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SKRIFTER

Nr. 97

THE DOWNTONIAN AND DEVONIAN VERTEBRATES OF SPITSBERGEN. IX

MORPHOLOGIC AND SYSTEMATIC STUDIES OF THE SPITSBERGEN CEPHALASPIDS

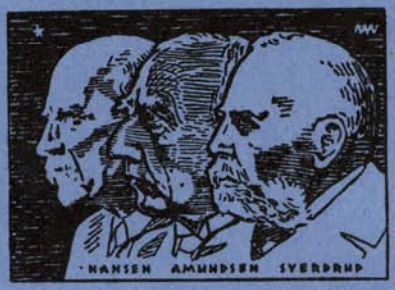
RESULTS OF TH. VOGT'S EXPEDITION 1928
AND THE ENGLISH-NORWEGIAN-SWEDISH EXPEDITION 1939

BY

GUSTAV WÄNGSJÖ

WITH 108 FIGURES IN THE TEXT AND 118 PLATES

B. PLATES



OSLO
I KOMMISJON HOS JACOB DYBWAD
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NORSK POLARINSTITUTT
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Observatoriegaten 1, Oslo

SKRIFTER

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„ 3. WERENSKIOLD, W. and I. OFTEDAL, *A burning Coal Seam at Mt. Pyramide, Spitsbergen.* 1922. Kr. 1,20.
„ 4. WOLLEBÆK, A., *The Spitsbergen Reindeer.* 1926. Kr. 10,00.
„ 5. LYNGE, B., *Lichens from Spitsbergen.* 1924. Kr. 2,50.
„ 6. HOEL, A., *The Coal Deposits and Coal Mining of Svalbard.* 1925. Kr. 10,00. [Out of print.]
„ 7. DAHL, K., *Contributions to the Biology of the Spitsbergen Char.* 1926. Kr. 1,00.
„ 8. HOLTEDAHL, O., *Notes on the Geology of Northwestern Spitsbergen.* 1926. Kr. 5,50.
„ 9. LYNGE, B., *Lichens from Bear Island (Bjørnøya).* 1926. Kr. 5,80.
„ 10. IVERSEN, T., *Hopen (Hope Island), Svalbard.* 1926. Kr. 7,50.
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„ 1—11: Vol. I. From Nr. 12 the papers are only numbered consecutively.

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Nr. 12. STENSIÖ, E. A:SON, *The Downtonian and Devonian Vertebrates of Spitsbergen.* Part I. *Cephalaspidae.* A. Text, and B. Plates. 1927. Kr. 60,00.

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„ 14. KJÆR, R. and J. E. FJELDSTAD, *Tidal Observations in the Arctic.* 1934. Kr. 6,00.
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„ 17. HORN, G., *Beiträge zur Kenntnis der Kohle von Svalbard.* 1928. Kr. 5,50.
„ 18. HOEL, A. und A. K. ORVIN, *Das Festungsprofil auf Spitzbergen. Karbon-Kreide.* I. Vermessungsresultate. 1937. Kr. 4,00.
„ 19. FREBOLD, H., *Das Festungsprofil auf Spitzbergen. Jura und Kreide.* II. *Die Stratigraphie.* 1928. Kr. 3,00.
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„ 23. HEINTZ, A., *Die Downtonischen und Devonischen Vertebraten von Spitzbergen.* III. *Acanthaspida. — Nachtrag.* 1929. Kr. 3,00.
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„ 30. ORVIN, A. K., *Beiträge zur Kenntnis des Oberdevons Ost-Grönlands.* HEINTZ, A., *Oberdevonische Fischreste aus Ost-Grönland.* 1930. Kr. 4,00.
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EMIL MOESTUE A/S BOKTRYKKERI

EXPLANATION OF PLATES

PLATE 1.

Fig. 1. — *Cephalaspis aarhusi* n. sp. (p. 252). Imperfect cephalic shield; dorsal view. ENS no. 487. Holotype. ¾.

Fig. 2. — *Cephalaspis dissimulata* n. sp. (p. 288). Exoskeleton and parts of the endoskeleton of the imperfect right half of a cephalic shield; oblique ventral view. Pal. Mus. Oslo no. 26 (same specimen as in Stensiö 1927, pl. 19:2-3). × 4¾.

adl$_3$, canal for the third lateral branch of the a. adorbitalis; *ds*, dorsal spine; *sel*$_1$*a*, *sel*$_2$*p*, canals for the anterior and the posterior branch of the first nerve to the lateral sensory field; *sel*$_2$—*sel*$_4$, canals for the second to fourth nerves to the lateral sensory field; *vls*$_2$—*vls*$_3$, canals for the second and third dorso-lateral superficial veins.

PLATE 2.

Figs. 1, 2. — *Cephalaspis cradleyensis* Stensiö (p. 255). Cephalic shield in counterpart; in fig. 2 the dorsal exoskeleton is exposed in ventral view (to the right mostly as an impression of the outer face). Pal. Mus. Oslo no. A30024. About × 2½.

dr, dorsal ridge; *sel*$_1$*a*, *sel*$_1$*p*, anterior and posterior branches of the canal for the first nerve of the lateral sensory field; *sel*$_2$, *sel*$_3$, *sel*$_5$, canals for the second, third, and fifth nerves to the lateral sensory field.

PLATE 3.

Figs. 1, 2. — *Cephalaspis acuminata* n. sp. (p. 258). Cephalic shield in counterpart; in fig. 1 the dorsal exoskeleton and a central part of the endoskeleton are split off; the exoskeleton of the ventral side of the cornu is exposed; in fig. 2 the dorsal exoskeleton and parts of the endoskeleton are displayed in ventral view. Stained with alizarin. Pal. Mus. Oslo no. A30025. Holotype. About × 2.

afac, canal for the a. facialis; *ao*, aortal groove; *aoc*, canal through the post-branchial wall for the aorta dorsalis; *bend*, postero-lateral margin of the inter-zonal endoskeleton; *cacu*, canalis acusticus; *gsel*$_1$, depression in the floor of the vestibulum for the ganglion of the first nerve for the lateral sensory field; *nc*, neural canal; *sel*$_1$*a*, *sel*$_1$*p*, anterior and posterior branches of the canal *sel*$_1$; *sel*$_1$—*sel*$_5$, canals for the first to fifth nerves of the lateral sensory field; *vcl*$_1$, canal for the preorbital division of the v. capitis lateralis; *vest*, vestibulum; *vsoc*, occipital vein sinus; V_2, canal for the r. maxillaris V; V_3a, V_3p, canals for the distal and proximal parts, respectively, of the r. mandibularis V; *X*, canal for the n. vagus; *Xld*, canal for a branch of the r. lateralis vagi for the dorsal sensory line; *Xll*, canal for the r. lateralis vagi.

PLATE 4.

Figs. 1, 2. — *Cephalaspis eurhynchus* n. sp. (p. 262). Imperfect cephalic shield in counterpart; in fig. 1 the dorsal exoskeleton and parts of the endoskeleton are exposed in ventral view. Pal. Mus. Oslo no. A30030. Holotype. Stained with alizarin. About 2½.

acar, canal for the a. carotis; *afac,* canal for the a. facialis; *med,* division of the cranial cavity for the medulla oblongata; *orb,* orbit; sel_1a, sel_1p, anterior and posterior branch of the canal for the first nerve of the lateral sensory field; sel_2— sel_5, canals for the second to fifth nerves to the lateral sensory field; *vcl,* canal for the v. capitis lateralis; vcl_1, canal for the preorbital division of the v. capitis lateralis; *vest,* vestibulum; vls_3—vls_6, canals for the third to sixth dorso-lateral superficial veins; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V; $IX + acom$, canal for the n. glossopharyngeus and the a. communicans.

PLATE 5.

Figs. 1, 2. — *Cephalaspis deltoides* n. sp. (p. 271). Rather complete cephalic shield in counterpart; in fig. 1 the dorsal exoskeleton is exposed in ventral view. The part in fig. 2 is stained with alizarin. ENS no. 494. Holotype. Somewhat more than ⅘.

Fig. 3. — *Cephalaspis heintzi* Stensiö (p. 281). Cephalic shield in dorsal view. Exoskeleton partly preserved. ENS no. 498. Stained with alizarin. × 1⅔.

Fig. 4. — *Cephalaspis føyni* n. sp. (p. 265). Imperfect cephalic shield, dorsal view. Pal. Mus. Oslo no. A30031. Holotype. Slightly more than × 2.

Fig. 5. — *Cephalaspis eurhynchus* n. sp. (p. 262). Imperfect cephalic shield, dorsal view. A central and posterior part of the shield is missing. Pal. Mus. Oslo no. A30028. About × 1⅓.

Fig. 6. — *Cephalaspis eurhynchus* n. sp. (p. 262). Part of cephalic shield with complete left cornu; for the rest only the dorsal exoskeleton is preserved. Ventral view. Pal. Mus. Oslo no. A30029. × 1½.

dsf, dorsal sensory field; *ifc,* infraorbital sensory line; ifc_1, anterior division of infraorbital sensory line; *lc,* main lateral sensory line; *orb,* orbit; sel_1a, sel_1p, anterior and posterior branches of the canal for the first nerve of the lateral sensory field; sel_2—sel_5, canals for the second to fifth nerves of the lateral sensory field; *vcl,* canal for the v. capitis lateralis.

PLATE 6.

Figs. 1, 2. — *Cephalaspis divaricata* n. sp. (p. 274). Imperfect cephalic shield in counterpart; in fig. 1 the dorsal exoskeleton is exposed in ventral view; in fig. 2 a central portion of the shield is missing. Stained with alizarin. Pal. Mus. Oslo no. A30032. Holotype. About × 2½.

afac, canal for the a. facialis; ala_3, canal for the third lateral branch of the a. adorbitalis; adl_3, canal for the third anterior dorso-lateral artery; *asc,* canal for the a. scapularis; *bu,* canal for a branch of the r. buccalis lateralis; ifc_1, anterior division of the infraorbital sensory line; na_1, anterior division of the naso-hypophyseal opening; sel_1—sel_5, canals for the first to fifth nerves of the lateral sensory field; vcl_1, canal for the preorbital division of the v. capitis lateralis; vls_3, vls_4, vls_6, canals for the third, fourth and sixth dorso-lateral superficial veins; *vsc,* canal for the v. scapularis; V_2, canal for the r. maxillaris V.

PLATE 7.

Figs. 1, 2. — *Cephalaspis broughi* n. sp. (p. 268). Imperfect cephalic shield in counterpart. Outer parts of dorsal exoskeleton split off and shown in ventral view in fig. 2. ENS no. 493. Holotype. Slightly reduced.

elc, extra-lateral sensory line; *ifc,* infraorbital sensory line; ifc_1, anterior division of infraorbital line; *lc,* main lateral line; *scc,* scapular sensory line; *stc,* supratemporal sensory line.

PLATE 8.

Fig. 1. — *Cephalaspis dissimulata* n. sp. (p. 288). Cephalic shield in dorsal view. Exoskeleton removed. Pal. Mus. Oslo no. A30042. Holotype. × 2⅔.

Fig. 2. — *Cephalaspis oreas* n. sp. (p. 278). Dorsal exoskeleton and parts of endoskeleton of cephalic shield; on the right cornu a small portion of the superficial layer of the ventral exoskeleton is exposed. Ventral view. Pal. Mus. Oslo no. A30036. Holotype. × 3⅖.

acar, canal for the a. carotis; *adsm,* canal for the a. postorbitalis superficialis; *afac,* canal for the a. facialis; adl_4, canal for the fourth lateral branch of the a. adorbitalis; *ala,* canal for an anterior dorso-lateral superficial artery; ala_3, ala_4, canals for the third and fourth dorso-lateral superficial arteries; *ars?,* canal possibly for a superficial branch of the a. rostralis; *asc,* canal for the a. scapularis; *ch,* canal for the notochord; d_1, canal mainly for the ductus endolymphaticus; *nc,* neural canal; *nv?,* canal possibly for the ventral root of a spinal nerve; sel_1a, sel_1p, canals for the anterior and posterior branches of the first nerve for the lateral sensory field; sel_1—sel_5, canals for the first to fifth nerves for the lateral sensory field; *vcer,* canal for a superficial branch of the v. cerebralis anterior; *vcl,* canal for the v. capitis lateralis; vcl_1, canal for the preorbital division of the v. capitis lateralis; *vcos,* canals for superficial branches of the v. cornualis medialis; *vest,* vestibulum; *vizl,* canal for the v. inter-zonalis lateralis; *vla,* basal trunk for some anterior dorso-lateral superficial veins; *vls,* canal for a dorso-lateral superficial vein; vls_2—vls_4, vls_6, canals for the second to fourth and the sixth dorso-lateral superficial veins; *vrd,* canals for superficial branches of the v. rostralis; *vsc,* canal for the v. scapularis; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V; V_3a, V_3p, canals for the distal and proximal parts, respectively, of the r. mandibularis V; *Vm,* canal for the motor roots of the r. maxillaris V; *IX,* canal for the n. glossopharyngeus; *X,* canal for the n. vagus; *Xl,* canal for the r. lateralis vagi.

PLATE 9.

Figs. 1, 2. — *Cephalaspis pygmaea* n. sp. (p. 285). Imperfect cephalic shield in counterpart (fig. 1 in ventral; fig. 2 in dorsal view); dorsal parts of the left side much abraded. Pal. Mus. Oslo no. A30040. Holotype. × 2.

Fig. 3. — *Cephalaspis pygmaea* n. sp. (p. 285). Dorsal exoskeleton of imperfect cephalic shield, ventral view. Pal. Mus. Oslo no. A30041. × 2.

Fig. 4. — *Cephalaspis retusa* n. sp. (p. 299). Cephalic shield. Dorsal exoskeleton and parts of the endoskeleton exposed in ventral view. ENS no. 508. Holotype. × 2.

Fig. 5. — *Cephalaspis retusa* n. sp. (p. 299). Imperfect cephalic shield; exoskeleton and much of the dorso-median endoskeleton lacking. Pal. Mus. Oslo no. 33. × 2.

Figs. 6, 7. — *Cephalaspis retusa* n. sp. (p. 299). Cephalic shield in dorsal view. Exoskeleton and a large part of the dorso-median endoskeleton missing. In fig. 6 an antero-lateral part of the shield is shown, further prepared and on larger scale than in fig. 7. Pal. Mus. Oslo no. 18. Fig. 6, × 4; fig. 7, × 2.

aeffcp, canal for the a. efferens communis (par); *amarg,* canal for the a. marginalis; d_1, canal for the ductus endolymphaticus; *dsf,* dorsal sensory field; k_1, k_2, first and second branchial fossae; *med,* division of the cranial cavity for the medulla oblongata; *nc,* neural canal; *psel,* ridge in the roof of the oralo-branchial chamber caused by the first nerve for the lateral sensory field; pV_2, ridge in the roof of the oralo-branchial chamber caused by the r. maxillaris V; sel_1a, sel_1p, canals for the anterior and posterior branches of the first nerve for the lateral sensory field; sel_3—sel_5, canals for the third to fifth nerves for the lateral sensory field; *vest,* vestibulum; *vmarg,* $vmarg_1$, canals for the v. marginalis; *vrs,* rostral vein sinus; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V.

PLATE 10.

Figs. 1, 2. — *Cephalaspis hoeli* Stensiö (p. 292). Imperfect cephalic shield in counterpart (fig. 1 in ventral, fig. 2 in dorsal view). Pal. Mus. Oslo no. A30050. × 2⅔.

aad, canal for the a. adorbitalis; adl_1—adl_3, canals for the first to third lateral branches of the a. adorbitalis; adl_2b, posterior branch of the canal adl_2; *adsm,* canal for the a. postorbitalis superficialis; *afac,* canal for the a. facialis; ala_2—ala_4, canals for the second to fourth anterior dorso-lateral superficial arteries; *alp,* canal for a posterior dorso-lateral superficial artery; *aor,* aortal ridge; *ifc,* infraorbital sensory line; *lc,* main lateral line; lc_1, anterior division of the main lateral line; *nc,* neural canal; sel_1a, sel_1p, canals for the anterior and posterior branches of the first nerve for the lateral sensory field; sel_1—sel_5, canals for the first to fifth nerves for the lateral sensory field; *stc,* supratemporal sensory line; *vcl,* canal for the v. capitis lateralis; vcl_1, canal for the preorbital division of the v. capitis lateralis; *vds,* canal for a dorso-median superficial branch of the v. capitis lateralis; *vizl,* canal for the v. inter-zonalis lateralis; *vlp,* basal trunk for some posterior dorso-lateral superficial veins; vls_3, vls_4, vls_6, vls_7, canals for the third, fourth, sixth, and seventh dorso-lateral superficial veins; V_1?, canals possibly for branches of the n. profundus; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V; *VII,* canal for the n. facialis.

PLATE 11.

Fig. 1. — *Cephalaspis excellens* n. sp. (p. 308). Outer division of the middle layer of the exoskeleton from the dorsal side of the cephalic shield between pectoral sinus and orbital opening, exposing circum-areal canals and the plexus of intra-areal canals; ventral view. ENS no. 523. About × 18.

Fig. 2. — *Cephalaspis excellens* n. sp. (p. 308). Middle layer of the dorsal exoskeleton just laterally to the orbital opening, ventral view. Pal. Mus. Oslo no. A30062. Holotype (same specimen as in pl. 13—15; 16:1). About × 18.

Fig. 3. — *Cephalaspis hoeli* Stensiö (p. 292). Dorsal exoskeleton of incomplete cephalic shield; ventral view.. Pal. Mus. Oslo no. A30047. × 2½.

Fig. 4. — *Cephalaspis exilis* n. sp. (p. 296). Cephalic shield, dorsal view. Exoskeleton largely removed. Pal. Mus. Oslo no. A30052. × 2½.

Fig. 5. — *Cephalaspis exilis* n. sp. (p. 296). Cephalic shield, dorsal exoskeleton in ventral view. Pal. Mus. Oslo no. A30053. Holotype. × 2½.

adsm, canal for the a. postorbitalis superficialis; *aor,* aortal ridge; *cac,* circumareal canal; *casc,* ascending vascular canals; *csemp,* division of the labyrinth cavity for the posterior semicircular canal; d_1, canal for the ductus endolymphaticus; *iac,* intraareal canals; *ifc,* infraorbital sensory line; ifc_1, anterior division of infraorbital sensory line; *lc,* main lateral line; *mp,* anterior transverse sensory line; *radc,* radiating vascular canal; *scc,* scapular sensory line; sel_1a, sel_1p, anterior and posterior branch of the canal for the first nerve of the lateral sensory field; sel_2—sel_5, canals for the second to fifth nerves for the lateral sensory field; *splx,* canals of the subepidermal vascular plexus; *stc,* supratemporal sensory line; *vcl,* canal for the v. capitis lateralis; *vizm,* canal for the v. inter-zonalis medialis; *vla,* canal for the basal stem of some anterior dorso-lateral superficial veins; *vlp,* canal for the basal stem of some posterior dorso-lateral superficial veins; vls_2—vls_4, canals for the second to fourth dorso-lateral superficial veins; V_2, canal for the r. maxillaris V; *VII,* canal for the n. facialis.

PLATE 12.

Fig. 1. — *Cephalaspis excellens* n. sp. (p. 308). Exoskeleton on distal part of right cornu (lateral margin down). Stained with alizarin. ENS no. 515 (same specimen as in pls. 16:2; 17). About × 18.

Fig. 2. — *Cephalaspis excellens* n. sp. (p. 308). Almost complete cephalic shield, dorsal view. Pal. Mus. Oslo no. A30063 (same specimen as in pl. 40:4-5). × 1½.

Figs. 3, 4. — *Cephalaspis hyperboreus* n. sp. (p. 305). Cephalic shield in counterpart (fig. 3 in ventral, fig. 4 in dorsal view). The part in fig. 4 is stained with alizarin. ENS no. 511. × 1¼.

Fig. 5. — *Cephalaspis vogti* Stensiö (p. 314). Exoskeleton and superficial parts of endoskeleton of right side of imperfect cephalic shield, ventral view. Stained with alizarin. Pal. Mus. Oslo no. A30065 (same specimen as in pl. 18:1). × 1¾.

ac, canal for the a. cornualis; adl_1—adl_3, canals for the first to third lateral branches of the a. adorbitalis; ala_1—ala_4, canals for the first to fourth anterior dorso-lateral superficial arteries; alp_2, canal for the second posterior dorso-lateral superficial artery; *ap,* antorbital prominence; *asc,* canal for the a. scapularis; *bu,* canal for a branch of the r. buccalis; na_1, opening for the hypophyseal duct; na_2, nasal opening; *p,* pore of the mucous canal system; *r,* ridge belonging to the external ornament of the exoskeleton; sel_1a, sel_1p, canals for the anterior and posterior branches of the first nerve for the lateral sensory field; sel_1—sel_5, canals for the first to fifth nerves for the lateral sensory field; *vcm,* canal for the v. cornualis medialis; *vlp,* canal for a basal trunk of some posterior dorso-lateral superficial veins; vls_1—vls_4, vls_6—vls_7, canals for the first to fourth, and the sixth and seventh dorso-lateral superficial veins; *vsc,* canal for the v. scapularis.

PLATE 13.

Cephalaspis excellens n. sp. (p. 308). Cephalic shield in dorsal view. Most of the exoskeleton split off so that many of the cavities and canals in the endoskeleton are exposed. Pal. Mus. Oslo no. A30062. Holotype (same specimen as in pls. 11:2; 14; 15:1-2; 16:1). × 2⅔.

acrl, canal for the a. cristae longitudinalis dorsalis; adl_3, canal for the third lateral branch of the a. adorbitalis; ala_2—ala_4, canals for the second to fourth dorso-lateral superficial arteries; alp_1, canal for the first posterior dorso-lateral superficial artery; *ao,* groove for the aorta dorsalis; *asb,* groove for a. segmental artery, *asc,* canal for the a. scapularis; asc_1, asc_2, canals for the first and second a. scapularis; ibr_1, first interbranchial ridge; *n,* nerve canals (for cutaneous nerves); na_1, opening for the hypo-

physeal sac; na_2, nasal opening; nd_2—nd_3, canals for the dorsal roots of the second and third spinal nerves; nv_2, canal for the ventral root of the second spinal nerve; *phg,* groove probably for the peripharyngeal ciliated groove; sel_1—sel_5, canals for the first to fifth nerves for the lateral sensory field; *vcl,* canal for the v. capitis lateralis; vls_3—vls_6, canals for the third to sixth dorso-lateral superficial veins; *vsc,* canal for the v. scapularis; *vso,* canal for a supraorbital vein; vvm_2—vvm_3, canals for the second and third vertebro-medullar veins; V_2, canal and grooves for the r. maxillaris V; V_3, grooves for the r. mandibularis V.

PLATE 14.

Cephalaspis excellens n. sp. (p. 308). Cephalic shield, dorsal exoskeleton and parts of the endoskeleton in ventral view. Pal. Mus. Oslo no. A30062. Holotype (same specimen as in pls. 11:2; 13; 15:1-2; 16:1). × 2⅔.

