A preliminary note on *Bobasatrania groenlandica.*

By

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The third part of my monograph on the Triassic fishes from East Greenland is planned to deal with *Bobasatrania,* a genus of deep-bodied Ganoids represented in the collections at my disposal by more than eight hundred specimens belonging to at least two species.

A study of the same genus based on large collections from Madagascar is at present being carried out by J.-P. Lehman, and as my investigations probably will not be ready for publication in the immediate future, he has asked me to give a short, preliminary note for purposes of comparaisons.

A few years ago E. Stensiö (1947) in an important study on the sensory lines and dermal bones has put forward new points of view on the homologisations of dermal bones, especially those of the cheek, in primitive vertebrates. In this brief note I do not intend to enter upon a discussion of Stensiö's study, and I therefore prefer here to use mainly the same terminology for the dermal bones as in my earlier papers on the Triassic fishes from Greenland.

The genus *Bobasatrania* with the genotype *B. mahavavica* from the Triassic of Madagascar was erected by E. I. White in 1932, and the species *B. groenlandica* from the Triassic of East Greenland was described in the same year by Stensiö (1932, pp. 132–164) who furthermore pointed out, that *Platysomus nathorsti* described by himself in 1921 (pp. 251–252) from the Triassic of Spitzbergen was not a *Platysomus* but should be referred to *Bobasatrania.*

Of the last-mentioned species only very few fragments have been found so far, and our knowledge of the genus is therefore almost exclusively based on *B. mahavavica* and *B. groenlandica.*

Of *B. mahavavica* White (1932) has given a very good sketch showing the outline of the body in side view, sparse remnants of the fins, and many details of the pattern of the dermal bones of the head. The description of *B. groenlandica* given by Stensiö (1932, pp. 132–164) is accompagnied by a long series of figures, including i. a. a restoration of the trunk with scale-covering and fins (fig. 48), another restoration of the endoskeleton of the trunk (fig. 44), and an attempted sketch of certain of the dermal bones of the head and of the dermal bones of the shoulder girdle (fig. 43).

As to the exo- and endoskeleton of the trunk of *B. groenlandica* the studies of the new large material does not necessitate any greater corrections of the restorations given by Stensiö but as to the skeleton of the head and the shoulder girdle Stensiö's attempted sketch has turned out to be rather far from the truth.

