along the costal region; *Sc* long, cell 1st M_2 relatively small, tending to be open by the atrophy of *m*; cell M_1 lacking.

Male.—Length 12 mm.; wing 11 mm.

Female.—Length 20 mm.; wing 15 mm.

Rostrum and palpi brownish black. Antennæ short in both sexes, black. Head brownish black, paler adjoining the inner margin of the eyes.

Thorax brownish black, sparsely dusted with brown. Halteres and legs brownish black. Wings with a strong brown tinge, the costal region more saturated, this intense coloration including the costal and subcostal cells and the radial region to the wing-apex; veins dark brown. Venation: *Sc* very long, Sc_1 ending approximately opposite *r*, Sc_2 some distance from the tip of Sc_1 , the latter alone being about equal to the deflection of R_{4+5} ; *Rs* elongate, arcuated at origin; cell 1st M_2 open or closed, *m* tending to be evanescent; veins beyond cell 1st M_2 very long and parallel; cell M_1 lacking; basal deflection of Cu_1 beyond the fork of *M*; Cu_2 and the basal deflection of Cu_1 subequal.

Abdomen black with a brown pollen. Abdomen of female relatively elongate; valves of ovipositor elongate, acicular, black, the apices of tergal valves horn-coloured.

Hab. Cameroun.

Holotype, ♂, Metet, 200 miles inland, east of Batanga, June 20, 1918 (*A. I. Good*).

Allotopotype, ♀, in *ccpula* with type.

Carnegie Museum, Accession No. 6317.

Type in the collection of the Carnegie Museum.

XXIX.—On the *Cœlacanth Fish*.

By D. M. S. WATSON, University College, London.

FOR some years I have been interested in *Cœlacanth* fish, because, although commonly included with the Osteolepids, they differ from those forms in many respects, and have in some ways marked resemblances to the Teleosts. I therefore investigated the structure of *Macropoma* in specimens partly of my own, partly lent me by Mr. G. E. Dibley, F.G.S. Whilst I was actually writing this paper I received from Dr. E. A. Stensio a copy of his great work on the 'Triassic Fishes from Spitzbergen' (Vienna, Adolf Holzhausen, 1921);

which is, in my opinion, one of the most important contributions ever made to fish morphology. I find, to my great pleasure, that Dr. Stensio has been able to describe in the new genus *Wimania* nearly all the structures which occur in *Macropoma*, and that his interpretation is in nearly all points in complete agreement with that which I had reached.

In some respects, however, my material is more complete than his, and I therefore give an account of the head of *Macropoma* as an introduction to a discussion of the relationships of the group to which it belongs.

Fig. 1.

Macropoma mantelli, Ag. Lateral view of the skull, with the dermal bones and pterygoidal apparatus of the left side removed. $\times 1$.

Ec.Pr., ectopterygoid; Ex.Oc., exoccipital; Op.Pr., foramen probably for the ophthalmicus profundus nerve; P.V., "prevomer" and its tooth-plate; P.AL., palatine tooth-plate; PAR.SP., parasphenoid; Pr.Or., prootic; Pr., pterygoid; Qu., quadrate; III., foramen for third or sixth cranial nerve; IV., foramen for fourth cranial nerve (?).

Basioccipital.—The basioccipital is a small very thin bone, with nearly flat dorsal and ventral surfaces, which are square. It only ossified in full-grown individuals. Its anterior and

posterior surfaces are free, the sides being clasped by backward projections of the prootics.

"*Basisphenoid*."—The "*basisphenoid*" is a massive ossification which has invaded the side-walls of the anterior part of the brain-case and extends up to the skull-roof.

It is a massive bone whose posterior surface is convex, and resembles a condyle in surface-structure; the rounded surface faces downwards and backwards towards the basioccipital, but is separated from that bone by a gap of more than 1 cm. The lower part of the bone in adults is massive and is covered by the hinder end of the parasphenoid. The upper surface, immediately above the condyle, is concave and has a smooth surface, which terminates at a strong rounded ridge, in front of which the bone is so deeply excavated as to consist essentially of two lateral walls. The hinder end of this excavation runs back behind the ridge, and is, without doubt, the

Fig. 2.