$acrl_1$, canal for a ventral branch of the a. cristae dorsalis to the neural canal; adl_4, canal for the fourth lateral branch of the a. adorbitalis; *ala?,* canal possibly for a dorso-lateral superficial artery; *ao,* aortal groove; *asb,* groove for a segmental artery; *asc,* canal for the (second) a. scapularis; ifc_1, anterior division of the infra-orbital sensory line; *n,* n_1, canals and grooves for cutaneous nerves; *nc,* neural canal; sel_1—sel_5, canals for the first to fifth nerves for the lateral sensory field; *vcl,* canal for the v. capitis lateralis; *vlp,* canal for the basal stem of some dorso-lateral superficial veins; vls_3, vls_6, canals for the third and sixth dorso-lateral superficial veins, respectively; *vrd,* canals for dorsal superficial branches of the v. rostralis; *vsc,* canal for the v. scapularis; vvm_2—vvm_3, canals for the second and the third v. vertebro-medullaris; V_3, canal for the r. mandibularis V; *VII,* canal for the n. facialis; *IX,* canal for the n. glossopharyngeus.

PLATE 15.

Figs. 1, 2. — *Cephalaspis excellens* n. sp. (p. 308). Dorso-median part of the cephalic shield, showing cavities and canals in the endoskeleton; ventral (fig. 1) and dorsal (fig. 2) view. A small portion of the dorsal exoskeleton preserved on the right side in fig. 2. Pal. Mus. Oslo no. A30062. Holotype (same specimen as in pls. 11:2; 13—14; 16:1). About × 6.

Figs. 3, 4. — *Cephalaspis excellens* n. sp. (p. 308). Dorso-median part of the cephalic shield; parts of the ethmoidal and orbito-temporal regions and of the roof of the oralo-branchial chamber. Fig. 3, right side in dorsal view; fig. 4, left side in ventral view. ENS no. 522. × 5.

aad, canal for the a. adorbitalis; *acar,* canal for the a. carotis; *acrl,* canal for the a. cristae dorsalis; $acrl_1$, canal for a branch of the a. cristae dorsalis; *adsm,* canal for the a. postorbitalis superficialis; *afac,* canal for the a. facialis; *afp,* canal for a posterior branch of the a. facialis; *ala,* canal for the basal trunk of some anterior dorso-lateral superficial arteries; ala_2, canal for the second anterior dorso-lateral superficial artery; *ao,* aortal groove; *ap,* antorbital prominence; *as,* canal for the a. segmentalis occipitalis; *cacu,* canalis acusticus; *ch,* canal for the notochord; *com,* commissural division for the labyrinth cavity; *cpost,* canal for the a. encephalica posterior; *csema, csemp,* divisions of the labyrinth cavity for the anterior and posterior semicircular canals, respectively; *des,* canal for the nerve of the dorsal sensory field; *dx,* canal for an artery, probably a branch of the a. encephalica posterior; *gch,* trigeminus-lateralis chamber; *hys,* division of the ethmoidal cavity for the hypophyseal sac; ibr_1, first inter-branchial ridge; *lat,* canal for the root fibres of the n. lateralis anterior; *med, mes, met,* divisions of the cranial cavity for the medulla oblongata, the mesencephalon, and the cerebellum, respectively; *n,* canals and grooves for cutaneous nerves; nd_3, canal for the dorsal root of the third spinal nerve; *orb,* orbit; pV_2, ridge in the roof of the oralo-branchial chamber, caused by the r. maxillaris V; sel_1, sel_3—sel_5, canals for the first, and third

to fifth nerves for the lateral sensory field; *soc,* supraorbital sensory line; *su,* canal for the r. ophthalmicus lateralis; *v,* canal for a branch of the v. cerebralis anterior; *vc,* vagus canal; *vcer,* canal for a dorsal branch of the v. cerebralis anterior; *vdsv,* canal for the otical vein; *vcl,* canal for the v. capitis lateralis; *vcl*$_1$*?,* canal possibly for the preorbital division of the v. capitis lateralis; *vest,* vestibulum; *vla, vlp,* canals for basal trunks of some dorso-lateral superficial arteries; *vls*$_2$—*vls*$_4$, canals for the second to fourth dorso-lateral superficial veins; *vso,* canal for a supraorbital vein; *vsoc,* occipital vein sinus; *vvm*$_1$*d, vvm*$_1$*s,* canals for the right and left first vertebro-medullar vein; *vvm*$_2$, canal for the second vertebro-medullar vein; *Vm,* canal for the motor root of the r. maxillaris V; *Vs,* canal for the sensory trigeminus roots; *V*$_2$, canal or groove for the r. maxillaris V; *V*$_3$, canal or groove for the r. mandibularis V; *V*$_3$*p,* canal for the proximal part of the r. mandibularis V; *VII,* canal for the n. facialis; *IX,* canal for the n. glossopharyngeus; *IXl,* canal for a cutaneous branch of the n. glossopharyngeus (probably a r. lateralis); *X,* canal for the n. vagus; *Xl,* canal for the r. lateralis vagi.

PLATE 16.

Fig. 1. — *Cephalaspis excellens* n. sp. (p. 308). Dorso-median part of the cephalic shield, showing impressions of the oralo-branchial chamber as well as cavities and canals in the endoskeleton; dorsal view. Pal. Mus. Oslo no. A30062. Holotype (same specimen as in pls. 11:2; 13—15). About × 5½.

Fig. 2. — *Cephalaspis excellens* n. sp. (p. 308). Cephalic shield in dorsal view. A dorso-median portion of the shield and most of the exoskeleton removed. Stained with alizarin. ENS no. 515 (same specimen as in pls. 12:1; 17). About × 2½.

acar, canal for the a. carotis; *adl*$_3$—*adl*$_4$, canals for the third and fourth lateral branches of the a. adorbitalis; *adl*$_4$*b,* posterior branch of the canal *adl*$_4$; *ala*$_1$—*ala*$_4$, canals for the first to fourth anterior dorso-lateral superficial arteries; *ala*$_{3\text{-}4}$, canal for the common basal stem of the third and fourth anterior dorso-lateral superficial arteries; *alp,* canal for the basal stem of the posterior dorso-lateral superficial arteries; *alp*$_1$, *alp*$_2$, canals for the first and second posterior dorso-lateral superficial arteries; *ars,* canals for superficial branches of the a. rostralis; *as,* canal for the a. segmentalis occipitalis; *cacu,* canalis acusticus; *ch,* canal for the notochord; *cpost,* canal for the a. encephalica posterior; *csemp,* division of the labyrinth cavity for the posterior semicircular canal; *gch,* trigeminus-lateralis chamber; *gsel*$_4$, division in the vestibulum for the ganglion of the fourth nerve for the lateral sensory field; *hys,* division of the ethmoid cavity for the hypophyseal sac; *ibr*$_1$—*ibr*$_2$, first and second interbranchial ridges; *n,* canals for somatic sensory nerve branches; *pg,* partitions from the floor of the vestibulum, partly subdividing this cavity in compartments for the ganglia of the nerves for the lateral sensory field; *sel*$_1$—*sel*$_5$, canals for the first to fifth nerves for the lateral sensory field; *vc,* vagus canal; *vcl,* canal for the v. capitis lateralis; *vcl*$_1$, canal for the preorbital division of the v. capitis lateralis; *vlabp,* canal for the v. labyrinthi posterior; *vlp,* canal for the common basal stem of some posterior dorso-lateral superficial veins; *vls*$_1$—*vls*$_7$, canals for the first to seventh dorso-lateral superficial veins; *vrd,* canals for dorsal superficial branches of the v. rostralis; *Vm,* canal for the motor roots of the r. maxillaris V; *V*$_2$, canal for the r. maxillaris V; *V*$_3$, canal for the r. mandibularis V; *V*$_3$*p,* proximal canal for the r. mandibularis V; *IX,* canal for the n. glossopharyngeus; *X,* canal for the n. vagus; *Xbr*$_1$, canal for the r. branchialis 1 of the n. vagus.

PLATE 17.

Cephalaspis excellens n. sp. (p. 308) Dorso-median part of a cephalic shield, showing cavities and canals in the endoskeleton; ventral view. Stained with alizarin. ENS no. 515 (same specimen as in pls. 12:1; 16:2). × 5.

acar, canal for the a. carotis; *afac,* canal for the a. facialis; *ao,* aortal groove; *aor,* aortal ridge; *cacu,* canalis acusticus; *csemp,* division of the labyrinth cavity for the posterior semicircular canal; *gch,* trigeminus-lateralis chamber; *hys,* division of the ethmoid cavity for the hypophyseal sac; *lat,* canal for the root fibres of the n. lateralis anterior; *nc,* neural canal; *vc,* vagus canal; *vcl,* canal for the v. capitis lateralis; *vlp,* canal for the common basal stem of some posterior dorso-lateral superficial veins; vls_3, canal for the third dorso-lateral superficial vein; *vsoc,* occipital vein sinus; *vvm,* canal for a v. vertebro-medullaris; *Vm,* canal for the motor root of the r. maxillaris V; *Vs,* canal for the sensory trigeminus roots; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V; V_3p, canal for the proximal division of the r. mandibularis V; *Xl,* canal for the r. lateralis vagi.

PLATE 18.

Fig. 1. — *Cephalaspis vogti* Stensiö (p. 314). Part of the right shoulder-girdle. To the left the ventral side of the cornu is exposed, to the right a ventral portion of the shield is removed so that parts of the endoskeleton are seen. Ventral view. Stained with alizarin. Pal. Mus. Oslo no. A30065 (same specimen as in pl. 12:5). × 4.

Fig. 2. — *Cephalaspis eurynotus* n. sp. (p. 320). Cephalic shield in dorsal view: a postero-median portion of the inter-zonal part and a postero-lateral part of the left cornu are missing. ENS no. 531. Holotype. × 1⅗.

a, groove for an artery in the roof of the marginal vein sinus, coming from the a. marginalis; *ac,* canal for the a. cornualis; *aca,* canal for the a. cornualis accessoria; *acant,* canal for an anterior ventral branch of the a. cornualis; *amarg,* canal for the a. marginalis; *asc,* canal for the a. scapularis; na_2, nasal opening; *nz,* canal for a nerve to the pectoral fin; *ov,* opening in the postbranchial wall from the marginal vein sinus to the trunk cavity; sel_5, fifth nerve canal for the lateral sensory field; *vbr,* canal for the v. brachialis; *vclat,* canal for the v. cornualis lateralis; *vcm,* canal for the v. cornualis medialis; *vlp,* canal for the common basal stem of some posterior dorso-lateral superficial veins; *vmarg,* canal for the v. marginalis; *vsc,* canal for the v. scapularis; *vsmarg,* marginal vein sinus.

PLATE 19.

Fig. 1. — *Cephalaspis hyperboreus* n. sp. (p. 305). Cephalic shield in dorsal view. Basal layer of the exoskeleton preserved, partly concealing the canals in the endoskeleton. ENS no. 512. Holotype. × 1⅗.

Fig. 2. — *Cephalaspis powriei* Lank. var. *polaris* n. var. (p. 317). Imperfect cephalic shield in dorsal view; a dorso-median portion missing. ENS no. 530. Nat. size.

aad, canal for the a. adorbitalis; adl_2—adl_3, canals for the second and third lateral branches of the a. adorbitalis; *afac,* canal for the a. facialis; *afp,* posterior branch of the canal *afac; sel*$_1$*a, sel*$_1$*p,* canals for the anterior and posterior branches of the first nerve for the lateral sensory field; sel_2—sel_5, canals for the second to fifth nerves for the lateral sensory field; vcl_1, canal for the preorbital division of the v. capitis lateralis; *vlp,* canal for the common basal trunk of the fifth and sixth dorso-lateral superficial veins; vls_2—vls_4, canals for the second to fourth dorso-lateral superficial veins; V_2, canal for the r. maxillaris V.

PLATE 20.

Cephalaspis recticornis n. sp. (p. 323). ENS no. 533. Holotype (same specimen as in pl. 114:3).

Fig. 1. — Part of the ventral rim from the antero-lateral margin of the cephalic shield, showing the outer face of the superficial layer of the exoskeleton. Ventral view. About × 5.

Fig. 2. — Cephalic shield in dorsal view; a postero-median portion, parts of the left antero-lateral margin and tips of the cornua missing. ¾.

p, pores of the mucous canal system; *sel*$_1$*a, sel*$_1$*p,* canals for the anterior and posterior branches of the first nerve for the lateral sensory field; *sel*$_2$, *sel*$_4$, *sel*$_5$, canals for the second, fourth and fifth nerves for the lateral sensory field.

PLATE 21.

Fig. 1. — *Cephalaspis recticornis* n. sp. (p. 323). Imperfect cephalic shield (most of the right side missing), consisting mainly of the dorsal exoskeleton. Ventral view. ENS no. 534. ⅔.

Fig. 2. — *Cephalaspis eurynotus* n. sp. (p. 320). Part of the dorsal exoskeleton near the dorsal sensory field; ventral view. Pal. Mus. Oslo no. A30066. About × 6.

Fig. 3. — *Cephalaspis recticornis* n. sp. (p. 323). Part of the dorsal exoskeleton near the dorsal sensory field; ventral view. ENS no. 535. About × 6.

casc, ascending vascular canals; *radc,* radiating vascular canals.

PLATE 22.

Figs. 1, 2. — *Cephalaspis platycephalus* n. sp. (p. 327). Cephalic shield in counterpart (fig. 1 in dorsal, fig. 2 in ventral view). Pal. Mus. Oslo no. A30067. Holotype. × 1½.

dr, dorsal ridge; *ifc,* infraorbital sensory line; *lc,* main lateral line.

PLATE 23.

Fig. 1. — *Cephalaspis sinuata* n. sp. (p. 334). Imperfect cephalic shield in dorsal view; most of the exoskeleton split off. ENS no. 545. About × 1⅔.

Fig. 2. — *Cephalaspis verruculosa* n. sp. (p. 330). Imperfect cephalic shield, dorsal view. Exoskeleton partly preserved on the inter-zonal part. Pal. Mus. Oslo no. A30069. Holotype. About × 1⅔.

aad, canal for the a. adorbitalis; *adl*$_1$—*adl*$_4$, canals for the first to fourth lateral branches of the a. adorbitalis; *afac,* canal for the a. facialis; *ala,* canal for the basal trunk of the anterior dorso-lateral superficial arteries; *ala*$_1$—*ala*$_4$, canals for the first to fourth anterior dorso-lateral superficial arteries; *d*$_1$, canal for the ductus endolymphaticus; *sel*$_1$*a, sel*$_1$*p,* canals for the anterior and posterior branches of the first nerve for the lateral sensory field; *sel*$_2$—*sel*$_5$, canals for the second to fifth nerves for lateral sensory field; *vcl*$_1$, canal for the preorbital division of the v. capitis lateralis; *vcos,* canal for a superficial branch of the v. cornualis medialis; *vizl,* canal for the v. inter-zonalis lateralis; *vlp,* canal for the basal trunk of some of the posterior dorso-lateral superficial veins; *vls*$_1$—*vls*$_7$, canals for the first to seventh dorso-lateral superficial veins; *vsc,* canal for the v. scapularis; *V*$_2$, canal for the r. maxillaris V; *V*$_3$*?,* canal, possibly for the r. mandibularis V.

PLATE 24.

Fig. 1. — *Cephalaspis verruculosa* n. sp. (p. 330). Fairly complete cephalic shield in dorsal view; distal part of left cornu missing. ENS no. 540. × 1½.

Fig. 2. — *Cephalaspis verruculosa* n. sp. (p. 330). Imperfect cephalic shield in dorsal view; a postero-lateral part of the shield is missing. ENS no. 539 (same specimen as in pl. 114:2). × 1½.

adl$_4$*?*, canal for a lateral branch (possibly the fourth one) of the a. adorbitalis; *adsm*, canal for the a. postorbitalis superficialis; *vizm*, canal for the v. inter-zonalis medialis.

PLATE 25.

Fig. 1. — *Cephalaspis arcticus* Stensiö (p. 342). Imperfect, much weathered and abraded cephalic shield in dorsal view. ENS no. 555. × 1⅓.

Figs. 2, 3. — *Cephalaspis sinuata* n. sp. (p. 334). Imperfect cephalic shield in counterpart; fig. 2 in dorsal view; fig. 3 dorsal exoskeleton in ventral view. A large antero-lateral part of the shield missing. The shield in fig. 2 is stained with alizarin. ENS no. 546. Holotype. × 1⅓.

adl$_2$, canal for the second lateral branch of the a. adorbitalis; *ala*$_1$—*ala*$_2$, canals for the first and second anterior dorso-lateral superficial arteries; *dsp*, dorsal spine; *sel*$_1$*a*, canal for the anterior branch of the first nerve for the lateral sensory field; *vls*$_3$—*vls*$_6$, canals for the third to sixth dorso-lateral superficial veins; *V*$_2$, canal for the r. maxillaris V.

PLATE 26.

Fig. 1. — *Cephalaspis tenuicornis* n. sp. (p. 338). Cephalic shield in dorsal view. A postero-median portion of the inter-zonal part and some peripheral parts on the left side of the shield are missing. Exoskeleton partly preserved. ENS no. 552. Holotype. Somewhat more than ½.

Fig. 2. — *Cephalaspis crofti* n. sp. (p. 344). Much abraded cephalic shield, dorsal view. A postero-median portion of the inter-zonal part is missing. Pal. Mus. Oslo no. A30084. Holotype. ¾.

aor, aortal ridge; *ba*, buccal area; *dext*, groove for the efferent external duct from the second gill-sac; *ibr*$_3$, third interbranchial ridge; *k*$_1$, first branchial fossa; *velr*, velar ridge.

PLATE 27.

Fig. 1. — *Cephalaspis exilis* n. sp. (p. 296). Cephalic shield, lacking the cornua and the most rostral part; preserved mainly as an impression of the oralo-branchial chamber. Dorsal view. ENS no. 505 (same specimen as in pl. 34:1). × 5.

Fig. 2. — *Cephalaspis signata* n. sp. (p. 347). Antero-lateral part of an impression of the oralo-branchial chamber (part of the same shield as in pl. 29:2 but more enlarged). Pal. Mus. Oslo no. A30085. Holotype (same specimen as in pls. 28:1; 29—31; 32:1-3; 35:3; 114:1). Coated with ammonium chloride. × 2½.

a, groove for a branch of the a. marginalis; *a* + *IXa*, groove for an efferent arteriole and for a branch of the n. glossopharyngeus; *aa*, grooves for afferent arterioles; *aaff*, groove for an afferent branchial artery; *aaff?*, groove possibly for an afferent branchial artery or a branch of it; *acar*, canal for the a. carotis; *aeff*$_1$—*aeff*$_8$, canals or grooves for the aa. branchiales efferentes 1—8; *aeffc*, canal for the a. branchialis efferens communis; *amarg*, canal for the a. marginalis; *ao*, aortal canal; *aor*, aortal ridge; *aq*$_1$, *aq*$_2$, groove probably for an efferent duct in the first and second gill-sacs; *arostr*, groove for the a. rostralis; *asp*, groove for the a. spiracularis;

asubcl, canal for the a. subclavia; *dext,* groove for the external efferent duct from the first gill-sac; *dexta,* impression of an unknown structure near the external duct; *gl,* ridges in the first branchial fossa, probably for the attachment of the gill-lamellae; k_1—k_6, k_9, first to sixth, and ninth branchial fossae; *kx,* fossa behind the last branchial fossa; *orb,* orbit; *pbg,* groove probably for the peripharyngeal ciliated groove; *praud,* impression of the otical prominence; *psel,* impression caused by a ridge enclosing the first nerve canal to the lateral sensory field; pV_2, impression caused by a ridge enclosing the canal for the r. maxillaris V; th_2, th_3, impressions in the roof of the second and third branchial fossae probably of the gl. thymus; v_2—v_6, canals for the vv. transversales ventrales 2—6; *vmarg,* $vmarg_1$, canals for the v. marginalis; *vnbr,* grooves for the vv. nutritiae branchiales; *vsmarg,* marginal vein sinus; *vx,* canal for the last ventral transversal vein; V_2, V_2a—V_2d, grooves for branches of the r. maxillaris V; V_3, V_3a—V_3c, grooves for branches of the r. mandibularis V; *VII, VIIa—VIId,* grooves for the n.facialis and its branches; *IX,* groove for the n. glossopharyngeus; *IX + acom,* canal (or groove) for the n. glossopharyngeus and the a. communicans; *IXb—IXd,* grooves for branches of the n. glossopharyngeus; *Xbr,* canal for some posterior branchial rami of the n. vagus; Xbr_1, canal for the first branchial ramus of the n. vagus.

PLATE 28.

Fig. 1. — *Cephalaspis signata* n. sp. (p. 347). Imperfect cephalic shield (most of the left side and distal parts of the right cornu missing); dorsal exoskeleton in ventral view. Pal. Mus. Oslo no. A30085. Holotype (same specimen as in pls. 27:2; 29—31; 32:1-3; 35:3; 114:1). Somewhat more than nat. size.

Fig. 2. — *Cephalaspis ibex* n. sp. (p. 360). Right shoulder-girdle seen from behind; cornu, in cross-section, to the right. Pal. Mus. Oslo no. A30090. Holotype (same specimen as in pls. 28:3; 36:1; 37—38). Slightly less than × 3½.

Fig. 3. — *Cephalaspis ibex* n. sp. (p. 360). Cephalic shield in lateral view; distal parts of dorsal spine and the right cornu missing. Pal. Mus. Oslo no. A30090. Holotype (same specimen as in pls. 28:2; 36:1, 37—38). Somewhat more than nat. size.

abr, canal for the a. brachialis; abr_1, canal for a branch of the a. brachialis; *ac,* canal for the a. cornualis; *dsf,* dorsal sensory field; *elc,* extra-lateral line; *ifc,* infraorbital sensory line; ifc_1, anterior division of the infraorbital sensory line; *lc,* main lateral line; *mp,* anterior transverse sensory line; na_2, posterior division of the naso-hypophyseal opening; *nz,* canal for a nerve to the pectoral fin; *pvdsp,* postero-ventral angle of the dorsal spine; *stc,* supratemporal sensory line; *v,* canal probably for a vein; vbr_1, canal for the main v. brachialis; vbr_2, canal for a secondary v. brachialis; *vclat,* canal for the v. cornualis lateralis; *vcm,* canal for the v. cornualis medialis; *vcos,* canal for a superficial branch of the v. cornualis medialis; *vsc,* canals for branches of the v. scapularis; *vsc?,* canal possibly for the v. scapularis.

PLATE 29.

Cephalaspis signata n. sp. (p. 347). Pal. Mus. Oslo no. A30085. Holotype (same specimen as in pls. 27:2; 28:1; 30—31; 32:1-3; 35:3; 114:1).

Fig. 1. — Imperfect cephalic shield in dorsal view. Exoskeleton partly removed. Nat. size.

Fig. 2. — Mainly impression of the roof of the oralo-branchial chamber; dorsal view (cf. pl. 27:2). × 1⅗.