The present note therefore will deal mainly with the head region of

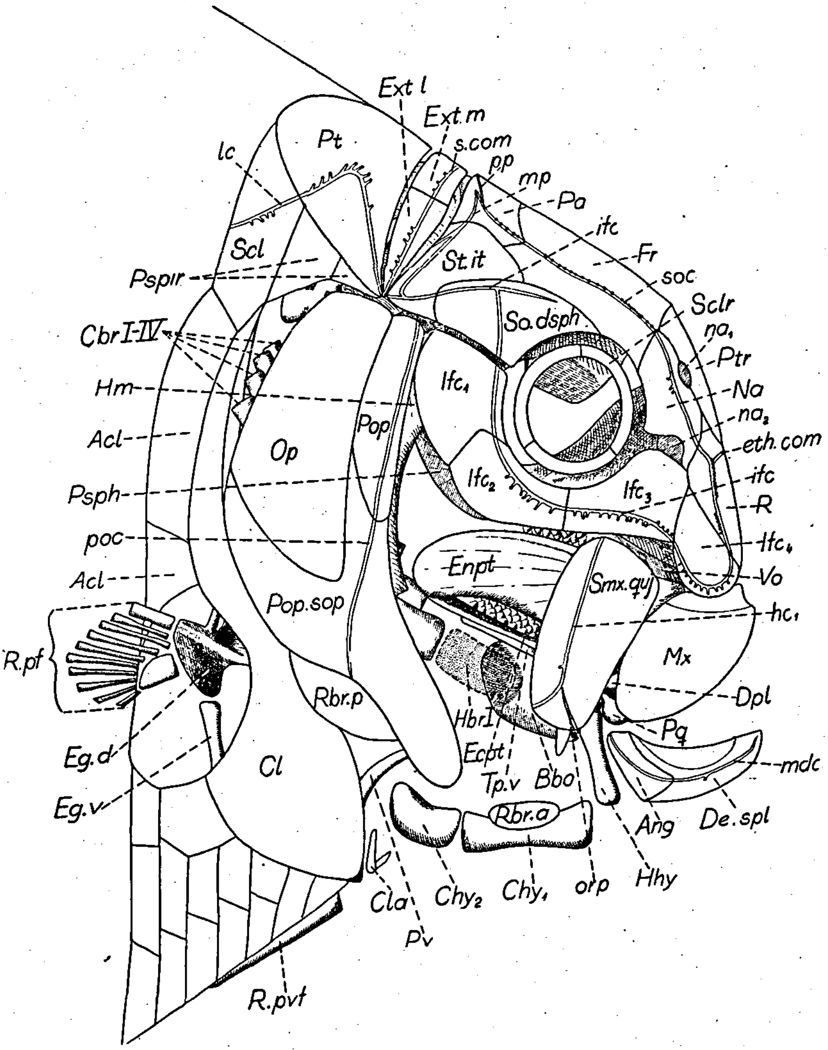

Fig. 1. *Bobasatrania groenlandica* Stensiö. Attempted restoration of the skeleton of the head and of certain skeletal elements of the foremost part of the trunk region. Based on several smaller and larger specimens.
Sclr, sclerotic ring; *ifc*, infraorbital sensory canal; *lc*, main lateral line of the trunk, s. com, supratemporal commisure. Other letters, see text.

Bobasatrania, of which I at present am able to give a fairly complete restoration (figs. 1–2) based on a number of especially well preserved specimens of *B. groenlandica* investigated by direct preparation, which method of investigation on account of the relatively large size of the specimens has been preferred to the tedious grinding method used during my studies on the heads of *Pteronisculus* (*Glaucolepis*), *Boreosomus*, and *Australosomus*.

The neural endocranium is unossified or very slightly ossified in most specimens and is therefore normally badly crushed. Only in very few especially large specimens the process of ossification has proceeded so far, that the outer shape of most of the endocranial structures can be recognised, but even in the most extensively ossified specimens the cranial walls seem to have been partly cartilaginous, as the cavum cerebrale cranii in all cases is devoid of a perichondral lining.

In the best ossified specimens the neural endocranium contains three unpaired ossifications, viz. a small occipital structure mainly corresponding to a pila occipitalis (*Occ*, fig. 2), a very large structure occupying the otic and the greater part of the orbitotemporal region (*Ecr. p.* fig. 2), and a large and extremely massive structure occupying the whole ethmoidal and the anterior portion of the orbitotemporal region (*Ecr. a*, fig. 2).

A detailed description of these structures, the relative extent of which is shown in fig. 2, is not intended in this note, I only want to point out, that the basisphenoid region in all investigated cases seems to be completely unossified.

The parasphenoid (*Psph*, figs. 1–2) extends backwards almost to the hind end of the neural endocranium and forwards below at least the greater part of the ethmoidal region. The long bone has a strong processus ascendens (*pr. asc*, fig. 2), the distal end of which enters the spiracular canal as normally in primitive Ganoids (E. Nielsen 1942, pp. 105–113; 1949, pp. 82, 211). On the ventral face of the ethmoidal ossification and to a rather considerable extent overlapping the foremost part of the ventral face of the pars anterior we find a large roughly elliptical very thick vomerine plate (*Vo*, figs. 1–2), the oral face of which is covered by a dense pavement of small, rounded conical teeth.

The extrascapular series consists of two plates (*Ext. l*, *Ext. m*, fig. 1) of either side of the median line instead of the single large plate shown on STENSIÖ's sketch. The parietals (*Pa*, fig. 1), frontals (*Fr*, fig. 1), supratemporo-intertemporals (*St. it*, fig. 1), and supraorbito-dermosphenotics (*So. dsph*, fig. 1) agree in their main features rather well with STENSIÖ's figure, but the same is not so regarding the elements forming the foremost part of the dermal cranial roof and indicated by STENSIÖ with broken lines. As shown in fig. 1 we find in this area an unpaired postrostral (*Ptr*, fig. 1) and a paired nasal (*Na*, fig. 1), and anterior to these three elements a large paired bone (*R*, fig. 1), which undoubtedly corresponds to the element in *Platysomus parvulus*, described by WATSON as a premaxillary (WATSON 1928, p. 65, fig. 13). From its relations to the ethmoidal commissure of the infraorbital sensory canals (*eth. com*, fig. 1) this paired bone must be interpreted as a rostral, although it is not excluded that its ventral part include a premaxillary component. Between the postrostral and the nasal we find the fenestra exonarina anterior (na_1, fig. 1), and the fenestra exonarina posterior is seen as a very deep notch (na_2, fig 1) in the orbital margin formed by the nasal and the third element in the infraorbital series (see below). The external nostril observed by STENSIÖ and by him interpreted as a posterior external nostril is without doubt the fenestra exonarina anterior.