Macropoma mantelli. The right side of the neural cranium and parietal in sagittal section. $\times 1$.

Reference-letters as before, with :—B.Oc., basioccipital;
S.Oc., supraoccipital.

pituitary fossa. The cavity becomes very narrow as it is traced forward, its floor contracting until the nearly straight side-walls meet in an acute angle. The side-wall of this cavity is pierced by four large foramina, three of which pass obliquely forward and outward, the fourth going dorsally. A pair of very minute foramina pierce the floor of the pituitary fossa.

In most individuals the lower part of the basisphenoid is unossified, so that it is not in contact with the parasphenoid in the middle line.

The outer surface of this sphenoidal element is mainly

formed by two strong rounded ridges, which subside into the flat outer surface anteriorly.

The ventral ridge overhangs a deep smooth groove, running along the side of the bone immediately above the upper edge of the parasphenoid. This ridge is overlapped posteriorly by the anterior end of the prootic.

Between the upper and lower ridges is another deep rounded groove, which passes backward and is very nearly converted into a foramen by a bowing outward of the anterior edge of the prootic; the aperture so formed is regarded by Stensio as the place of exit of the facial nerve, a view which is undoubtedly correct.

The upper ridge dorsally turns forward and outward until it terminates in a rounded process, regarded by Stensio as a basiptyergoid process, an interpretation which I once held, but found it necessary to abandon. This process lies close under, but is not in contact with, the skull-roof. From its inner anterior face a thin lamina—Stensio's alisphenoid—runs almost directly forward, terminating in a truncated extremity, which lies immediately below the hinder end of the frontal, but which is not fused with that bone, as it is in *Wimania*. This lamina is partially separated from the "basiptyergoid" by a deep, very narrow slit.

The sphenoid is completed by a pair of very thin long walls, which arise from a feebly ossified common base lying over the parasphenoid and rise toward the roof of the skull. The external surface of each of these plates is pierced by three foramina.

Otic Region.—The lateral walls of the hinder part of the brain-case are largely formed by the great bones called prootico-opisthotic by Stensio. I prefer to call these bones prootic, because there is very little reason for believing that they include a real opisthotic.

Each consists of a body whose flat inner surface articulates with the lower ridge of the sphenoid in front and with the side of the basioccipital behind.

From the outer surface of the body posteriorly a strong ridge gradually rises as it is traced forward, until it turns dorsally and then backward, sweeping round so as to form a deep backwardly directed pocket, bounded mesially by the body of the bone. The hinder end of this ridge comes into contact and in adults fuses with a special descending flange from that dermal bone, called by Stensio the supratemporo-extrascapular. This descending flange of the supratemporal is continued forward by a deep slender ridge.

Separated from the process of the prootic above described by a V-shaped notch is another upstanding process, which rises from the outer surface of the body of the bone, so as to leave a notch which continues the middle groove on the sphenoid and gives exit to the facialis.

This process touches, and in adults fuses with, a slender descending process from the parietal, the bar so formed being separated from the hinder border of the upper part of the sphenoid by a slit.

Three other bones occur in the neural cranium of old individuals. The mutual relations of these elements is clear, but their exact position in the skull cannot be determined.

One of these bones is bilaterally symmetrical, and can only be a supraoccipital. It is known to me only from the visceral surface in one very large skull.

It is a small hexagonal bone, lightly ossified, but of considerable thickness. The dorsal surface has a considerable extension, the smooth endocranial surface being very small. It was undoubtedly separated from all other bones by a great deal of residual cartilage.

The posterior of the two remaining pairs of bones is the first of the series to ossify.

It consists of an almost square, vertically placed sheet of bone with a flat admesial surface. The upper margin of this sheet is turned outward, so that it lies horizontally. The posterior lateral corner of this region projects as a definite process of comparatively small antero-posterior width.

