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GEOLOGISK EKSPEDITION TIL ØSTGRØNLAND 1936—38

UNDER LEDELSE AF LAUGE KOCH

MIDDLE DEVONIAN VERTEBRATES
FROM CANNING LAND AND WEGENER
PENINSULA (EAST GREENLAND)

BY

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PART I

PLACODERMI, ICHTHYODORULITHES

WITH 16 FIGURES IN THE TEXT AND 14 PLATES

KØBENHAVN

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BIANCO LUNOS BOGTRYKKERI A/S

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PREFACE

The material described in the present publication was collected by the Danish East Greenland expeditions under the leadership of Dr. LAUGE KOCH 1934 and 1936, and belongs to the Geological Survey of Greenland (chief, Dr. LAUGE KOCH, Copenhagen). The authors are indebted to Dr. KOCH, not only for permission to work out this interesting material, but also for valuable support and a very pleasant collaboration during the work.

The work was partly made jointly, but for the greater part divided between the two authors. The chapters on the *Placodermi* and *Ichthyodorulithes* were thus prepared and written by E. STENSIÖ, whereas the Introduction was written by G. SÄVE-SÖDERBERGH. The latter author also proposes to give in the forthcoming part II of the work a chapter on the *Crossopterygii*, and wishes to express his gratitude to the authorities of the British Museum of Natural History, London, the Geological Survey and Museum of Practical Geology, London, the Royal Scottish Museum, Edinburgh, and the University Museum, Manchester, for generous loan of material of British fossil *Crossopterygii*, important for comparison with the finds from Greenland.

INTRODUCTION

(G. S.-S.).

Fossiliferous Devonian deposits have long been known in East Greenland, and the Upper Devonian beds of the district around the outer parts of Franz Joseph Fjord (cf. SÄVE-SÖDERBERGH 1932 a, 1933 a, 1934; JOHANSSON 1935) are by now famous for their rich and interesting fauna of extinct Vertebrates (cf. WOODWARD 1900; STENSIÖ 1931, 1934 a, 1936; SÄVE-SÖDERBERGH 1932 b, 1937 a). But it was not until 1933, that a determination (SÄVE-SÖDERBERGH 1933 b, pp. 103—107) of a single fossil brought home by A. NOE-NYGAARD from the wintering expedition 1931—1932 enabled us to state the presence in the district around Nathorst Fjord and Fleming Inlet of Devonian deposits of another age than the Upper Devonian series of the more northern district. The fossil was determined as *Diplopterax* sp. and the fossiliferous beds were provisionally parallelized with the Scottish Orcadian series, and accordingly dated as belonging to the lower part of the Upper Middle Devonian (SÄVE-SÖDERBERGH 1933 b, pp. 103—107).

The scanty but interesting material thus found and described stimulated the interest in the Southern Devonian district of East Greenland, but the difficult access to this part of the coast prevented a longer stay here during the subsequent expeditions. In 1934 and 1936, however, parties under the leadership of G. SÄVE-SÖDERBERGH were enabled to work a short time in the district, during two days in 1934, and eight days in 1936. The stratigraphy was studied, and the collection of fossil vertebrates described in the present paper was brought together, mostly in 1936. The stratigraphy and the fossiliferous localities are described in a separate publication (SÄVE-SÖDERBERGH 1937 b), from which the following tables are quoted (SÄVE-SÖDERBERGH 1937 b, pp. 29—30; 33), showing the different local series on Canning Land (SE. of Nathorst Fjord) and Wegener Peninsula (between Nathorst Fjord and Fleming Inlet), and their stratigraphical position.

The Middle Devonian strata on Canning Land and on Wegener Peninsula may (with some reservation for the less completely known sequence on Wegener Peninsula) be tabulated as follows:

Canning Land		Wegener Peninsula
4. Series with <i>Canningius groenlandicus</i> : greyish and reddish sandstones and dark-grey to black partly bituminous shaly flagstones with <i>Canningius groenlandicus</i> , ? <i>Tristichopterus</i> sp., and other <i>Crossopterygii</i> .		3. Series with <i>Canningius groenlandicus</i> : greyish and reddish sandstones and dark-grey to black partly bituminous shaly flagstones with <i>Canningius groenlandicus</i> .
3. Greenish-grey sandstone series (with badly preserved plant fossils).		
2. Series with <i>Asterolepis säve-söderberghi</i>	Upper part: alternating brownish-red and greenish-grey sandstone with <i>Ast. säve-söderberghi</i> , <i>Crossopterygii</i> , and <i>Psilophyton</i> sp.	2. Alternating brownish-red and grey or greenish-grey sandstone, with <i>Asterolepis säve-söderberghi</i> , <i>Asterolepis</i> sp., <i>Homostius kochi</i> , <i>Osteolepidae</i> , and other <i>Crossopterygii</i> .
	Lower part: brownish-red sandstone.	
1. <i>Heterostius</i> Series: basal conglomerate and greyish white arkose with <i>Heterostius groenlandicus</i> , <i>Homostius kochi</i> , <i>Thursophyton</i> sp.		1. Basal conglomerate and light grey arkose.

Summarizing the common features and the evidence of the fossil contents, the stratigraphical sequence of the Middle Devonian on Canning Land and Wegener Peninsula may be given as follows:

3. Series with *Canningius groenlandicus*: reddish and greyish sandstones, and dark-grey to black partly bituminous flagstones with *C. groenlandicus* and ?*Tristichopterus* sp.
2. Series with *Asterolepis säve-söderberghi*: brownish-red and greenish-grey sandstone with *A. säve-söderberghi*, small Arthrodiæ, *Crossopterygii*, and *Psilophyton*, also with *Homostius kochi*, possibly only in the lower part.
1. *Heterostius* Series: basal conglomerates and greyish-white arkose with *Homostius kochi*, *Heterostius groenlandicus*, and *Thursophyton*, probably also *Asterolepis* sp.

The Series with *Asterolepis säve-söderberghi* (2) here provisionally includes also the third (greenish-grey) local series of Canning Land, which has not yet yielded any determinable fossils.

The correlation with deposits in other areas is given in the table on p. 7 (SÄVE-SÖDERBERGH 1937 b, p. 33).

The position of the fossiliferous localities is shown on the maps in the stratigraphical paper published by SÄVE-SÖDERBERGH (1937 b, pls. 1, 2).

Age (marine sequence)		Old Red sequence	Baltic States	Scotland (especially Orkneys)		East Greenland (especially Canning Land)
Upper Middle Devonian	Upper part	<i>Asterolepis</i> Beds	Dm ₅ : <i>Aster. radiata</i>	Nairn beds: <i>Aster. maxima</i>		3. Series with <i>Canningius groenlandicus</i> , ? <i>Tristichopterus</i> sp.
			Dm ₄ : <i>Aster. ornata</i>	Eday Sandstone, John o'Groats Sandstone Group, Brindister Beds: <i>Microbrachius</i> , <i>Tristichopterus</i> , <i>Pentlandia</i> , <i>Aster. thule</i>		
				Zone w. <i>Coccosteus fletti</i>		
	Lower part	<i>Heterostius</i> Beds	Dm ₃ : <i>Heterostius</i> , <i>Homostius</i>	Rousay Beds	Zone w. <i>Aster. orcadensis</i>	2. Series with <i>Asterolepis säve-söderberghi</i> : brownish-red and striped sandstone with <i>Aster. säve-söderberghi</i> , <i>Homostius</i> , and <i>Crossopterygii</i>
					Zone w. <i>Thursius pholidotus</i> , <i>Coccosteus minor</i> , <i>Homostius</i>	
	<i>Pterichthyodes</i> Beds	Dm ₁₋₂ : <i>Pterichthyodes</i>	Stromness Beds: <i>Pterichthyodes</i> , <i>Homostius</i>		1. <i>Heterostius</i> Series: greyish-white arkose with <i>Heterostius</i> , <i>Homostius</i> Basal conglomerate	

Placodermi. (E. S.)

Antiarchi.

Subfamily *Asterolepinae* STENSIÖ 1931.

Genus *Asterolepis* EICHWALD.

The synonyms of the genus *Asterolepis* have been so thoroughly considered by PANDER (1857, pp. 7—27), WOODWARD (1891 a, pp. 203—208), TRAQUAIR (1894, pp. 71—75) and GROSS (1932 a, pp. 13—18) that it is not needed to give any list of them here.

The history of *Asterolepis* has been treated by PANDER up to 1857 (PANDER 1857, pp. 7—27), by TRAQUAIR up to 1894 (1894, pp. 71—75) and by the present writer up to 1931 (STENSIÖ 1931, pp. 32—36). After the lastmentioned year new contributions to our knowledge of the genus have been given by WATSON 1932 (pp. 161—165), GROSS 1933 (1933 b, pp. 33—36) and OBRUTSCHEW 1933 (1933 b, p. 14). WATSON described two new species one of which, *A. orcadensis* WATSON, is of special interest, as in certain respects it resembles the new species *A. säve-söderberghi* from East Greenland to be described in the present paper. GROSS gave further notes on *A. ornata* and some new details concerning *A. radiata* ROHON. Finally OBRUTSCHEW described a new species from the North-Western Russia.

For the time being the species clearly referable to *Asterolepis* are as follows (cf. GROSS 1932 a).

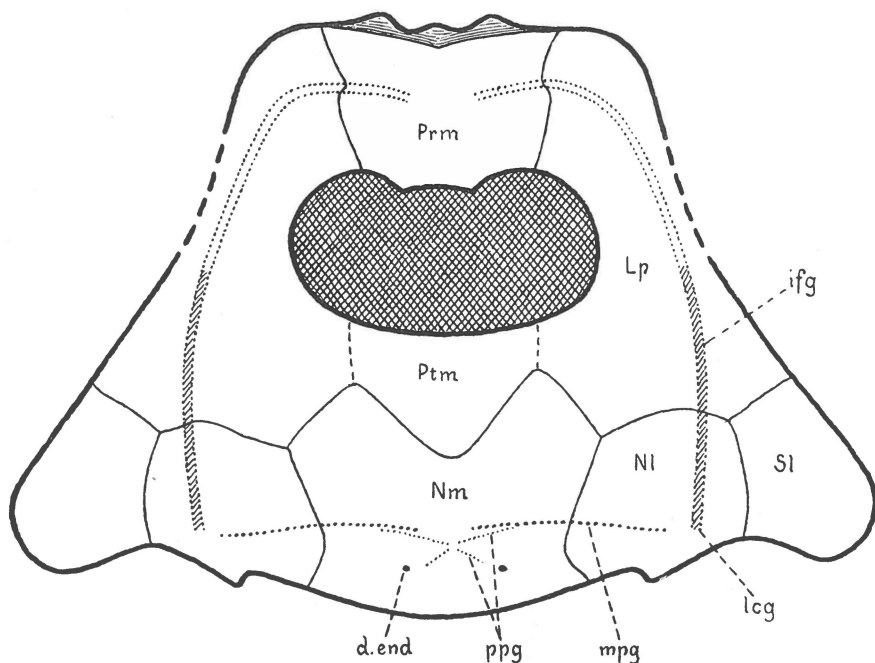
- A. ornata* EICHWALD (Genotype),
- A. maxima* AGASSIZ,
- A. radiata* ROHON,
- A. scabra* (WOODWARD),
- A. cristata* OBRUTSCHEW,
- A. orcadensis* WATSON,
- A. thule* WATSON,
- A. säve-söderberghi* STENSIÖ.

With the exception of *A. radiata* and not nearer determined forms, which possibly range into the lowermost Upper Devonian (GROSS 1932 a, p. 13; 1933 b, p. 36; JARVIK 1937, p. 121; WESTOLL 1937 b, p. 521) all the *Asterolepis* species enumerated are from the upper part of the Upper Middle (Devonian cf. SÄVE-SÖDERBERGH 1937 b, pp. 30—35). Thus far the genus has been recorded with full certainty from Russia (Timan and NW. Russia), the Baltic States, Scotland, Spitsbergen and East Greenland (cf. GROSS 1932 a, p. 13; SÄVE-SÖDERBERGH 1937 b, p. 30).

Asterolepis säve-söderberghi n. sp.

(Text-figs. 1—8; pls. 1—8; pl. 9, figs. 1—3; pl. 10, fig. 1; pl. 13, fig. 1).

Material. — The material at hand is fairly large (specimens nos. 10.000 *a-p*—10.016) comprising a somewhat complete skull roof (no. 10.000 *a*), a detached median nuchal plate (no. 10.000 *b*), detached plates of the trunk armour (nos. 10.000 *c-k*, 10.001—10.014, 10.016) and a few detached plates of the pectoral fins (nos. 10.000 *l, m, n, o*; 10.015).



Text-fig. 1. *Asterolepis säve-söderberghi* n. sp. Attempted restoration of head in dorsal view. $\times 1\frac{1}{3}$ diam.

Lp, lateral plate; *Nl*, lateral nuchal plate; *Nm*, median nuchal plate; *Prm*, premedian plate; *Ptm*, postmedian plate; *Sl*, sufflaminal plate; *d. end*, opening, probably for the ductus endolymphaticus; *ifg*, infraorbital sensory groove preserved only in the lateral nuchal plate and in the posterior half of the lateral plate. The parts preserved denoted with an oblique striation; *lcg*, cephalic division of the main lateral line groove; *mpg*, groove, probably corresponding to the middle head-line of pit organs of fishes in general; *ppg*, pit-line probably corresponding to the posterior head-line of pit organs in fishes in general.

The skull roof, the median nuchal plate and several of the other detached plates are found associated in one large slab of rock.

Holotype. — As a holotype I choose the skull roof (no. 10.000 *a*; text-fig. 1, pl. 1) which is preserved so as to show many characteristic features.

Description. — The skull roof just referred to is approximately 6 cm long in the median line, and approximately 8.4 cm broad at its

broadest place, across the posterior halves of the sufflaminal plates (text-figs. 1, 7; pl. 1). The two most complete anterior median dorsal plates are 8.5 cm and 9.4 cm long respectively. Finally the single posterior median dorsal plate found preserved is 6 cm long approximately. Judging from these measurements the total length of the dorsal wall of the trunk armour may have been 14 or 15 cm.

In regard to its proportions the skull roof (text-figs. 1, 7; pl. 1, figs. 1, 2) is narrow in front at its rostral margin, but widens rapidly backwards. More precisely, it widens so much backwards as to have its posterior margin more than twice as long as its rostral one. And in that respect it is thus of a similar type to that in *A. orcadensis*. Otherwise the rostral margin is in all essentials as in the other *Asterolepis*-species (GROSS 1931 a, p. 26; STENSIÖ 1931, p. 31). The lateral margin is imperfectly preserved, but this much is clear that it is concave and that opposite the fenestra orbitalis it must have had a fairly well marked concavity. The fenestra orbitalis is broad and large, and the sufflaminal plate is of a similar broad type to that in *A. orcadensis*.

The premedian plate (*Prm*, text-figs. 1, 7; pl. 1, fig. 1) is almost as long as broad, probably with a small notch in the anterior half of each lateral margin. Both in regard to its lower face and to its anterior part the plate is of the normal type characteristic of the genus *Asterolepis* (cf. STENSIÖ 1931, pp. 31—36, text-fig. 7 A—C and text-fig. 9 A).

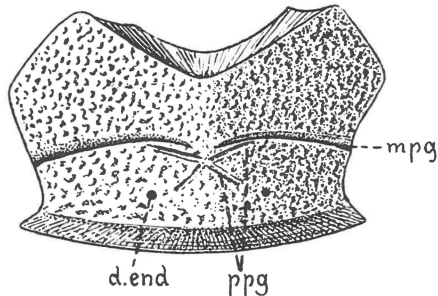
The lateral plate (*Lp*, text-figs. 1, 7; pl. 1, figs. 1, 2) is imperfectly preserved laterally, but it is evident that its lateral margin was somewhat concave with a broad shallow concavity approximately at the middle. In all fundamental respects it is as in the other *Asterolepis*-species in which it is known as yet. (STENSIÖ 1931, pp. 36—39, text-figs. 8, 9, 30, 32, 73).

The prepineal plate and the pineal plate are not preserved. In this connection it should be mentioned that the opinion advanced by the writer in 1931 (STENSIÖ, pp. 28—29, 52—57), that the external nasal openings were situated on the dorsal side of the head between the antero-medial corners of the orbits, immediately behind the prepineal plate, seems to be confirmed by new *Remigolepis* material from East Greenland. In *Remigolepis* the broad prepineal plate has a paired very marked notch on its anterior margin, a notch which can hardly be anything else but the external nasal opening. The conditions in *Remigolepis* in this respect are much clearer than those in *Bothriolepis* on which the writer based his conclusion in 1931.