The infraorbital series contains four elements (Ifc_{1-4}, fig. 1) the foremost of which is homologous to the bone termed rostral in WATSON's description of *Platysomus parvulus* (WATSON 1928, p. 65, fig. 13).

The gape is extraordinarily shortened and neither the upper or the lower jaw carries teeth. The maxillary (*Mx*, fig. 1) is a short and relatively high plate not joined by suture with any other dermal bones. The dorsal part

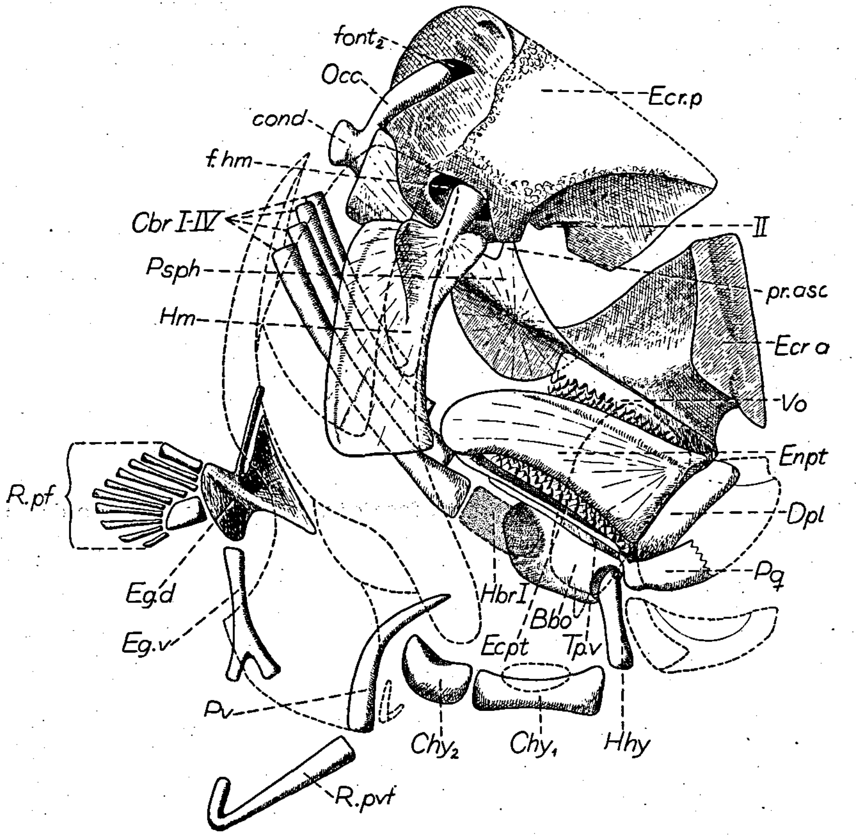

Fig. 2. *Bobasatrania groenlandica* STENSIÖ. The same restoration as in fig. 1 with certain of the dermal bones omitted and others drawn with broken lines only. *Cond*, condyle of occipital region; *font. 2*, posterior dorsal fontanelle; *f. hm*, articular fossa for the hyomandibular; II, place of exit for the nervi optici. Other letters, see text.

of the maxillary is as pointed out by STENSIÖ devoid of ornamentation, and it is probable that this smooth surface of the bone was pushed in below the foremost element of the infraorbital series, when the gape opened.