The vertical part of this bone is pierced near its hinder margin by two small foramina, the anterior and larger of which lies at the upper end of a deep well-defined groove.

The third element is attached to the lower two-thirds of the anterior margin of the vertical part of that just described.

It also is a mere sheet of bone standing vertically, but is placed nearly transversely in the skull. The inner border is smoothly rounded and cut out into a wide shallow bay round the brain-cavity.

From the middle point of the upper edge of the inner surface of this bone a special very thin bony spicule arises and runs directly forward parallel to the middle line.

Palato-quadrate.—Two ossifications occur in the palato-quadrate cartilage—a quadrate and the bone called hyomandibular by most authors, which has been correctly determined by Stensio as a metapterygoid.

The quadrate is a deep slender bone, a large part of whose inner surface is covered by the pterygoid, the two bones

uniting by deeply striate sutural surfaces. The quadrate stands out nearly transversely, but the inner condyle—an almost hemispherical head—lies a little in front of the cylindrical outer condyle, whose lateral surface is slightly concave.

The metapterygoid is a relatively large sheet of bone lying on the outer surface of the pterygoid. Its hinder margin is turned outward and ends dorsally in a process which touches the lower surface of the parietal. The upper border is divided into two concavities by a low elevation in the middle of its length. This general concavity surrounds the process of the sphenoid called basipterygoid by Stensio. In three cases

Fig. 3.

Macropoma mantelli. Left pterygo-quadrate apparatus seen from without. $\times 1$.

Reference-letters as before, with PAL.TH., the tooth-bearing plate attached to the palatine, represented displaced. The epipterygoid is also slightly twisted backward.

where I have removed the metapterygoid in exposing the brain-case, I have satisfied myself that there is no contact between the two elements, which are always separated by a layer of chalk and do not bear any articular facets.

The anterior end of the metapterygoid is produced into a long process of nearly cylindrical section, whose lower and part of whose admesian surfaces are supported by a long splint of bone projecting from the upper margin of the pterygoid.

Pterygoid.—The structure of the pterygoid has long been well known. It is a triangular bone, very deep posteriorly, where it extends down to the quadrate and up to the metapterygoid. Between these two bones its outer surface bears a deep groove, bounded anteriorly by a strong rounded ridge. In front of this ridge the upper border is nearly straight, lies parallel to the upper edge of the parasphenoid, and must have been very powerfully attached to that bone by a tough membrane during life, because specimens are not uncommon in which the whole skull, except the sphenoid, parasphenoid, and pterygoids, has been lost. In a specimen of this sort in my collection both metapterygoids were removed before burial without any displacement of the pterygoids.

Anteriorly the lower edge of the pterygoid turns outward, so that the oral surface of the bone becomes inclined at only a small angle to the horizontal.

The lateral margin of the pterygoid anteriorly is grooved for the reception of the ectopterygoid.

Palatine.—The palatine is a small quadricylindrical bone whose hinder end is underlain by the pterygoid. The inner part of the bone stands vertically and lies against the wall of the anterior end of the parasphenoid.

The anterior end of the bone is pointed and lies in a groove on the lateral and under surface of the bone called by Stensio a pre-ethmoid.

The palatine has no teeth attached to it, and might, if viewed in the light of teleost morphology, be regarded as an autopalatine—that is, an ossification in the palato-quadrate cartilage. The texture of the bone and the details of its suture with the pterygoid differ, however, from those of the metapterygoid, and there is really no sound reason for regarding it as other than a strict homologue of the Tetrapod palatine.

Loosely attached to the oral surface of the palatine is a thin bony plate, consisting mainly of the fused bases of a multitude of minute teeth; this element bears a single large tooth, which lies in an area, also including a shallow concavity for the development of its alternative tooth, surrounded by a circle of denticles somewhat larger than those which cover most of the bone. This element might be considered a dermo-palatine if the palatine be called auto-palatine; but, although probably homologous to that element in Teleosts, I prefer to regard it merely as a product of the fusion of teeth.