The postmedian plate (*Ptm*, text-figs. 1, 7; pl. 1, figs. 1, 2) is preserved mainly as an impression of its lower face. It is probably somewhat longer in proportion to its breadth than in *A. maxima* (TRA-

QUAIR 1894, text-fig. 37), *A. ornata* (GROSS 1931 a, pl. 4, fig. 1; pl. 12, fig. 7; STENSIÖ 1931, text-fig. 12) and *A. orcadensis* (WATSON 1932, text-fig. 3, pl. 4, fig. 1), but not as long as in *A. thule* (WATSON 1932, text-fig. 4). Its lower face was in all main respects as in *A. ornata* (GROSS 1931 a, p. 25; STENSIÖ 1931, p. 42).

The median nuchal plate (*Nm*, text-figs. 1, 7; pl. 1, figs. 1, 2) of the holotype is fairly long in proportion to its breadth, whereas the detached median nuchal plate found in the same sample of rock with the holotype (text-fig. 2; pl. 3, fig. 1; pl. 9, fig. 1) is shorter and broader, but probably not so broad as that in *A. orcadensis* (WATSON 1932, text-fig. 3; pl. 4, fig. 1). If the last-mentioned plate really belongs to



Text-fig. 2. *Asterolepis säve-söderberghi*? Restoration of a detached median nuchal plate found in the same sample of rock with the holotype of *A. säve-söderberghi* $\times 1\frac{1}{2}$ diam.

d. end, canal probably for the ductus endolymphaticus; *mpg*, groove, probably corresponding to the middle head-line of pit organs of fishes in general; *ppg*, pit-line, probably corresponding to the posterior head-line of pit organs of fishes in general.

the species just under description the median nuchal plate of this species must obviously have varied in proportions in a similar manner to that in *A. ornata* (cf. STENSIÖ 1931, text-fig. 13).

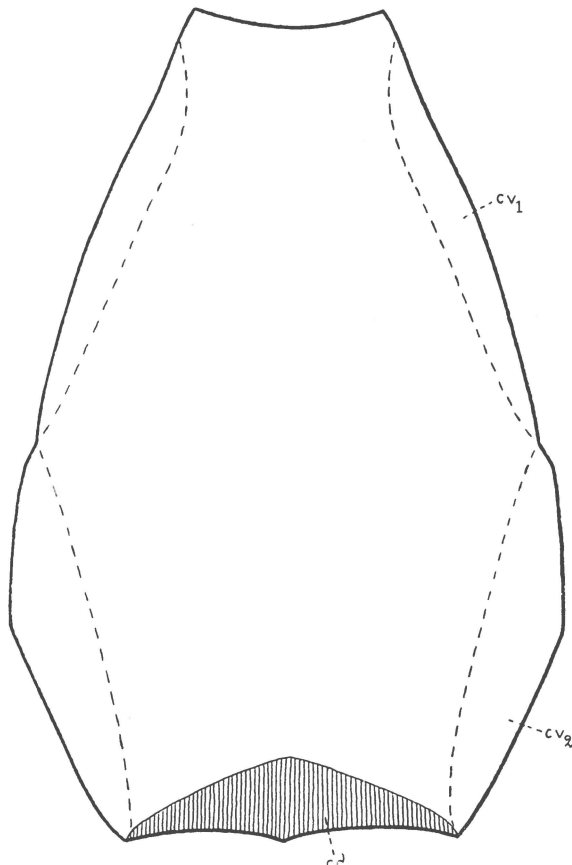
The lateral nuchal plate (*Nl*, text-figs. 1, 7; pl. 1, figs. 1, 2) is broad and reminds in its shape mostly of that in *A. ornata* and *A. maxima*.

Finally the sufflaminal plate (*Sl*, text-figs. 1, 7; pl. 1, figs. 1, 2) is much broader than that in *A. ornata* (cf. GROSS 1931 a, pl. 4; figs. 2, 3), *A. maxima* (TRAQUAIR 1894; pl. 17, fig. 1) and *A. thule* (WATSON 1932, text-fig. 4), and it is therefore in this respect as in *A. orcadensis* (WATSON 1932, text-fig. 3, pl. 4, fig. 1).

The ornament of the skull roof (pl. 1, fig. 2; pl. 3, fig. 1) is fairly delicate. It consists of numerous, small, rather closely set tubercles, which are only rarely confluent. Accordingly it is of a type similar to that in *A. orcadensis*, *A. maxima* and *A. ornata*.

As has already been mentioned no coherent trunk armour is found among the material at hand. The detached trunk plates that may be

recognised with full certainty are as follows: the anterior median dorsal plate, the posterior median dorsal plate, the anterior dorso-lateral plate, and the mixilateral plate. In addition there are imperfect remains of plates which possibly may be the anterior and posterior ventro-lateral plate.



Text-fig. 3. *Asterolepis säve-söderberghi* n. sp. Restoration of the anterior median dorsal plate, mainly after the imperfect plate shown in pl. 3, fig. 2 and pl. 4, fig. 1. Extent of the overlapped area (*cd*) indicated by vertical striation; extent of the overlapping areas (*cv₁*, *cv₂*) indicated by broken lines. Slightly enlarged.

The anterior median dorsal plate (text-figs. 3, 7; pl. 2, fig. 3; pl. 3, fig. 2; pl. 4, fig. 3; pl. 10, fig. 1) is represented by several more or less complete specimens, which, as is clear from the measurements given above (p. 9), come from animals of somewhat different size. Its maximum width is situated further backwards than in other species described, more precisely across the middle of the posterior divisions of the lateral margins; the breadth: length ratio is approximately 2:3. The anterior end of the plate is strikingly broad, with a well developed,

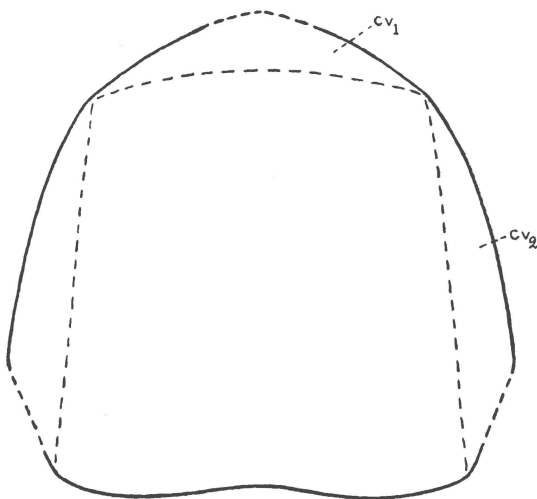
somewhat concave anterior margin, the length of which corresponds to one third approximately of the maximum width of the plate. The lateral margin is distinguished by the presence of an angular notch at the transition between its anterior and posterior divisions, and by the presence of two distinct lateral angles: an anterior one, situated immediately behind the angular notch just referred to, and a posterior one, situated almost midway between the anterior one and the hind end of the margin, at the broadest place of the plate¹). The anterior part of the anterior division of the margin is slightly concave. The posterior margin is twice as broad approximately as the anterior margin; at the middle it has, as in *A. orcadensis* (WATSON 1932, pl. 4, fig. 2), a short, rounded, median process. The highest part of the plate is situated almost midway, between the anterior and posterior margins. The overlapped area (*cd*, text-fig. 3) is imperfectly exposed, but as far as may be judged it was rather small. The overlapping areas (*cv*₁, *cv*₂) are both well developed; the posterior one (*cv*₂) is even strikingly broad; they meet at the angular notch immediately in front of the anterior, lateral angle of the lateral margin. The paired antero-lateral ridge (*alr*, pl. 3, fig. 2) of the ventral face of the plate is developed, and it is in essentials as in other *Asterolepis*-species. As normally in *Asterolepis* a median ventral groove, a median ventral ridge and a median ventral pit are absent (cf. STENSIÖ 1931, pp. 75—77).

The posterior median dorsal plate (text-fig. 4; pl. 5, fig. 1), in the material at my disposal, is represented only by a single imperfect and somewhat distorted specimen. It is almost as broad as it is long, and as far as may be judged, it is only slightly narrower than the anterior median dorsal plate. The anterior margin is imperfect, but it is likely that it was somewhat as shown in the restorations (text-figs. 4, 7). The lateral margin is also imperfect, but everything seems to indicate that in all essentials it was as in *A. ornata* (cf. GROSS 1931 a, text-fig. 15). The posterior margin is slightly concave without any indication of a median process similar to that in *A. maxima* (TRAQUAIR 1894, text-fig. 37; pl. 15; pl. 16, fig. 2); in the whole this margin is therefore suggestive of that in *A. ornata* (GROSS 1931, text-fig. 15). The ventral face is of the normal type characteristic of the genus (STENSIÖ 1931, pp. 77—79), lacking both a median longitudinal groove and a tuberosity. The crista transversalis interna posterior (*crtip*) is present only on a median part of the ventral face. Immediately in front of that crista we find, as

¹) Two similarly situated lateral angles are found also in *A. scabra* (STENSIÖ 1931, text-fig. 37) and *A. orcadensis* (WATSON 1932, pl. 4, fig. 2) and may be suspected to occur in still more of the previously described *Asterolepis*-species. However, both in *A. scabra* and *A. orcadensis* the maximum width of the plate is across the anterior lateral angles, not across the posterior ones as in *A. säve-söderberghi*.

normally in the genus, a ventral pit (*tp*). The overlapping areas (*cv*₁, *cv*₂) are all well developed.

In the collection brought home there are four imperfect specimens of the anterior dorso-lateral plate (text-fig. 5; pl. 5, fig. 2; pl. 6, fig. 2). These four specimens are not only from animals of a different size, but are also of two different types: a long one (text-fig. 5 A; pl. 6, fig. 2), and a short one (text-fig. 5 B; pl. 5, fig. 2). These two types, are of interest, as they indicate that the trunk armour as a whole varied in length in a similar way to that in *Pterichtyodes* (TRAQUAIR 1894,

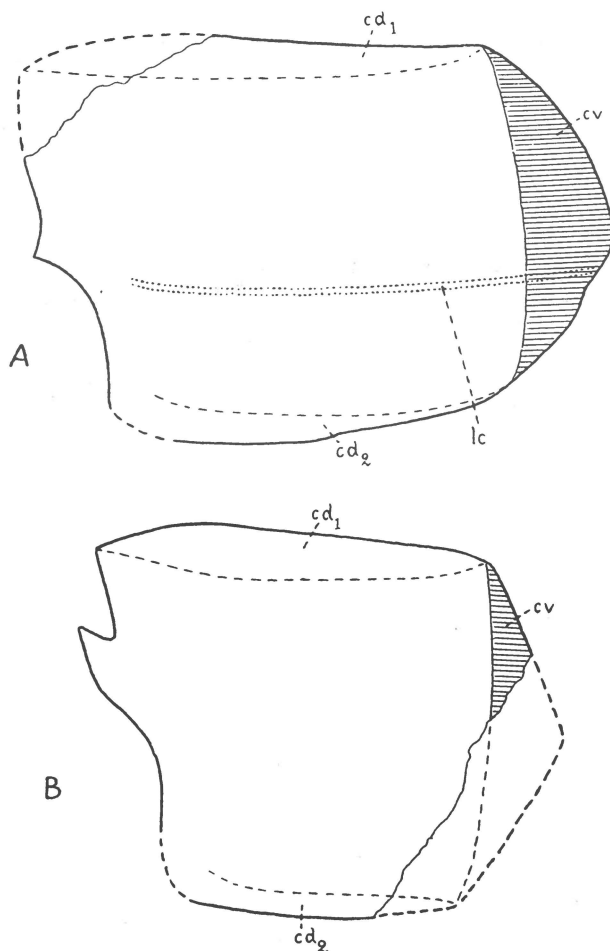


Text-fig. 4. *Asterolepis säve-söderberghi* n. sp. Attempted restoration of the posterior median dorsal plate. Extent of overlapping areas (*cv*₁, *cv*₂) denoted with broken lines. Nat. size.

pp. 102—104) and *Remigolepis*. In both the types the plate seems to be higher in proportion to its length than in *A. ornata* and *A. maxima*. The antero-dorsal corner is not produced. A dorso-lateral ridge is present on the outer face. The shape of the overlapped areas is imperfectly known. The overlapping area (*cv*) is in all essentials as normally in the genus.

The mixilateral plate (the posterior dorso-lateral plate + the posterior lateral plate; cf. STENSIÖ 1931, pp. 84—89) is represented by several specimens, of which only a single one is so complete as to show parts of all the margins (text-fig. 6; pl. 6, fig. 1; pls. 7, 8; pl. 9, fig. 2; pl. 13, fig. 1). Its two components are completely fused with each other only with their posterior third, whereas in the anterior two thirds they are separated either by a real suture or by clear vestiges of a suture (*su*); the fusion is so strong, however, that they do not become detached.

The suture is always better developed in the smaller plates than in the larger ones; it thus tends to disappear with the increase in age of the animals.



Text-fig. 5. *Asterolepis säve-söderberghi* n. sp. Attempted restoration of the anterior dorso-lateral plate in medial view; A, of the long type. Shape of anterior margin uncertain; B, of the short type. The extent of the overlapping area (cv) indicated with shading. The extent of the overlapped areas, cd_1 , cd_2 , indicated with broken lines. Nat. size.

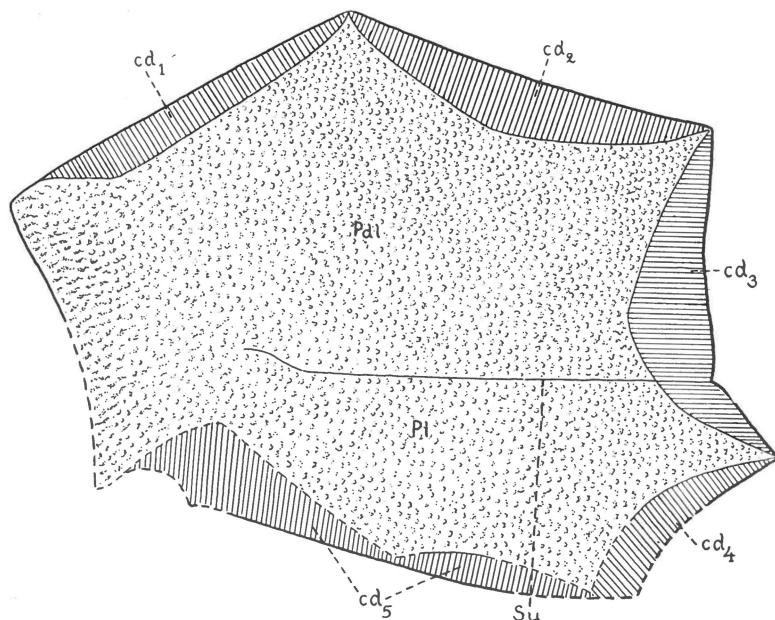
cd_1 , cd_2 , overlapped areas; cv, overlapping area; lc, position of the lateral sensory groove.

As regards its general proportions the mixilateral plate is higher than in both *A. ornata* and *A. maxima* and has also a higher free posterior margin than in these two species. Its dorsal angle is fairly pronounced. In these characters it is in fact most suggestive of that in *A. orcadensis* (WATSON 1932, p. 163). The crista transversalis interna posterior seems

to be very slightly developed. The overlapped areas (cd_1 — cd_5) are imperfectly exposed, but, as far as may be judged, they are fundamentally as in the earlier described *Asterolepis*-species.

The remains of the supposed anterior and posterior ventro-lateral plates are too fragmentary to show any details of importance.