Immediately postero-dorsally to the maxillary we find a very large, four-sided cheek-plate (*Smx.quj*, fig. 1) pierced by two sensory canals, probably corresponding to the supramaxillary (hc_1, fig. 1) and the postmaxillary (*orp*, fig. 1) lines, respectively, of other Actinopterygians (cf. STENSIÖ 1947), and if so the bone might best be termed a supramaxillo-quadratojugal. A similar cheek-plate is developed in *Ecrinesomus dixoni*, in which form it occupies the whole space between the maxillary and the preopercular series and furthermore forms part of the bordering of the somewhat longer gape. On the internal face of the cheek-plate in *Bobasatrania* a strong ridge is developed, and the ventral end of this ridge protrudes below the ventral margin of the external face of the plate as a long and pointed process. Probably this ridge served as a place of attachment for muscles.

The palatoquadrate was cartilaginous except for a small posterior portion (*Pq*, figs 1–2) corresponding to that part of the palatoquadrate in for instance *Pteronisculus* (cf. E. NIELSEN 1942, p. 145) which bounded laterally the hindmost part of the space for the musculus adductor mandibulae.

The extent of the unossified part of the palatoquadrate is indicated by two distinct ridges situated on the aboral faces of the entopterygoid (*Enpt*, figs. 1—2) and the ectopterygoid (*Ecpt*, figs. 1–2) respectively, but not traceable on the dermopalatine (*Dpl*, figs. 1–2).

The three dermal bones of the palate form together a roughly triangular structure with a short, straight antero-ventral, a long, likewise straight postero-ventral, and a still longer, somewhat convex, dorsal margin. Between the large and broad entopterygoid and the long rod-like ectopterygoid a long, fissure-like opening is found.

In the lower jaw the only dermal bones observed are the angular (*Ang*, fig. 1) and the dentalo-splenial (*De. spl*, fig. 1), and as far as can be seen the Meckelian cartilage was completely unossified.

The hyoid arch contains a very large, almost vertically placed hyomandibular (*Hm*, figs. 1–2), a posterior and an anterior ceratohyal (Chy_{1-2}, figs. 1–2), and a relatively strong, vertically placed hypohyal (*Hhy*, figs. 1–2). The hyomandibular and the posterior ceratohyal are separated by a very long interspace. A symplectic is not developed.

Of dermal bones of the opercular apparatus STENSIÖ described an operculum (*Op*, fig. 1), a dorsal (*Pop*, fig. 1) and a ventral (*Pop. sop*, fig. 1) preoperculum, of which the last-mentioned had a backward extension below the operculum, which possibly should be regarded as a subopercular component. The interpretation of these three bones, the detailed shape of which have been somewhat altered in the restoration here given, is probably correct, and if so, a fourth element now observed (*Rbr. p*, fig. 1), belonging to the same complex of dermal bones and situated between the preoperculo-suboperculum and the cleithrum, must be regarded as a branchiostegal ray. From WHITE's figure of *B. mahavavica* it is not possible to decide, if the bone described as a quadrate branchiostegal corresponds to the branchiostegal ray in *B. groenlandica.* Curiously enough Stensiö in his diagnosis of *Bobasatrania* (Stensiö 1932, p. 129) mentions this quadrate branchiostegal ray, although in his description of B. *groenlandica* (op. cit. p. 139) he takes it for almost certain that the radii branchiostegi in this species have become entirely reduced.

In the new restoration another, more anteriorly placed branchiostegal ray (*Rbr. a*, fig. 1) is shown as a very small element situated laterally to the anterior ceratohyal ossification and without contact with any other dermal bones.

The ceratobranchials (*Cbr I–IV*, figs. 1–2) of the first four branchial arches are well ossified even in rather small specimens, but the only other branchial ossification is an unpaired very massive basibranchial structure (*Bbo*, figs. 1–2) articulating anteriorly with the dorsal ends of the vertically placed hypohyals and with a more posteriorly placed articular groove on either lateral face presumably for the articulation with cartilaginous hypobranchials, one of which (*Hbr I*, figs. 1–2) is indicated in the restoration. The dorsal face of the basibranchial ossification carries a massive dental plate (*Tp. v*, figs. 1–2) with a roughly elliptical outline and with teeth of the same type as those on the opposing vomerine dental-plate already mentioned.