Vomer (?).—The element which for the moment I regard as a prevomer is that which is described by Stensio as a pre-

ethmoid. It is a thin shell of bone consisting of an oral plate which continues that of the palatine, and is perforated antero-laterally by a small foramen; and a lateral vertical plate which anteriorly passes gradually into the oral part, but posteriorly is sharply marked off by a ridge, the lateral

Fig. 4.

Macropoma mantelli. The palate. $\times 1$.

Reference-letters as before. The reference-lines of P.V. and PAL. end on the tooth-plates.

surface being recessed to receive the anterior edge of the palatine.

The hinder end of the prevomer passes dorsally to the anterior end of the parasphenoid.

The oral surface supports a bone formed of fused tooth-bases which exactly resembles that which rests on the palatine. The large tusk is, however, placed at the caudal end.

Ectopterygoid.—The ectopterygoid is the bone which has usually been called maxilla. It is a long, very delicate element attached to a groove in the outer margins of the pterygoid and palatine. It bears a single row of small, recurved, sharp-pointed teeth, and its outer surface, which faces towards the inner surface of the suborbital, is covered with a granulation of small denticles like those on the pterygoid.

It is quite clear that this element cannot be the maxilla, because there is no evidence of the attachment of any bone to the lower margin of the suborbital.

That in B. M. N. H. no. 39070 (A. S. Woodward, pl. xxxv. fig. 10) it lies below and parallel to the suborbital is explained by the fact that the outer margin of the pterygoid is very nearly parallel to the lower edge of the suborbital in the articulated skull, and in the specimen referred to a slight inward displacement of that bone has brought the two into one plane.

Premaxilla.—The recognition of a complete series of palatal bones shows that the curious median tooth-bearing element $\times$ of Huxley's figure and Smith Woodward's vomer must be the fused præmaxillæ.

In no. 39070 and other specimens in the British Museum it stands vertically at the end of the snout, with the elongated teeth of its lower lateral corner directed downward. Its exact mode of articulation is not, however, determinable.

A *Cœlacanth* from the Solenhofen stone, in the Royal Scottish Museum, shows a similar premaxilla *in situ*.

Septomaxilla (?).—Within the nasal cavity, lying freely, dorsal to the prevomers and below the dorsal surface, are a pair of bones which together form an arched roof. I know these only in transverse section, and can give no account of their shape. They may be true septomaxillæ, but are more probably ossifications in the ethmoidal cartilages.

Dermal Bones of the Outer Surface of the Head.—The general shape of the parietals is well known. They terminate anteriorly in a transverse margin whose edge is rounded, entirely unlike a suture and always separated from the similar hinder edge of the frontal by a space.

There is, in fact, no doubt possible that the *Cœlacanth*s had a movable joint between these two bones, which were in life connected by a ligament.

The produced postero-lateral corners of the parietal plate are not in any specimens I have seen separated by distinct sutures, but as they are not present in three young individuals of my series, they are no doubt in origin separate bones,

Fig. 5.

Macropoma mantelli. Reconstruction of the right side of the anterior end of the fish. $\times 1$.

Reference-letters as before, with:—ANG., angular; CLAV., clavicle; CLEI., cleithrum; COR., coronoid; DEN., dentary; E.Pt., epipterygoid=metacoracoid; GU., gular; PR.ART., prearticular; S.C.L., supracleithrum; Sp., splenial. The small tooth-bearing bones above the prearticular and dentary are described in the text.

called by Stensio supratemporo-extrascapula. For the present I shall call them supratemporals.

The supratemporal has projecting from its lower surface a ridge which is produced caudally into a descending point and

anteriorly into a lamina which fuses with the prootic. The bone terminates in a transverse suture with the last of the parafrontals at a point behind the middle of the parietal. In front of this spot the parietal is continued out laterally as a thin shell of bone, which in the articulated skull is completely concealed by the two posterior parafrontals. From the lower surface of this part of the parietal a descending process reaches, and in adults fuses with, the prootic.