Fig. 3. — Part of the right postbranchial wall, the perichondrial bone-layer of the posterior side and some canals in the wall, seen from in front. × 3.

aaff, groove for an afferent branchial artery; *adl*$_1$—*adl*$_2$, canals for the first and second lateral branches of the a. adorbitalis; *adsp?,* canal possibly for an artery in the dorsal spine; *aeff*$_1$—*aeff*$_5$, grooves and canals for the aa. branchiales efferentes 1—5; *afc,* groove for some posterior branchial arteries (probably the common trunk for the aa. efferentes 6—8); *ala*$_1$—*ala*$_4$, canals for the first to fourth anterior dorso-lateral superficial arteries; *alp,* canal for a posterior dorso-lateral superficial artery, *alp*$_1$, *alp*$_2$, canals for the first and second posterior dorso-lateral superficial arteries; *amarg,* canal for the a. marginalis; *apw,* grooves (or canals) for branches of the a. subclavia to the posterior side of the postbranchial wall; *aq*$_1$—*aq*$_3$, grooves probably for an efferent duct in the first to third gill-sacs; *ard*$_1$, grooves for a dorsal branch of the unpaired a. rostralis to the roof of the oralo-branchial chamber; *arostr,* groove and canal for the paired a. rostralis; *asp,* groove for the a. spiracularis; *asubcl,* canal for the a. subclavia; *avs,* canals for a branch of the a. subclavia to the ventral side of the shoulder-girdle; *aX,* groove for the a. branchialis efferens 5 and a branch of the n. vagus; *a*$_1$*X,* canal for the a. branchialis efferens 5 and the r. branchialis 2 vagi; *a*$_2$*X,* canal for the r. branchialis 3 vagi and probably the common basal stem of the three posterior efferent arteries; *d*$_1$, canal for the ductus endolymphaticus; *gl,* ridges in the branchial fossa probably for the attachment of the gill-lamellae; *ibr*$_4$, fourth interbranchial ridge; *igl,* pits or grooves between the ridges *gl; orb,* orbit; *pbg,* groove probably for the peripharyngeal ciliated groove; *th*$_1$—*th*$_3$, impressions in the branchial fossae 1—3 probably caused by the gl. thymus; *vbp,* grooves for the v. bucco-pharyngealis; *vcl*$_1$, canal for the preorbital division of the v. capitis lateralis; *vest,* vestibulum; *vizl,* canal for the v. inter-zonalis lateralis; *vls*$_1$—*vls*$_8$, canals for the first to eighth dorso-lateral superficial veins; *vmarg,* canal for the v. marginalis; *vnbr,* canals for the vv. nutritiae branchiales; *vr,* canal for the v. rostralis; *vsd*$_1$,*vsd*$_4$, canals for dorsal segmental veins; *vvs,* canal for a branch of the v. marginalis to the ventral side of the shouldergirdle; *V*$_2$, *V*$_2$*a*—*V*$_2$*d,* grooves for branches of the r. maxillaris V; *V*$_3$, *V*$_3$*b,* grooves for branches of the r. mandibularis V; *VII,* groove for the n. facialis, *IX* + *acom,* canal (or groove) for the n. glossopharyngeus and the a. communicans; *Xbr*$_1$, *Xbr*$_1$*a, Xbr*$_{2\text{-}3}$, *Xbr*$_3$, grooves for branchial rami of the n. vagus; *X*$_1$, canal for a branch of the n. vagus.

PLATE 30.

Cephalaspis signata n. sp. (p. 347). Pal. Mus. Oslo no. A30085. Holotype (same specimen as in pls. 27:2; 28:1; 29; 31; 32:1-3; 35:3; 114:1).

Fig. 1. — Rostral part of the cephalic shield with most anterior part of the roof of the oralo-branchial chamber. Ventral view. × 1⅗.

Fig. 2. — Right shoulder-girdle, seen from behind; inter-zonal part to the left; a ventro-median part removed so that some canals are exposed. × 4.

Fig. 3. — Dorso-median part of the cephalic shield, transversely sectioned on level with the posterior part of the orbital opening; seen from behind. About × 2½.

Fig. 4. — Part of the occipital region of the endocranium with certain cavities and canals; dorsal view. × 3.

abr, canal for the a. brachialis; *abr*$_1$, canal for a branch of the a. brachialis; *acom,* canal for the a. communicans; *adsm,* canal for the a. postorbitalis superficialis; *adspd, adsps,* canals for the right and left base vessels, respectively, of the a. spinae dorsalis; *aeffcp,* groove for the a. afferens communis (par); *amarg,* canal for the a. marginalis; *ao,* aortal canal; *aor,* aortal ridge; *ap,* antorbital prominence; *arostr,* grooves for the paired a. rostralis; *as,* canal for the a. segmentalis occipitalis; *avest,* canals for the aa. vestibulares; *com,* commissural division of the labyrinth cavity; *des,* canal for the nerve of the dorsal sensory field; *dx,* canal for an artery (probably a branch of the a. encephalica posterior); *igl,* grooves between the ridges in the branchial fossae which probably served as an attachment for the gill-lamellae; *lat,* canal for the root fibres of the n. lateralis anterior; *med, met,* divisions of the cranial cavity for the medulla oblongata and the cerebellum, respectively; *orb,* orbit; *sel*$_3$—*sel*$_5$, canals for the third to fifth nerves of the lateral sensory field; *t,* canal possibly for a branch of the a. encephalica

posterior; th_1, impression in the first branchial fossa, probably caused by the gl.thymus; *v,* vein canal; *vbr,* canal for the v. brachialis; *vc,* vagus canal; *vcl,* canal for the v. capitis lateralis; *vest,* vestibulum; *vlabp?,* canal possibly for the v. labyrinthi posterior; *vmarg,* canal for the v. marginalis; *vmargd,* canal for a dorsal branch of the v. marginalis; *vr,* canal for the v.rostralis; *vsc,* canal for the v. scapularis; V_2, grooves for branches of the r. maxillaris V; V_2s, canal for a cutaneous branch of the r. maxillaris V; IX_1, canal for the r. branchialis glossopharyngei; *X,* canal for the n.vagus; Xbr_2, canal for the r. branchialis 2 of the n. vagus.

PLATE 31.

Cephalaspis signata n. sp. (p. 347). Pal. Mus. Oslo no. A30085. Holotype (same specimen as in pls. 27:2; 28:1; 29—30; 32:1-3; 35:3; 114:1).

Fig. 1. — Dorso-median part of the cephalic shield, transversely sectioned mainly on level with the middle part of the left orbital opening; to the left a part of the occipital region is exposed seen from in front. About × 2½.

Fig. 2. — Cephalic shield, oblique transverse section, to the left through the occipital region, to the right through the orbito-temporal region; below, to the right, a part of the postbranchial wall is seen. View from in front. About × 2½.

Fig. 3. — Ventro-median portion of the same part as in fig. 2; a small median piece removed. About × 2½.

Fig. 4. — A dorso-median portion of the left side of the shield, showing parts of the inter-zonal endoskeleton, the occipital region and the postbranchial wall; some parts removed so that certain canals are exposed. Postero-ventral view. About × 3.

Fig. 5. — Antero-ventral part of the same portion as in fig. 4 with some ventral parts of the postbranchial wall removed. Oblique ventral view. About × 3.

Fig. 6. — Same as in fig. 5 but an additional part of the postbranchial wall removed. About × 3.

a, arterial canals; *a + Xbr,* canal for the a. branchialis efferens 5 and the rami branchiales 2—3 of the n. vagus; *acom,* canal for the a. communicans; *adsm,* canal for the a. postorbitalis superficialis; *adspd,* origin of the canal for the right base vessel of the a. spinae dorsalis; *aeffc,* canal for the a. branchialis efferens communis (par); $aeff_5$, canal for the a. branchialis efferens 5; *ampa,* division of the labyrinth cavity for the ampulla anterior; *ao,* aortal canal or groove; *apwd, apwv,* canals for dorsal and ventral branches of the a. subclavia to the postbranchial wall; *as,* canal for the a. segmentalis occipitalis; as_1, canal for the distal part of the a. segmentalis occipitalis; *asubcl,* canal for the a. subclavia; *asubclx,* groove in the canal for the a. subclavia (of unknown significance); *cer,* division of the cranial cavity for the brain (transitional part between the diencephalon and mesencephalon); *ds,* dorsum sellae; *dsv,* groove in the median wall of the labyrinth cavity for the nerve to the dorsal sensory field; *gch,* trigeminus-lateralis chamber; $gsel_1$, division of the labyrinth cavity for the ganglion of the first nerve to the lateral sensory field; *lat,* canal for the root fibres of the n. lateralis anterior; nd_1, canal for the dorsal root of the first spinal nerve; nv_1, canal for the ventral root of the first spinal nerve; *pin,* canal for the saccus dorsalis and the pineal organ; sel_1, sel_2, canals for the first and second nerves to the lateral sensory field; *v,* vein canal; *vc,* vagus canal; *vcl,* canal for the v. capitis lateralis; *vct,* canal for a collector vein of the three first vertebro-medullar veins; *vest,* vestibulum; *vlabp,* canal for the v. labyrinthi posterior; vls_3, canal for the third dorso-lateral superficial vein; *vsocv,* ventral canals from the occipital vein sinus, transmitting veins from the trunk cavity; *vvma, vvmb,* canals for an anterior and posterior vessel forming the first vertebro-medullar vein; vvm_2, vvm_3, canals for the second and third vertebro-medullar veins; *x,* canal for unknown significance; *IV,* canal for the n. trochlearis; *Vm,* canal for the motor root of the r. maxillaris V; *Vs,* canal for the sensory root of the n. trige-

minus proper; *Vsa,* canal for the sensory root of the n. profundus; V_3, canal for the r. mandibularis V; V_3p, canal for the proximal division of the r. mandibularis V; *IX,* canal for the proximal division of the n. glossopharyngeus; IX_1, canal for the branchial ramus of the n. glossopharyngeus; *IXla, IXlp,* canals for somatic-sensory branches of the n. glossopharyngeus; *X,* canal for the n. vagus; X_1, X_2, canals for branches of the n. vagus; $X_{1\text{-}2}$, connecting canal between the canals X_1 and X_2; *Xbr,* canal for some posterior rami branchiales of the n. vagus; Xbr_1—Xbr_2, canals for the r. branchialis 1 and 2 of the n. vagus; *Xl,* canal for the r. lateralis vagi.

PLATE 32.

Figs. 1—3. — *Cephalaspis signata* n. sp. (p. 347). Pal. Mus. Oslo no. A30085. Holotype (same specimen as in pls. 27:2; 28:1; 29—31; 35:3; 114:1).

Fig. 1. — Dorso-median part of the cephalic shield, sectioned longitudinally along the lateral margin of the endocranium. A postero-lateral portion of the otical region removed in order to show some deeply situated canals. Inter-zonal endoskeleton below; a median part removed. × 3.

Fig. 2. — Dorso-median part of the endoskeleton in ventral view, some ventral parts removed. × 3⅕.

Fig. 3. — Antero-lateral portion of the part in fig. 2; some ventral parts removed. × 2½.

Fig. 4. — *Cephalaspis hastata* n. sp. ? (p. 356). Postero-dorso-median portion of the cephalic shield; a large postero-median part removed. Oblique posterior view. Stained with alizarin. Pal. Mus. Oslo no. A30089 (same specimen as in pl. 33:1). × 3⅕.

a, canal for a branch of the a. communicans; *acom,* canal for the a. communicans; *adsp,* canal for the a. spinae dorsalis; *adspx,* canal for a lateral branch of the a. spinae dorsalis; $aeff_1$—$aeff_2$, grooves for the aa. branchiales efferentes 1—2; *ala,* canal for the basal trunk of the anterior dorso-lateral superficial arteries; *ao,* aortal groove; *as, as*$_1$, canals for the a. segmentalis occipitalis; *avest,* canal for the a. vestibularis; *des,* canals for the peripheral branches of the nerve to the dorsal sensory field; d_1, canal for the ductus endolymphaticus; $gsel_1$, division of the labyrinth cavity for the ganglion of the first nerve to the lateral sensory field; ibr_1—ibr_2, first and second interbranchial ridges; *n,* canals for cutaneous nerves; *nc,* neural groove; *nd,* canal for the dorsal root of a spinal nerve; nd_1, canal for the dorsal root of the first spinal nerve; nv_1, canals for the ventral root of the first spinal nerve; *orb,* orbit; *prorb,* orbital prominence; pV_2, ridge caused by the r. maxillaris V; sel_1—sel_5, canals for the first to fifth nerves to the lateral sensory field; *v,* canal for a vein from the vagus ganglion complex to the occipital vein sinus; *vcl,* canal for the v. capitis lateralis; *vct,* canal for a collector vein for the anterior vertebro-medullar veins; *vest,* vestibulum; *vizl,* canal for the v. inter-zonalis lateralis; *vizm,* canal for the v. inter-zonalis medialis; vls_3—vls_6, canals for the third to sixth dorso-lateral superficial veins; *vnc,* canal possibly for a transformed anterior vertebro-medullar vein; *vsocv,* canals for veins from the trunk cavity to the occipital vein sinus; *vvm,* canal for a vertebro-medullar vein; *vvma, vvmb,* canals for two vessels which formed the first vertebro-medullar vein; *VII,* canal for the n. facialis; $IX + acom$, canal common for the branchial ramus of the n. glossopharyngeus and the a. communicans; IX_1, canal for the branchial ramus of the n. glossopharyngeus; *IXl,* canal for a cutaneous branch of the n. glossopharyngeus (consisting of or including lateralis fibres); *X,* canal for the n. vagus; *Xl,* canal for the r. lateralis vagi.

PLATE 33.

Fig. 1. — *Cephalaspis hastata* n. sp. ? (p. 356). Dorso-median part of the cephalic shield in lateral view; some posterior and lateral parts removed. Stained with alizarin. Pal. Mus. Oslo no. A30089 (same specimen as in pl. 32:4). × 3⅕.

Fig. 2. — *Cephalaspis corystis* n. sp. (p. 352). Imperfect cephalic shield; mainly the dorsal exoskeleton but also some parts of the rostral visceral endoskeleton displayed. Pal. Mus. Oslo no. A30088. Holotype (same specimen as in pl. 34:2-3). ⅔.

Fig. 3. — *Cephalaspis signata* n. sp. (p. 347). Much abraded incomplete cephalic shield; dorsal view. Pal. Mus. Oslo no. A30086. ⅘.

adspd, adsps, canals for the right and left base vessels for the a. spinae dorsalis; *ao,* aortal groove; *aor,* aortal ridge; *com,* commissural division of the labyrinth cavity; *cp,* opening from the aortal canal into the right base canal for the a. spinae dorsalis; *csema,* division of the labyrinth cavity for the anterior semicircular canal; *des,* canal for the nerve to the dorsal sensory field; *dsf,* dorsal sensory field; *dsp,* base of dorsal spine; *ifc,* infraorbital sensory line; *igl,* groove between the ridges in the branchial fossa which probably served as an attachment for the gill-lamellae; *lc,* main lateral line; lc_1, anterior division of the main lateral line; *nc,* neural groove; *orb,* orbit; *scc,* scapular sensory line; *vcer,* canal for the v. cerebralis anterior; *vcl,* canal for the v. capitis lateralis; *velr,* velar ridge; *vest,* vestibulum; *vizl,* canal for the v. inter-zonalis lateralis; *vcn,* canal possibly for a transformed anterior vertebro-medullar vein.

PLATE 34.

Fig. 1. — *Cephalaspis exilis* n. sp. (p. 296). Rostral part of the cephalic shield. Exoskeleton and superficial parts of the endoskeleton; ventral view. ENS no. 505 (same specimen as in pl. 27:1). × 4½.

Figs. 2, 3. — *Cephalaspis corystis* n. sp. (p. 352). Imperfect cephalic shield in lateral (fig. 2) and dorsal (fig. 3) view. Pal. Mus. Oslo no. A30088. Holotype (same specimen as in pl. 33:2). Fig. 2, ¾; fig. 3, somewhat less than nat. size.

afac, canal for the a. facialis (or, possibly, for the n. profundus); *ap,* antorbital prominence; *ars,* canals probably for superficial dorsal branches of the a. rostralis; *bu,* canal for a branch of the r. buccalis; *lsf,* lateral sensory field; *n,* canal for a cutaneous nerve branch; na_2, posterior division of the naso-hypophyseal opening; *orb,* orbit; *pvdsp,* postero-ventral angle of the dorsal spine; sel_1, canal for the first nerve to the lateral sensory field; vcl_1, canal for the preorbital division of the v. capitis lateralis; vls_1, canal for the first dorso-lateral superficial vein; $vls_2?$, canal possibly for the second dorso-lateral superficial vein; *vrd,* canal for superficial dorsal branches of the v. rostralis.

PLATE 35.

Fig. 1. — *Cephalaspis hastata* n. sp. (p. 356). Imperfect cephalic shield; exoskeleton of the right side of the shield seen from the inner side; almost complete dorsal spine in lateral view. ENS no. 557. Holotype (same specimen as in pl. 36:2). Nat. size.

Fig. 2. — *Cephalaspis ibex* n. sp. (p. 360). Imperfect cephalic shield in lateral view; rostral and lateral parts of the shield including the cornua are missing; dorsal spine almost completely preserved. ENS no. 558. Nat. size.

Fig. 3. — *Cephalaspis signata* n. sp. (p. 347). Part of the postbranchial wall of the right side of the shield; oblique posterior view. Pal. Mus. Oslo no. A30085. Holotype (same specimen as in pls. 27:2; 28:1; 29—31; 32:1-3; 114:1). About × 2½.

$aeff_4$—$aeff_6$, canals or grooves for the fourth to sixth a. branchialis efferens; afc_1, opening into the oralo-branchial chamber of the canal for the seventh and eighth a. branchialis efferens; *asubcl,* canal for the a. subclavia; a_1X, canal for the a. branchialis

efferens 5 and the r. branchialis 2 vagi; *dspv,* canals for vessels in the dorsal spine; *Xa, Xb, Xc,* grooves for branches of the r. branchialis 2 vagi; Xbr_1, groove for the main branch of the r. branchialis 1 vagi; Xbr_1a, canal for a branch of the r. branchialis 1 vagi.

PLATE 36.

Fig. 1. — *Cephalaspis ibex* n. sp. (p. 360). Imperfect cephalic shield in dorsal view; the left side of the shield is incomplete and crushed; the tip of the dorsal spine and of the right cornu is missing. The size of the postero-dorso-median parts of the shield is somewhat exaggerated (as these parts were lying nearer to the photographic objective than the other parts). Most of the exoskeleton is split off. Pal. Mus. Oslo no. A30090. Holotype (same specimen as in pls. 28:2-3; 37—38). × 1½.

Fig. 2. — *Cephalaspis hastata* n. sp. (p. 356). Incomplete cephalic shield; dorsal view. A major part of the left side of the shield and the tip of the right cornu are missing; the dorsal spine and most of the exoskeleton are removed. ENS no. 557. Holotype (same specimen as in pl. 35:1). × 1½.

aad, canal for the a. adorbitalis; adl_1—adl_4, canals for the first to fourth lateral branches of the a. adorbitalis; *adsm,* canal for the a. postorbitalis superficialis; ala_1, ala_3—ala_4, canals for the first, third and fourth anterior dorso-lateral superficial arteries; *alp,* canal for a posterior dorso-lateral superficial artery; alp_1—alp_2, canals for the first and second posterior dorso-lateral superficial arteries; asc_1—asc_2, canals for the first and second a. scapularis; *csema,* division of the labyrinth cavity for the anterior semicircular canal; d_1, canal for the ductus endolymphaticus; *igl,* groove between ridges in the first branchial fossa which probably served as an attachment for the gill-lamellae; *n,* canals for cutaneous nerves; *pbg,* groove probably for the peripharyngeal ciliated groove; sel_1a, sel_1p, canals for the anterior and posterior branches of the first nerve to the lateral sensory field; sel_2, canal for the second nerve to the lateral sensory field; *v,* vein canal (for a supraorbital vein or for a superficial branch of the v. cerebralis anterior); *vcos,* canal for a dorsal superficial branch of the v. cornualis medialis; *velr,* velar ridge; *vizl,* canal for the v. inter-zonalis lateralis; *vizm,* canal for the v. inter-zonalis medialis; *vizms,* canal for a superficial branch of the v. inter-zonalis medialis; vls_1a, vls_1b, canals for branches of the first dorso-lateral superficial vein; vls_2—vls_7, canals for the second to seventh dorso-lateral superficial veins; *vsc,* canal for the v. scapularis; V_2, canal for the r. maxillaris V.

PLATE 37.

Cephalaspis ibex n. sp. (p. 360). Cephalic shield in oblique lateral view. Most of the exoskeleton is split off so that many of the superficial canals in the endoskeleton are exposed. Pal. Mus. Oslo no. A30090. Holotype (same specimen as in pls. 28:2-3; 36:1; 38). × 2.

adl_1—adl_3, canals for the first to third lateral branches of the a. adorbitalis; *afac,* canal for the a. facialis; *afp,* canal for a posterior branch of the a. facialis; ala_1— ala_5, canals for the first to fifth anterior dorso-lateral superficial arteries; alp_1—alp_2, canals for the first and second posterior dorso-lateral superficial arteries; *ams,* canal for a superficial branch of the a. marginalis; asc_1?, asc_2?, canals probably for the first and second a. scapularis; *n,* canals for cutaneous nerves; vcl_1, canal for the preorbital division of the v. capitis lateralis; *vcos,* canal for a dorsal superficial branch of the v. cornualis medialis; *vds?,* canal possibly for a dorso-median superficial vein; vls_1a, vls_1b, canals for anterior and posterior branches of the first dorso-lateral superficial vein; vls_2—vls_7, canals for the second to seventh dorso-lateral superficial veins; *vmarg,* canal for the v. marginalis; *vms,* canal for a superficial branch of the v. marginalis; *vsc,* canal for the v. scapularis; *vsop,* canal for a supraorbital vein; V_1?, canal possibly for the n. profundus; V_2, canal for the r. maxillaris V.

PLATE 38.

Cephalaspis ibex n. sp. (p. 360). Pal. Mus. Oslo no. A30090. Holotype (same specimen as in pls. 28:2-3; 36:1; 37).

Fig. 1. — Cephalic shield in ventral view; only the ventral rim and some parts of the visceral endoskeleton and the zonal endoskeleton are exposed. × 1⅓.

Fig. 2. — Anterior part of the cephalic shield in somewhat oblique dorsal view. Exoskeleton mostly split off and superficial canals in the endoskeleton exposed. About × 2½.

adl$_1$—*adl*$_4$, canals for the first to fourth lateral branches of the a. adorbitalis; *afac,* canal for the a. facialis; *afm,* canal for a branch of the a. facialis; *afp,* canal for a posterior branch of the a. facialis; *ala*$_1$—*ala*$_4$, canals for the first to fourth anterior dorso-lateral superficial arteries; *aor,* aortal ridge; *ars,* canal probably for a dorsal superficial branch of the a. rostralis; *des,* canals for branches of the nerve to the dorsal sensory field; *dext*$_1$—*dext*$_2$, grooves for the external efferent duct from the first and second gill-sacs; *ibs*$_3$—*ibs*$_5$, third to fifth interbranchial septa; *igl,* grooves between the ridges in the first branchial fossa, which probably served as an attachment for the gill-lamellae; k_1—k_2, first and second branchial fossae; *n,* canals for cutaneous nerves; *pbg,* groove probably for the peripharyngeal ciliated groove; *sel*$_1$, canals for distal branches of the first nerve to the lateral sensory field; *vbr*$_2$, canal for the accessory v. brachialis; *vcl*$_1$, canal for the preorbital division of the v. capitis lateralis; *velr,* velar ridge; *vls*$_1$*a, vls*$_1$*b,* canals for branches of the first dorso-lateral superficial vein; *vls*$_2$—*vls*$_6$, canals for the second to sixth dorso-lateral superficial veins; *vrd,* canals for dorsal superficial branches of the v. rostralis; *vsoa, vsop,* canals for supraorbital veins; *vvs,* canal for a ventral superficial branch of the v. marginalis; V_1*?,* canal possibly for the n. profundus; V_2, canal for the r. maxillaris V.

PLATE 39.

