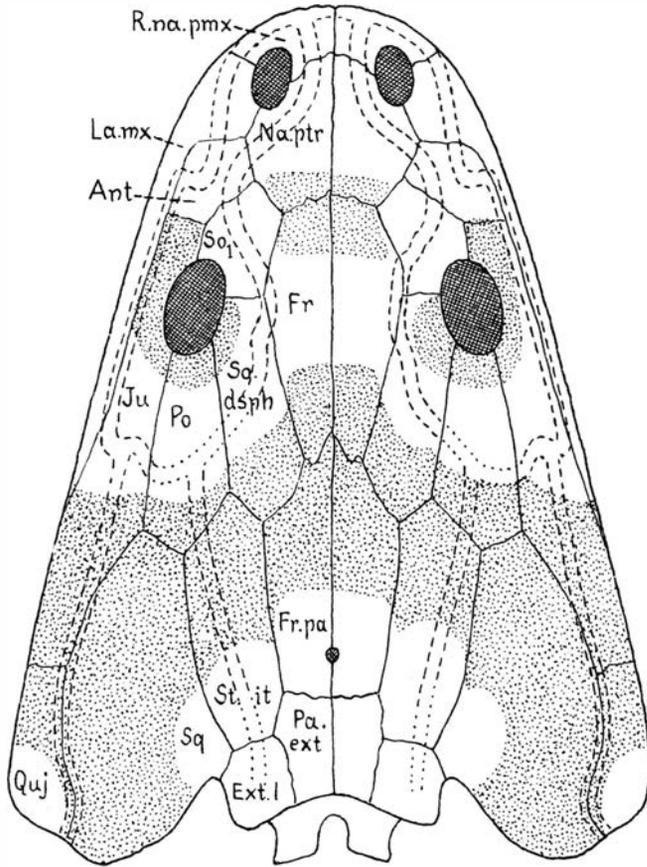


Fig. 12. *Metoposaurus diagnosticus*. Schematic figure, showing the dorsal aspect of the skull with the zones of intense growth (dotted). Based on BYSTROW'S restoration (1935, fig. 22) after FRAAS (1889).

*Ant*, posterior antorbital; *Ext.l*, lateral extrascapular; *Fr*, frontal; *Fr.pa*, fronto-parietal; *Ju*, jugal; *La.mx*, lachrymo-maxillary; *Na.ptr*, naso-postrostral; *Pa.ext*, parieto-extrascapular; *Po*, postorbital; *Quj*, quadratojugal; *R.na.pmx*, naso-rostro-premaxillary; *So.*, anterior supraorbital; *So.dsph*, supraorbital-dermosphenotic; *Sq*, squamosal; *St.it*, supratemporo-intertemporal.

zones in different groups of *Labyrinthodontia* strongly supports my attempted phylogenetic classification of the *Labyrinthodontia* (1935, pp. 74—92; 199—200), and even enables us to characterize some of the larger groups more briefly than before. In the said classification, the *Labyrinthodontia* were divided as follows:

Order *Labyrinthodontia*.

A. Suborder *Loxommoidei*.

B. Suborder *Capitosauroides*.

1. *Eryopoideae*.

2. *Capitosauroides*.

C. Suborder *Trematosauroidi*.

1. *Metoposauroidae*.
2. *Trematosauroidae*.

D. Suborder *Brachyopoidi*.

1. *Dvinosauroidae*.
2. *Brachyopoidae*.

The *Loxommoidei* form a primitive group, which may possibly have to be further subdivided when more fully known.

In the Suborder *Capitosauroidi* I included the *Capitosauridae*, *Wetlugosauridae*, and *Mastodonsauridae* (superfamily *Capitosauroidae*), together with some rhachitinous forms (the superfamily *Eryopoideae*).

All these are characterized (i. a.) by a strongly developed preorbital zone of intense growth — marked by the proportions of the skull and the ornamentation in the *Capitosauroidae*, by the same proportions in the *Eryopoideae* — and by the absence of any transverse postorbital zone of intense growth of the dermal cranial roof. The cheek zones in these forms are isolated, or continued anteriorly by lateral circumorbital zones, themselves continuous with the preorbital zones. I illustrate this type here by schematic figures showing the distribution of the zones of intense growth in *Cyclotosaurus* (fig. 11) and *Mastodonsaurus* (fig. 10 B).

The presence of a well marked transverse postorbital zone of intense growth of the dermal cranial roof (continuous with the two cheek zones, and forming with them a complicated postorbital area of characteristic appearance) is typical of the Suborder *Trematosauroidi*, which is divided into the two superfamilies *Metoposauroidae* (with rudimentary preorbital zone, see fig. 12) and *Trematosauroidae* (with well developed preorbital zone, see for instance fig. 4). The circumorbital zones of the *Trematosauroidi* are either posterior and lateral to, or surround entirely, the orbital openings.

The Suborder *Brachyopoidi* is characterized inter alia by a strong tendency to a broadening of the skull, due to the presence of a number of longitudinal zones of intense growth.

The Spitsbergen genera *Lyrocephalus* and *Aphaneramma* should in this classification clearly be placed among the *Trematosauroidae*, and the Russian genus *Benthosaurus* equally clearly among the *Capitosauroidi*.

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