As has long been known, the narrow frontals of *Macropoma* are continued forward by a series of small square elements, which seem to be either four or five in number in different individuals.

From the lateral borders of the lower surface of these elements and of the frontals thin flanges of bone pass outward below the parafrontals.

The parafrontal series of bones begin at sutures with the supratemporals, and continue forward as straight rows lying on the flanges of the parietals, frontals, and preceding bones until they turn inward and meet in the middle bone immediately behind the premaxillæ.

The number of parafrontals in each row is extremely difficult to determine, and appears to be variable in different individuals; it is of the order of ten.

There may be a median parafrontal in the front (Stensio's inter-rostral), and the second of the paired series (Stensio's nasalo-anorbital) is always large, although in *Macropoma* it is never perforated by narial openings.

Attached to the lateral margin of this large second parafrontal is a remarkable and very characteristic bone, which can be recognized in *Undina*. This bone stands nearly vertically on the side of the face. Its anterior border is vertical and no doubt supported the hinder edge of the premaxilla. The lower border is produced downwards into a long slender process, which ends freely and perhaps separated the two nasal apertures.

Above and caudally to the process the outer surface of the bone is depressed and is smooth, in marked contrast to the extremely rough dorsal part and parafrontals.

The hinder end of the suture between this bone and the parafrontal with which it articulates is widened out into a large nearly circular hole, which, as it continues one of the deep grooves on the suborbital, is certainly merely for part of the lateral line apparatus.

The suborbital is already well known and sufficiently shown in fig. 5. Anteriorly it articulates with two para-

frontals and with the undetermined bone described above. Just behind its articulation it is excavated by two deep channels, which plunge down into the bone.

The postorbital and other cheek-plates are sufficiently explained by fig. 5.

There is, however, in one of my specimens and in B. M. N. H. no. 49834 a small bone covered with "denticles" like a scale lying below the quadrato-jugal and in front of the lower end of the operculum.

Lower Jaw.—The lower jaw has been already well described by Smith Woodward. The long straight prearticular extends forward from the hinder end to the symphysis, where it meets its fellow as a massive rounded bone on the dorsal surface of the jaw.

The articular and the postglenoid ossicles have already been described by Smith Woodward, although in my specimens they are not visibly separated by sutures from the angular. The dentary, splenial=infradentary, and coronoid are also well known.

I find, however, that the dentaries do not quite meet at the symphysis; they are separated by the prearticulars for a space of about 8 mm. in a large skull.

The upper surface of the prearticular and dentary for a distance of about 1 cm. from the symphysis is covered by a series of three small bones built up of fused tooth-bases. The anterior of these, at any rate, supports a single larger tusk on its posterior surface.

The opercular apparatus and shoulder-girdle are so well known as to require no further description.

Shape of Head.—Specimens of *Macropoma* are in general only very slightly distorted. The height of the skull is fixed very definitely by the pterygoid apparatus, which extends from the quadrate to the skull-roof. The width of the head can be determined with considerable accuracy, because the gulars obviously, as in *Polypterus*, fill up the whole space between the rami of the lower jaw. In transverse section each gular is bent round very nearly for a quadrant of a circle; when placed together in natural position the ventral surface is horizontal, and in section there is a smooth transition into the vertical lateral surface of the angular—in fact, the section between points at about half the height of the angulars is rather accurately semicircular.

This fixes the position of the lower jaws, and that of the pterygoids and sides of the face follows directly.

The anterior end of *Macropoma* so reconstructed is very

deep and remarkably narrow, differing considerably from the much more usual shape of *Wimania* and *Alexia*.

General Discussion of the Coelacanth Skull.

Although in general I accept Dr. Stensio's interpretation of the Coelacanth skull, I am unable to concur in some of the identifications he makes.

A term like supratemporo-extrascapularis implies that there has been an actual fusion of bones, and that we should expect to find that the bone so called develops from two centres. That this is so there is no evidence in the case of any bone which Stensio calls by a name of this type.