Cephalaspis doryphorus n. sp. (p. 364). Pal. Mus. Oslo no. A30091. Holotype (same specimen as in pl. 40:1-3).

Fig. 1. — Posterior part of the cephalic shield in ventral view; some ventral parts in the anterior half are removed so that several cavities and canals in the endocranium are exposed. Stained with alizarin. × 4.

Fig. 2. — Imperfect cephalic shield in dorsal view. A large anterior and left lateral part is missing as well as the right cornu and the tip of the dorsal spine. Somewhat less than × 2.

Fig. 3. — Posterior part of the cephalic shield; a part of the right shoulder-girdle and impression of the ventral face of the shield behind the postbranchial wall. Counterpart to fig. 1. Coated with ammonium chloride in order to bring the impressions into strong relief. × 4½.

Fig. 4. — Posterior part of the shield in lateral view; a lateral part and the tip of the dorsal spine removed. × 3.

adspa, canal for the anterior a. spinae dorsalis; *adspp,* canal for the posterior a. spinae dorsalis; *ampp,* division of the labyrinth cavity for the ampulla posterior; *as,* canal for the a. segmentalis occipitalis; *as?,* canal possibly for the a. segmentalis occipitalis; *asb?,* canal possibly for a segmental artery; a_1, a_2, canals for a ventral and lateral branch, respectively, of the a. spinae dorsalis; *cacu,* canalis acusticus; *ch,* canal for the notochord; *cpost,* canals for the a. encephalica posterior (and the a. segmentalis occipitalis); *des,* canal for the nerve to the dorsal sensory field; *gch,* trigeminus-lateralis chamber; *nd,* canal for the dorsal root of a spinal nerve; *sel*$_5$, canal for the fifth nerve to the lateral sensory field; *vc,* vagus canal; *vcl,* canal for the v. capitis lateralis; *vizl,* canal for the v. inter-zonalis lateralis; *vsc,* canal for the v. scapularis; *vvm,* canal for a vertebro-medullar vein; *v,* groove for a vessel of unknown signi-

ficance; *Vm,* canal for the motor root of the r. maxillaris V; V_2, groove for the r. maxillaris V; V_3, groove for the r. mandibularis V; V_3p, canal for the proximal division of the r. mandibularis V; *IXl, IXla, IXlp,* canals or grooves for cutaneous nerve branches (incl. lateralis branches) of the n. glossopharyngeus; *X, Xa, Xb,* canals and grooves for the n. vagus; *Xl,* canal for the r. lateralis vagi; *Xld,* groove for a branch of the r. lateralis vagi for the dorsal lateral line; *Xll,* groove for a branch of the r. lateralis vagi (for the main lateral line and possibly for the extra-lateral line).

PLATE 40.

Figs. 1—3. — *Cephalaspis doryphorus* n. sp. (p. 364). Pal. Mus. Oslo no. A30091. Holotype (same specimen as in pl. 39).

Fig. 1. — Imperfect cephalic shield; a large anterior part missing. Mainly the dorsal exoskeleton of the right side, median view. About × 1⅔.

Fig. 2. — Exoskeleton of the right lateral region of the shield and parts of the endoskeleton; ventral view. Somewhat less than × 2.

Fig. 3. — Dorso-median part of the shield with incomplete dorsal spine; lateral view. Stained with alizarin. × 3.

Figs. 4, 5. — *Cephalaspis excellens* n. sp. (p. 308). Pal. Mus. Oslo no. A30063 (same specimen as in pl. 12:2).

Fig. 4. — Exoskeleton of the antorbital prominence. About × 25.

Fig. 5. — Exoskeleton from the antero-lateral margin of the shield. About × 17.

abr, canal for the a. brachialis; *adspas,* canal for a superficial branch af the anterior a. spinae dorsalis; *adspps,* canal for a superficial branch of the posterior a. spinae dorsalis; *asubcl,* canal for the a. subclavia; *ch,* canal for the notochord; *dlc,* dorsal lateral line; *gch,* trigeminus-lateralis chamber; *ifc,* infraorbital sensory line; *mp,* anterior transverse sensory line; *orb,* orbit; *p,* pore of the mucous canal system; *r,* ridge of the exoskeleton; sel_4, canal for the fourth nerve to the lateral sensory field; *stc,* supratemporal sensory line; *t,* tubercle of the ornament of the exoskeleton; *v,* vein canal; vbr_2, canal for the accessory v. brachialis; *vest,* vestibulum; *vizl,* canal for the v. inter-zonalis lateralis; *vsmarg,* marginal vein sinus; *Vm,* canal for the motor root of the r. maxillaris V; V_2, groove for the r. maxillaris V.

PLATE 41.

Figs. 1, 2. — *Cephalaspis metopias* n. sp. (p. 366). Imperfect cephalic shield in counterpart. Pal. Mus. Oslo no. A30092. Holotype. ¾.

PLATE 42.

Cephalaspis pinnifera n. sp. (p. 370). Pal. Mus. Oslo no. A30096. Holotype (same specimen as in pl. 43:2).

Fig. 1. — Incomplete specimen in lateral view; the anterior part of the dorsal crest is only preserved as an impression of its left side (the impression is painted white). Cf. Stensiö 1932, fig. 22. ⅘.

Fig. 2. — Dorsal crest; lateral view. Somewhat more than nat. size.

cs, caudal scale; *d,* dorsal crest; *dls,* dorso-lateral scale; *drs,* dorsal ridge scale; *dsp,* tip of the dorsal spine; *fcn,* fossa circum-nasalis; *ls,* lateral scale; *plsf,* exoskeletal plate of the lateral sensory field; $sdcr_3$, third scute of the dorsal crest; vls_3, canal for the third dorso-lateral superficial vein; *vs,* ventro-lateral scale.

PLATE 43.

Fig. 1. — *Cephalaspis producta* n. sp. (p. 390). Cephalic shield in dorsal view. ENS no. 575. Holotype. About $^{7}/_{10}$.

Fig. 2. — *Cephalaspis pinnifera* n. sp. (p. 370). Imperfect cephalic shield and anterior part of the trunk in dorsal view. Pal. Mus. Oslo no. A30096. Holotype (same specimen as in pl. 42). ¾.

dls, dorso-lateral scale; *dsp,* dorsal spine; *ls,* lateral scale; *orb,* orbit; *par,* polygonal area in the exoskeleton of the ventral side of the shield; *plsf,* exoskeletal plate of the lateral sensory field; vls_3, canal for the third dorso-lateral superficial vein.

PLATE 44.

Fig. 1. — *Cephalaspis fracticornis* n. sp. (p. 385). Incomplete and abraded cephalic shield in dorsal view. ENS no. 572. Holotype. ⅔.

Fig. 2. — *Cephalaspis pinnifera* n. sp. (p. 370). Imperfect cephalic shield (anterior and lateral parts missing); dorsal exoskeleton and superficial parts of the endoskeleton in ventral view. Pal. Mus. Oslo no. A30095. ⅔.

PLATE 45.

Figs. 1, 2. — *Cephalaspis ? pedata* n. sp. (p. 375). Cephalic shield in counterpart. An anterior part of the shield and the major parts of the cornua missing. Pal. Mus. Oslo no. A21501. Holotype (same specimen as in pl. 68:1). ⅘.

ifc, infraorbital sensory line; *lc,* main lateral line; *scc,* scapular sensory line.

PLATE 46.

Fig. 1. — *Cephalaspis brevicornis* Stensiö (p. 388). Abraded dorsal exoskeleton of an imperfect cephalic shield; most of the right side and the tip of the left cornu missing; ventral view. ENS no. 574. ⅔.

Fig. 2. — *Cephalaspis jarviki* n. sp. (p. 378). Imperfect cephalic shield, sonsisting mainly of the dorsal exoskeleton. Ventral view. ENS no. 565. Holotype. About ⅗.

dsp, dorsal spine; *d,* opening for the ductus endolymphaticus; *lsfp,* posterior end of the lateral sensory field.

PLATE 47.

Fig. 1. — *Cephalaspis fracticornis* n. sp. (p. 385). Oblique section through the exoskeleton of the anterior margin of the shield, showing vascular canals in the middle layer. ENS no. 573. × 7½.

Figs. 2, 3. — *Cephalaspis curta* n. sp. (p. 382). Imperfect cephalic shield in ventral view; in fig. 2 some ventral parts of the shield are removed so that the whole dorsal exoskeleton is exposed. ENS no. 569. Holotype. × 2¼.

casc, ascending vascular canal; *lvc,* longitudinal vascular canal; *izv,* ventral division of the inter-zonal part; *mg,* groove of the mucous canal system; *scc,* scapular sensory line.

PLATE 48.

Fig. 1. — *Cephalaspis semicircularis* n. sp. (p. 399). Imperfect cephalic shield (a large part of the left side is missing); dorsal view. ENS no. 584. Holotype. Slightly less than nat. size.

Fig. 2. — *Cephalaspis oblonga* Stensiö (p. 393). Imperfect cephalic shield (a part of the left side missing). To the right mainly the dorsal exoskeleton, to the left the ventral side of the cornu and adjacent parts are exposed. Ventral view. ENS no. 577. ¾.

Fig. 3. — *Cephalaspis oblonga* Stensiö (?) (p. 393) Imperfect and distorted cephalic shield (most of the right side and the posterior portion of the inter-zonal part missing). Dorsal view. ENS no. 579. ¾.

lsf, lateral sensory field; sel_1a, sel_1p, canals for the anterior and posterior branches of the first nerve to the lateral sensory field; sel_2—sel_5, canals for the second to fifth nerves to the lateral sensory field.

PLATE 49.

Fig. 1. — *Cephalaspis menoides* n. sp. (p. 402). Imperfect cephalic shield (an anterior part and the tip of the right cornu missing); mainly the dorsal exoskeleton; ventral view. ENS no. 588. Holotype. ⅘.

Fig. 2. — *Cephalaspis moy-thomasi* n. sp. (p. 396). Distorted cephalic shield; dorsal exoskeleton in ventral view. ENS no. 582. Holotype. ⅘.

lsf, lateral sensory field.

PLATE 50.

Fig. 1. — *Cephalaspis laticornis* Stensiö (p. 405). Right half of a cephalic shield in ventral view. ENS no. 590. Nat. size.

Fig. 2. — *Cephalaspis laticornis* Stensiö (p. 405). Imperfect and somewhat distorted cephalic shield, lacking most of its right side; dorsal exoskeleton in ventral view. ENS no. 589. Nat. size.

dsf, dorsal sensory field.

PLATE 51.

Fig. 1. — *Cephalaspis caroli* n. sp. ? (p. 408). Imperfect and distorted cephalic shield (a large anterior part of the shield and most of its right side missing); abraded dorsal exoskeleton in ventral view. ENS no. 594. ⅚.

Fig. 2. — *Cephalaspis caroli* n. sp. (p. 408). Imperfect cephalic shield (most of the inter-zonal part and a large portion of the left side of the shield missing); dorsal view ENS no. 592. Holotype. ⅚.

lsf, lateral sensory field.

PLATE 52.

Cephalaspis gigas n. sp. (p. 411). Imperfect and somewhat distorted cephalic shield in dorsal view. The basal layer of the exoskeleton is preserved. ENS no. 597. Holotype. Slightly more than ½.

PLATE 53.

Cephalaspis gigas n. sp. (p. 411). Imperfect cephalic shield; mainly the dorsal exoskeleton in ventral view. ENS no. 595. Somewhat less than ⅔.

PLATE 54.

Cephalaspis lanternaria n. sp. (p. 416). Cephalic shield, partly only consisting of the dorsal exoskeleton. Ventral view. ENS no. 602. Holotype. ½.

PLATE 55.

Fig. 1. — *Cephalaspis* sp. (p. 423). Imperfect and crushed cephalic shield (most of the anterior parts and the left side missing). Dorsal view. ENS no. 606. Slightly more than ½.

Fig. 2. — *Cephalaspis* sp. (p. 423). Cephalic shield; mainly the ventral rim and the right cornu. Ventral view. ENS no. 607. ⅓.

dext, grooves for the external efferent duct from the gill-sacs; *lb,* limbus cornualis; *lsf,* lateral sensory field; *ps,* pectoral sinus.

PLATE 56.

Cephalaspis sp. (p. 425). ENS no. 610 (same specimen as in pl. 57).

Fig. 1. — Postero-dorso-median part of the cephalic shield; a dorso-posterior portion (figs. 2—4) removed; dorsal view. × 2½.

Fig. 2. — Postero-dorsal part of the cephalic shield; ventral view. × 3⅓.

Fig. 3. — Same part as in fig. 2; lateral view. About × 4½.

Fig. 4. — Antero-ventral portion of the part shown in fig. 3; sectioned longitudinally; lateral view (anterior end to the right). × 3.

aad, canal for the a. adorbitalis; *adsm,* canal for the a. postorbitalis superficialis; *adsp,* canal for the a. spinae dorsalis; *adsps,* canal for a superficial branch of the a. spinae dorsalis to the basal part of the dorsal spine; *asd,* canal for a dorsal segmental artery; a_1, canal for a dorsal superficial branch of the a. spinae dorsalis; a_2—a_4, canals for superficial arteries, probably branches of a dorsal segmental artery; *bend,* dorsal margin of the endoskeleton in the dorsal spine; *com,* commissural division of the labyrinth cavity; *csema,* division of the labyrinth cavity for the anterior semicircular canal; *dsf,* dorsal sensory field; d_1, canal for the ductus endolymphaticus; *nc,* neural canal; *vcl,* canal for the v. capitis lateralis; *vcp,* canal for the v. cerebralis posterior; *vdsp,* canal for a posterior superficial vein from the dorsal spine; *vizl,* canal for the v. inter-zonalis lateralis; *vsds,* canal for a superficial branch of a dorsal segmental vein; vsd_1—vsd_5, canals for dorsal segmental veins; *vsoc,* occipital vein sinus; *vvm,* canal for a vertebro-medullar vein.

PLATE 57.

Cephalaspis sp. (p. 425). ENS no. 610 (same specimen as in pl. 56). × 10.

Fig. 1. — Left anterior part of the shield in pl. 56:1, in postero-median view. To the left impression of the left orbit, to the right part of the endocranial wall.

Fig. 2. — Right posterior part of the shield in pl. 56:1; oblique median view. Part of the right wall of the cranial cavity.

Fig. 3. — Parts of the left anterior and posterior portions of the shield in pl. 56:1; oblique median view. Part of the left wall of the cranial cavity.

adsm, canal for the a. postorbitalis superficialis; *adsp,* canal for the a. spinae dorsalis; *ch,* canal for the notochord; *cpost,* canal for the a. encephalica posterior; *dx,* canal for an artery, possibly a branch of the a. encephalica posterior to the dorsal sensory field; *des* + *vdsv,* common canal for the nerve for the dorsal sensory field and the otical vein; *facu,* fenestra acustica; *gch,* trigeminus-lateralis chamber; *lat,* canal

for the root fibres of the n. lateralis anterior; *t,* canal possibly for an artery; *u,* canal for a vessel; *v,* canal for a ventral branch of the v. cerebralis anterior; *vc,* vagus canal; *vcer, vcer*$_1$—*vcer*$_4$, canals for the v. cerebralis anterior and dorsal branches of this vein; *vcp,* canal for the v. cerebralis posterior; *vlabp,* canal for the v. labyrinthi posterior; *vvm?,* canal possibly for a vertebro-medullar vein; *III,* canal for the n. oculomotorius; *IV,* canal for the n. trochlearis; *Vm,* canal for the motor root of the r. maxillaris V; *Vma,* canal for motor root fibres of the r. maxillaris V or possibly for the n. abducens; *Vs,* canal for the sensory root of the n. trigeminus proper; *Vsa,* canal for the sensory profundus root; *V*$_3$, exit of the r. mandibularis from the cavum cerebrale cranii; *V*$_3$*p,* opening into the orbit of the canal for the proximal division of the r. mandibularis; *IX* + *X,* common canal for the n. glossopharyngeus and the n.vagus.

PLATE 58.

Fig. 1. — *Cephalaspis* sp. (p. 424). Imperfect and distorted cephalic shield in dorsal view. Pal. Mus. Oslo no. A30098. × 3.

Fig. 2. — *Cephalaspis* sp. (p. 424). Dorso-median part of the dorsal exoskeleton of a large cephalic shield; ventral view. ENS no. 609. ¾.

Fig. 3. — *Cephalaspis eukeraspidoides* Stensiö (p. 302). Imperfect cephalic shield (a large part of the right side and the distal part of the left cornu missing); dorsal view. ENS no. 509. × 1½.

dsf, dorsal sensory field; *na*$_1$*?,* possibly opening for the naso-hypophyseal pouch.

PLATE 59.

Fig. 1. — *Cephalaspis* sp. (p. 425). Left part of a cephalic shield; mainly exoskeleton and superficial parts of the endoskeleton in ventral view. ENS no. 608 (counterpart to pl. 60). × 2.

Fig. 2. — *Cephalaspis* sp. (p. 425). Part of the dorsal spine, seen from the right side, exhibiting i. a. the superficial vein canals. ENS no. 611. × 1⅓.

adl$_3$, *adl*$_4$, canals for the third and fourth lateral branches of the a. adorbitalis; *aiz,* canal for an artery in the inter-zonal part; *ala*$_1$—*ala*$_4$*?,* canals for the first to third, and possibly the fourth anterior dorso-lateral superficial arteries; *asc,* canal for the (second) a. scapularis; *asc*$_1$*?,* canal possibly for the first a. scapularis; *n,* canals for cutaneous nerves; *sel*$_4$, canal for the fourth nerve to the lateral sensory field; *vizl,* canal for the v. inter-zonalis lateralis; *vls*$_3$, *vls*$_5$, *vls*$_7$, canals for the third, fifth, and seventh dorso-lateral superficial veins; *vms,* canals for superficial dorsal branches of the v. marginalis; *vsc,* canal for the v. scapularis.

PLATE 60.

Cephalaspis sp. (p. 425). Left part of a cephalic shield; exoskeleton and superficial parts of the endoskeleton split off. Dorsal view. ENS no. 608 (same specimen as in pl. 59:1). × 2.

aiz, canal for an inter-zonal artery; *ala*$_1$—*ala*$_3$, canals for the first to third anterior dorso-lateral superficial arteries; *alp?,* canal possibly for a posterior dorso-lateral superficial artery; *ams,* canals for dorsal superficial branches of the a. marginalis; *asc,* canal for the (second) a. scapularis; *asc*$_1$*?,* canal possibly for the first a. scapularis; *n,* canals for cutaneous nerves; *sel*$_1$*a, sel*$_1$*p,* canals for the anterior and posterior branches of the first nerve for the lateral sensory field; *sel*$_2$—*sel*$_4$, canals for the second to fourth nerves for the lateral sensory field; *vcm,* canal for the v. cornualis medialis; *vcom,* canal for a vein connecting the sixth dorso-lateral superficial vein with the v. cornualis medialis; *vizl,* canal for the v. inter-zonalis lateralis;

vls$_3$, canal for the third dorso-lateral superficial vein; *vls*$_4$*l*, canal for a transformed distal part of the fourth dorso-lateral superficial vein; *vls*$_4$*m*, canal for the basal part of the fourth dorso-lateral superficial vein; *vls*$_5$—*vls*$_7$, canals for the fifth to seventh dorso-lateral superficial veins; *vms*, canals for dorsal superficial branches of the v. marginalis; *vmsd*, canal for a big dorsal superficial branch of the v. marginalis, connecting with the sixth dorso-lateral superficial vein; *vsc*, canal for the v. scapularis.

PLATE 61.

Securiaspis staxrudi (Stensiö) (p. 429). Imperfect cephalic shield (postero-lateral parts including the cornua missing). Pal. Mus. Oslo no. A30015. × 2⅔.

adl$_2$—*adl*$_3$, canals for the second and third lateral branches of the a. adorbitalis; *dr*, dorsal median ridge; d_1, canal for the ductus endolymphaticus; *sel*$_1$*a*, *sel*$_1$*p*, canals for the anterior and the posterior branch of the first nerve to the lateral sensory field; *sel*$_2$—*sel*$_5$, canals for the second to fifth nerves to the lateral sensory field; *vlp*, canal for a basal common trunk for some posterior dorso-lateral superficial veins; *vls*$_6$—*vls*$_7$, canals for the sixth and seventh dorso-lateral superficial veins; *vrs*, rostral vein sinus; V_2l, V_2m, canals for a lateral and a median superficial branch of the r. maxillaris V; V_3, canal for the r. mandibularis V; V_3a, canal for a branch of the r. mandibularis V; *VII*, canal for the n. facialis.

PLATE 62.

Fig. 1. — *Securiaspis staxrudi* (Stensiö) (p. 429). Fragmentary cephalic shield, dorsal view. Most of the exoskeleton is removed so that many superficial canals in the endoskeleton are exposed. Pal. Mus. Oslo no. A30020. About × 2⅔.

Fig. 2. — *Securiaspis staxrudi* (Stensiö) (p. 429). Imperfect cephalic shield (a large anterior and a major part of the left side of the shield are missing); mainly the dorsal exoskeleton in ventral view. ENS no. 486. × 1½.

aad, canal for the a. adorbitalis; *adl*$_3$, canal for the third lateral branch of the a. adorbitalis; *adsm*, canal for the a. postorbitalis superficialis; *afac*, canal for the a. facialis; *ala*$_4$*?*, *ala*$_5$*?*, canals possibly for the fourth and fifth anterior dorso-lateral superficial arteries; *ifc*, infraorbital sensory line; *lc*, main lateral line; *med*, *met*, divisions of the cranial cavity for the medulla oblongata and the cerebellum, respectively; *sel*$_1$*a*, *sel*$_1$*p*, canals for the anterior and the posterior branch of the first nerve to the lateral sensory field; *sel*$_2$—*sel*$_5$, canals for the second to fifth nerves to the lateral sensory field; *stc*, supratemporal sensory line; *vcl*, canal for the v. capitis lateralis; *vcl*$_1$, canal for the preorbital division of the v. capitis lateralis; *vizl*, canal for the v. inter-zonalis lateralis; *vla*, *vlp*, canals for basal trunks of some anterior and posterior dorso-lateral superficial veins, respectively; *vls*$_2$—*vls*$_7$, canals for the second to seventh dorso-lateral superficial veins; *vsoc*, occipital vein sinus; V_2l, V_2m, canals for branches of the r. maxillaris V; V_3, canal for the r. mandibularis V.

PLATE 63.

Fig. 1. — *Securiaspis staxrudi* (Stensiö) (p. 429). Imperfect cephalic shield (an anterior portion, parts of the right side of the shield and the tip of the left cornu missing); mainly the dorsal exoskeleton in ventral view. Pal. Mus. Oslo no. A30017. About 2¼.

Fig. 2. — *Securiaspis* sp. (p. 435). Imperfect cephalic shield (anterior and lateral parts including the cornua missing); dorsal view. Most of the exoskeleton is split off. Pal. Mus. Oslo no. A30023. About × 3.

adl$_3$, canal for the third lateral branch of the a. adorbitalis; *afac,* canal for the a. facialis; *ala*$_2$, canal for the second anterior dorso-lateral superficial artery; *d*$_1$, canal for the ductus endolymphaticus; *sel*$_1$—*sel*$_5$, canals for the first to fifth nerves to the lateral sensory field; *sel*$_1$*a, sel*$_1$*p,* canals for the anterior and the posterior branch of the first nerve to the lateral sensory field; *vcl,* canal for the v. capitis lateralis; *vcl*$_1$, canal for the preorbital division of the v. capitis lateralis; *vls*$_1$, *vls*$_3$, canals for the first and third dorso-lateral superficial veins; *V*$_2$, canal for the r. maxillaris V; *V*$_3$, canal for the r. mandibularis V.