On fig. 1 the sensory canal system of the head has been mapped fairly completely except for the tubuli of certain parts of the system. A detailed description is of course out of place in this note, and the following short comments must suffice for the present. The supramaxillary and the postmaxillary lines already mentioned are in all specimens developed as closed canals and the same is the case with the "pit-lines" on the posterior part of the cranial roof, of which one line (*mp*, fig. 1) extends from the centre of the parietal to the centre of the supratemporo–intertemporal with a side branch extending towards the hind border of the last-mentioned bone, and another line (*pp*, fig. 1) connects the posterior part of the right and left supraorbital sensory canal (*Soc*, fig. 1) across the hindmost part of the parietals. The preopercular canal (*poc*, fig. 1) tapers to a point at the postero-ventral margin of the preoperculo–suboperculum, where it thus ends blindly and accordingly had no direct connection even superficially in the skin with the mandibular sensory canal (*mdc*, fig. 1).

The new restoration also show the endo- and exoskeleton of the shoulder girdle, the pelvic girdle, and the endoskeleton of the paired fins.

The endoskeleton of the shoulder girdle contains two large ossifications of which the dorsal one (*Eg. d*, figs. 1–2) has a very complicated shape and carries the steep, but not quite vertical, margo radialis, while the ventral one (*Eg. v*, figs. 1–2) is developed as a long, vertically placed and farthest ventrally bifurcating rod. The arrangement of the ossifications of the radials of the pectoral fin (*R. pf*, figs. 1–9) is well shown on the figure and need no further description.

The exoskeleton of the shoulder girdle comprises a posttemporal (*Pt*, fig. 1), a supracleithrum (*Scl*, fig. 1), a cleithrum (*Cl*, fig. 1), two anocleithra (*Acl*, fig. 1), and an extremely reduced clavicle (*Cla*, fig. 1). In the angle between the posttemporal and the supracleithrum we find two small dermal bones (*P. spir*, fig. 1) which I have termed postspiracular bones, as the hindmost of the two bones without doubt is comparable to the single postspiracular bone in *Pteronisculus* (E. NIELSEN 1942, p. 182; figs. 27, 30).

Allthough the pelvic fins are lacking, the pelvic girdle instead of being reduced is developed as a paired, long, rather strongly bent, and somewhat laterally flattened rod (*Pv*, figs. 1–2) situated in the area antero-ventrally to the endoskeletal shoulder girdle. The rod increases considerably in thickness from its foremost to its hindmost end and is continued in a backward direction of one or, at least in some specimens, even two strong rod-shaped radial ossifications (*R. pvf.*, figs. 1–2). The anterior and greater part of these rods lies close to and fairly parallel with the ventral margin of the trunk, while their hindmost part after a very sharp bend extends directly upwards.

As will be understood from the above description *Bobasatrania* as regards the skeleton of the head and the foremost part of the trunk is still more specialised than previously assumed.

The masticatory functions have been entirely taken over by the two strong dental plates resting on the lower face of the foremost part of the neural endocranium and the upper face of the large basibranchial element, respectively. The crushing of the food of *Bobasatrania* must have taken place by an upward movement of the lower dental plate and thus of the whole ventral part of the branchial skeleton. The strong development of the ventral part of the hyoid arch, the pelvic girdle, and the radial skeleton of the pelvic fin, as well as the presence of the strong ridge on the inner face of the large dermal cheek-plate all speaks for the assumption that a systems of very strong muscles effected the movements of the masticatory apparatus, and that thus the biting or rather the crushing force of the apparatus was very considerable.

The palatoquadrate-maxillary apparatus had no firm connections either with the neural endocranium, the hyoid arch, or the dermal covering of the cheek, and everything seems to indicate, that the opening of the gape was effected not only by the normal movement of the lower jaw, but also by a rotation of the palatoquadrate-maxillary apparatus itself, by which rotation the anterior end of the maxillary was raised, while the posterior or upper end of the palatoquadrate was lowered.

The affinities of *Bobasatrania* will not be discussed in this note, I only want to emphasize the near relationship between *Bobasatrania* and the less specialised *Ecrinesomus*, and the close similarity in many respects, between these two genera and the much more primitive form, *Platysomus parvulus*.

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