The evidence on which he relies is simply that the bone in question covers an area which in a more primitive form is covered by two or more bones.

If this mode of interpretation were carried to its logical conclusion, one would have to call the parietal of such a mammal as lemur a parieto-post-fronto-postorbital, because it occupies an area which in a Gorgonopsid is filled by these three independent bones. It is, however, quite certain from its development that the mammalian parietal is single, and we have series of Anomodont reptiles which show a steady reduction in size of the postfrontal until that bone is represented by an extremely minute strip partially separating the parietal and postorbital.

In reptiles, at any rate, there can be no doubt that the normal way in which the number of membrane-bones in the skull is reduced is not by the fusion of neighbouring bones, but by a gradual reduction in size and final loss of one of them.

It seems to me most probable that this method of loss is that which usually occurs in bony vertebrates, and as a general policy I have always of recent years regarded a bone as single and corresponding to a single bone in an ancestor, unless there is very good direct evidence that it is formed by fusion of two or more bones.

That such fusions do sometimes occur is certain; in this paper I record a fusion taking place quite late in development between the parietal and supratemporal of *Macropoma* and the formation of the interparietal in mammals by the fusion of a pair of bones is familiar to everyone.

Thus, until he adduces direct evidence that they are formed by fusion, I am unable to accept any of Dr. Stensio's compound names of bones.

The prearticular of *Macropoma* corresponds exactly to that bone in *Megalichthys*; in both they form the greater part of the inner surface of the jaw and in both they meet at the symphysis.

The dentary of *Cœlacanth* is undoubtedly correctly determined.

The three little tooth-bearing bones which rest on the upper and lingual surfaces of the anterior ends of the prearticular and dentary are interpreted by Stensio as precoronoids. This view cannot be accepted; their relation to the bones on which they rest are quite different to those held by the precoronoids in *Osteolepids* and *Tetrapods*, and they are much further forward than those bones ever are.

They can, it seems to me, be most usefully interpreted as new formations, formed by the fusion of teeth. They agree with the little tooth-bearing plates which occur on the copula in *Macropoma* and on the branchial arches in other *Cœlacanth*s, which are certainly neomorphs.

The coronoid of *Cœlacanth* is certainly that bone, and the angular, although incapable of certain determination, is one of the three posterior infradentaries.

Palate.—The pterygoid of *Cœlacanthus* is extremely similar in its relation to the pterygoid of *Osteolepids* and *Labyrinthodontia*, and is determined with certainty.

The metapterygoid, certainly an ossification on the palatoquadrate cartilage, is analogous and probably homologous with the metapterygoid. It agrees closely with one of the continuous series of ossification which occurs in the cartilage in *Osteolepids* and rather strikingly with the epipterygoid of an *Embolomerous Labyrinthodont* which I am describing shortly.

There can be no doubt that the bay in its upper edge transmitted the maxillary and mandibular divisions of the fifth nerve, and that the ophthalmicus profundus passed out in front of it.

These relations, considered in connection with the absence of any direct contact with the sphenoid, show that the so-called basipterygoid is not necessarily that process.

The palatine is considered by Stensio as an autopalatine—a substitution-bone; this view is founded presumably on the fact that it does not support teeth directly. In *Macropoma*, however, it has not the appearance of a cartilage-bone, and the fact that the teeth are attached to a separate element does not provide conclusive evidence, because this bone is identical in type with the tooth-bearing bones of the front of the lower

jaw and visceral arches, which we have seen to be neomorphs without morphological importance. At the same time, I think it probable that we have in *Macropoma* the beginning of the process which results in Teleosts in the production of an auto- and a dermo-palatine: all I wish to make clear is that the palatine of *Cœlacanth*s is not to be regarded as an original ossification in the palato-quadrato cartilage.