PLATE 64.

Figs. 1, 2. — *Securiaspis quadrata* n. sp. (p. 433). Cephalic shield in counterpart. ENS no. 484. Holotype. About × 2½.

csemp, division of the labyrinth cavity for the posterior semicircular canal; *ifc,* infraorbital sensory line; *lc,* main lateral line; *sel*$_1$—*sel*$_5$, canals for the first to fifth nerves to the lateral sensory field; *vcl,* canal for the v. capitis lateralis; *vls*$_3$, *vls*$_4$, *vls*$_6$, canals for the third, fourth, and sixth dorso-lateral superficial veins; *V*$_2$, canal for the r. maxillaris V.

PLATE 65.

Fig. 1. — *Tegaspis kolleri* (Stensiö) (p. 438). Imperfect cephalic shield (a major part of the right side of the shield and the tip of the left cornu missing); dorsal view. Pal. Mus. Oslo no. A30010. ¾.

Fig. 2. — *Securiaspis staxrudi* (Stensiö) (p. 429). Outer parts of the exoskeleton from the preorbital region of the cephalic shield; ventral view. Pal. Mus. Oslo no. A30021. × 6.

Fig. 3. — *Cephalaspis excellens* n. sp. (p. 308). Middle layer of the exoskeleton from the region around the opening of the hypophyseal pouch; ventral view. ENS no. 527. × 9.

cac, circum-areal mucous canal; *casc,* ascending vascular canal; *lsf,* lateral sensory field; *na*$_1$, opening for the hypophyseal pouch; *na*$_2$, nasal opening (fig. 3) or posterior division of the naso-hypophyseal opening (fig. 2); *orb,* orbit; *par,* polygonal areas in the exoskeleton; *plsf,* exoskeletal plates in the lateral sensory field; *radc,* radiating vascular canals; *radc*$_1$, vascular canals radiating from the opening for the hypophyseal pouch.

PLATE 66.

Tegaspis kolleri (Stensiö) (p. 438). Fairly complete cephalic shield in dorsal view. ENS no. 483. Slightly less than ¾.

pclsf, postero-lateral corner of the lateral sensory field; *sel*$_1$*a, sel*$_1$*p,* canals for the anterior and the posterior branch of the first nerve to the lateral sensory field; *V*$_2$, canal for the r. maxillaris V.

PLATE 67.

Figs. 1, 2. — *Ectinaspis heintzi* n. sp. (p. 443). Imperfect cephalic shield (a lateral part of the right side missing) in counterpart. The part in fig. 1 is stained with alizarin. Pal. Mus. Oslo no. A30014. Holotype. About × 2⅓.

aad, canal for the a. adorbitalis; *adl,* canal for a lateral branch of the a. adorbitalis; *ala,* canals for anterior dorso-lateral superficial arteries; *asc,* canal for the a. scapularis; *bend,* posterior margin of the endoskeleton; *d*$_1$, canal for the ductus endo-

lymphaticus; *sel*$_1$—*sel*$_5$, canals for the first to fifth nerves to the lateral sensory field; *vcl*$_1$, canal for the preorbital division of the v. capitis lateralis; *vizm*, canal for the v. inter-zonalis medialis; *vls*$_2$—*vls*$_6$, canals for the second to sixth dorso-lateral superficial veins; *vsc*, canal for the v. scapularis; V_2, canal for the r. maxillaris V; *VII?*, canal possibly for the n. facialis.

PLATE 68.

Fig. 1. — *Cephalaspis ? pedata* n. sp. (p. 375). Outer parts of the exoskeleton from the region laterally to the right orbit; ventral view. Pal. Mus. Oslo no. A21501. Holotype (same specimen as in pl. 45). × 3⅓.

Fig. 2. — *Benneviaspis* sp. 1 (p. 456). Fragmentary cephalic shield; mainly the dorsal exoskeleton, in ventral view. Pal. Mus. Oslo no. A24899. × 2.

Fig. 3. — *Benneviaspis longicornis* Wängsjö (p. 448). Imperfect cephalic shield; dorsal view. Pal. Mus. Oslo no. A24900. Holotype (same specimen as in Wängsjö 1937, fig. 1). × 4.

ala$_2$—*ala*$_4$, canals for the second to fourth anterior dorso-lateral superficial arteries; *alp?*, canal possibly for a posterior dorso-lateral superficial artery; *csemp*, division of the labyrinth cavity for the posterior semicircular canal; *dsf*, dorsal sensory field; *ifc*, infraorbital sensory line; *lc*, main lateral line; *mp*, anterior transverse sensory line; *orb*, orbit; *scc*, scapular sensory line; *sel*$_1$—*sel*$_5$, canals for the first to fifth nerves to the lateral sensory field; *stc*, supratemporal sensory line; *vcl*, canal for the v. capitis lateralis; *vlp*, canal for the common basal stem of some posterior dorso-lateral superficial veins; *vls*$_3$—*vls*$_6$, canals for the third to sixth dorso-lateral superficial veins; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V.

PLATE 69.

Figs. 1, 2. — *Benneviaspis holtedahli* Stensiö (p. 450). Imperfect cephalic shield (the cornua missing) in counterpart. Pal. Mus. Oslo no. A30003. × 2.

acar, canal for the a. carotis; *adl*$_3$, canal for the third lateral branch of the a. adorbitalis; *ala*, canal for an anterior dorso-lateral superficial artery; *asc?*, canal possibly for the a. scapularis; *cm*, lateral branch from the main lateral line; *dsf*, dorsal sensory field; d_1, canal for the ductus endolymphaticus; *ifc*, infraorbital sensory line; *lc*, main lateral line; lc_1, anterior division of the main lateral line; *scc*, scapular sensory line; *sel*$_1$—*sel*$_5$, canals for the first to fifth nerves to the lateral sensory field; *stc*, supratemporal sensory line; *vls*$_2$—*vls*$_7$, canals for the second to seventh dorso-lateral superficial veins; *vsc*, canal for the v. scapularis; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V.

PLATE 70.

Fig. 1. — *Benneviaspis holtedahli* Stensiö (p. 450). Imperfect cephalic shield in dorsal view. A postero-dorso-median part is removed so that the postbranchial wall and a ventral portion of the inter-zonal part are exposed. The exoskeleton is partly preserved. Pal. Mus. Oslo no. A30005. × 2.

Fig. 2. — *Benneviaspis holtedahli* Stensiö (p. 450). Imperfect cephalic shield (an anterior part of the shield and the distal parts of the cornua missing); dorsal view. Pal. Mus. Oslo no A30001. × 2.

ala$_1$, canal for the first of the anterior dorso-lateral superficial arteries; *ao*, aortal canal; *asubcl*, canal for the a. subclavia; d_1, canal for the ductus endolymphaticus; *ifc*, infraorbital sensory line; *izv*, ventral division of the inter-zonal part; *lc*, main lateral line; lc_1, anterior division of the main lateral line; *oes* + *tr*, opening in the postbranchial wall for the oesophagus and the truncus arteriosus; *pbrw*, postbranchial wall; *scc*, scapular sensory line; *sel*$_1$—*sel*$_5$, canals for the first to fifth nerves to the

lateral sensory field; *vcl*$_1$, canal for the preorbital division of the v. capitis lateralis; *vizm,* canal for the v. inter-zonalis medialis; *vls*$_1$, *vls*$_3$—*vls*$_7$, canals for the first, and for the third to seventh dorso-lateral superficial veins; *vms,* canal for a dorsal superficial branch of the v. marginalis; *vrd,* canal for a dorsal superficial branch of the v. rostralis; *vsc,* canal for the v. scapularis; *vsmarg,* marginal vein sinus; v_5—v_7, canals for the fifth to seventh ventral transversal veins; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V.

PLATE 71.

Fig. 1. — *Benneviaspis holtedahli* Stensiö (p. 450). Imperfectly preserved cephalic shield; an anterior part of the shield is missing; the ventral side of the cornua and some adjacent part are exposed; of the main shield mostly the exoskeleton is preserved. Ventral view. Pal. Mus. Oslo no. A30006. × 1½.

Fig. 2. — *Benneviaspis holtedahli* Stensiö (p. 450). Imperfect cephalic shield (distal parts of the cornua and a postero-dorsal portion of the inter-zonal part missing). Dorsal view. Pal. Mus. Oslo no. A30004. × 1½.

Fig. 3. — *Benneviaspis holtedahli* Stensiö (p. 450). Cephalic shield; dorsal exoskeleton and parts of the endoskeleton in ventral view; the ventral side of the cornua is exposed. Pal. Mus. Oslo no. A30002. × 1½.

ac, canal for the a. cornualis; *adl?,* canal possibly for a lateral branch of the a. adorbitalis; *afac,* canal for the a. facialis; *aor,* aortal ridge; *asc?,* canal possibly for the a. scapularis; *ba,* buccal area; *dsf,* dorsal sensory field; d_1, canal for the ductus endolymphaticus; *ibs,* interbranchial septum, *ifc,* infraorbital sensory line; *k,* branchial fossa; *lc,* main lateral line; *lsf,* lateral sensory field; *orb,* orbit; *ps,* pectoral sinus; *scc,* scapular sensory line; *sel*$_1$—*sel*$_5$, canals for the first to fifth nerves to the lateral sensory field; *stc,* supratemporal sensory line; *vbr,* canal for the v. brachialis; *vcl*$_1$, canal for the preorbital division of the v. capitis lateralis; *vcm,* canal for the v. cornualis medialis; *velr,* velar ridge; *vest,* vestibulum; *vla,* canal for the common basal trunk for some anterior dorso-lateral superficial veins; *vls*$_1$—*vls*$_6$, canals for the first to sixth dorso-lateral superficial veins; *vsc?,* canal possibly for the v. scapularis; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V; *VII,* canal for the n. facialis.

PLATE 72.

Fig. 1. — *Benneviaspis* sp. 2 (p. 466). Imperfect cephalic shield, partly preserved as an impression of the dorsal side; ventral view. Pal. Mus. Oslo no. D5808. × 1¼.

Fig. 2. — *Benneviaspis platessa* n. sp. (p. 454). Fragmentary cephalic shield (most of the right side of the shield and the inter-zonal part missing); mainly the dorsal exoskeleton, in ventral view. Pal. Mus. Oslo no. A24901. Holotype. × 1¼.

orb, orbit; *sel*$_1$—*sel*$_4$, canals for the first to fourth nerves to the lateral sensory field; V_2, canal for the r. mandibularis V.

PLATE 73.

Benneviaspis grandis n. sp. (p. 460). Cephalic shield; mainly the dorsal exoskeleton, in ventral view. ENS no. 469. Holotype. ⅝.

PLATE 74.

Benneviaspis maxima n. sp. (p. 462). Fragmentary cephalic shield in dorsal view. ENS no. 471. Holotype. ⅝.

PLATE 75.

Fig. 1. — *Benneviaspis lövgreeni* n. sp. (p. 458). Imperfect cephalic shield (anterior margin, parts of the right side of the shield and tip of the left cornu missing); mainly the dorsal exoskeleton, in ventral view. ENS no. 612. Holotype. Somewhat more than nat. size.

Fig. 2. — *Benneviaspis maxima* n. sp. (p. 462). Fragmentary cephalic shield (mainly left side of the shield); ventral view. ENS no. 470. About $^{7}/_{10}$.

izv, ventral division of the inter-zonal part; *lsf,* lateral sensory field; *pclsf,* postero-lateral corner of the lateral sensory field.

PLATE 76.

Figs. 1, 2. — *Hoelaspis angulata* Stensiö (p. 469). Cephalic shield in counterpart. Pal. Mus. Oslo no. A24896. × 4.

ifc, infraorbital sensory line; *lc,* main lateral line; lc_1, anterior division of the main lateral line; *vizm,* canal for the v. inter-zonalis medialis; *vsc,* canal for the v. scapularis.

PLATE 77.

Fig. 1. — *Hoelaspis angulata* Stensiö (p. 469). Dorsal exoskeleton with main lateral line (from the posterior part of the left side of the cephalic shield). Ventral view. Pal. Mus. Oslo no. 89. Holotype (same specimen as in Stensiö 1927, pls. 44—45). About × 36.

Fig. 2. — *Hoelaspis angulata* Stensiö (p. 469). Imperfect cephalic shield (rostral process and most of the cornua missing); the anterior part of the shield is much abraded. Pal. Mus. Oslo no. A24897. × 4.

adsm, canal for the a. postorbitalis superficialis; *afac,* canal for the a. facialis; *alp?,* canal possibly for a posterior dorso-lateral superficial artery; *asc?,* canal possibly for the a. scapularis; *com,* commissural division of the labyrinth cavity; *csema,* division of the labyrinth cavity for the anterior semicircular canal; d_1, canal for the ductus endolymphaticus; *lc,* main lateral line; *mc,* mucous canal; sel_1a, sel_1p, canals for the anterior and the posterior branch of the first nerve to the lateral sensory field; sel_2—sel_5, canals for the second to fifth nerves to the lateral sensory field; *vcl,* canal for the v. capitis lateralis; vcl_1, canal for the preorbital division of the v. capitis lateralis; *vlp,* canal for the common basal stem of some posterior dorso-lateral superficial veins; vls_3—vls_7, canals for the third to seventh dorso-lateral superficial veins; V_2, canal for the r. maxillaris V; *VII,* canal for the n. facialis.

PLATE 78.

Fig. 1. — *Boreaspis robusta* n. sp. (p. 476). Imperfect cephalic shield (part of the left side of the shield, tips of the cornua and of the rostral process missing); mainly the dorsal exoskeleton, in ventral view. ENS no. 82. × 2⅔.

Figs. 2, 3. — *Boreaspis robusta* n. sp. (p. 476). Cephalic shield; an anterior part of the shield with the complete rostral process is removed and exposed in ventral view in fig. 2. The shield in fig. 3 is stained with alizarin. ENS no. 81. Holotype. Fig. 2, × 3; fig. 3, × 6.

acar, canal for the a. carotis; *adl,* canal for a lateral branch of the a. adorbitalis; adl_3, adl_4, canals for the third and fourth lateral branches of the a. adorbitalis; *adsm?,* canal possibly for the a. postorbitalis superficialis; *afac,* canal for the a. facialis;

aia, canal for an anterior dorso-lateral superficial artery; *ao,* aortal groove; *aor,* aortal ridge; *arostr,* canals for the a. rostralis; d_1, canal for the ductus endolymphaticus; sel_1a, sel_1p, canals for the anterior and the posterior branch of the first nerve to the lateral sensory field; sel_1—sel_5, canals for the first to fifth nerves to the lateral sensory field; *velr?,* indistinct ridge, possibly corresponding to the velar ridge; *vizm,* canal for the v. inter-zonalis medialis; *vlp,* canal for the common basal stem of some posterior dorso-lateral superficial veins; vls_3—vls_6, canals for the third to sixth dorso-lateral superficial veins; *vmarg,* canal for the v. marginalis; *vrs,* groove for the rostral vein sinus; V_2, canal for the r. maxillaris V; V_3, canals and grooves for the r. mandibularis V; *VII,* canal for the n. facialis.

PLATE 79.

Fig. 1. — *Boreaspis robusta* n. sp. (p. 476). Imperfect cephalic shield (rostral process and tip of the right cornu missing); parts of the dorsal exoskeleton and the endoskeleton are exposed in ventral view; the ventral parts of the postbranchial wall are removed. Pal. Mus. Oslo no. A24873. × 4.

Fig. 2. — *Boreaspis robusta* n. sp. (p. 476). Somewhat incomplete cephalic shield; mainly the dorsal exoskeleton, in ventral view. ENS no. 1. × 4.

ifc, infraorbital sensory line; ifc_1, anterior division of the infraorbital sensory line; *lc,* main lateral line; lc_1, anterior division of the main lateral line; *mp,* anterior transverse sensory line; *nr,* neural ridge; *pbrw,* postbranchial wall; *rostrv,* canal in the rostral process for a vessel; *rpr,* basis of the rostral process; sel_1—sel_4, canals for the first to fourth nerves for the lateral sensory field; *scc,* scapular sensory line; *stc,* supratemporal sensory line; V_2, canal for the r. maxillaris V.

PLATE 80.

Fig. 1. — *Boreaspis robusta* n. sp. (p. 476). Cephalic shield in dorsal view. ENS no. 143. × 3.

Fig. 2. — *Boreaspis robusta* n. sp. (p 476). Slightly distorted cephalic shield; dorsal exoskeleton and parts of the endoskeleton in ventral view. ENS no. 12. × 3.

PLATE 81.

Fig. 1. — *Boreaspis robusta* n. sp. (p. 476). Fragmentary cephalic shield: parts of the endoskeleton and the dorsal exoskeleton. Ventral view. ENS no. 8. About × 6½.

Fig. 2. — *Boreaspis robusta* n. sp. ? (p. 476). Fragmentary cephalic shield: mainly impression of the roof of the right side of the oralo-branchial chamber. ENS no. 149. × 6.

ao, aortal canal; *ch,* canal for the notochord; *dext,* groove for the external efferent duct from the gill-sac; *gsel,* divisions in the floor of the vestibulum for the ganglia of the nerves for the lateral sensory field; ibr_1, ibr_2, first and second interbranchial ridges; *ifc,* infraorbital sensory line; ifc_1, anterior division of the infraorbital sensory line; k_1, first branchial fossa; k_2a, k_2b, anterior and posterior divisions in the lateral part of the second branchial fossa; k_3a, k_3b, anterior and posterior divisions in the lateral part of the third branchial fossa; k_4—k_7, fourth to seventh branchial fossae; *oes,* opening in the postbranchial wall for the oesophagus; *pbrw,* postbranchial wall; sel_1, sel_2, sel_4, canals for the first, second and fourth nerves for the lateral sensory field; *vest,* vestibulum; *vsmarg,* marginal vein sinus; v_1—v_7, canals for the first to seventh ventral transversal veins; V_2, canal and groove for the r. maxillaris V; V_3, canal for the r. mandibularis V; *VII,* canal for the n. facialis; *IX,* canal for the n. glossopharyngeus; Xbr_1, canal for the first branchial ramus of the n. vagus.

PLATE 82.

Fig. 1. — *Boreaspis puella* n. sp. (p. 481). Cephalic shield in ventral view. Ventro-lateral parts of the shield and parts of the ventral division of the inter-zonal part removed. ENS no. 156. × 3.

Fig. 2. — *Boreaspis puella* n. sp. (p. 481). Somewhat imperfect cephalic shield (tips of the rostral process and of the cornua missing); most of the dorsal exoskeleton and parts of the endoskeleton removed. Dorsal view. ENS no. 152. Holotype (same specimen as in pl. 82:4). × 3.

Fig. 3. — *Boreaspis puella* n. sp. (p. 481). Fairly complete cephalic shield in ventral view. Lateral parts of the endoskeleton and ventral parts of the postbranchial wall as well as the whole ventral division of the inter-zonal part are removed. ENS no. 157. × 3.

Fig. 4. — *Boreaspis puella* n. sp. (p. 481). Imperfect cephalic shield; mainly the dorsal exoskeleton, in ventral view. ENS no. 152. Holotype (same specimen as in pl. 82:2). × 3.

aor, aortal ridge; *nr,* neural ridge; sel_1—sel_4, canals for the first to fourth nerves to the lateral sensory field; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V; *VII,* canal for the n.facialis.

PLATE 83.

Fig. 1. — *Boreaspis puella* n. sp. (p. 481). Cephalic shield in dorsal view; parts of the dorsal exoskeleton and of the endoskeleton are removed. ENS no. 158. Slightly les than × 6.

Fig. 2. — *Boreaspis puella* n. sp. (p. 481). Cephalic shield in dorsal view; most of the dorso-median exoskeleton and endoskeleton is split off. ENS no. 159. About × 5.

acar, canal for the a. carotis; *ao,* aortal canal; *oes,* opening in the postbranchial wall for the oesophagus; sel_1—sel_3, canals for the first to third nerves to the lateral sensory field; *tr,* opening in the postbranchial wall for the truncus arteriosus; *vsmarg,* marginal vein sinus; V_2, canal for the r. maxillaris V; V_3, groove for the r. mandibularis V; *VII,* groove for the n. facialis; *IX,* groove for the n. glossopharyngeus.

PLATE 84.

Fig. 1. — *Boreaspis costata* n. sp. (p. 483). Fragmentary cephalic shield, doubtfully referred to this species. Mainly the dorsal exoskeleton, in ventral view. ENS no. 170. × 2½.

Fig. 2. — *Boreaspis costata* n. sp. (p. 483). Somewhat distorted cephalic shield in ventral view; ventral parts removed. ENS no. 167. × 2½.

ao, aortal canal; *aor,* aortal ridge; *ibr,* interbranchial ridge; *oes,* opening in the postbranchial wall for the oesophagus; *tr,* opening in the postbranchial wall for the truncus arteriosus; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V.

PLATE 85.

Boreaspis costata n. sp. (p. 483). Cephalich shield in dorsal view; most of the exoskeleton, parts of the endoskeleton and the whole dorsal division of the inter-zonal part split off. ENS no. 168. Holotype (same specimen as in pl. 86:2). × 4.

abr, canal for the a. brachialis; *aeffc,* canal for the a. branchialis efferens communis; *ao,* aortal canal; *apn,* canal for an artery, possibly to the pronephros; *asubcl,* canal for the a. subclavia; *c,* cornu; ibr_1—ibr_4, first to fourth interbranchial ridges; *oes,* opening in the postbranchial wall for the oesophagus; *psubcl,* subclavian ridge; *tr,* opening in the postbranchial wall for the truncus arteriosus; *vmarg,* canal for the v. marginalis; *vsmarg,* marginal vein sinus; *vvs,* canals for ventral superficial branches from the v. marginalis; V_2, groove for the r. maxillaris V; V_3, groove for the r. mandibularis V; *VII,* groove for the n. facialis.

PLATE 86.

Fig. 1. — *Boreaspis gracilis* n. sp. (p. 510). Imperfect cephalic shield (tip of the rostral process and a posterior part of the main shield missing); dorsal view. Swed. Mus. N. H. Stockholm no. C995. Holotype. × 3.

Fig. 2. — *Boreaspis costata* n. sp. (p. 483). Cephalic shield in ventral view. Parts of the endoskeleton and of the dorsal exoskeleton exposed. Stained with alizarin. ENS no. 168. Holotype (same specimen as in pl. 85). About × 4.

abr, canal for the a. brachialis; *acar,* canal for the a. carotis; *afc,* canal for the common basal stem of some posterior efferent branchial arteries; *ao,* aortal groove or canal; *apn,* canal for an artery, possibly to the pronephros; *asubcl,* canal for the a. subclavia; *cpost,* canal for the a. encephalica posterior; *hys,* division of the ethmoidal cavity for the hypophyseal sac; ibr_1, ibr_2, ibr_4, first, second, and fourth inter-branchial ridges; *oes,* opening in the postbranchial wall for the oesophagus; *pliz,* postero-lateral angle of the (dorsal) inter-zonal part; sel_1—sel_5, canals for the first to fifth nerves to the lateral sensory field; *vest,* vestibulum; *vsmarg,* marginal vein sinus; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V; *VII,* canal for the n. facialis.

PLATE 87.