As is evident from the description just given all the dorsal and dorso-lateral plates of the trunk armour are fairly well known and



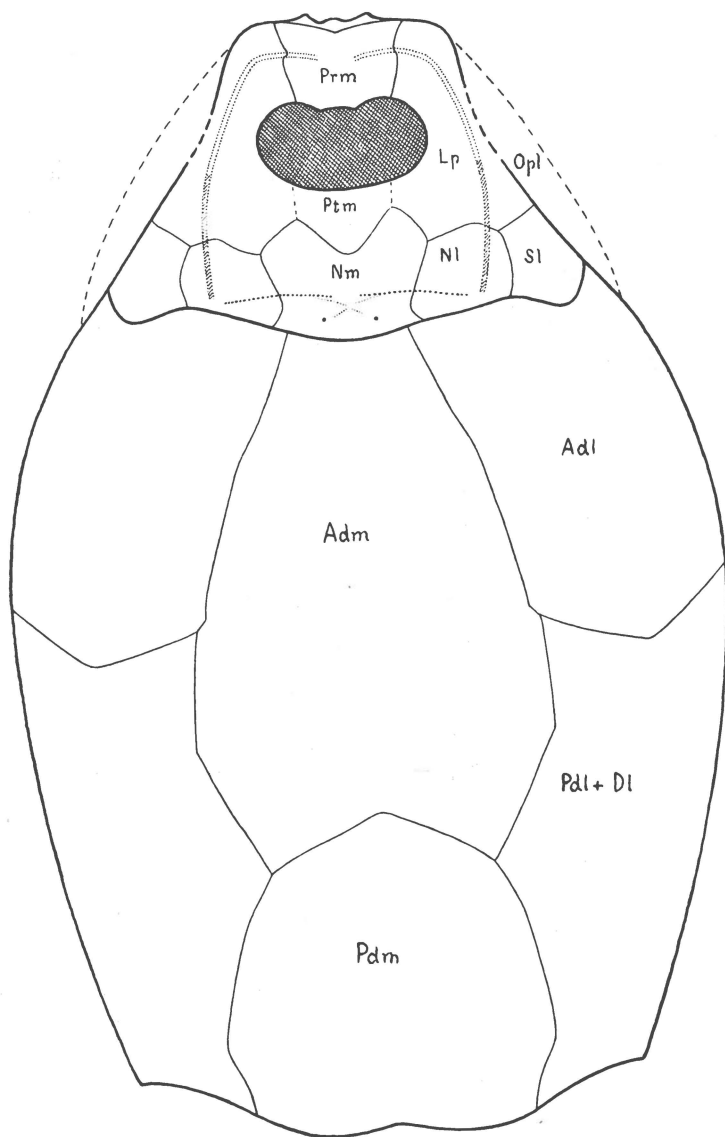
Text-fig. 6. *Asterolepis säve-söderberghi* n. sp. Attempted restoration of the mixilateral plate (posterior dorso-lateral plate + posterior lateral plate). Extent of the overlapped areas partly uncertain. Nat. size.

Pdl, component representing the posterior dorso-lateral plate; *Pl*, component representing the posterior lateral plate; cd_1 — cd_5 , overlapped areas; *su*, vestiges of suture.

because of this an attempt could be made to restore the dorsal side of the trunk armour. The result of that attempt is given in text-fig. 7 which also shows the skull roof.

The ornament of the trunk armour is correspondingly developed to that of the skull roof (pl 6, fig. 2; pl. 8; pl. 9, fig. 3). However, it is evident that the tubercles may be somewhat lengthened in an antero-posterior direction furthest back on the mixi-lateral plate (text-fig. 6; pl. 8).

The sensory canal system is imperfectly known but everything seems to indicate that it is of the normal type characteristic of *Asterolepis* (cf. STENSIÖ 1931, pp. 141—150).

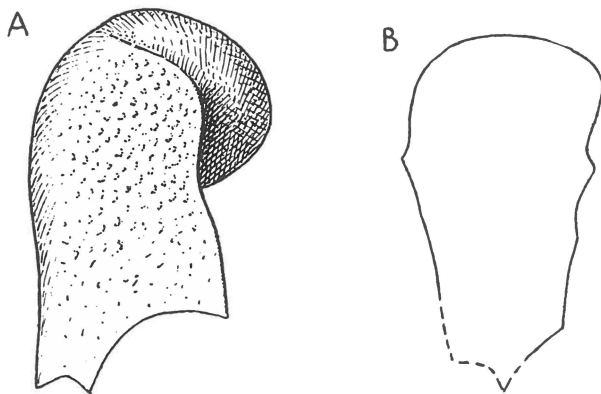


Text-fig. 7. *Asterolepis säve-söderberghi* n.sp. Attempted restoration of the head and trunk armour in dorsal view. From a specimen with trunk armour of the long type. $\frac{3}{4}$ of the natural size.

Adl, anterior dorso-lateral plate; *Adm*, anterior median dorsal plate; *Lp*, lateral plate; *Nl*, lateral nuchal plate; *Nm*, median nuchal plate; *Opl*, opercular plate; *Pdl + Dl*, mixilateral plate (posterior dorso-lateral + posterior lateral plate); *Pdm*, posterior median dorsal plate; *Prm*, premedian plate; *Ptm*, postmedian plate; *Sl*, sufflaminal plate.

The plates preserved of the pectoral fins are the dorsal and ventral articular plates (text-fig. 8; pl. 2, fig. 2; pl. 3, figs. 2, 3). As in all essentials they agree with those in *A. ornata* (cf. STENSIÖ 1931, pp. 114—123) a description of them is not needed here.

Remarks. — *A. säve-söderberghi* just described is named in honour of professor G. SÄVE-SÖDERBERGH, Uppsala. In the general shape of the



Text-fig. 8. *Asterolepis säve-söderberghi* n. sp.

A, restoration of a left dorsal articular plate. External view; B, sketch of a left ventral articular plate. $\times 1\frac{1}{2}$ diam.

skull roof, in the development of the sufflaminal plate and in the shape of the mixilateral plate, it is suggestive of *A. orcadensis*, whereas in certain other characters, e. g. the shape of the median nuchal plate and the configuration of the posterior margin of the posterior median dorsal plate it agrees mostly with *A. ornata*. It is clearly distinguished as a species of its own by the outlines of its skull roof, by the shape of certain of the bones of the skull roof, by the shape of the anterior and posterior median dorsal plates, and by the shape of the mixilateral plate.

Diagnosis. — Skull roof much narrower anteriorly than posteriorly, its lateral margins inclining much towards each other forwards. Sufflaminal plate broad. Median nuchal plate with the posterior part of the lateral margin concave and without any *Bothriolepis*-like pit lines. Anterior median dorsal plate with the maximum width far back, about at the middle of the posterior half; its anterior margin very broad, slightly concave; its lateral margin with an angular notch immediately in front of the lateral angle, and with a second, a posterior, lateral angle at the middle of its posterior half; posterior margin almost straight only with a short, rounded median process. Posterior median dorsal plate with a clearly concave posterior margin without any median process. Mixilateral plate relatively high, with a rather long posterior margin

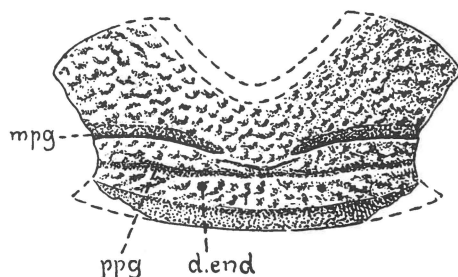
and a somewhat pronounced dorsal angle; its components partly clearly separated by a suture or vestiges of a suture. Ornament delicate, consisting of numerous closely set rounded tubercles, which mostly are not confluent.

Horizon and localities. — Series with *Asterolepis säve-söderberghi* (see pp. 5—7 above). Canning Land and Wegener Peninsula. The localities in Canning Land are as follows: Southern ridge (the edge), E. Horseshoe Mountain (E. slope), Basis Valley (N. part and S. part). In the Wegener Peninsula there is only one locality: Cape Brown Mountain, below 303 m. For further information concerning the position of the various localities the reader is referred to the paper on the geology by SÄVE-SÖDERBERGH (1937b).

Asterolepis sp.

(Text-fig. 9; pl. 2, fig. 1).

Among the material at hand there is a detached median nuchal plate (no. 10.017), which belongs to *Asterolepis*, but which is much wider in proportion to its rostro-caudal extent (text-fig. 9; pl. 2, fig. 1) than the two ones known as yet of *A. säve-söderberghi*. It is true, as has been pointed out above (p. 11) that the median nuchal plate may vary in regard to its width, but whether that variation is so considerable that the plate under consideration really may be assigned to *A. säve-söderberghi* is still impossible to say.



Text-fig. 9. *Asterolepis* sp. Attempted restoration of a detached median nuchal plate.

Dorsal view. $\times 1\frac{1}{2}$ diam.

d. end, canal probably for the ductus endolymphaticus (dorsal opening); *mpg*, transverse sensory canal groove, perhaps corresponding to the middle or posterior pit-line of fishes in general; *ppg*, pit-line, perhaps corresponding either to the posterior head-line of pit organs or to the supratemporal cross-commissure of fishes in general.

The external face of the plate agrees in regard to pit-lines and ornament in the whole with the corresponding one in *A. ornata* (cf. STENSIÖ 1931, text-fig. 13).

Horizon and locality. — Series with *Asterolepis säve-söderberghi* (see p. 5—7 above). Cape Brown Mountain, 304 m, Wegener Peninsula.

Arthrodira.

Euarthrodira.

Genus *Heterostius* ASMUSS.

- Syn. *Trionyx* (in part) KUTORGA 1835, pp. 11—15.
Ichthyosauroides KUTORGA 1837, pp. 35—38.
Chelonichthys (name only; in part) AGASSIZ 1844 a, p. XXXIII.
Asterolepis (in part) AGASSIZ 1844 b, pp. 89—96, 146.
Heterostius ASMUSS 1856, pp. 7—8, 26—27.
Heterostius PANDER 1857, pp. 82—85.
Heterostius v. EICHWALD 1860, p. 1523.
Heterosteus WOODWARD 1891 a, p. 308.
Heterostius BOGOLIUBOFF 1916.
Heterostius ABEL 1927, pp. 314—319.
Heterosteus HEINTZ 1929.
Heterostius HEINTZ 1930.
Heterostius (errore?) LAVERDIÈRE 1930, p. 61.
Heterostius GROSS 1933 a, p. 38.
Heterostius GROSS 1937, p. 34.

Detached, imperfectly preserved bones belonging to the genus here under description and to *Homostius* were first described by KUTORGA in 1835 and 1837 from the surroundings of Tartu (Dorpat) in Esthonia (HEINTZ 1934, pp. 82—83). All these bones were considered by KUTORGA to be of reptiles. For one of the *Heterostius* bones he erected a new genus *Ichthyosauroides*. In this genus, which he believed to be akin both to Ichthyosaurians and Plesiosaurians, he also included teeth of Crossopterygians. The other *Heterostius* bones he referred to the recent turtle genus *Trionyx*.

In 1840, in a letter to professor BAER, ASMUSS advanced the opinion that the Devonian bones interpreted by KUTORGA as reptile bones in fact belonged to fishes (v. BAER, 1840, p. 221). Not very long afterwards he made some series of plaster casts of *Heterostius* and *Homostius* bones of which he too had brought together material from the surroundings of Tartu. One of these series of casts was sent to professor AGASSIZ.

From the study of that series AGASSIZ in 1844 arrived at the conclusion that both ASMUSS' material and the plates ascribed by KUTORGA to *Trionyx* belonged to *Asterolepis* EICHWALD (AGASSIZ, 1844 b, pp. 89—96; 146—148; pl. 30, fig. 1; pl. 30 a, fig. 11; pl. 32, figs. 7, 11—13, 15—19). On the other hand, he did not say anything concerning the genus *Ichthyosauroides* KUTORGA and, therefore, it is most likely that he had been unable to form any opinion of the systematic position of that.

AGASSIZ thus included in the genus *Asterolepis* among others both *Heterostius* and *Homostius* remains. As he grouped *Asterolepis* with the *Coelacanthi* of his own definition (cf. STENSIÖ 1921, pp. 43—44; 1931, pp. 13—14) it is evident that he had no real idea of the relationship of this genus to other fishes.

The fact that the *Heterostius* remains from the surroundings of Tartu referred by AGASSIZ to *Asterolepis*, really belonged to the genus *Ichthyosauroides* KUTORGA was shown by ASMUSS in 1856. As the last-mentioned genus thus was a fish genus ASMUSS found the name of *Ichthyosauroides* so inappropriate as to suggest instead of it a new one, *Heterostius*. *Heterostius* has been accepted by all subsequent writers, though by several it has been altered to *Heterosteus*.

In 1856 ASMUSS gave also a good description of his *Heterostius* and *Homostius* material. HEINTZ, who has studied that material and, therefore, is able to estimate ASMUSS' description wrote in 1934 (p. 6) concerning this as follows: "It is in fact wonderfull that ASMUSS was able to give such a complete and perfect description of the single plates and such fine reconstructions of the whole carapace of these two gigantic *Arthrodira*. To him the papers and drawings of H. MILLER (of *Homostius*) were unknown and he based all his descriptions on the fragments of isolated plates he himself had gathered. Although ASMUSS correctly described the single plates, he was mistaken in the placing of the carapace. He supposed that its largest part, which we now know covered the head, protected the caudal region and the body carapace the front of the body. According to him, the joint, which he was the first to describe, was placed between the caudal region and the front part of the body."

ASMUSS placed *Heterostius* in a family *Chelonichthyda*, which, together with five other families — *Spatularida*, *Accipenserida*, *Coccosteida*, *Pterichthyida* and *Cephalaspida* — he united under the common term of "Panzeranoiden (*Ganoidea loricata*)".

In his classical work "Die Placodermen des devonischen Systems" published in 1857 PANDER gave an excellent account also of *Heterostius* identifying correctly which parts of the armour belonged to the head and which were from the trunk. He called attention to the close agreements between *Heterostius* and *Coccosteus* and included *Heterostius* together with *Coccosteus*, *Asterolepis* (according to his opinion *Asterolepis* EICHWALD + *Pterichthyodes* BLEEKER + *Bothriolepis* EICHWALD), *Homostius*, and *Chelyophorus* AGASSIZ in the family *Placodermi*, which he adopted with M'COY's definition (M'COY 1848; cf. STENSIÖ 1927, p. 56; 1931, pp. 14—15). PANDER was thus the first palaeontologist to recognize the true kinship of *Heterostius* and to assign it to the *Placodermi*.

Further contributions to our knowledge of *Heterostius* have been published by EICHWALD (1860, pp. 1523—1525), WOODWARD (1891 a, pp. 308—310; 1916), BOGOLIUBOFF (1916), ABEL (1927), HEINTZ (1928; 1930; 1931 a, b; 1934) and GROSS (1930, p. 18; 1933 a, pp. 38—40; 1933 b, p. 28; 1937, p. 34)¹). In this connection it should also be mentioned that brief remarks on *Heterostius* have been given by several writers discussing the *Arthrodira*. Among such remarks those by JAEKEL in 1919 (pp. 96—101) may be specially mentioned.

As is evident from what has been set forth above and as was also emphasised already by PANDER (1857, p. 82) the genus name of *Ichthyosauroides* KUTORGA has priority over *Heterostius* ASMUSS. Since the description given by KUTORGA of *Ichthyosauroides* is very misleading, however, there is in my opinion strong reason for dropping the genus name of *Ichthyosauroides*. And there is the more reason for doing so, since, as is well known, the genus name of *Heterostius* has been generally accepted. At any rate *Heterostius* is a genus name, which ought to be among the *nomina conservanda*.

In total nine *Heterostius* species have been erected thus far, eight by ASMUSS (1857) and one by GROSS (1933 a, pp. 38—40). Of these nine species only three, *H. convexus* (ABEL 1927; GROSS 1933 a, text-fig. 9 F), *H. ingens* (HEINTZ 1930) and *H. rhenanus* (GROSS 1933 a, pp. 38—40) have been more thoroughly described. The remaining six are so imperfectly known that it is impossible to decide how many of them really are to be retained as independent species (cf. WOODWARD 1891 a, pp. 308—309; HEINTZ 1937, table).