The so-called pre-ethmoid of *Cœlacanth*s resembles in structure the palatine, with which it articulates, and, like that bone, supports a tooth-plate. In position on the palate and in the associated teeth it recalls the prevomer of an *Osteolepis*. I am extremely doubtful of its being an ossification on the nasal capsule, and prefer to regard it as a prevomer, fully recognizing that it is very unusual in passing on to the dorsal surface of the parasphenoid, in extending so far dorsally over the side of the olfactory capsule, and in its perforation by a foramen.

The ectopterygoid is identified without difficulty.

The accurate determination of the homologies of the dermal bones of the outer surface of the head in *Cœlacanth*s seems to me at present impossible. Only in *Osteolepis*, *Megalichthys*, *Eusthenopteron*, and *Dictyonosteus* is the structure of the snout known at all. In *Osteolepis* and *Megalichthys*, where I have been able to examine considerable numbers of good specimens, the number and arrangement of the bones in the anterior region of the skull vary enormously; in the latter genus especially they are seldom symmetrical, and I prefer not to attach independent names to them.

The skull of *Eusthenopteron* represented in Stensio's fig. 57 differs very greatly from Bryant's restoration, which is borne out by his photographic plates, and in the passage of the supratemporal cross-commissure of the lateral line apparatus over the tabulare and interparietal differs from all *Osteolepis* skulls I have ever examined.

Macropoma clearly presents a multiplication of dermal bones, and is not a favourable subject for study; but I think it probable that the peculiar bone with a downwardly directed process and the second paired parafrontal are separated parts of Stensio's nasalo-antorbital, and that the process separated the two narial apertures.

One of the most striking characters of the *Cœlacanth* skull is the hinge between the parietals and frontals, which is in *Macropoma* continued outwards between bones of the parafrontal series.

This hinge is exactly similar to that which occurs in an

identical position in all Osteolepids, and by itself goes far to establish a derivation of the *Coelacanth*s from that group.

In a paper now ready for publication I have pointed out that the long unossified region which separates the basisphenoid and basioccipital of Osteolepids, as shown in Bryant's description of *Eusthenopteron*, is functionally connected with the hinge in the dorsal roof of the head.

The neural cranium of *Coelacanth*s is very difficult to interpret. Dr. Stensio is, of course, perfectly correct in his interpretation of the "sphenoid." It is probable that the most dorsal foramen passing through that bone is for the *ophthalmicus profundus*, and that the lower and most anterior of these transmitted the third or sixth nerve. The remaining foramen may have transmitted the trochlearius.

I am very doubtful of Stensio's interpretation of the space between the basisphenoid and parasphenoid as a myodome. In *Macropoma* the basisphenoid fades away gradually until it is represented only by bony spicules. In different individuals there is some evidence that there is a progressive growth of bone into this region, and the conclusion seems obvious that it was in life occupied by cartilage which failed to ossify. The basisphenoids of *Macropoma*, *Wimania*, and *Axelia* are much less completely ossified than those of the Coal Measure and Upper Permian *Coelacanth*s. In these forms the hinder surface of the basisphenoid is formed by a large, nearly circular, concave condyle, extended laterally and upward by small additional faces; it is entirely identical with that of *Megalichthys*. In these forms it is most probable that the lower surface of the basisphenoid is in direct contact with the parasphenoid.

In any case, the position of this hole is not that of the Palæoniscid myodome which lies dorsal to the basipterygoid process and lateral of the body of the basisphenoid.

The large bone called by Stensio the prootico-opisthotic corresponds most accurately with the prootic in *Eusthenopteron* (Bryant, 1919). The two bones agree in articulating with the lateral borders of the basioccipital, and stretching forward in front of that bone along the sides of the great unossified tract of the basis cranii. In Osteolepids they do not reach the basisphenoid as they do in *Coelacanth*s. In both forms there are anterior and posterior flanges from the skull-roof which meet or nearly meet the upper edge of the prootic. The two bones differ, however, in the absence in *Eusthenopteron* of the pocket which occupies the hinder part of the side of the *Coelacanth* prootic. The function of this

pocket is not clear to me, but it may have surrounded the labyrinth, the outer side of the otic capsule having been unossified.