Fig. 1. — *Boreaspis costata* n. sp. (p. 483). Imperfect cephalic shield (a posterior part missing); ventral view. ENS no. 166. × 2.

Fig. 2. — *Boreaspis puella* n. sp. (p. 481). Median vertical section through the anterior part of the main shield and the basis of the rostral process. (Shield-fragment from Spitsbergen, Mt Sigurd, slope towards the Hoffnung Glacier.)

bvr, postero-ventral thickened border of the ventral rim ("maxillary tooth-plate"); *bvrs,* posterior border of the groove for the rostral vein sinus; ibr_1—ibr_4, first to fourth interbranchial ridges; *orb,* orbit; *ps,* pectoral sinus; *rostrv,* canal for a vessel to the rostral process; *rpr,* basis of the rostral process; *vrs,* groove for the rostral vein sinus; V_2, canal for the r. maxillaris V; V_3, opening into the oralo-branchial chamber of the canal for the r. mandibularis V; *VII,* opening of the canal for the n. facialis; *IX,* opening of the canal for the n. glossopharyngeus.

PLATE 88.

Figs. 1, 2. — *Boreaspis intermedia* n. sp. (p. 486). Imperfect cephalic shield (a considerable antero-lateral part of the shield is missing) in counterpart. ENS no. 171. Holotype. × 2.

Figs. 3, 4. — *Boreaspis intermedia* n. sp. (p. 486). Imperfect cephalic shield in counterpart (a large antero-lateral part of the shield missing); the dorsal division of the inter-zonal part is removed in fig. 4 so that the post-branchial wall and a part of the lateral and ventral regions of the inter-zonal part are exposed. ENS no. 172. × 2.

Fig. 5. — *Boreaspis intermedia* n. sp. (p. 486). Imperfect cephalic shield (a large antero-lateral portion is missing); dorsal view. ENS no. 174. × 2.

Fig. 6. — *Boreaspis intermedia* n. sp. (p. 486). Fragmentary cephalic shield (posterior and postero-lateral parts of the shield as well as the distal part of the rostral process missing); dorsal view. ENS no. 175. × 2.

ao, aortal canal; *oes,* opening in the postbranchial wall for the oesophagus; *tr,* opening in the postbranchial wall for the truncus arteriosus; *vsmarg,* marginal vein sinus.

PLATE 89.

Fig. 1. — *Boreaspis intermedia* n. sp. ? (p. 486). Fragmentary cephalic shield. ENS no. 179. × 2.

Fig. 2. — *Boreaspis spinicornis* n. sp. (p. 497). Imperfect cephalic shield (rostral process and most of the right side of the shield missing). Parts of the endoskeleton and of the dorsal exoskeleton exposed in ventral view. ENS no. 230. × 4.

Fig. 3. — *Boreaspis spinicornis* n. sp. (p. 497). Cephalic shield (only a small posterior part missing); mainly the dorsal exoskeleton, in ventral view. ENS no. 213. Holotype. × 2⅔.

Fig. 4. — *Boreaspis spinicornis* n. sp. (p. 497). Cephalic shield (lacking the left cornu); partly the dorsal exoskeleton, in ventral view. ENS no. 210. × 2⅔.

Fig. 5. — *Boreaspis spinicornis* n. sp. (p. 497). Cephalic shield in dorsal view; a postero-dorsal portion of the shield is missing. ENS no. 211. × 2⅔.

Fig. 6. — *Boreaspis* sp. (p. 516). Cephalic shield; mainly the dorsal exoskeleton in ventral view. ENS no. 284. × 2⅔.

aor, aortal ridge; *dsf,* dorsal sensory field; *lsf,* lateral sensory field; lsf_1, lsf_2, anterior and posterior divisions of the subdivided lateral sensory field; *med,* division of the cranial cavity for the medulla oblongata; *orb,* orbit; sel_1—sel_4, canals for the first to fourth nerves to the lateral sensory field; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V.

PLATE 90.

Fig. 1. — *Boreaspis circinus* n. sp. (p. 504). Cephalic shield; mainly the dorsal exoskeleton, in ventral view. ENS no. 191. Holotype. × 2⅔.

Fig. 2. — *Boreaspis circinus* n. sp. (p. 504). Cephalic shield; dorsal view. ENS no. 190. × 2⅔.

Fig. 3. — *Boreaspis triangularis* n. sp. (p. 501). Imperfect cephalic shield (distal parts of the cornua missing, and a postero-dorsal part of the shield removed). Dorsal view. ENS no. 248. × 4.

Fig. 4. — *Boreaspis triangularis* n. sp. (p. 501). Somewhat distorted cephalic shield; mainly the dorsal exoskeleton, in ventral view. ENS no. 251. Holotype. × 4.

Fig. 5. — *Boreaspis triangularis* n. sp. (p. 501). Cephalic shield lacking the cornua; dorsal view. ENS no. 250. × 4.

lsf_1, lsf_2, anterior and posterior divisions of the subdivided lateral sensory field; sel_1—sel_4, canals for the first to fourth nerves to the lateral sensory field; vls_3, canal for the third dorso-lateral superficial vein; V_2, canal for the r. maxillaris V.

PLATE 91.

Figs. 1, 2. — *Boreaspis rostrata* Stensiö (p. 494). Imperfect and somewhat distorted cephalic shield (tips of the rostral process and of the cornua missing), in counterpart. ENS no. 254. × 6.

sel_1—sel_5, canals for the first to fifth nerves to the lateral sensory field; *vlp*, canal for the basal common stem of two posterior dorso-lateral superficial veins; *vls_3*, canal for the third dorso-lateral superficial vein; *V_3*, canal for the r. mandibularis V; *VII*, groove for the n. facialis.

PLATE 92.

Fig. 1. — *Boreaspis macrorhynchus* n. sp. (p. 491). Imperfect cephalic shield (a part of the right side of the shield missing); mainly the dorsal exoskeleton of the main shield in ventral view; ventral side of the rostral process and of the right cornu exposed. ENS no. 183. Holotype (same specimen as in pl. 94:1). About × 2½.

Fig. 2. — *Boreaspis circinus* n. sp. (p. 504). Cephalic shield lacking the tip of the left cornu; exoskeleton and parts of the endoskeleton in ventral view. ENS no. 193. About × 2½.

Fig. 3. — *Boreaspis curtirostris* n. sp. (p. 506). Fragmentary cephalic shield; mainly the dorsal exoskeleton, in ventral view. ENS no. 261. × 3.

Fig. 4. — *Boreaspis curtirostris* n. sp. (p. 506). Imperfect cephalic shield (some lateral and posterior parts of the shield as well as the very tip of the rostral process missing); dorsal exoskeleton, in ventral view. ENS no. 269. × 3.

Fig. 5. — *Boreaspis curtirostris* n. sp. (p. 506). Cephalic shield in dorsal view; some lateral parts of the shield are removed so that the ventral exoskeleton of the cornua is exposed. ENS no. 262. Holotype. × 3.

ao, aortal groove; *csemp*, division of the labyrinth cavity for the posterior semicircular canal; *des*, canal for the nerve to the dorsal sensory field; *lsf*, lateral sensory field; *lsf_1*, *lsf_2*, anterior and posterior divisions of the subdivided lateral sensory field; *nr*, neural ridge.

PLATE 93.

Fig. 1. — *Boreaspis macrorhynchus* n. sp. (p. 491). Imperfect cephalic shield in dorsal view; most of the exoskeleton, dorso-median parts of the endoskeleton and most of the inter-zonal part removed. ENS no. 181 (same specimen as in pl. 94:2). × 4½.

Fig. 2. — *Boreaspis curtirostris* n. sp. ? (p. 506). Imperfect cephalic shield in dorsal view (rostral process, left cornu and some posterior parts of the shield missing); the exoskeleton and parts of the endoskeleton weathered away so that many of the canals and cavities in the endoskeleton are exposed. ENS no. 274. About × 5⅔.

acar, canal for the a. carotis; *adl_2*, canal for the second lateral branch of the a. adorbitalis; *aeffc*, canal for the a. branchialis efferens communis; *$aeff_1$*—*$aeff_4$*, grooves for the a. branchialis efferens 1—4; *ampa*, division of the labyrinth cavity for the ampulla anterior; *ao*, aortal groove; *csemp*, division of the labyrinth cavity for the posterior semicircular canal; *facu*, fenestra acustica; *fopt*, fenestra optica; *k_1*—*k_7*, first to seventh branchial fossae (lateral parts); *sel_1*—*sel_5*, canals for the first to fifth nerves to the lateral sensory field; *vcl*, canal for the v. capitis lateralis; *vls_3*—*vls_4*, canals for the third and fourth dorso-lateral superficial veins; *vsmarg*, marginal vein sinus; *IV*, canal for the n. trochlearis; *V_2*, canal for the r. maxillaris V; *V_3*, canal for the r mandibularis V; *VII*, canal for the n. facialis; *IX*, canal for the n. glossopharyngeus.

PLATE 94.

Fig. 1. — *Boreaspis macrorhynchus* n. sp. (p. 491). Imperfect cephalic shield in dorsal view; the dorsal region of the inter-zonal part, the exoskeleton and some parts of the endoskeleton removed. ENS no. 283. Holotype (same specimen as in pl. 92:1). × 4.

Fig. 2. — *Boreaspis macrorhynchus* n. sp. (p. 491). Imperfect cephalic shield (some antero-lateral, lateral, and posterior parts removed); ventral view. ENS no. 181 (same specimen as in pl. 93:1). About × 5½.

acar, canals for the a. carotis; *aeffc,* canal for the a. branchialis efferens communis; *aeff*$_4$, groove for the fourth efferent branchial artery; *ao,* aortal canal; *apnd, apns,* canals for arteries to the trunk cavity; *ch,* canal for the notochord; *gsel,* divisions in the lower part of the vestibulum for the ganglia of the nerves to the lateral sensory field; *ibr*$_1$—*ibr*$_2$, first and second interbranchial ridges; k_2—k_3, k_5, k_7, second, third, fifth, and seventh branchial fossae; *oes,* opening in the postbranchial wall for the oesophagus; *rpr,* basis of the rostral process; *sel*$_1$—*sel*$_4$, canals for the first to fourth nerves to the lateral sensory field; *vest,* vestibulum; *vsmarg,* marginal vein sinus; v_4—v_7, canals for the fourth to seventh ventral transversal veins; V_2, canal for the r. maxillaris V; V_2l, V_2m, canals for a median and a lateral cutaneous nerve branch of the r. maxillaris; V_3, canal for the r. mandibularis V; *VII,* canal for the n. facialis.

PLATE 95.

Fig. 1. — *Boreaspis batoides* n. sp. (p. 489). Fairly complete cephalic shield (distal parts of the cornua missing); the dorsal exoskeleton and an anterior portion of the endoskeleton split off. Dorsal view. ENS no. 180. Holotype. × 3⅕.

Fig. 2. — *Boreaspis macrorhynchus* n. sp. (p. 491). Fairly complete cephalic shield, lacking the tips of the cornua. Dorsal view. ENS no. 182. × 4.

aeff$_1$—*aeff*$_2$, grooves for the first and second efferent branchial arteries; *csemp,* division of the labyrinth cavity for the posterior semicircular canal; *sel*$_1$—*sel*$_5$, canals for the first to fifth nerves to the lateral sensory field; *sel*$_2$*a, sel*$_2$*b,* canals for the main second and for an accessory nerve to the lateral sensory field; *vlp,* canal for the basal common stem of some posterior dorso-lateral superficial veins; V_2, canal for the r. maxillaris V; V_3, canal and groove for the r. mandibularis V; *VII,* canal for the n. facialis.

PLATE 96.

Figs. 1, 2. — *Boreaspis ceratops* n. sp. (p. 513). Imperfect cephalic shield (rostral process and distal parts of cornua missing), in counterpart. ENS no. 283. Holotype. × 3.

etm, ethmoidal cavity; *mes,* division of the cranial cavity for the mesencephalon; *pin,* division of the cranial cavity i. a. for the pineal body; *psel*$_1$, ridge in the roof of the oralo-branchial chamber caused by the first nerve to the lateral sensory field; *pV*$_2$, ridge caused by the r. maxillaris V; *sel*$_2$—*sel*$_5$, canals for the second to fifth nerves to the lateral sensory field; V_3, canal and groove for the r. mandibularis V; *VII,* canal and groove for the n. facialis; *IX,* canal and groove for the n. glossopharyngeus.

PLATE 97.

Fig. 1. — *Kiaeraspis auchenaspidoides* Stensiö (p. 519). Cephalic shield; mainly the dorsal exoskeleton in ventral view. ENS no. 472. × 4.

Fig. 2. — *Kiaeraspis auchenaspidoides* Stensiö (p. 519). Fragmentary cephalic shield; dorsal exoskeleton in ventral view. ENS no. 475. About × 7.

Fig. 3. — *Kiaeraspis auchenaspidoides* Stensiö (p. 519). Part of the right side of the cephalic shield in dorsal view; canals for some marginal vessels are exposed. Pal. Mus. Oslo no. A24895. × 6.

Fig. 4. — *Axinaspis whitei* n. sp. (p. 523). Anterior and lateral parts of a cephalic shield in ventral view; the ventral rim of the rostral margin is preserved, otherwise only the dorsal exoskeleton is exposed. ENS no. 466. Holotype (same specimen as in pl. 98:1). × 2.

ac, canal for the a. cornualis; *aca*, canal for the a. cornualis accessoria; *aeff*$_6$, canal for probably the sixth efferent branchial artery; *afc*, canal for the basal stem of some (probably the seventh to ninth) efferent arteries, *amarg*, canal for the a. marginalis; *asubcl*, canal for the a. subclavia; *lsf*$_1$—*lsf*$_2$, anterior and posterior divisions of the subdivided lateral sensory field; *sel*$_1$—*sel*$_5$, canals for the first to fifth nerves to the lateral sensory field; *v*, canals for ventral transversal veins; *vmarg*, canal for the v. marginalis; *vsmarg*, marginal vein sinus; *V*$_2$, canal for the r. maxillaris V; *V*$_3$, canal for the r. mandibularis V.

PLATE 98.

Fig. 1. — *Axinaspis whitei* n. sp. (p. 523). Imperfect cephalic shield in dorsal view. Stained with alizarin. ENS no. 466. Holotype (same specimen as in pl. 97:4). × 2½.

Figs. 2, 3. — *Axinaspis whitei* n. sp. (p. 523). ENS no. 467 (same specimen as in pls. 99; 100:2-3; 116:2; 117:1).

Fig. 2. Right lateral wall of the zonal and inter-zonal part in median view; ventral side to the left, dorsal side to the right. × 2½.

Fig. 3. Impression of the left pectoral area; median view. Anterior end to the right. × 4.

a, canal for an artery; *abr?*, canal possibly for the a. brachialis; *abr*$_1$, *abr*$_2$, canals for the posterior and anterior a. brachialis; *adl*$_2$, canal for the second lateral branch of the a. adorbitalis; *afac*, canal for the a. facialis; *anz*, canal for an artery and a nerve to the pectoral fin; *gr*, a pit in the inner face of the lateral wall of the zonal part, of unknown significance; *izd*, *izv*, inter-zonal part, dorsal and ventral divisions, respectively; *nz*, canal for a nerve to the pectoral fin; *sel*$_1$—*sel*$_2$, *sel*$_5$, canals for the first, second, and fifth nerves to the lateral sensory fields; *v*, *v?*, canals probably or possibly for veins; *vbr*, canal for the v. brachialis; *vls*$_3$, canal for the third dorso-lateral superficial vein; *x*, canals of unknown significance; *V*$_2$, canal for the r. maxillaris V.

PLATE 99.

Figs. 1, 2. — *Axinaspis whitei* n. sp. (p. 523). Posterior part of the cephalic shield; in fig. 1 the ventral region of the inter-zonal part and the postbranchial wall are exposed in ventral view; in fig. 2 the same part is seen from in front (a dorso-median part of the postbranchial wall is preserved mainly as an impression of its posterior side). ENS no. 467 (same specimen as in pls. 98:2-3; 100:2-3; 116:2; 117:1). × 3⅓.

a, canal for an artery; *aeffc*, canal for the a. branchialis efferens communis; *ao*, aortal canal; *asubcl*, canal for the a. subclavia; *ibs*$_4$—*ibs*$_8$, fourth to eighth interbranchial septa; *k*$_5$—*k*$_8$, fifth to eighth branchial fossae; *kx*, fossa behind the eighth branchial fossa; *oes* + *tr*, opening in the postbranchial wall for the oesophagus and the truncus arteriosus; *priz*, median anterior process of the ventral inter-zonal part; *prn*, impressions of the pronephros; *roes*, ridge from the interbranchial septum 7 to the dorsal margin of the opening for the oesophagus and the truncus arteriosus; *vms*, canal for a dorsal superficial branch of the v. marginalis; *vsmarg*, marginal vein sinus; *v*$_5$, *v*$_7$, canals for the fifth and the seventh ventral transversal vein.

PLATE 100.

Fig. 1. — *Axinaspis whitei* n. sp. (p. 523). Complete, distorted cephalic shield in dorsal view; the dorso-median parts are much worn and abraded. ENS no. 468. × 2¼.

Fig. 2, 3. — *Axinaspis whitei* n. sp. (p. 523). Posterior part of the cephalic shield in counterpart (in fig. 2 the dorsal exoskeleton is exposed in ventral view). ENS no. 467 (same specimen as in pls. 98:2-3; 99; 116:2; 117:1). × 2¼.

bend, posterior margin of the endoskeleton (in the inter-zonal part); *cva,* center of a vascular area; *dr,* dorsal ridge; *dsf,* dorsal sensory field; d_1, canal for the ductus endolymphaticus; ibr_1, ibr_2, first and second interbranchial ridges; lsf_2, second lateral sensory field; sel_1—sel_5, canals for the first to fifth nerves to the lateral sensory fields; *vel,* velar ridge; *vizm,* canal for the v. inter-zonalis medialis; vls_6, vls_7, canals for the sixth and seventh dorso-lateral superficial veins; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V; *VII,* canal for the n. facialis.

PLATE 101.

Figs. 1, 2. — *Acrotomaspis instabilis* n. sp. (p. 529). Cephalic shield in counterpart. Fig. 1 in dorsal view; in fig. 2 the dorsal exoskeleton is exposed in ventral view (a small dorso-median portion is missing). ENS no. 450. Holotype (same specimen as in pl. 102:2). × 8.

dsf, dorsal sensory field; *dsfa,* anterior end of the dorsal sensory field; lsf_1—lsf_4, first to fourth lateral sensory fields; sel_1—sel_5, canals for the first to fifth nerves to the lateral sensory fields; *t,* tubercles of the exoskeleton.

PLATE 102.

Fig. 1. — *Acrotomaspis instabilis* n. sp. (p. 529). Somewhat incomplete cephalic shield; exoskeleton and parts of the endoskeleton in ventral view (anteriorly to the right a part of the roof of the oralo-branchial chamber is exposed). ENS no. 451. × 8.

Fig. 2. — *Acrotomaspis instabilis* n. sp. (p. 529). Cephalic shield in antero-lateral view. ENS no. 450. Holotype (same specimen as in pl. 101). × 8.

Fig. 3. — *Acrotomaspis instabilis* n. sp. (p. 529). Distorted cephalic shield in dorsal view. ENS no. 449. About × 5.

bc, buccal cavity; *dsf,* dorsal sensory field; ibr_1—ibr_2, first and second interbranchial ridges; lsf_1—lsf_4, first to fourth lateral sensory fields; na_1, anterior division of the naso-hypophyseal opening; *orb,* orbit; pV_2, ridge enclosing the canal for the r. maxillaris V; sel_1—sel_2, canals for the first and second nerves to the lateral sensory fields; vcl_1, canal for the preorbital division of the v. capitis lateralis; *velr,* velar ridge; V_2, canal for the r. maxillaris V; V_2a, canal for a branch of the r. maxillaris V; V_3, canal for the r. mandibularis V; *IX?,* canal possibly for the n. glossopharyngeus.

PLATE 103.

Fig. 1. — *Acrotomaspis instabilis* n. sp. (p. 529). Left part of a distorted cephalic shield; exoskeleton and parts of the endoskeleton in ventral view. ENS no. 453. × 7½.

Fig. 2. — *Acrotomaspis instabilis* n. sp. (p. 529). Right antero-lateral part of a cephalic shield with the anterior lateral sensory field; exo-

skeleton and a small part of the endoskeleton in ventral view. ENS no. 455. × 7½.

Fig. 3. — *Acrotomaspis instabilis* n. sp. (p. 529). Part of the left side of a cephalic shield with the 2nd—4th lateral sensory fields; dorsal exoskeleton in ventral view. ENS no. 456. About × 7.

Fig. 4. — *Acrotomaspis instabilis* n. sp. (p. 529). Imperfect cephalic shield (a considerable part of the right side and some lateral parts of the left side missing); dorsal exoskeleton and a small part of the endoskeleton in ventral view. ENS no. 454. × 7½.

lsf$_1$—*lsf*$_4$, first to fourth lateral sensory fields; *orb,* orbit; *sel*$_1$—*sel*$_3$, *sel*$_5$, first to third, and fifth nerve canals for the lateral sensory fields; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V; *VII,* canal for the n. facialis.

PLATE 104.

Figs. 1, 2. — *Acrotomaspis instabilis* n. sp. (p. 529). Posterior part of a distorted cephalic shield; fig. 1 in view from the right side; fig. 2. in ventral view. ENS no. 452. × 4⅔.

Fig. 3. — *Acrotomaspis* sp. 1 (p. 533). Badly preserved cephalic shield in dorsal view. ENS no. 465. × 4.

Fig. 4. — *Acrotomaspis* sp. 2 (p. 536). Somewhat imperfect cephalic shield (certain lateral parts missing); mainly the dorsal exoskeleton, in ventral view. ENS no. 448. × 2⅔.

dsf, dorsal sensory field; *lsf*$_1$—*lsf*$_4$, first to fourth lateral sensory fields; *velr,* velar ridge; V_2, canal for the r. maxillaris V.

PLATE 105.

Fig. 1. — *Acrotomaspis trinodis* n. sp. (p. 533). Distorted cephalic shield; dorsal exoskeleton in ventral view. ENS no. 436. × 2½.

Fig. 2. — *Acrotomaspis trinodis* n. sp. (p. 533). Distorted imperfect cephalic shield in dorsal view. ENS no. 439. × 2½.

Fig. 3. — *Acrotomaspis trinodis* n. sp. (p. 533). Rather complete, somewhat flattened cephalic shield; dorsal exoskeleton in ventral view. ENS no. 434. Holotype. × 2½.

Fig. 4. — *Acrotomaspis trinodis* n. sp. (p. 533). Distorted cephalic shield in dorsal view; the middle layer of the exoskeleton with the radiating vascular canals is exposed. ENS no. 437. × 2½.

lsf$_1$—*lsf*$_4$, first to fourth lateral sensory fields; *sel*$_1$, canal for the first nerve to the lateral sensory fields; *velr,* velar ridge.

PLATE 106.