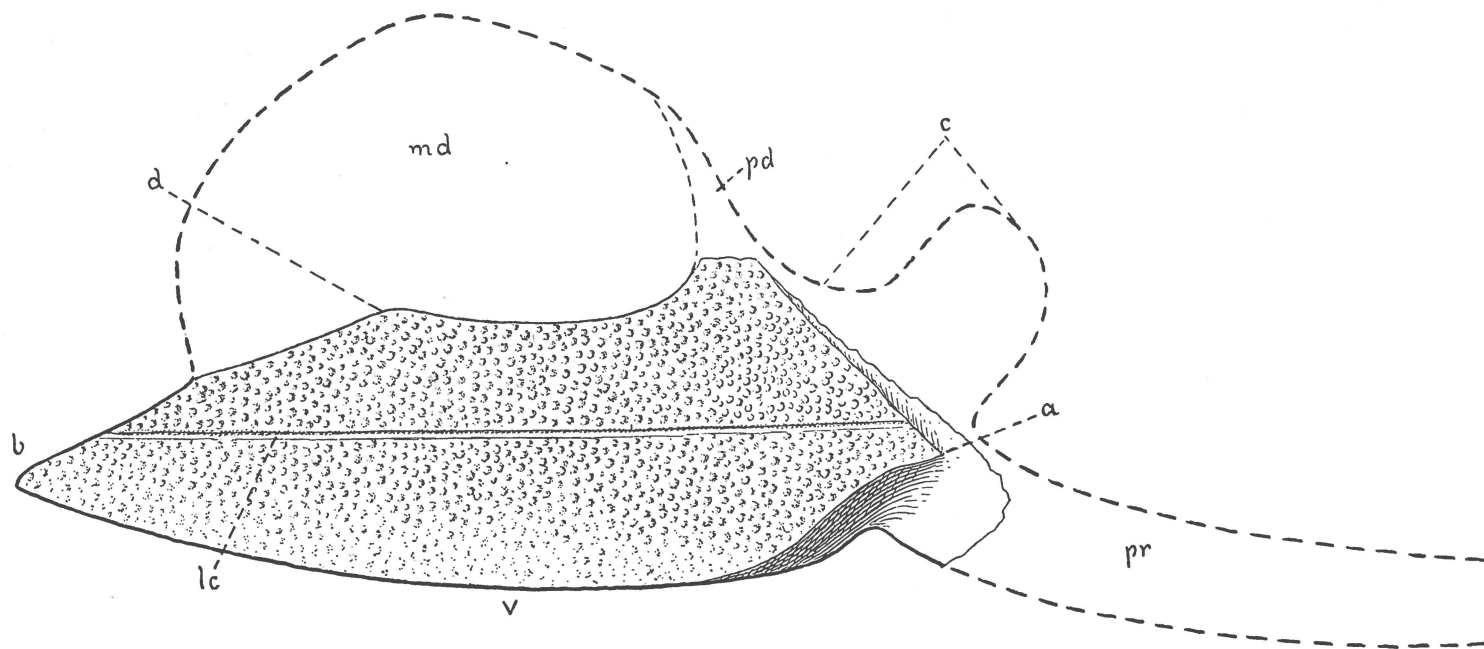
Heterostius has thus far been recorded from Russia, the Baltic States (cf. JARVIK 1937; HEINTZ 1937, p. 18), the Rhine Land in Germany (GROSS 1933 a, pp. 38—40; 1937, p. 34), Spitsbergen (HEINTZ 1937, pp. 15—21 and special table at the end of the paper) and East Greenland. According to LAVERDIÈRE it would occur also in Northern France, but there is much reason to assume that the remains described by him in fact belong to some other large Arthrodire¹). All clearly determinable remains are from the lower part of the Upper Middle Devonian (cf. SÄVE-SÖDERBERGH 1937 b, pp. 30—35 and the table on p. 7 above).

Heterostius groenlandicus n. sp.

(Text-fig. 10; pl. 14).

Of this species there is, in the material at hand, only a single bone: the bone arisen by fusion of the anterior dorso-lateral and the anterior

¹) The large Arthrodire bones described by LAVERDIÈRE under the title of *Heterostius* (1930, pp. 61—69) are, in my opinion, hardly determinable as genus. As these bones come from deposits of Upper Devonian age it is very unlikely that they belong to *Heterostius*.



Text-fig. 10. *Heterostius groenlandicus* n.sp. Attempted restoration of the anterior dorso-lateral + the anterior lateral plate. Lateral view.
 $\frac{2}{3}$ of the nat. size.

a, anterior angle of ornamented area; *b*, posterior angle; *c*, condylar margin; *d*, dorsal margin of exposed part; *lc*, lateral line groove; *md*, area overlapped by the median dorsal plate; *pd*, dorsal extension of the ornamented area; *pr*, anterior ventral process, representing a large antero-ventral part of the anterior lateral plate; *v*, ventral margin.

lateral plates (no. 10.018). The fusion is so intimate that any traces of the original suture between the two components cannot be noticed. The antero-ventral process, *pr*, representing a large antero-ventral part of the anterior lateral plate, the processus articularis, and the area, *md*, overlapped by the median dorsal plate that represents the dorsal part of the anterior dorso-lateral plate are missing. The remaining part has a length of 23 cm. The total length of the bone may, therefore, be estimated at 45—50 cm or more.

As whole the bone was probably more slender than in *H. convexus*, *H. ingens* and *H. rhenanus* (ABEL 1927, fig. 2; HEINTZ 1930, figs. 2, 3; 1931, fig. 30; GROSS 1933 a, text-fig. 9). The condylar margin, *c*, (text-fig. 10) is not preserved, but everything seems to indicate that it was long. The dorsal margin, *d*, of the ornamented area, thus the ventral margin of the area *md*, overlapped by the median dorsal plate, is concave in its anterior and angularly convex in its posterior part. The corner of the ornamented area between the dorsal margin just described and the condylar margin is continued dorso-medially as a narrow stripe, *pd*, in front of the area *md*, in the normal way characteristic of the genus. The ventral margin, *v*, is slightly convex, except in the most anterior part, where at the transition to the ventral margin of the antero-ventral process, *pr*, approximately opposite the condyle, it shows a marked concavity, a concavity which seems to be more pronounced than in the species previously described. The ventral margin, *v*, and the margin *d*, meet at a rather pointed corner, *b*. The ornament, which consists of numerous fairly small stellate tubercles (pl. 14, fig. 2), ends anteriorly at a marked angle, *a*, at the transition to the antero-ventral process *pr*. On the medial face of the part preserved we find an antero-caudal thickening which gradually increases in height forwards.

The lateral line groove (*lc*) crosses the ornamented area from a point close above the posterior corner *b* to a point somewhat dorsally to the angle *a*. It does not curve upwards in its anterior part as in *H. convexus* and *H. ingens*, but is straight throughout.

Remarks. — The bone just described differs from the one in *H. convexus*, *H. ingens* and *H. rhenanus* among others by a more slender shape, by a probably long condylar margin, by a pronounced concavity of the lower margin approximately opposite the condyle, by a pointed posterior end of the ornamented part, and by a straight course of the lateral line groove. Thus, as it cannot be referred to any of the three species mentioned, I have considered it appropriate to erect a new species for it.

Diagnosis. — The anterior dorso-lateral and the anterior lateral plate completely fused. The bone thus formed of a rather slender shape,

with a probably long condylar margin, with a marked concavity in the lower margin approximately opposite the condyle, and with a pointed posterior end on the ornament-bearing part.

Geological horizon and locality. — *Heterostius* Series (see pp. 5—7 above). N.E. corner of E. Horseshoe Mountain, Canning Land.

Genus *Homostius* ASMUSS.

Syn. *Asterolepis* (in part) AGASSIZ 1844 b, pp. 89—96, 146—148.

Asterolepis (in part) MILLER 1849, p. 70.

Asterolepis (in part) MORRIS 1854, p. 318.

Homostius ASMUSS 1856, pp. 8—9.

Homostius PANDER 1857, pp. 74—81.

Homostius v. EICHWALD 1860, p. 1519.

Homosteus TRAQUAIR 1888, p. 511.

Homosteus TRAQUAIR 1889, p. 1.

Homosteus WOODWARD 1891 a, p. 304.

Homosteus WOODWARD 1891 b, pp. 198—201.

Homosteus WOODWARD 1916.

Homosteus HEINTZ 1928.

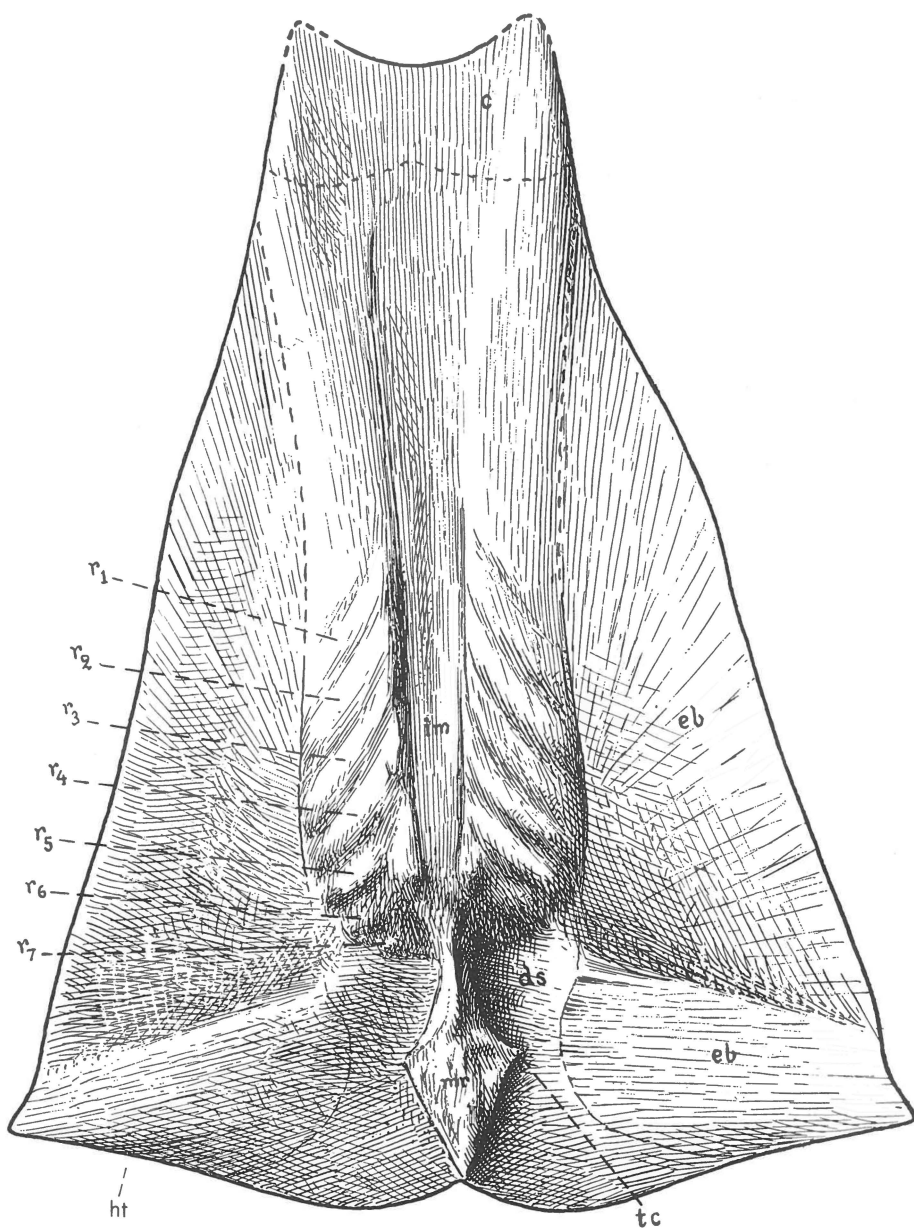
Homostius HEINTZ 1934.

The history of this genus has been exhaustively treated by PANDER in 1857 (pp. 7—27, 74—75), TRAQUAIR in 1889 (pp. 1—4) and HEINTZ in 1934 (pp. 5—7, 81—96).

Homostius seems to be closely allied to *Angarichthys* OBRUTSCHEW (OBRUTSCHEW 1927; HEINTZ 1934). These two genera were united by HEINTZ (1934) in a common family which was named *Homostiidae*.

After the revision of it undertaken by HEINTZ in 1934 the genus *Homostius* comprises in all six species of which five, *H. arcticus* HEINTZ, *H. sulcatus* (KUTORGA), *H. formosissimus* ASMUSS, *H. latus* ASMUSS and *H. milleri* TRAQUAIR bear species names, whereas the sixth is described by HEINTZ merely as *Homostius* sp. (HEINTZ 1934, pp. 95—96). To these is now added a seventh species, *H. kochi*, from East Greenland.

Homostius is at present known from the Baltic States and probably also from Russia (HEINTZ 1934, p. 87; 1937, p. 18), from Scotland (cf. HEINTZ 1934; 1937, special table at the end of the text; WATSON 1935 pp. 159, 167, WESTOLL 1937 a, pp. 36—40; SÄVE-SÖDERBERGH 1937 b, pp. 30—35), from Spitsbergen (HEINTZ 1934, pp. 86—87; 1937, p. 18 and table at the end of the paper) and from East Greenland. In regard to its geographical distribution it is therefore almost as *Heterostius*. And as *Heterostius* it occurs only in the lower part of the Upper Middle Devonian (cf. SÄVE-SÖDERBERGH 1937 b, pp. 30—35 and table on p. 7 above).



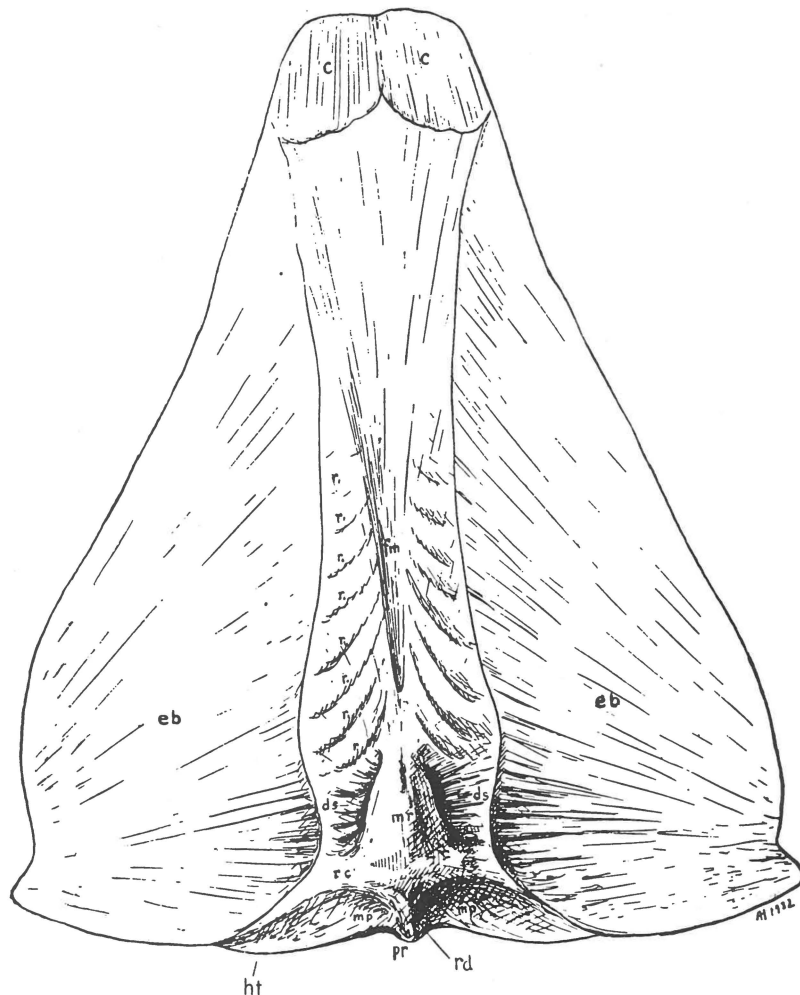
Text-fig. 11. *Homostius kochi* n. sp. Nuchal plate (median occipital, median basal) in ventral view. $\frac{2}{3}$ of the nat. size.

c, area overlapping the central plate; *ds*, "double socket" of HEINTZ's descriptions; *eb*, area overlapping the paranuchal plate (external basal); *ht*, posterior transverse thickening; *im*, median groove; *mr*, median ridge; *r*₁—*r*₇, transverse ridges; *tc*, transversal elevation, "transversal wall" of HEINTZ descriptions.

Homostius kochi n. sp.

Text-figs. 11, 13, 14; pl. 10, figs. 2, 3; pls. 11, 12; pl. 13, fig. 2).

Material. — The material with certainty pertaining to *H. kochi* comprises only two nuchal plates (nos. 10.019, 10.020) and a piece of



Text-fig. 12. The nuchal plate of *Homostius* (after *H. sulcatus* (KUTORGA) and *H. milneri* TRAQUAIR) in ventral view. From HEINTZ 1934.

c, area overlapping the central plate; *ds*, "double socket" of HEINTZ's descriptions; *eb*, area overlapping the paranuchal plate; *ht*, posterior transverse thickening; *im*, median groove; *mr*, median ridge; *pr*, posterior process; *r*₁, *r*₂, *r*₃, etc. transverse ridges; *tc*, transversal elevation, "transversal wall" of HEINTZ's descriptions.

a plate the position of which in the armour is not nearer determinable (no. 10.021). Although it is still uncertain whether they belong to this species. I shall here describe also an imperfect right inferognathal (no. 10.022) and an imperfect right anterior dorso-lateral plate (no. 10.023).

Holotype. — As a holotype I choose the largest one (no. 10.019) of the two nuchal plates (text-fig. 11; pls. 11, 12).

Description. — Judging from the remains now available *H. kochi* attained a somewhat similar size to *H. milleri*.

The nuchal plate¹⁾ (text-fig. 11; pl. 10, fig. 2; pls. 11, 12) is of a similar long type to that in the other species of the genus (text-fig. 12). The largest one (the holotype) is 23.7 cm long and 18 cm broad at its broadest plate, across the postero-lateral angles; the other specimen is considerably smaller, its corresponding dimensions being 14.5 cm and 11.2 cm respectively. The maximum breadth constitutes 75–78 % of the length and is thus somewhat smaller than in the other species known in detail in this respect, as in these it is said by HEINTZ (1934, p. 19) to be approximately 85 % of the length.