Another important difference is that whilst a foramen for the seventh nerve passes through the prootic in *Eusthenopteron*, that of *Coelacanth*s is imperforate.

These comparisons show that Dr. Stensio is correct in finding the points of exit of the seventh and fifth nerve between the sphenoid and prootic. Consideration of the position of the metapterygoid shows that he is probably also correct in placing the latter nerve very high up.

Of the other three elements of the brain-case, one—the supraoccipital—is homologous with the ossified supraoccipital region of *Megalichthys*. The large posterior paired element agrees closely with the exoccipital of *Eusthenopteron*, the foramina piercing it being for two occipital nerves—that is, essentially for a hypoglossus. The remaining element may probably be an opisthotic.

Thus a fuller knowledge confirms the close similarity between the neural crania of Osteolepids and *Coelacanth*s which Dr. Stensio has shown to exist.

The curious unossified region of the basis cranii and the hinge in the dorsal surface which is functionally connected with it are not known in any early bony vertebrates except these forms; they are specializations which are specific to the Osteolepids, and were developed in those fish after their separation from the Amphibian, Dipnoan, and Actinopterygian stocks.

The occurrence of these features in a typical form in *Coelacanth*s seems, in my eyes, almost conclusive evidence of a descent from Osteolepids.

Such descent allows us to draw most important conclusions as to the kinds of structures which may be found in fish derived from the Osteolepids.

As Stensio has pointed out, we have in *Coelacanth*s a complete loss of the hyomandibular as a supporting element of the jaw. This loss is an exact parallel to that which has occurred in Tetrapods and Dipnoi.

We have a separation of the teeth from the bones to which they were formerly attached and their fusion into independent ossicles, which is exactly parallel to that which occurs in many Actinopterygians (e. g., *Amia*).

We have a great reduction or loss of the external tooth-supporting bones analogous to that of Dipnoi and certain Urodeles.

This comparison lends additional support to the view, so

much used by Dr. A. S. Woodward, that in evolution the dermal fin-rays become correlated with the endoskeletal fin-supports.

Finally, as all Osteolepids have an archipterygial fin, with only a single element articulating with the pectoral girdle, we have to take into consideration the somewhat Teleost-like skeleton of the pectoral fin found in *Cœlacanthus* according to Wellburn and in an undetermined *Cœlacanth* described by Smith Woodward.

The whole literature is listed and discussed in E. A. Stensio, 'Triassic Fishes from Spitzbergen' (Adolf. Holzhausen, Vienna, 1921).

I have to acknowledge my indebtedness to Mr. G. E. Dibley for the loan of specimens, two of which proved invaluable in my studies.

XXX.—On the Genus *Lasiadora*, C. Koch. By MELLO-LEITÃO, M.D., Fellow of the Brazilian Society of Sciences.

THE genus *Lasiadora*, C. Koch, is essentially neotropical, and all its species but one (*L. weijenberghi*, Thorell, from Argentina) are found in the Brazilian fauna. I have seen in the collection of the Natural History Museums of S. Paulo and Rio de Janeiro specimens of all the Brazilian species.

Lasiadora differs from all the other *Lasiodoreæ*, Simon, in having a stridulating-organ similar to that of *Grammostola*; but in *Lasiadora* the stridulating bristles are much less numerous, and those on coxa i. are situated only upon the suture. The characters of this stridulating-organ distinguish the species, the number and disposition of the stridulating bristles being variable. I give the following table of Brazilian species:—

- A. Falces with a rose-thorn-like spur in the external surface *acanthognatha*, sp. n.
- AA. Falces without external spur.
 - B. Stridulating-organ with only three large bristles upon the suture on coxa i. .. *dulcicola*, sp. n.
 - BB. Stridulating-organ with more than seven bristles upon the suture on coxa i.
 - C. Stridulating-organ with some short stout spines on the anterior side of coxa i. amongst the stridulating bristles (median anterior eyes larger than laterals).