Nectaspis areolata n. sp. (p. 542). Cephalic shield in dorsal view. An anterior part of the shield is removed, leaving an imperfect impression of the roof of the oralo-branchial chamber. Stained with alizarin. ENS no. 320. Holotype (same specimen as in pls. 107—109). × 5.

afac, canal for the a. facialis; *aiz*$_1$—*aiz*$_2$, canals for superficial inter-zonal arteries; *ao,* aortal groove; *bc,* buccal cavity; *bend,* posterior border of the endoskeleton; *des,* canal for the nerve to the dorsal sensory field; d_1, canal for the ductus endolymphaticus;

lsf_3, third lateral sensory field; na_2, nasal opening proper; *pin,* pineal canal; sel_1—sel_5, canals for the first to fifth nerves to the lateral sensory fields; *velr,* velar ridge; *vizl,* canal for the v. inter-zonalis lateralis; *vizm,* canal for the v. inter-zonalis medialis; *vmarg,* canal for the v. marginalis; V_1*?,* canal possibly for the n. profundus; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V.

PLATE 107.

Nectaspis areolata n. sp. (p. 542). Lateral part of the same shield as in pl. 106, more enlarged. Below to the right two small portions of the exoskeleton are preserved, showing its outer face. Stained with alizarin. ENS no. 320. H o l o t y p e (same specimen as in pls. 106; 108—109). × 10.

aad, canal for the a. adorbitalis; adl_1—adl_3, canals for the first to third lateral branches of the a. adorbitalis; *ads,* canal for a dorso-median artery; *adsm,* canal for the a. postorbitalis superficialis; *afac,* canal for the a. facialis; *afp,* canal for a posterior branch of the a. facialis; ala_1—ala_2, canals for the first and second anterior dorso-lateral superficial arteries; d_1, canal for the ductus endolymphaticus; sel_1—sel_5, canals for the first to fifth nerves to the lateral sensory fields; *vds,* canal for a dorso-median vein; *vizl,* canal for the v. inter-zonalis lateralis; *vizm,* canal for the v. inter-zonalis medialis; vls_3—vls_6, canals for the third to sixth dorso-lateral superficial veins; *vmarg,* canal for the v. marginalis; *vsmarg,* marginal vein sinus; *vsop,* canal for a posterior v. supraorbitalis; V_1*?,* canal possibly for the n. profundus; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V; *VII,* canal for the n. facialis; *IX?,* canal possibly for the n. glossopharyngeus.

PLATE 108.

Nectaspis areolata n. sp. (p. 542). Cephalic shield, counterpart to pl. 106; the dorsal exoskeleton and an antero-lateral part of the endoskeleton in ventral view (cf. pl. 109). Stained with alizarin. ENS no. 320. H o l o t y p e (same specimen as in pls. 106—107; 109). About × 4⅔.

adl, canal for a lateral branch of the a. adorbitalis; ala_2, canal for the second anterior dorso-lateral superficial artery; *amarg,* canal for the a. marginalis or for a branch of this artery; *arostr,* canals for the a. rostralis; *bc,* buccal cavity; *cm,* transverse branch of the main lateral line; *lc,* main lateral line; lsf_1—lsf_3, first to third lateral sensory fields; *n,* canal for a cutaneous nerve; *scc,* scapular sensory line; sel_1—sel_3, canals for the first to third nerves for the lateral sensory fields; *velr,* velar ridge; vls_3—vls_5, canals for the third to fifth dorso-lateral superficial veins; *vmarg,* canal for the marginal vein; *vmargl,* canals for lateral branches of the v. marginalis; *vrs,* rostral vein sinus; V_2, canal for the r. maxillaris V; V_3, canal for the r. mandibularis V; *VII,* canal for the n. facialis.

PLATE 109.

Nectaspis areolata n. sp. (p. 542). Lateral part of the same shield as in pl. 108, more enlarged, showing parts of the endoskeleton. Stained with alizarin. ENS no. 320. H o l o t y p e (same specimen as in pls. 106—108). About × 9⅓.

adl_3, canal for a lateral branch (possibly the third one) of the a. adorbitalis; $aeff_1$, groove for the first efferent branchial artery; *afac,* canal for the a. facialis; *afm,* canal for a median branch of the a. facialis; ala_2—ala_3, canals for the second and third anterior dorso-lateral superficial arteries; *amarg,* canal for the a. marginalis; *amargm?,* canal possibly for a median branch of the a. marginalis; *ao,* aortal groove; *arostr,* canals for the a. rostralis; *asp,* groove for the a. spiracularis; *av,* groove for the a. velaris; k_1, first branchial fossa; lsf_1, first lateral sensory field; *n,* nerve canals;

na$_2$, nasal opening proper; *orb,* orbit; *sel*$_1$—*sel*$_3$, canals for the first to third nerves for the lateral sensory fields; *velr,* velar ridge; *vls*$_3$—*vls*$_5$, canals for the third to fifth dorso-lateral superficial veins; *vmarg,* canal for the v. marginalis; *vmargl,* canals for lateral branches of the v. marginalis; *vmarg*$_1$, anterior opening of the canal for the v. marginalis; *vrs,* rostral vein sinus; *V*$_2$, canal for the r. maxillaris V; *V*$_2$*a,* openings for branches of the r. maxillaris V into the buccal cavity; *V*$_3$, canal for the r. mandibularis V; *VII,* canal for the n. facialis.

PLATE 110.

Figs. 1, 2. — *Nectaspis areolata* n. sp. (p. 542). Somewhat imperfect cephalic shield, partly in counterpart. In fig. 1 an anterior portion of the shield is shown in dorsal view (partly only preserved as an impression of the roof of the oralo-branchial chamber); in fig. 2 the dorsal exoskeleton and parts of the endoskeleton are exposed in ventral view. Stained with alizarin. ENS no. 321 (same specimen as in pl. 112:1). × 5.

abr, canal for the a. brachialis; *asubcl,* canal for the a. subclavia; *ibs*$_1$, first interbranchial septum; *ifc,* infraorbital sensory line; *ifc*$_1$, anterior division of the infraorbital sensory line; *lc,* main lateral line; *lsf*$_1$, first lateral sensory field; *mp,* anterior transverse sensory line; *na*$_1$, opening for the hypophyseal pouch; *na*$_2$, nasal opening proper; *pV*$_2$, ridge (or impression of it) enclosing the canal for the r. maxillaris V; *scc,* scapular sensory line; *vclat?,* canal for a vein, possibly corresponding to the v. cornualis lateralis; *velr,* velar ridge; *vmarg,* canal for the v. marginalis; *vsmarg,* marginal vein sinus; *V*$_2$, canal for the r. maxillaris V; *V*$_3$, canal for the r. mandibularis V.

PLATE 111.

Fig. 1. — *Nectaspis areolata* n. sp. (p. 542). Cephalic shield in dorsal view. ENS no. 360. × 2½.

Fig. 2. — *Nectaspis areolata* n. sp. (p. 542). Cephalic shield in dorsal view (a small postero-dorsal part of the shield missing). ENS no. 363. × 2½.

Fig. 3. — *Nectaspis areolata* n. sp. (p. 542). Distorted cephalic shield (exoskeleton removed), dorsal view. Pal. Mus. Oslo no. A24876. × 2½.

Fig. 4. — *Nectaspis areolata* n. sp. (p. 542). Distorted cephalic shield (exoskeleton removed), dorsal view. Pal. Mus. Oslo no. A24877. × 2½.

ao, aortal groove; *lsf*$_1$—*lsf*$_3$, first to third lateral sensory fields; *na*$_1$, opening for the hypophyseal pouch; *na*$_2$, nasal opening proper; *sel*$_1$—*sel*$_2$, canals for the first and second nerves for the lateral sensory fields; *velr,* velar ridge.

PLATE 112.

Fig. 1. — *Nectaspis areolata* n. sp. (p. 542). Dorso-median part of the endoskeleton in ventral view, showing the labyrinth cavities, the ethmoidal and brain cavities, the posterior parts of the orbits, several nerve canals, etc. Stained with alizarin. ENS no. 321 (same specimen as in pl. 110). × 12.

Figs. 2, 3. — *Nectaspis peltata* n. sp. (p. 539). Cephalic shield in counterpart (in fig. 2 a considerable portion of the inter-zonal part is missing). ENS no. 300. Holotype. × 3.

acar, canal for the a. carotis; *as,* canal and groove for the a. segmentalis occipitalis; *ch,* canal for the notochord; *copt,* canalis opticus; *cpost,* canal for the a. encephalica posterior; *facu,* fenestra acustica; *gch,* trigeminus-lateralis chamber; *hyf,* fossa hypophyseos; *lsf*$_2$—*lsf*$_3$, second and third lateral sensory fields; *n,* nerve canals for general cutaneous or lateralis fibres entering the canal for the r. mandibularis V;

na$_1$, opening for the hypophyseal sac; *na*$_2$, nasal opening proper; *rV*, canal for the trigeminus roots; *rIX + X*, canal for the roots of the metotic cranial nerves; *sel*$_1$—*sel*$_4$, canals for the first to fourth nerves to the lateral sensory fields; *v*, canal possibly for for a vein; *vls?*, canal possibly for a dorso-lateral superficial vein; *V*$_3$, canal for the r. mandibularis V; *VII*, canal for the n. facialis; *IX*, canal for the n. glossopharyngeus (and probably also for the a. communicans); *Xbr*, canal for some posterior branchial rami of the n. vagus; *Xbr*$_1$, canal for the first branchial ramus of the n. vagus.

PLATE 113.

Fig. 1. — *Nectaspis peltata* n. sp. (p. 539). Lateral part of a cephalic shield; the dorsal exoskeleton exposed in ventral view. ENS no. 306. About × 5.

Fig. 2. — *Nectaspis dellei* n. sp. (p. 547). Distorted cephalic shield; the dorsal exoskeleton and a small part of the ventral region of the inter-zonal part and of the post-branchial wall in ventral view. ENS no. 406. × 2.

Fig. 3. — *Nectaspis dellei* n. sp. (p. 547). Slightly imperfect and distorted cephalic shield (some lateral parts and a very small posterior portion of the shield missing); the dorsal exoskeleton exposed in ventral view. ENS no. 400. Holotype. × 2.

Fig. 4. — *Nectaspis dellei* n. sp. (p. 547). Distorted cephalic shield in dorsal view. ENS no. 403. × 2.

lsf$_1$—*lsf*$_3$, first to third lateral sensory fields; *pbrw*, postbranchial wall; *velr*, velar ridge.

PLATE 114.

Fig. 1. — *Cephalaspis signata* n. sp. (p. 347). Part of the dorsal exoskeleton with the main lateral line; ventral view. (Anterior end to the right.) Pal. Mus Oslo no. A30085. Holotype (same specimen as in pls. 27:2; 28:1; 29—31; 32:1-3; 35:3). × 11.

Fig. 2. — *Cephalaspis verruculosa* n. sp. (p. 330). Section through the exoskeleton and subcutaneous canal plexus of the endoskeleton from the dorsal side of the cephalic shield in front of the pectoral sinus. ENS no. 539 (same specimen as in pl. 24:2). About × 45.

Fig. 3. — *Cephalaspis recticornis* n. sp. (p. 323). Section through the exoskeleton from the inter-zonal part of the cephalic shield. ENS no. 533. Holotype (same specimen as in pl. 20). About × 43.

cac, circum-areal mucous canal; *casc?*, possibly ascending vascular canal; *desc*, descending vascular canal; *dplx*, subcutaneous vascular plexus; *ebc*, external branches from the vascular canals in the lower division of the middle layer; *iac*, intra-areal mucous canals; *lc*, main lateral line; *mc*, mucous canals; *mg*, mucous grooves; *radc*, radiating vascular canals; *t*, tubercle.

PLATE 115.

Fig. 1. — *Cephalaspis* sp. Section through the exoskeleton (with smooth outer face of the superficial layer and exceptionally well developed inner division of the middle layer). Stained with alizarin. Shield-fragment from Spitsbergen, Mt Borgen, middle part. × 40.

Fig. 2. — *Cephalaspis excellens* n. sp. (p. 308). Section through the exoskeleton. ENS no. 518. About × 80.

Fig. 3. — *Cephalaspis excellens* n. sp. (p. 308). Sagittal section through the exoskeleton of the rostral part of the shield. ENS no. 519. About × 45.

cac, circum-areal mucous canal; *desc,* descending vascular canal; *dplx,* subcutaneous vascular canal plexus; *ebc,* external branches from the vascular canals in the inner division of the middle layer; *iac,* intra-areal mucous canals; *mc,* mucous canals; *radc,* radiating vascular canals; *t,* tubercle; *vascc,* vascular canals.

PLATE 116.

Fig. 1. — *Tegaspis kolleri* (Stensiö) (p. 438). Section through the exoskeleton from the lateral side of the shield; the lateral sensory field to the left. ENS no. 480. About × 7.

Fig. 2. — *Axinaspis whitei* n. sp. (p. 523). Section through the exoskeleton of the posterior dorsal portion of the inter-zonal part. ENS no. 467 (same specimen as in pls. 98:2-3; 99; 100:2-3; 117:1). About × 60.

bch, cavity in the basal layer of the exoskeletal plate of the lateral sensory field; *casc,* ascending vascular canal; *dplx,* subcutaneous vascular canal plexus; *ebc,* external branches of the vascular canals in the inner division of the middle layer; *mc,* mucous canals; *mg,* mucous grooves; *radc,* radiating vascular canals; *t,* tubercle; *vascc,* vascular canals.

PLATE 117.

Fig. 1. — *Axinaspis whitei* n. sp. (p. 523). Section through the exoskeleton of the posterior portion of the inter-zonal part. ENS no. 467 (same specimen as in pls. 98:2-3; 99; 100:2-3; 116:2). × 93.

Fig. 2. — *Boreaspis robusta* n. sp. (?) (p. 476). Section through the exoskeleton and a part of the endoskeleton from the dorso-median part of the shield. Stained with alizarin. Shield-fragment in a red sandstone from Spitsbergen, Mt Kronprinz, E. slope, opposite Stjørdalen Valley. × 93.

Fig. 3. — *Boreaspis robusta* n. sp. (p. 476). Section through the exoskeleton and a part of the endoskeleton from the antero-median part of the main cephalic shield. Shield fragment in a grey sandstone from Spitsbergen, Mt Kronprinz, E. slope, opposite Stjørdalen Valley. × 93.

casc, ascending vascular canal; *dplx,* subcutaneous vascular canal plexus; *dsf,* dorsal sensory field; *ebc,* external branches from the vascular canals of the inner division of the middle layer; *end,* endoskeletal trabeculae; *mc,* mucous canals; *radc,* radiating vascular canals; *t,* tubercle, *vascc,* vascular canals.

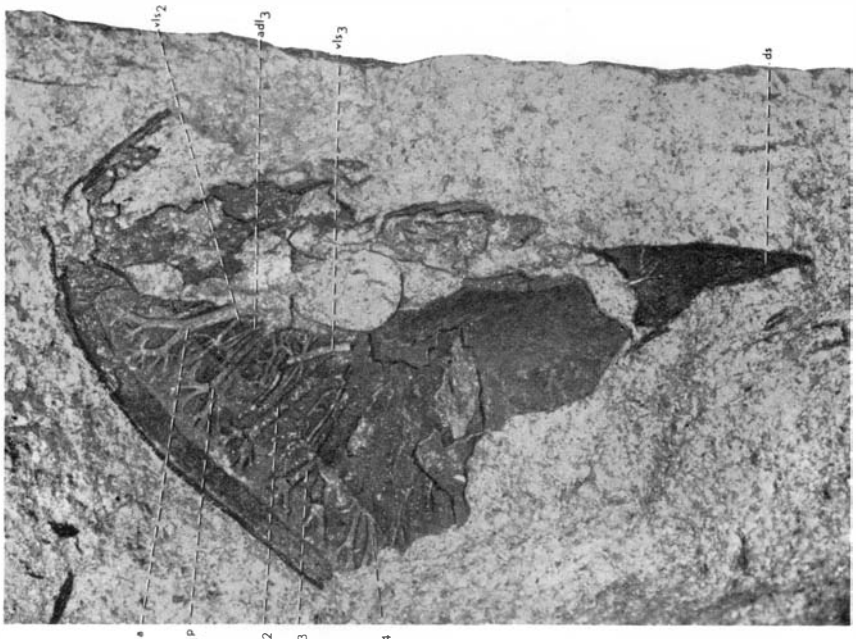
PLATE 118.

Figs. 1, 2. — *Acrotomaspis instabilis* n. sp. (p. 529). Section through the exoskeleton from the postero-dorso-median part of the cephalic shield. In fig. 1 most of the basal layer is destroyed. ENS no. 458. About × 120.

Fig. 3. — *Nectaspis peltata* n. sp. ? (p. 539). Section through the exoskeleton. Fragmentary shield from Spitsbergen, Mt Kronprinz, E. slope, opposite Stjørdalen Valley, in a grey sandstone. About × 92.

bl, basal layer; *mc,* mucous canals; *radc,* radiating vascular canals; *vascc,* vascular canals.

PLATES



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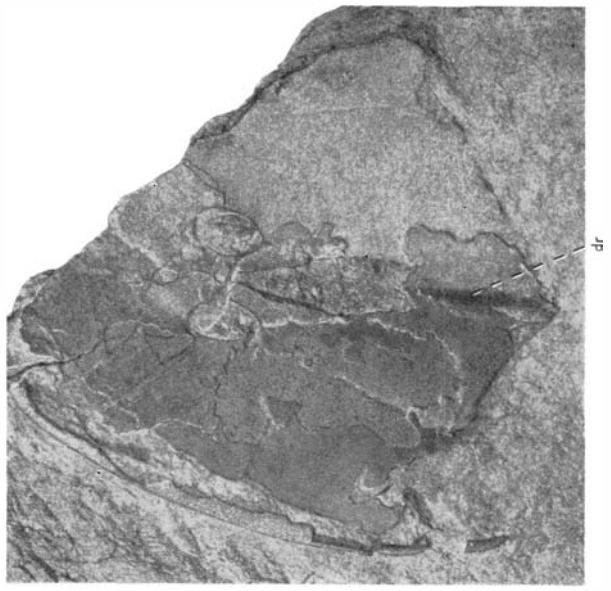

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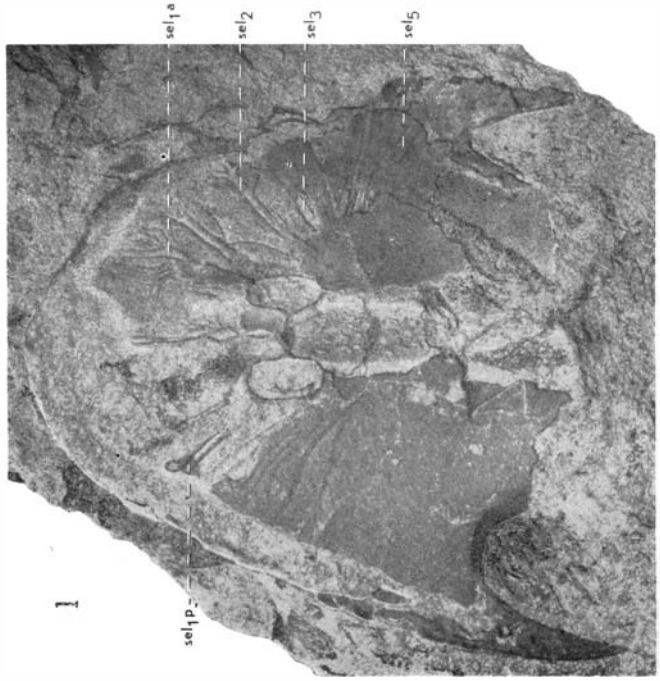

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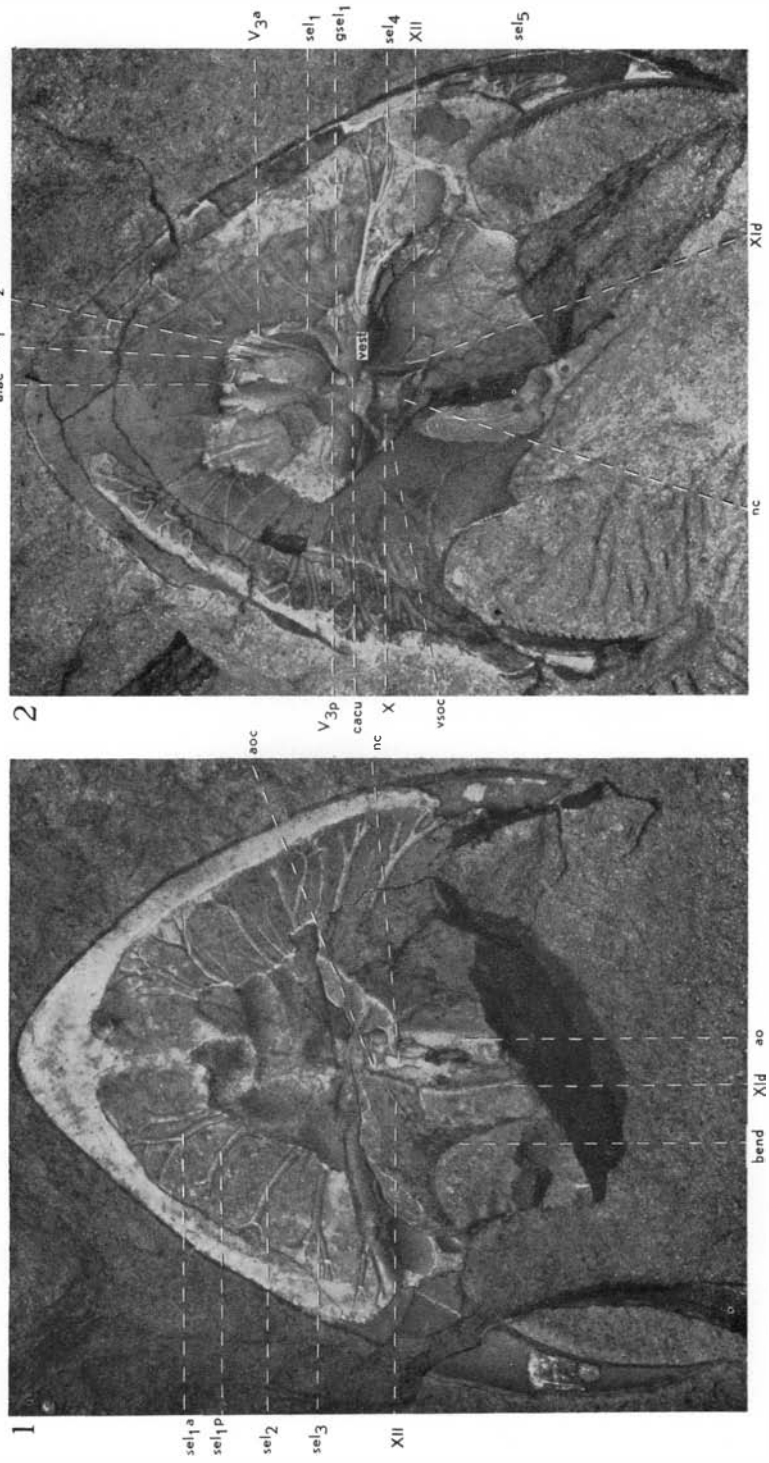
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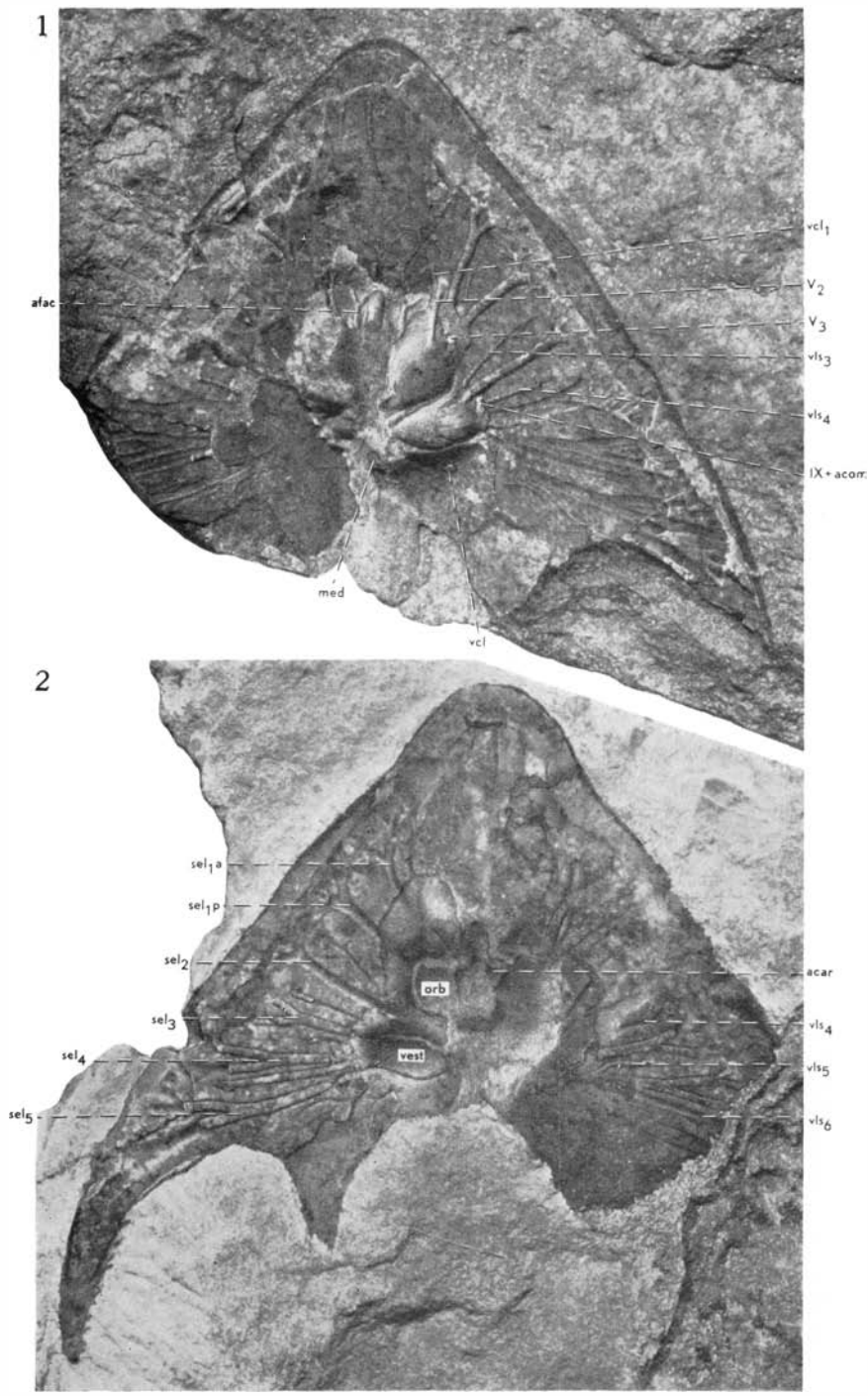
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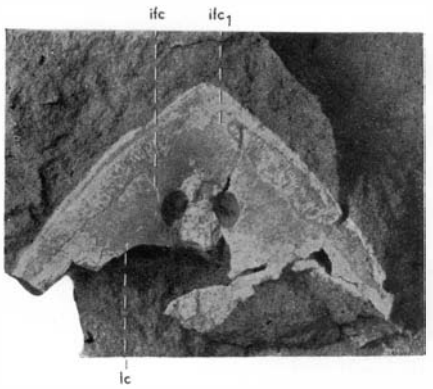