The anterior margin is in both the specimens at hand, fairly strongly concave. For comparison it should be mentioned that HEINTZ obviously also has found this margin developed in a similar way in certain of the plates studied by him (HEINTZ 1934, p. 19). However, in the restoration given by him it is as a whole convex, with a small median notch only (text-fig. 12 in the present paper). The lateral margin is in all essentials as in the restoration by HEINTZ just referred to, though its anterior concavity is slightly more pronounced. Finally, the posterior margin differs from that in the said restoration published by HEINTZ by a somewhat more concave lateral part and by the total absence of the small median process (*pr*, text-fig. 12).

The upper (external) face shows indications of a low, ill-defined median ridge (pl. 10, fig. 2). Except most posteriorly along the posterior margin where it did not reach up to the most superficial parts of the corium, it is ornamented in the typical way with numerous, closely set tubercles of a uniform size.

The lower (ventral) face (text-fig. 11; pls. 11, 12) differs in several characters from the one in the species described by HEINTZ (cf. text-figs. 11 and 12). The transversal thickening, *ht*, is broad and well developed, and, contrary to what is the case, at any rate, in *H. sulcatus* and *H. milleri*, it is not represented only by a short medial part, but it reaches as far laterally as to the postero-lateral process-like angle of the plate and thus entirely across its half of the plate. In spite of this

¹⁾ Termed median occipital (TRAQUAIR and English writers in general) or median basal (HEINTZ). The term of nuchal plate was suggested by GROSS 1932 (GROSS 1932 b; cf. also STENSIÖ 1934, p. 32).

condition, however, it could be clearly established that the area, *eb*, overlapping the paranuchal plate extended backward to the posterior margin of the plate exactly as it does in *H. sulcatus* and *H. milleri*. The transverse elevation *tc*, termed by HEINTZ the "transversal wall", is almost reduced, being represented only by a pronounced angle on each side of the median ridge, *mr*. On account of this circumstance the paired pit *ds*, called by HEINTZ the "double socket", is here without any posterior boundary and it is, therefore, continued backward on each side by a rostro-caudal depression, a depression which is situated between the median ridge, *mr*, and the low proximal part of the transverse thickening *ht*. The part of the median ridge, *mr*, situated between the right and left half of the "double socket" is narrower than in *H. sulcatus* and *H. milleri* (cf. text-figs. 11, 12), whereas the median groove, *im*, is broader than in those species. The transverse ridges, r_1 — r_7 , are fewer than in the two species just mentioned, numbering five in front of and two or perhaps three laterally to each half of the "double socket". These hindmost two or three ridges are, as normally in the genus, more straightly transverse than the other ones. Finally the area *c*, overlapping the central plate, is imperfectly exposed, but there is reason to assume that in the whole it was as in the species previously described.

Judging from the conditions in the Acanthaspids (cf. STENSIÖ 1934, text-figs. 27, 28 and p. 60), in which the dermal cranial roof beyond question rests directly on the endocranium and in which the dermal cranial roof in addition seems to have had a deep descending lamina covering a considerable part of the posterior face of the occipital region, the segmental (trunk) musculature of the primitive Arthrodira did not extend forward between the nuchal plate and the endocranium. It is therefore also very unlikely that it did so in *Homostius*. There is also no reason to assume that the "double socket" should be a muscular pit (cf. HEINTZ 1934, pp. 23—24). Accordingly I agree with HEINTZ (1934, p. 25) that the peculiar markings on the lower side of the nuchal plate cannot have been caused by muscles. That the "double socket" would be an impression of a cranio-spinal process similar to that in *Macropetalichthys* (STENSIÖ 1925, text-figs. 1, 2, 5), as has been supposed by OBRUTSCHEW (1931, p. 298) and STETSON (1930, pp. 30—31) is also impossible, for a cranio-spinal process of the *Macropetalichthys*-type would have been broader and more transversal than the "double socket", and in addition, if really present, a cranio-spinal process of that type would have been situated further back than the "double socket": above the very posterior end of the occipital region, immediately behind the transverse elevation *tc*, or "transversal wall" of HEINTZ descriptions

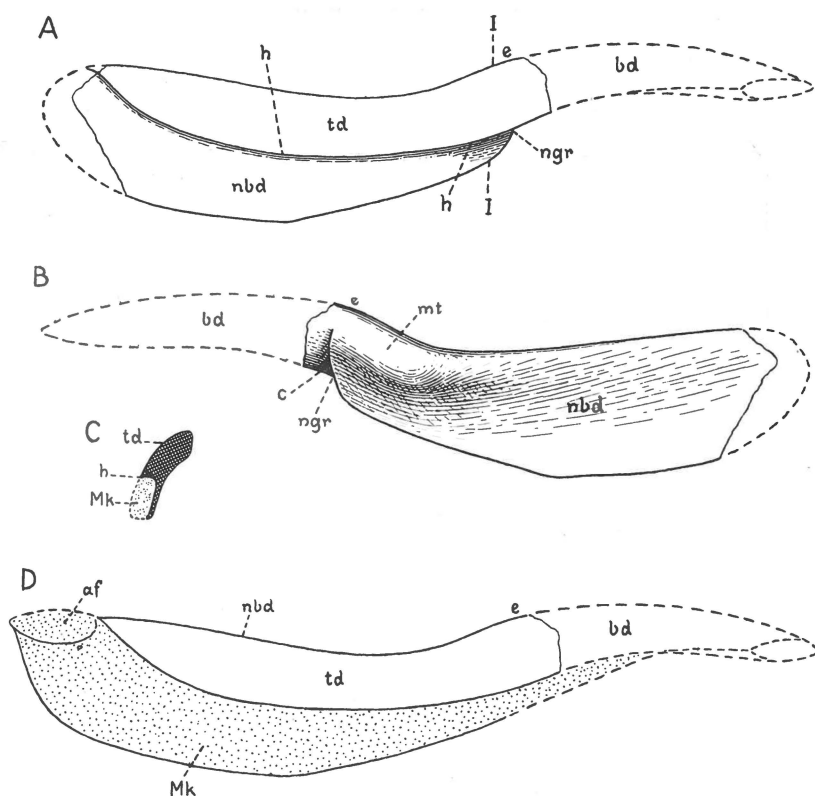
(cf. JAEKEL 1926, text-fig. 2)¹). There is, however, in the *Homostius*-species dealt with by HEINTZ a depressed area, *mp*, which is found in a similar development not only in the majority of the *Arthrodira* but also in the *Antiarchi* (STENSIÖ 1931, pp. 44, text-figs. 15, 16) and which probably was caused by the supposed musc. levator capitis (HEINTZ 1932, p. 189). As the conditions thus are the writer agrees with HEINTZ (1934, pp. 24, 25) that any explanation cannot for the time being be given either of the transverse ridges r_1 , r_2 etc. or of the "double socket". Our knowledge of the Arthrodire skull is still much too imperfect for this.

The inferognathal (text-fig. 13; pl. 10, fig. 3) is imperfectly preserved, lacking almost the entire biting division ("functional portion" of HEINTZ descriptions) and a posterior part of the non-biting division (termed the "blade" by HEINTZ). It is fully evident, however, that the two divisions were "twisted" in relation to each other in the manner characteristic of the genus (HEINTZ 1934, pp. 41—52), and that, as normally in the Arthrodires, the biting division had a more lateral position than the non-biting one, a condition, which, as pointed out by the writer in a previous paper (STENSIÖ 1934, pp. 45—47), is due to their position in relation to the Meckelian cartilage. The biting division was situated laterally and the non-biting division medially to that cartilage. The notch and groove *ngr*, on the lower margin of the bone at the transition between its two divisions indicates the place where the Meckelian cartilage crossed the bone. The external face of the non-biting division was covered by the Meckelian cartilage as far dorsally as to the lower margin (*h*) of the longitudinal thickening *td*. That thickening *td*, which thus marks the dorsal extent of the Meckelian cartilage, is developed in a fundamentally similar way to that in the species studied by HEINTZ (HEINTZ 1934, text-figs. 27—29), though it is higher than that.

As may be gathered from what has just been set forth the opinion advanced by HEINTZ in 1934 concerning the orientation of the plate just under description is fully correct.

In regard to its proportions and outlines the plate seems to differ from the ones studied by HEINTZ in the following respects: The non-biting division is lower and longer, the upper margin of the non-biting

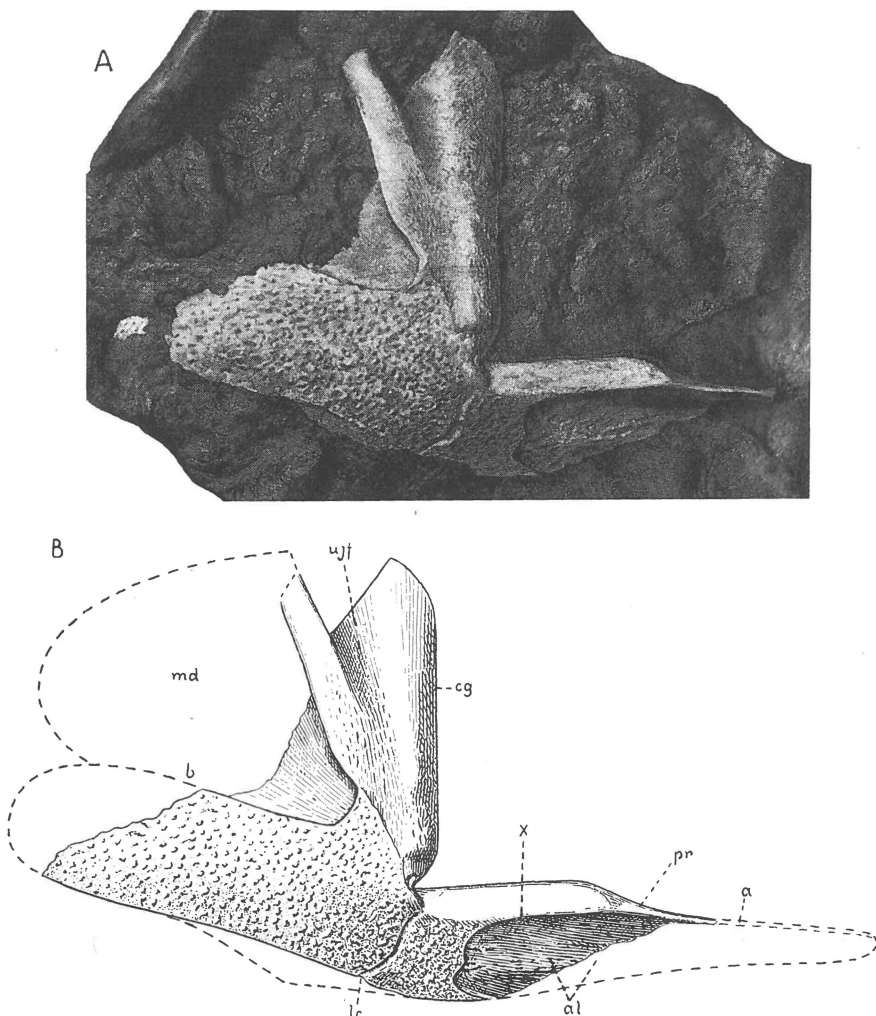
¹) The occipital region of *Homostius* cannot have reached backward beyond the dermal cranial roof as supposed by HEINTZ (1934, p. 24), for the joint between the occipital region and the vertebral column must have lain in the same transverse plane with the joint between the dermal cranial roof and the trunk armour. On the other hand, the occipital region reaches backward beyond the dermal cranial roof in such Arthrodire-forms in which the posterior margin of the dermal cranial roof is concave (cf. STENSIÖ 1934, p. 40, and text-figs. 21, 22). Forms belonging to the latter category are *Dinichthys*, *Leiosteus* etc.



Text-fig. 13. *Homostius kochi*? n. sp. Attempted restoration of a right inferognathal. *A*, in lateral view (the non-biting division with its axis of height vertical; in the figure given by HEINTZ in 1934 and said by him to be from the lateral side the axis of height of the bone is probably somewhat inclined to the medial side); *B*, in medial view (with the axis of height of the non-biting division vertical); *C*, diagrammatic transverse section at the transverse plane I—I; *D*, in lateral view with the Meckelian cartilage restored. Cartilage dotted. Somewhat less than one half of the nat. size.

Mk, Meckelian cartilage; *bd*, biting division; *c*, raised margin, marking the anterior limit of the non-biting division (the margin was termed "step" by HEINTZ); *h*, lower margin of the longitudinal thickening, marking the dorsal extent of the Meckelian cartilage; *l*, upper thickened part of the biting division; *nbd*, non-biting division; *ngr*, groove and notch caused by the Meckelian cartilage, where that crossed the bone; *td*, longitudinal thickening on the dorsal part of the outside of the non-biting division, dorsally to the Meckelian cartilage.

division is much more concave in its anterior part, the lower margin of the non-biting division is less convex, the longitudinal thickening of the dorsal part of the external side of the non-biting division is broader (higher), and, finally, the ovoid elevation (*mt*) on the anterior part of the medial face of the non-biting division seems to be more sharply pronounced.

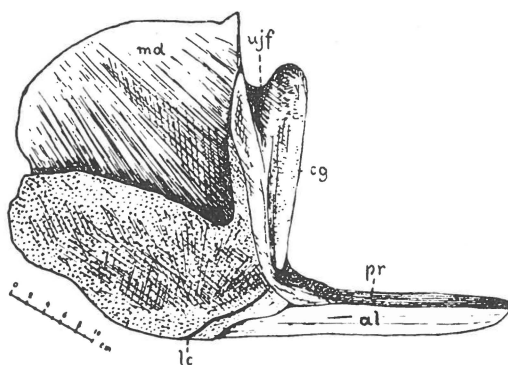


Text-fig. 14. *Homostius kochi*? n. sp. A, parts preserved of a right anterior dorso-lateral plate; B, attempted restoration of the same plate. External view. $\frac{2}{3}$ of the nat. size.

al, area overlapped by the anterior lateral plate; cg, condylus for the articulation with the paranuchal plate; md, area overlapped by the median dorsal plate; lc, sensory canal groove; pr, anterior process-like part; uff, dorsal articular fossa; x, margin forming the dorsal boundary of the area al.

The anterior dorso-lateral plate (text-fig. 14; pl. 13, fig. 2) is of a fairly small individual. Thus the distance across the bone between the points denoted with the letters a and b is only 10 cm approximately, whereas in *H. milleri* the corresponding distance seems to be about one and a half and in the Baltic forms even three times as large. Though in its present state of preservation it lacks large anterior and posterior

parts the plate must obviously have had a similar shape to that in *H. milleri* and the Baltic species. The anterior process-like part, *pr*, is well developed with a clearly marked area, *al*, which was overlapped by the anterior lateral plate. The area *md*, overlapped by the median dorsal plate, is also fairly well shown. As normally in the genus the condyle (*cg*) is very long and bounded behind on the external face of the bone by a groove-like depression (*ujf*), termed by HEINTZ "the dorsal articular fossa". The ornamented area extends only a fairly short distance dorso-medially between the area *md*, and the dorsal articular



Text-fig. 15. *Homostius*. Restoration of the anterior dorso-lateral plate of an Estonian form. From HEINTZ 1934. Approximately $\frac{1}{2}$ of the nat. size.

For explanation of index letters, see text-fig. 14.

fossa and thus in front of the median dorsal plate. Any details concerning the structure of the tubercles forming the ornament cannot be ascertained. The lateral sensory groove (*lc*) crosses the ornamented area in a similar way to that in the Baltic and Scottish species.

For comparison a copy of HEINTZ's restoration of the bone of an Estonian form (HEINTZ, 1934, text-fig. 33) is given in the accompanying text-fig. 15.

Remarks. — The nuchal plates described here differ clearly from those previously known and it is therefore evident that they must belong to a species of their own, a species which has been named *H. kochi* in honour of Dr. LAUGE KOCH.

Whether the inferognathal and the anterior dorso-lateral plate really pertain to *H. kochi* can be decided first with the help of new and better preserved material. However, it is evident that both the last-mentioned bones are so different from the corresponding ones described by HEINTZ (1934, text-figs. 29, 33, 47), that they cannot be referred to any of the species previously named.

Diagnosis. — Nuchal plate fairly narrow in proportion to its length, the maximum breadth constituting 75—78 % of the length. The

transverse elevation ("transversal wall" of HEINTZ's descriptions) on the lower face of the nuchal plate almost completely reduced and the "double socket" therefore without any posterior bounding. Transverse ridges of the lower face of the nuchal plate numbering 7 approximately. Inferognathal with its non-biting division low in proportion to the length. Ornamented area of anterior dorso-lateral plate extending only a short distance dorso-medially in front of the median dorsal plate.

Geological horizons and localities. — The largest and best preserved nuchal plate (the holotype, no. 10.019) is from the *Heterostius* Series, E. Horseshoe Mountain (N.E. corner), Canning Land. The other nuchal plate (no. 10.020) probably comes from the Series with *Asterolepis säve-söderberghi*, Mt. Quensel, Wegener Peninsula (cf. SÄVE-SÖDERBERGH 1937 b, p. 20). The fragmentary bone plate (no. 10.021) is from the Series with *Asterolepis säve-söderberghi*, Cape Brown Mountain (304 m), Wegener Peninsula. The inferognathal is from the Series with *Asterolepis säve-söderberghi*, Southern Ridge, (S. side), Canning Land. Finally the anterior dorso-lateral plate is from the Series with *Asterolepis säve-söderberghi*, N. Basis Valley, Canning Land.

Ichthyodorulites. (E. S.).

Onchus sp.

(Text-fig. 16; pl 9, fig. 4).

In a piece of rock with fragments of Crossopterygians and Placoderms there is also an imperfectly preserved spine (no. 10.026) which will be described here under the provisional title of *Onchus* sp.



Text-fig. 16. *Onchus* sp. Restoration of preserved part of a spine. Lateral view.
× 3 diam.

The spine lacks a proximal part with the entire inserted portion. It is clearly symmetrical with the transverse diameter considerably

smaller than the antero-posterior one. The pulp cavity (*p*, pl. 9, fig. 4) is well shown, and in the part preserved, it is completely closed behind. On each lateral face the spine exhibits in the entire exposed portion a deep longitudinal groove situated nearer to the anterior than to the posterior margin.

Remarks. — The spine here described is somewhat suggestive of that named *Onchus marginalis* AGASSIZ (cf. GROSS 1933 b, p. 19, text-fig. 7 A, B), differs, however, from this in its flatter shape, in the broader and more rounded longitudinal groove, and in the greater breadth from one lateral side to the other of the part situated in front of the groove.

Geological horizon and locality. — Series with *Asterolepis säve-söderberghi*. Cape Brown Mountain, (304 m), Wegener Peninsula.

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EXPLANATION OF THE PLATES

All the specimens here figured belong to the Geological Survey of Greenland, Copenhagen. They have been taken on Ilford special rapid panchromatic plates. The objectives used were Zeiss Tessar 1:6,3, F. 36 cm, and 1:6,3, F. 25 cm.

Plate 1.

Asterolepis säve-söderberghi n. sp.

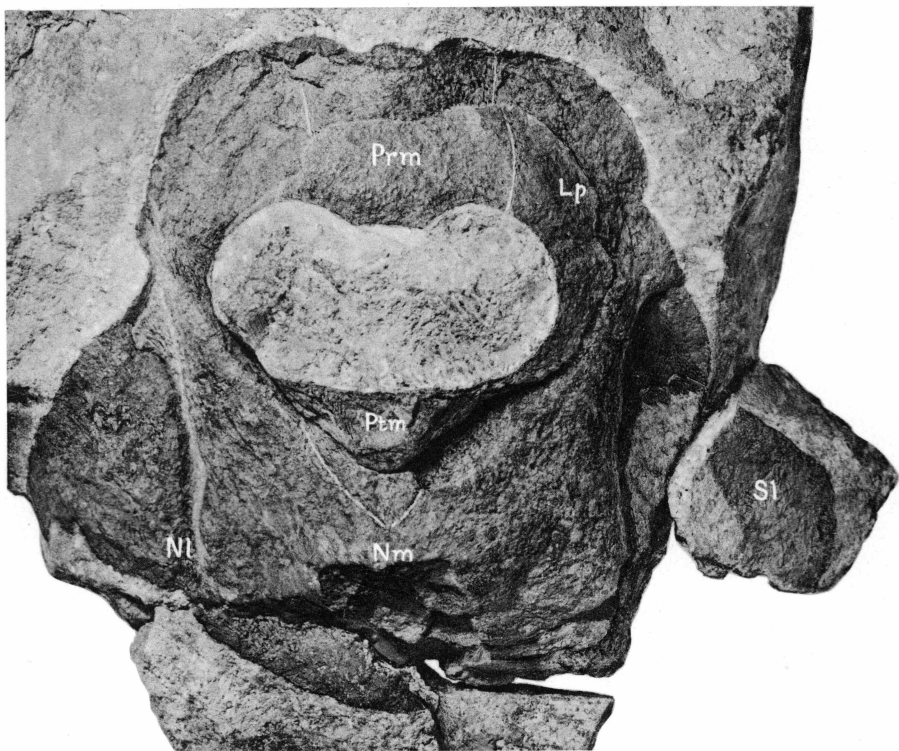
Fig. 1. Dermal cranial roof, preserved mainly as impression of the lower face. Specimen no. 10.000 *a.* $\times 1\frac{1}{2}$ diam.

Fig. 2. Impression of the upper (external) face of a posterior part of the dermal cranial roof. Same specimen as in fig. 1. $\times 1\frac{1}{2}$ diam.

Explanation of index letters.

Lp, lateral plate; *Nl*, lateral nuchal plate; *Nm*, median nuchal plate; *Prm*, pre-median plate; *Ptm*, postmedian plate; *Sl*, sufflaminal plate; *ifg*, infraorbital sensory groove; *lcl*₁, cephalic division of the main lateral line; *mpg*, groove, corresponding to the middle head-line of fishes in general.

1



2

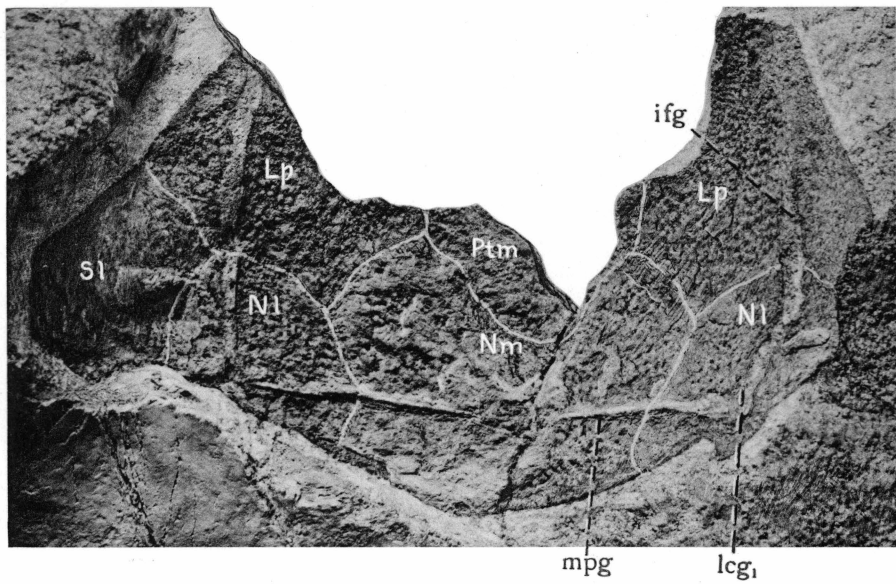


Plate 2.

- Fig. 1. *Asterolepis* sp. Imperfect median nuchal plate. Dorsal view. Specimen no. 10.017. $\times 1\frac{1}{2}$ diam.
- Fig. 2. *Asterolepis säve-söderberghi* n. sp. Left ventral articular plate seen from the inner face. Specimen no. 10.000 o. $\times 1\frac{1}{2}$ diam.
- Fig. 3. *Asterolepis säve-söderberghi* n. sp. Anterior median dorsal plate. Ventral view. Specimen no. 10.003. $\times 1\frac{1}{2}$ diam.

Explanation of index letters.

d. end, canal for the ductus endolymphaticus; *mpg*, groove representing the middle head-line in fishes in general; *ppg*, groove probably representing the posterior head-line of fishes in general.

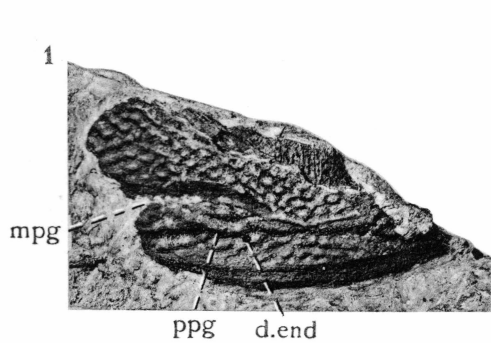
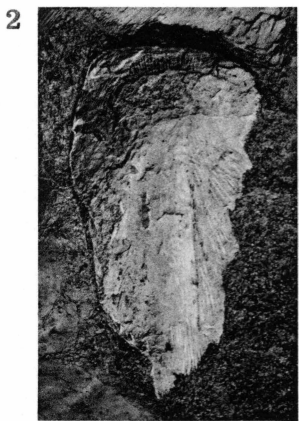
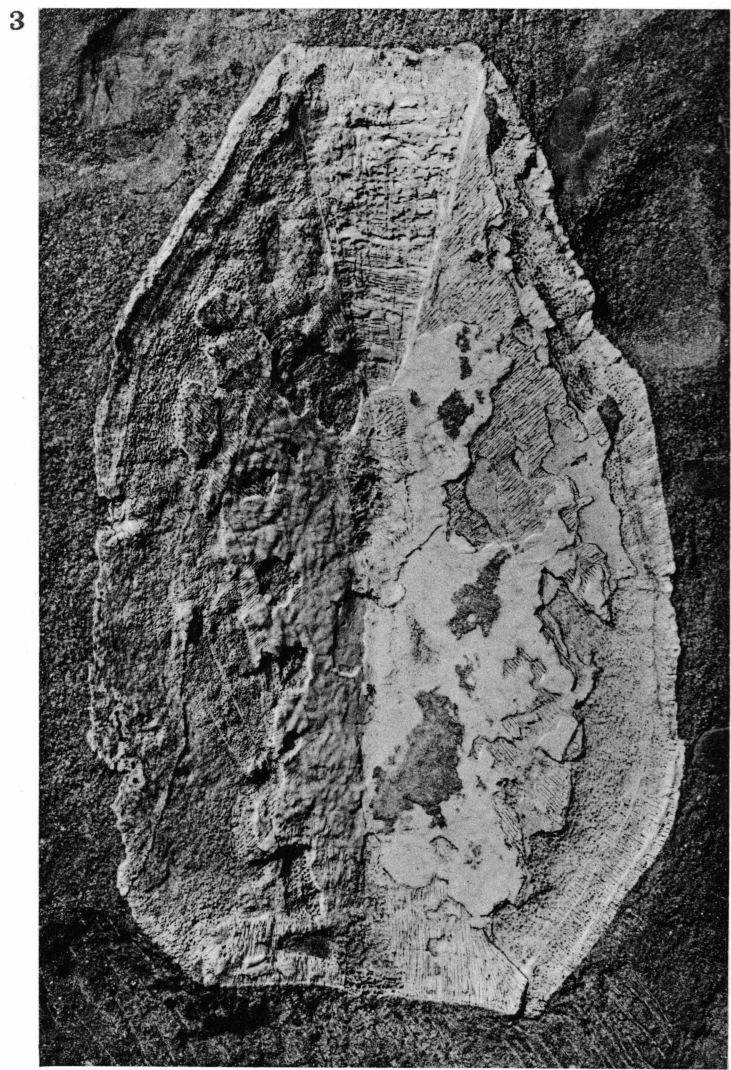


Plate 3.

Asterolepis säve-söderberghi n. sp.

- Fig. 1. Detached median nuchal plate. Impression of the external face. Specimen no. 10.000 *b*. (Same specimen as in pl. 9, fig. 1). $\times 1\frac{1}{2}$ diam.
- Fig. 2. Imperfect anterior median dorsal plate in ventral view. Specimen no. 10.000 *d* (same specimen as in pl. 4, fig. 1 and pl. 10, fig. 1). $\times 1\frac{1}{2}$ diam.

Explanation of index letters.

a_1, a_2 , anterior and posterior angle respectively of the lateral margin of the anterior median dorsal plate; *alr*, antero-lateral ridge; cv_1 , area overlapping the anterior dorso-lateral plate; cv_2 , area overlapping the mixilateral plate; *mpg*, groove corresponding to the middle head-line of fishes in general; *ppg*, groove corresponding to the posterior head-line in fishes in general.

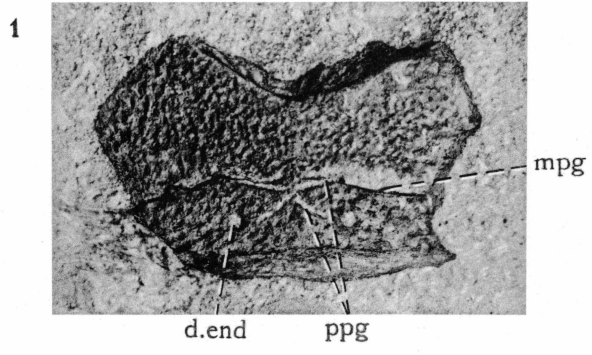
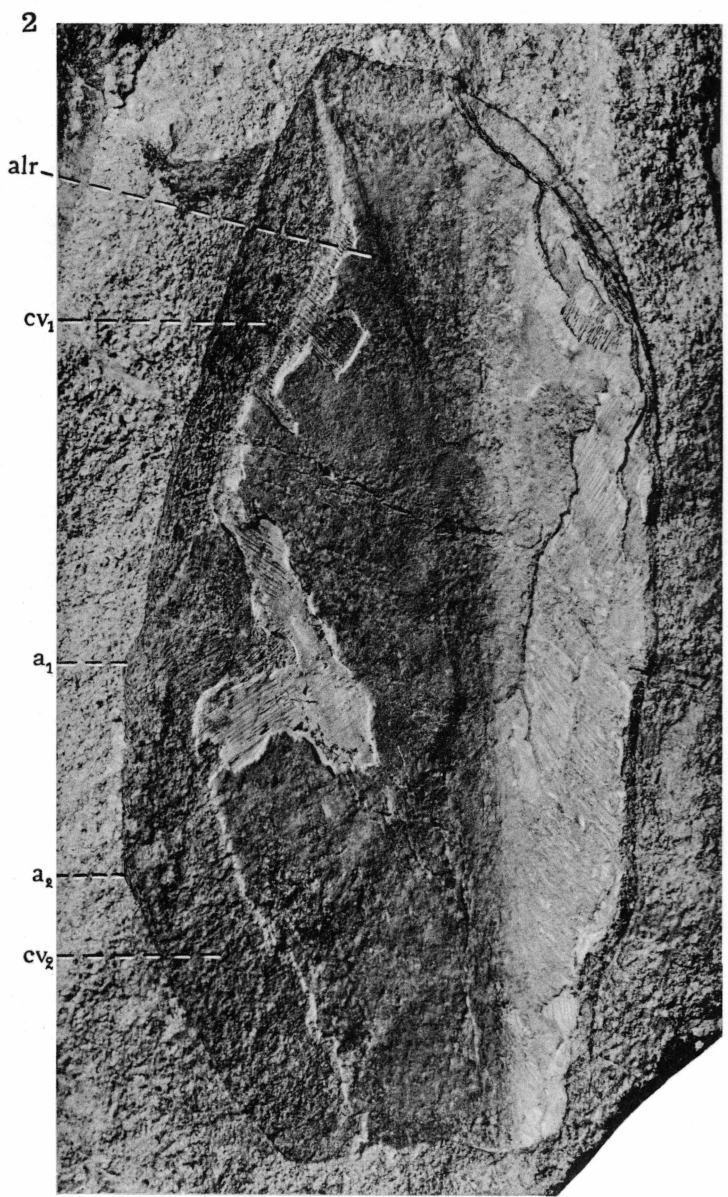


Plate 4.

Asterolepis säve-söderberghi n. sp.

Fig. 1. Anterior median dorsal plate preserved mainly as impression of the lower face. Specimen no. 10.000 *d* (same specimen as in pl. 3, fig. 2 and pl. 10, fig. 1). $\times 1\frac{1}{2}$ diam.

Figs. 2, 3. Left dorsal articular plate. Fig. 2, impression of the external face; fig. 3 in part impression of the internal face. Specimen no. 10.000 *l*. $\times 1\frac{1}{2}$ diam.

Explanation of index letters.

a_1 , anterior lateral angle; a_2 , posterior lateral angle; cv_1 , area overlapping the anterior dorso-lateral plate; cv_2 , area overlapping the mixi-lateral plate.

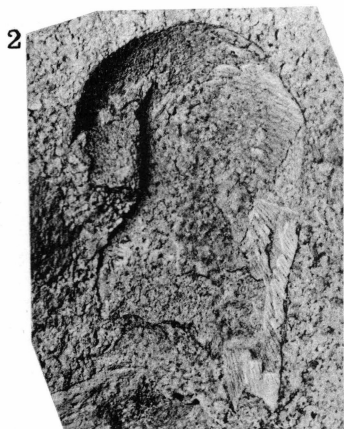
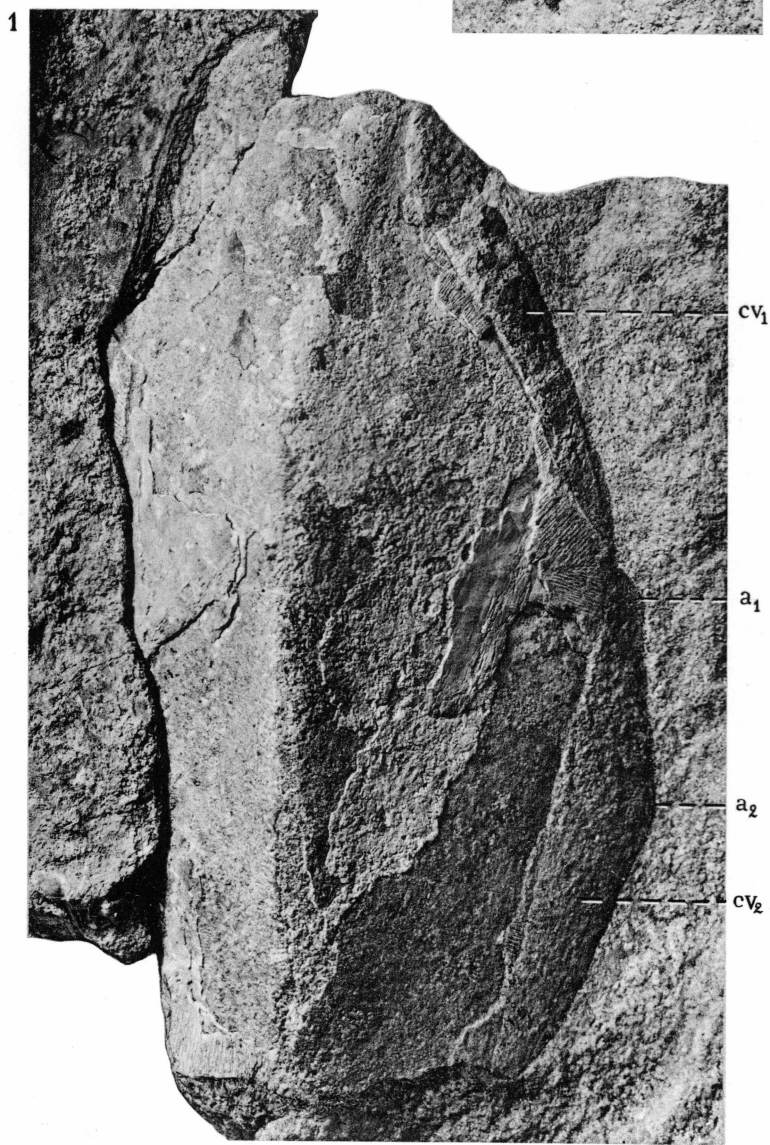


Plate 5.

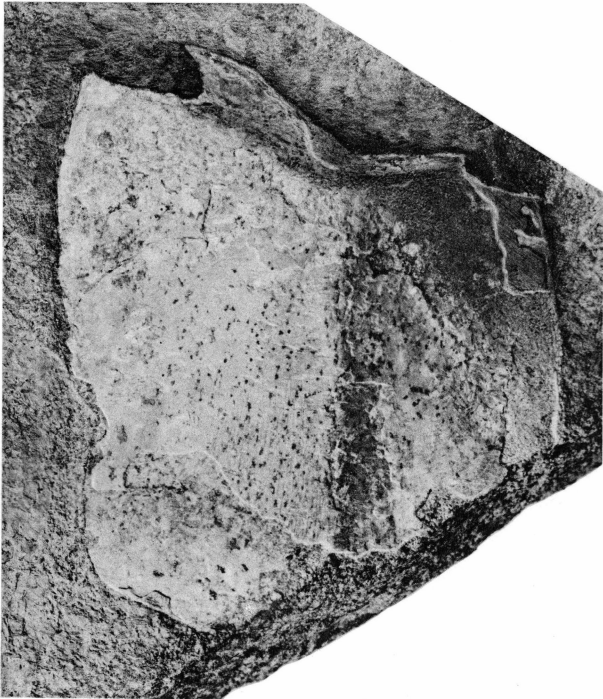
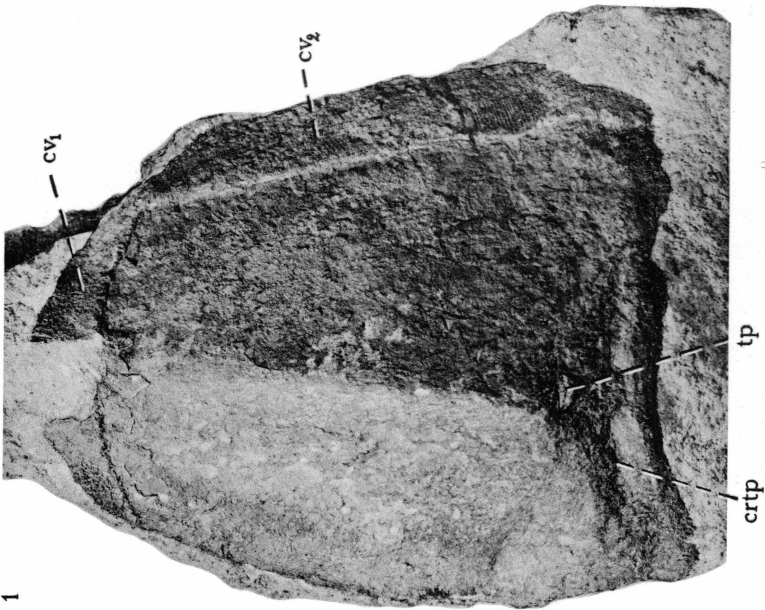
Asterolepis säve-söderberghi n. sp.

- Fig. 1. Posterior median dorsal plate. Impression of the lower face. Specimen no. 10.000 *f.* $\times 1\frac{1}{2}$ diam.
- Fig. 2. Right anterior dorso-lateral plate of the short type. Mainly only the basal bone-layer preserved. Specimen no. 10.000 *n.* $\times 1\frac{1}{2}$ diam.

Explanation of index letters.

*crt**p*, crista transversalis interna posterior (impression); *cv*₁, *cv*₂, overlapping areas;
tp, ventral pit.

2



1

Plate 6.

Asterolepis säve-söderberghi n. sp.

Fig. 1. Imperfect mixilateral plate. Medial view. Specimen no. 10.002 *c.* $\times 1\frac{1}{2}$ diam.

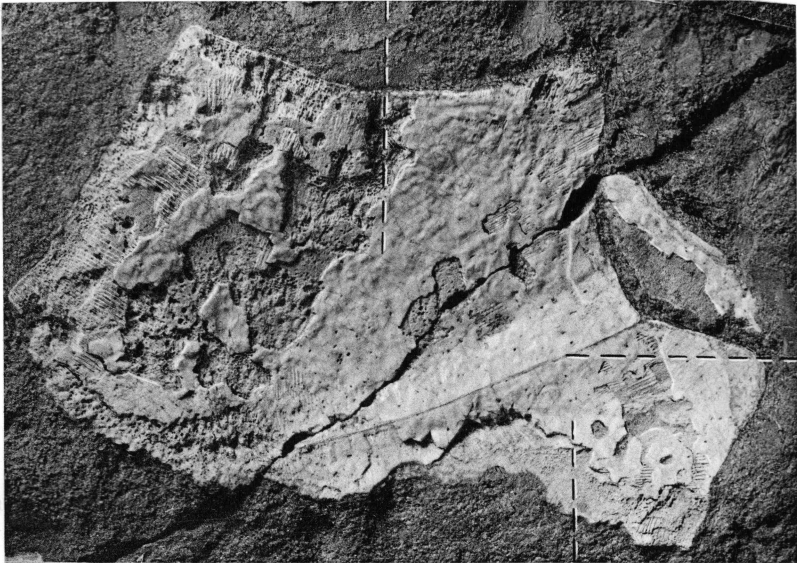
Fig. 2. Imperfect anterior dorso-lateral plate. Medial view. Specimen no. 10.009.
 $\times 1\frac{1}{2}$ diam.

Explanation of index letters.

Pdl, posterior dorso-lateral component of mixilateral plate; *Pl*, posterior lateral component of mixilateral plate; *cv*, area on the anterior dorso-lateral plate overlapping the mixilateral plate; *lc*, lateral sensory groove; *su*, vestigial suture.

1

Pdl

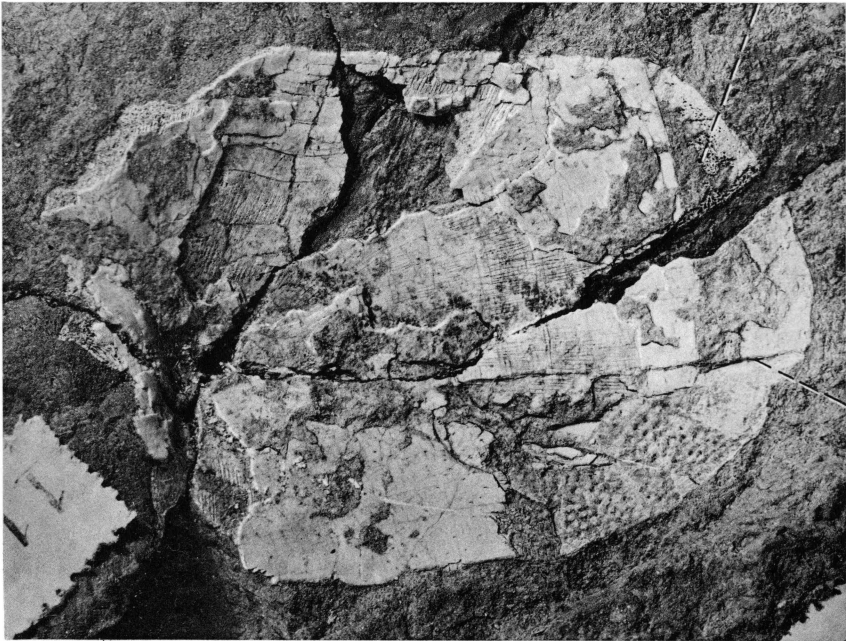


su

P1

2

cv



lc

Plate 7.

Asterolepis säve-söderberghi n. sp.

Impression of the medial face of an imperfectly preserved right mixilateral plate. Specimen no. 10.000 *g.* $\times 1\frac{1}{2}$ diam.

Explanation of index letters.

Pdl, component corresponding to the posterior dorso-lateral plate; *Pl*, component corresponding to the posterior lateral plate; *su*, vestige of the suture between the components *Pdl* and *Pl*.



Plate 8.

Asterolepis säve-söderberghi n. sp.

A left mixilateral plate in medial view, preserved partly as impression of the lateral face. Specimen no. 10.000 *e.* $\times 1\frac{1}{2}$ diam.

Explanation of index letters.

Pdl, component representing the posterior dorso-lateral plate; *Pl*, component representing the posterior lateral plate; *cd*₁, area, overlapped by the posterior median dorsal plate; *cd*₂, area overlapped by the anterior median dorsal plate; *cd*₃, area overlapped by the anterior dorso-lateral plate; *cd*₄, area overlapped by the anterior ventro-lateral plate; *cd*₅, area overlapped by the posterior ventro-lateral plate.



Plate 9.

- Fig. 1. *Asterolepis säve-söderberghi* n. sp. Median nuchal plate, preserved in part as impression of the lower face. Counter part of the specimen shown in pl. 3, fig. 1. Specimen no. 10.000 *b.* $\times 1\frac{1}{2}$ diam.
- Fig. 2. *Asterolepis säve-söderberghi* n. sp. Posterior part of a mixilateral plate, showing clearly the suture between the components forming this plate. Specimen no. 10.000 *h.* $\times 3$ diam.
- Fig. 3. *Asterolepis säve-söderberghi* n. sp. Part of a plate, showing ornament. Specimen no. 10.004. $\times 3$ diam.
- Fig. 4. *Onchus* sp. Spine, missing a basal and a distal part. Lateral view. Specimen no. 10.027. $\times 3$ diam.

Explanation of index letters.

Pdl, component representing the posterior dorso-lateral plate; *Pl*, component representing the posterior lateral plate; *gr*, groove; *p*, pulp cavity; *su*, suture.

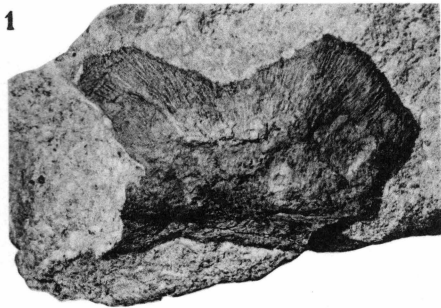
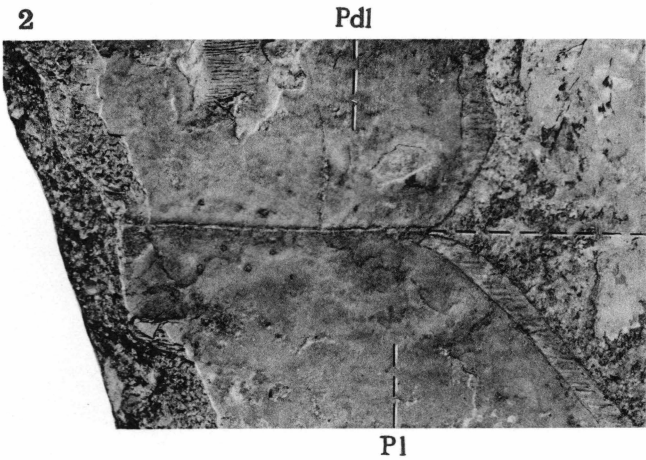
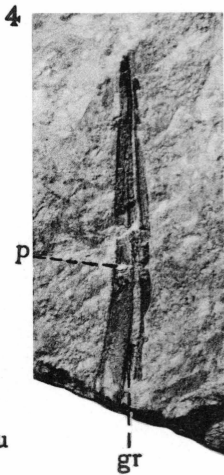
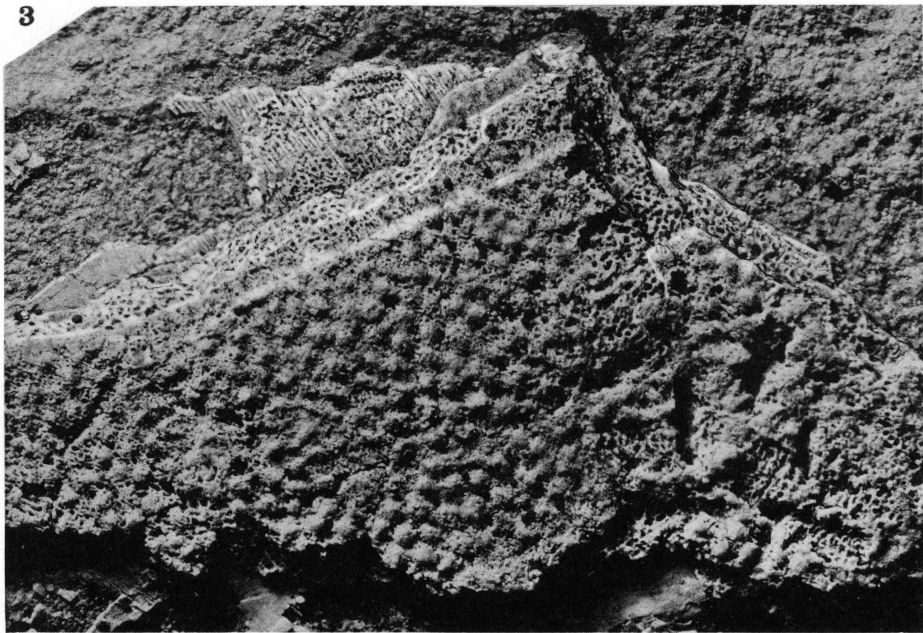


Plate 10.

- Fig. 1. *Asterolepis säve-söderberghi* n. sp. Anterior median dorsal plate preserved as impression of the lower face. Lateral view. Specimen no. 10.000 *d* (same specimen as in pl. 3, fig. 2, and pl. 4, fig. 1). $\times 1\frac{1}{2}$ diam.
- Fig. 2. *Homostius kochi* n. sp. Nuchal plate, preserved mainly as impression of the upper (external) face. Specimen no. 10.020. $\frac{2}{3}$ of the nat. size.
- Fig. 3. *Homostius kochi* n. sp. Right inferognathal missing the larger anterior part of the biting ("functional") division. Medial view. Specimen no. 10.022. $\frac{2}{3}$ of the nat. size.

Explanation of index letters.

a_1 , a_2 , anterior and posterior angle respectively of the posterior division of the lateral margin of the anterior median dorsal plate; *bd*, biting division of inferognathal (short posterior part only preserved); *c*, raised margin, marking the anterior limit of the non-biting division of the inferognathal ("step" in HEINTZ's terminology); cv_1 , cv_2 , overlapping areas; *h*, lower margin of the thickening *td*; *mt*, ovoid elevation on the medial face of the inferognathal; *ngr*, groove and notch for the Meckelian cartilage; *td*, longitudinal thickening on the dorsal half of the outside of the inferognathal.

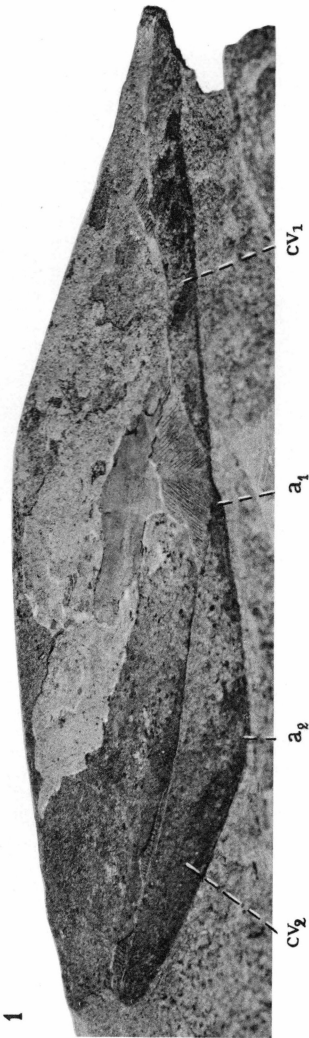
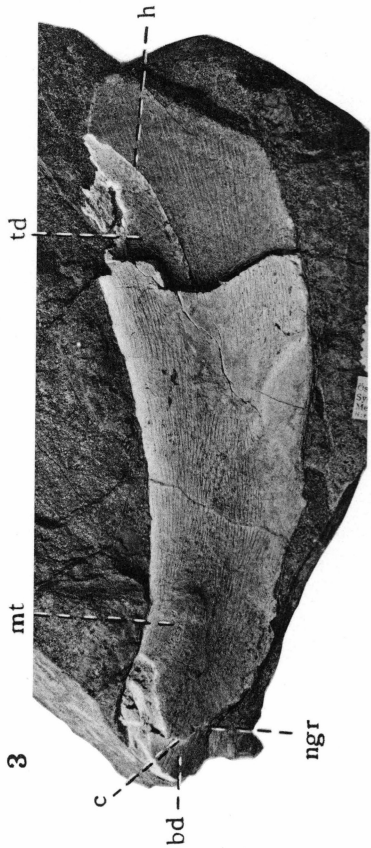


Plate 11.

Homostius kochi n. sp.

Nuchal plate preserved mainly as impression of the lower face. Unprepared. Specimen no. 10.019. $\frac{2}{3}$ of the natural size. Plaster cast of this plate shown in pl. 12.

Explanation of index letters.

c, area overlapping the central plate; *ds*, "double socket" of HEINTZ's descriptions; *eb*, area overlapping the paranuchal plate; *im*, median groove; *mr*, median ridge; *r*₁, *r*₂ etc. transverse ridges; *tc*, transversal elevation, "transversal wall" of HEINTZ's descriptions (short part only developed; the remaining parts reduced).

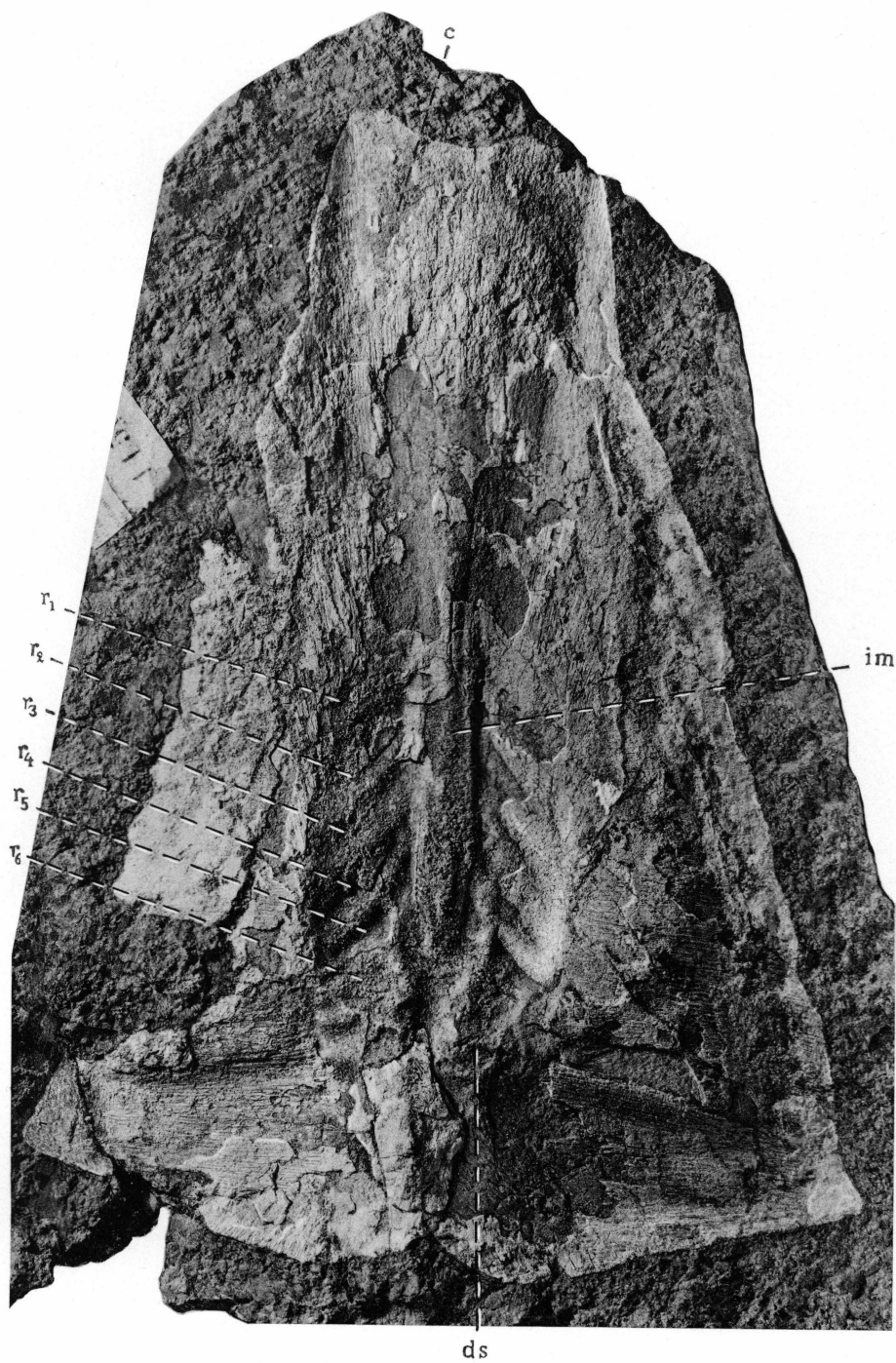


Plate 12.

Homostius kochi n. sp.

Plaster cast of the plate shown in pl. 11 (prepared). $\frac{2}{3}$ of the nat. size.

Explanation of index letters.

See explanation of pl. 11.

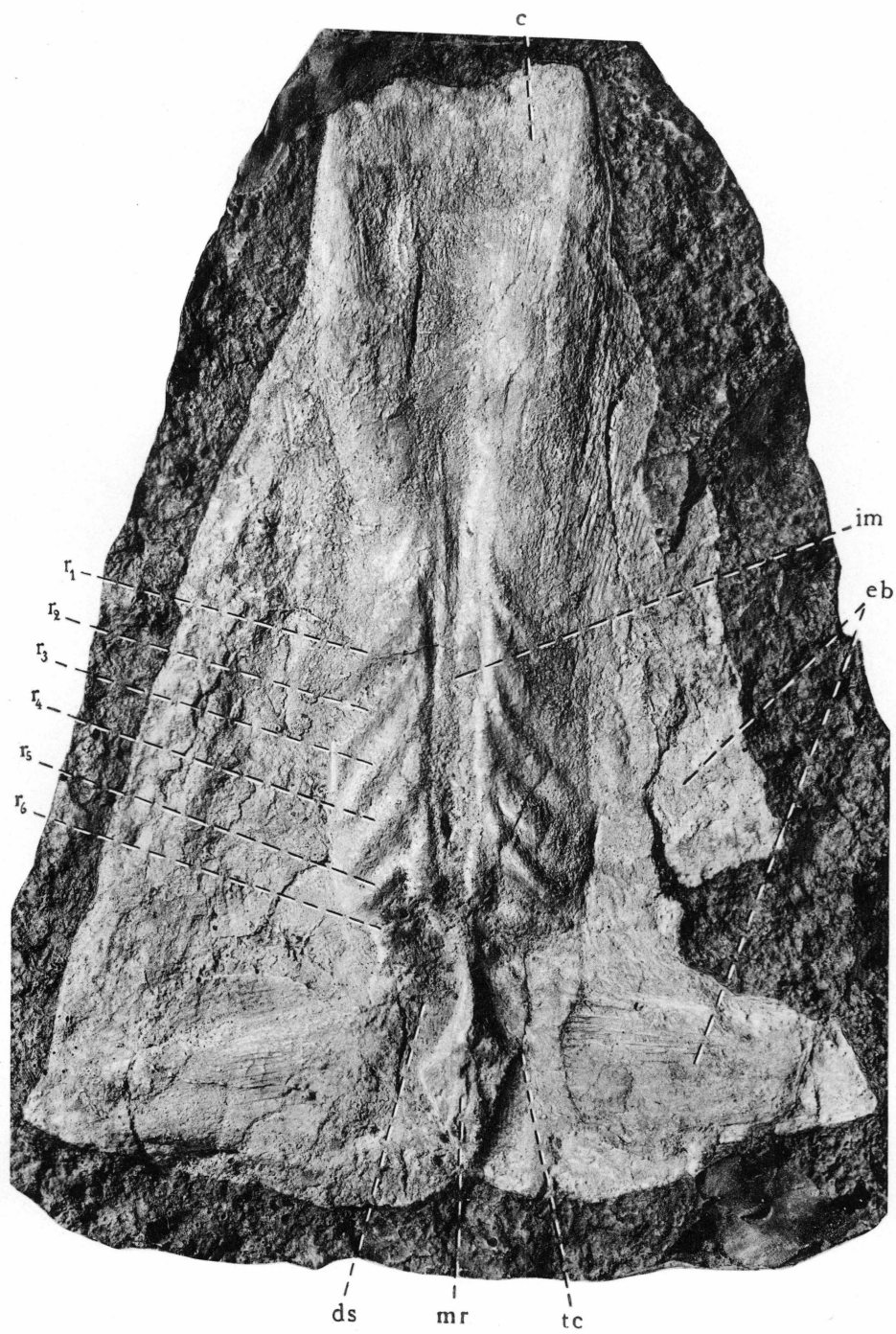


Plate 13.

- Fig. 1. *Asterolepis säve-söderberghi* n. sp. Imperfect mixilateral plate. Medial view. Specimen no. 10.005. $\times 1\frac{1}{2}$ diam.
- Fig. 2. *Homostius kochi* n. sp. Imperfect anterior dorso-lateral plate, preserved as impression of the external face. Specimen no. 10.023. Nat. size.

Explanation of index letters.

Pdl, component representing the posterior dorso-lateral plate; *Pl*, component representing the posterior lateral plate; *al*, area overlapped by the anterior lateral plate; *cg*, condylus for the articulation with the paranuchal plate; *lc*, lateral line groove; *md*, area overlapped by the median dorsal plate; *pr*, anterior, process-like part; *su*, vestigial suture *uff*, dorsal articular fossa; *x*, margin forming the dorsal boundary of the area *al*.

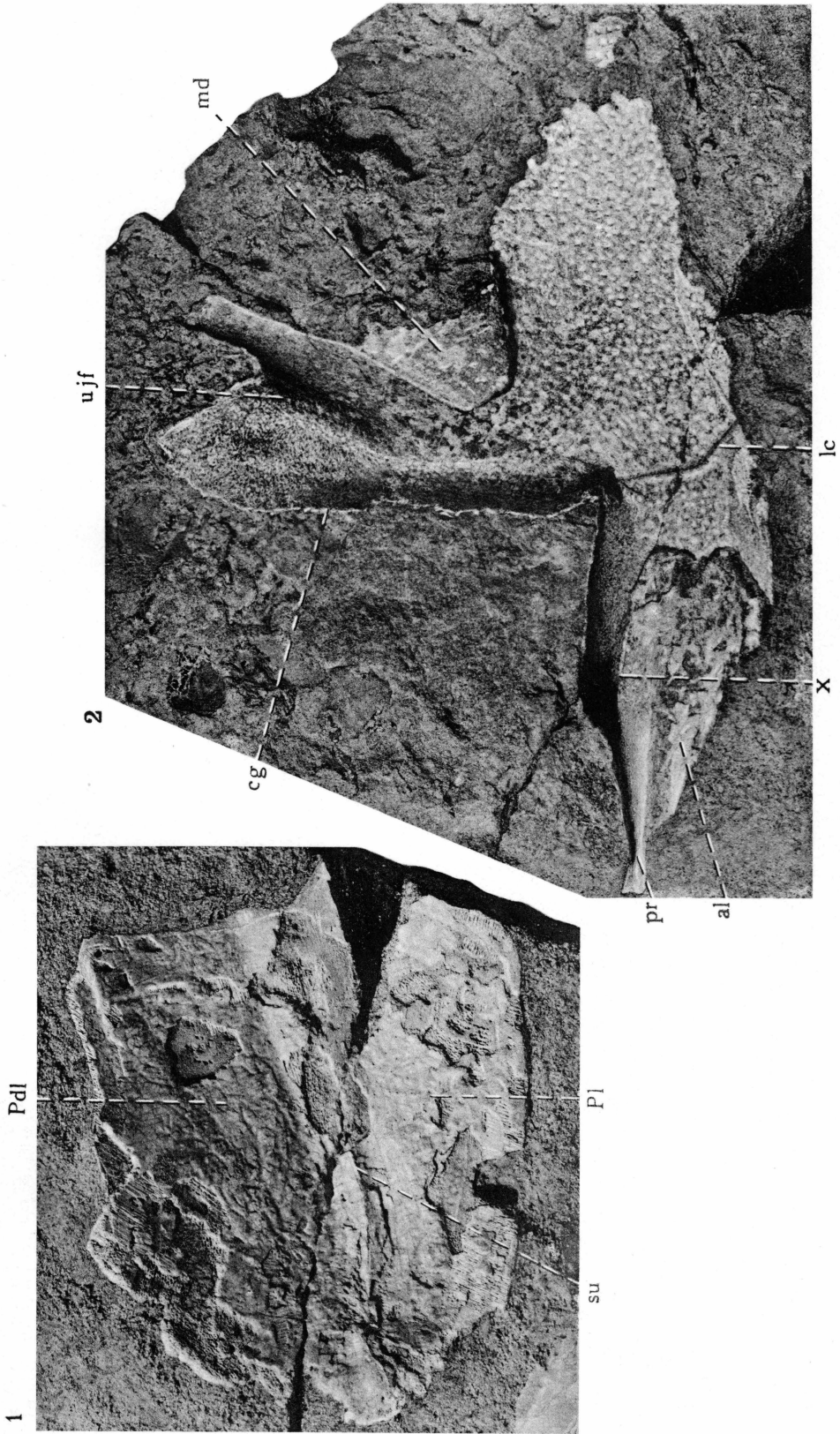


Plate 14.

Heterostius groenlandicus n. sp.

Figs. 1, 2. Part of the bone of the right side arisen by fusion of the anterior dorso-lateral and anterior lateral plates. Specimen no. 10.018. $\frac{2}{3}$ of the nat. size. Fig. 1 shows an imperfect impression of the ornamented area, fig. 2 the main part of the ornament-bearing division of the bone, preserved in part as impression of the medial face.

Explanation of index letters.

a, anterior angle of ornamented area; *b*, posterior angle; *d*, dorsal margin of the exposed ornament-bearing part; *v*, ventral margin; *lc*, lateral line groove; *pr*, anterior ventral process, representing a large antero-ventral part of the anterior lateral plate.