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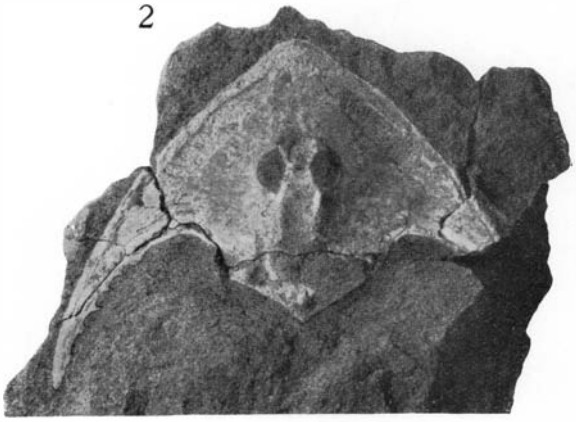

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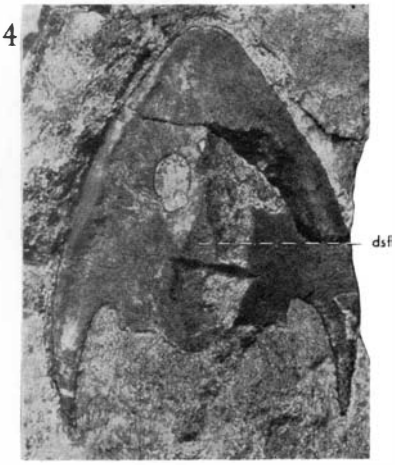

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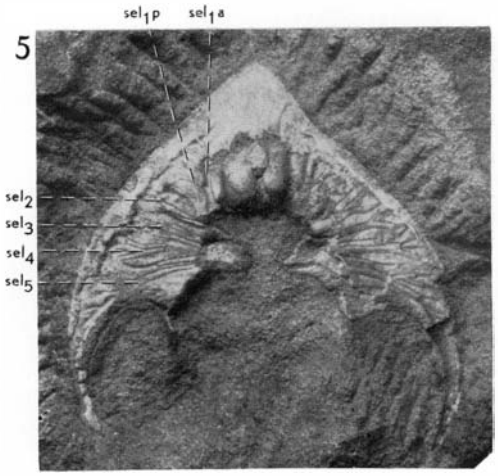

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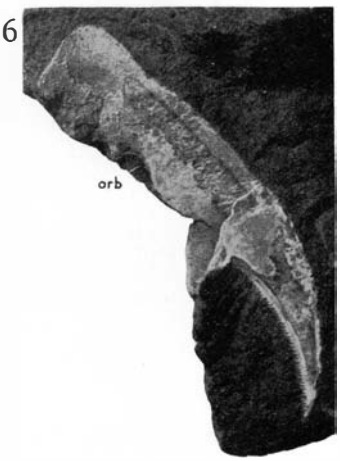

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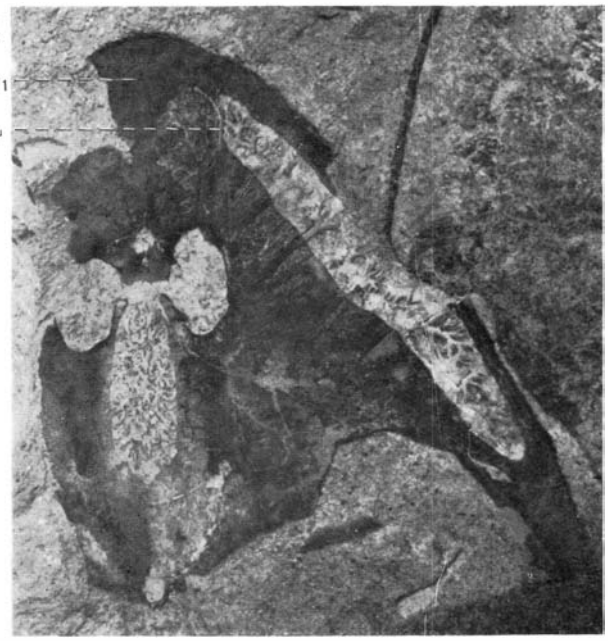
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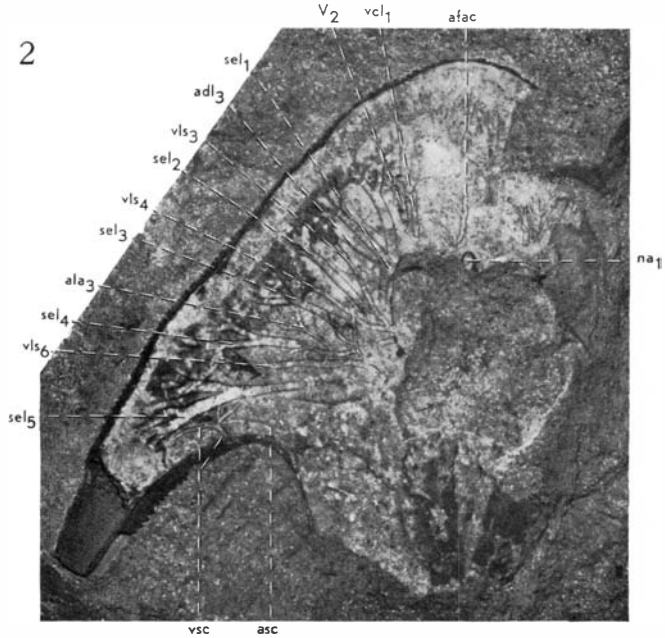
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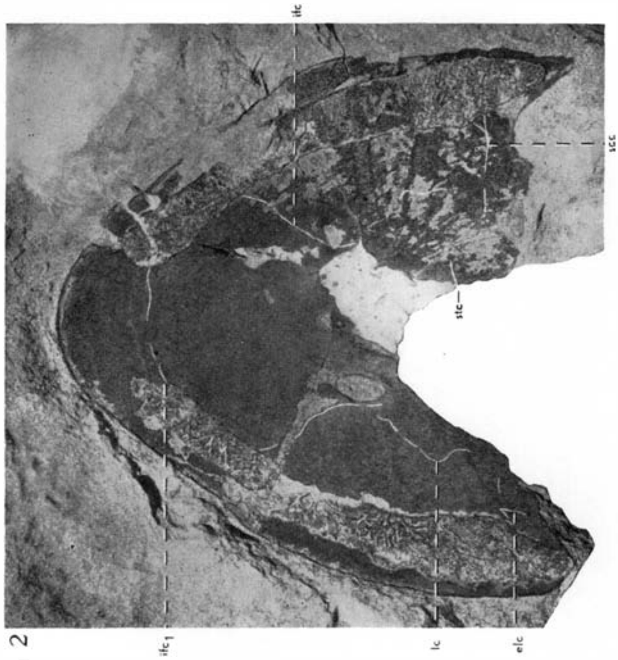

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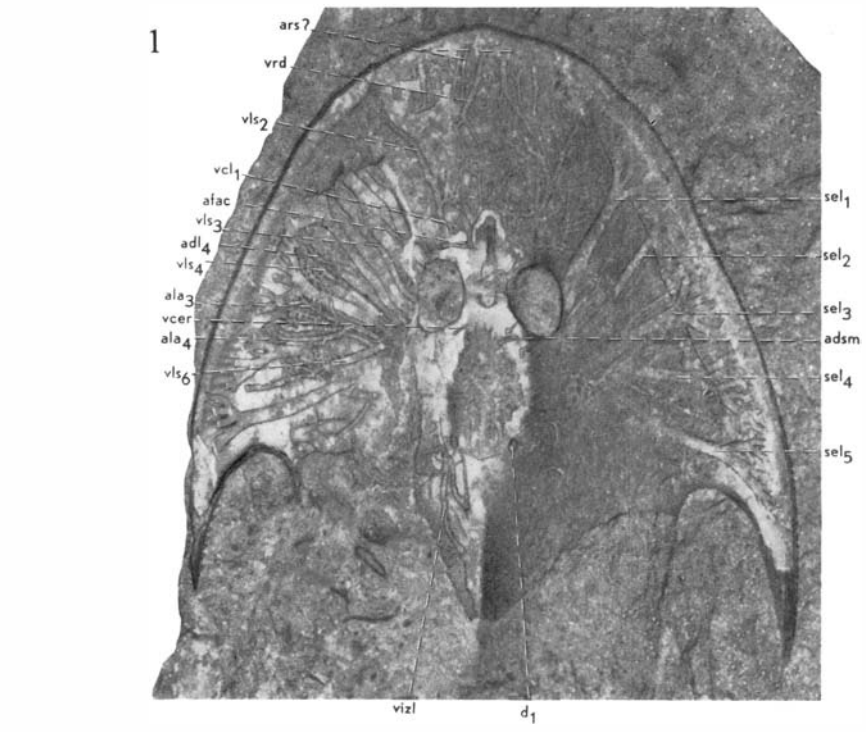
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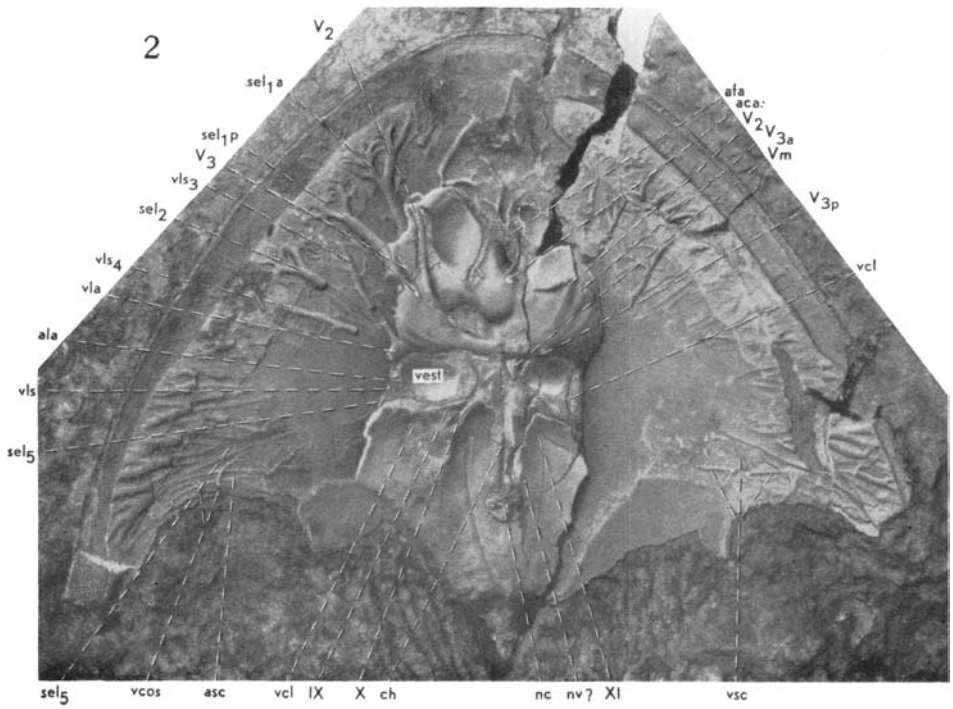
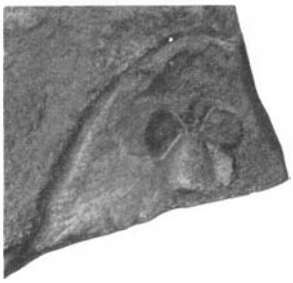
afac
vls3
adl4
vls4
ala3
vcer
ala4
vls6
sel1
sel2
sel3
adsm
sel4
sel5
vizl
d1


2
V2
sel1a
sel1p
V3
vls3
sel2
vls4
vla
ala
vls
sel5
afa
aca
V2
V3a
Vm
V3p
vcl
vest
sel5
vcos
asc
vcl IX
X ch
nc nv? XI
vsc

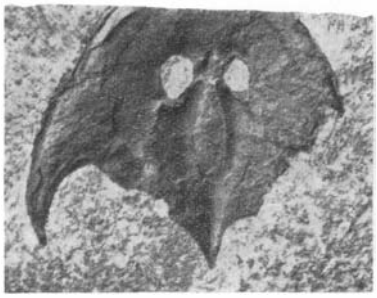
1



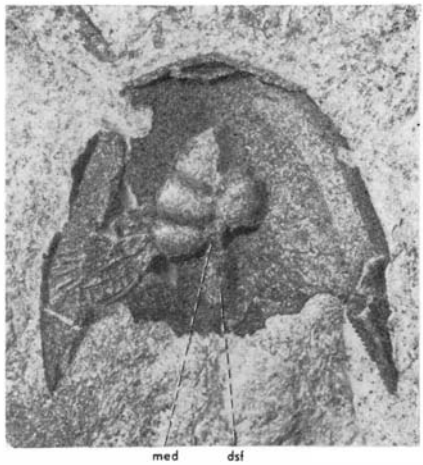
2


d_1

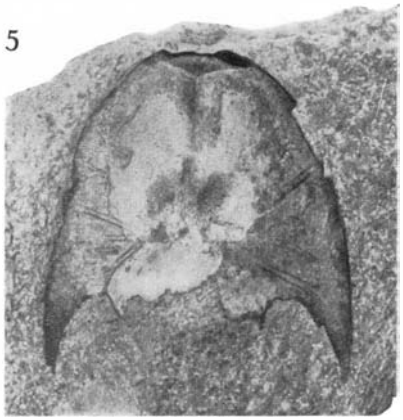
3



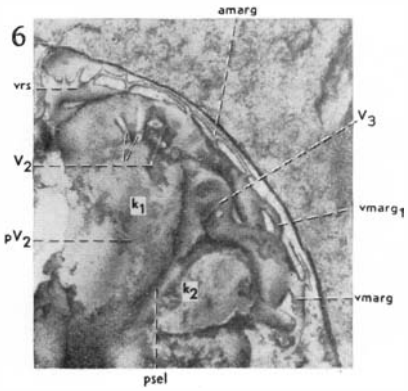
4


med
dsf

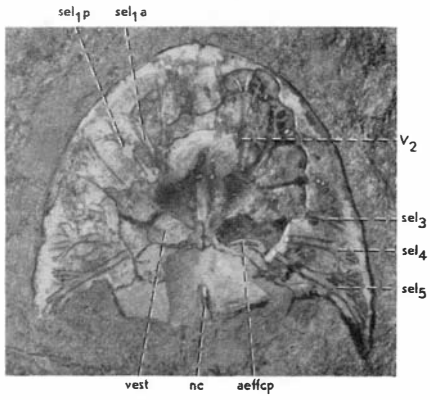
5

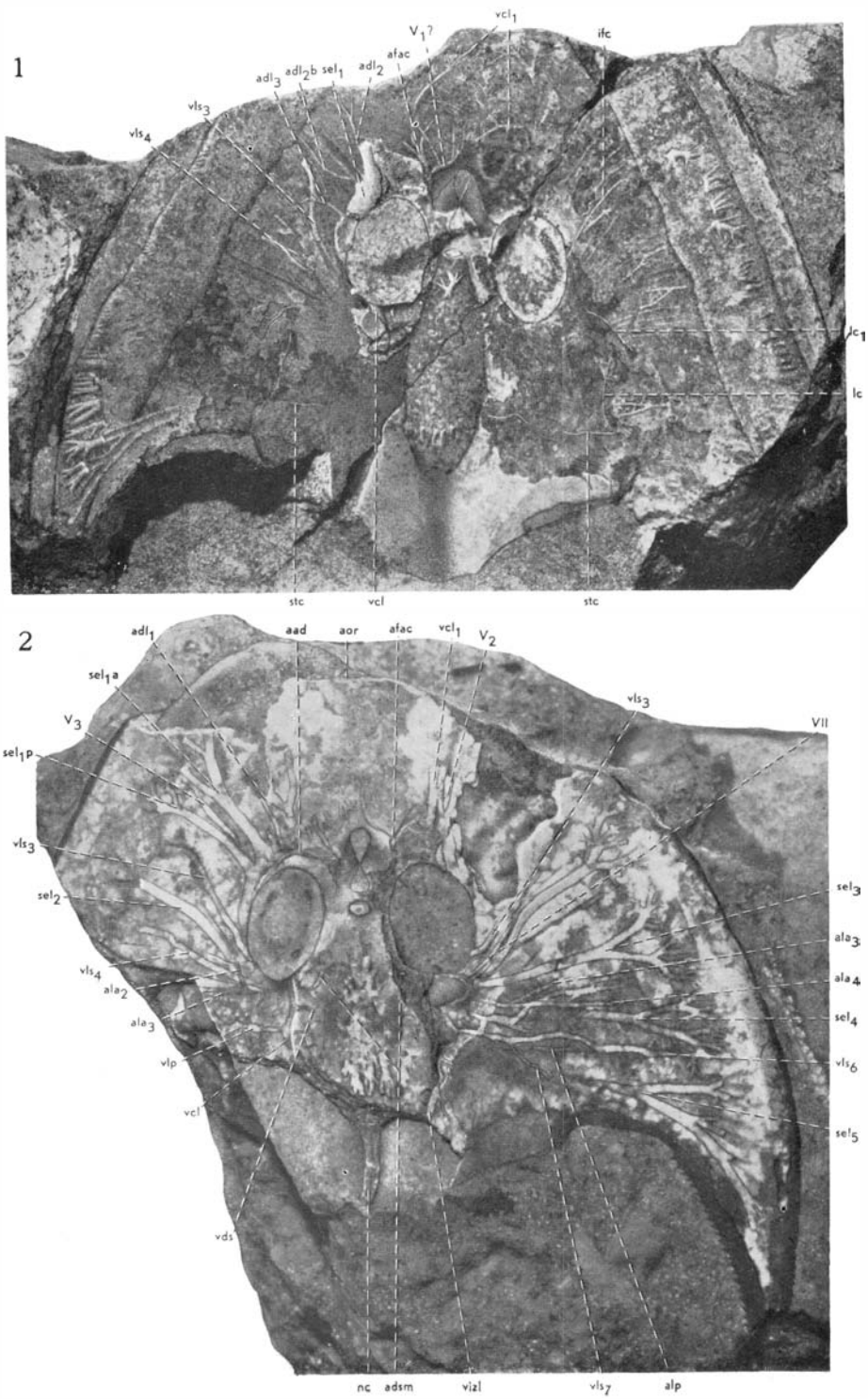


6

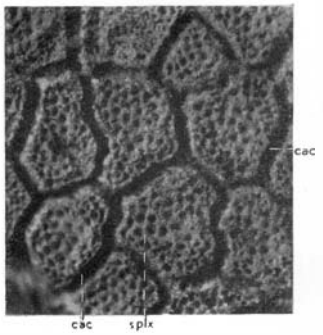

amarg
vrs
V_3
V_2
k_1
$vmarg_1$
pV_2
k_2
vmarg
psel

7

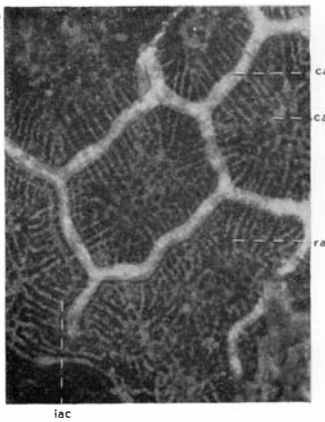

sel_1p
sel_1a
V_2
sel_3
sel_4
sel_5
vest
nc
aeffcp


1
vcl1
V1?
ifc
afac
adl3
adl2b
sel1
adl2
vls3
vls4
lc1
lc
stc
vcl
stc
2
adl1
aad
aor
afac
vcl1
V2
sel1a
vls3
VII
V3
sel1p
vls3
sel2
sel3
ala3
vls4
ala2
ala4
ala3
sel4
vlp
vls6
vcl
sel5
vds
nc
adsm
vizl
vls7
alp

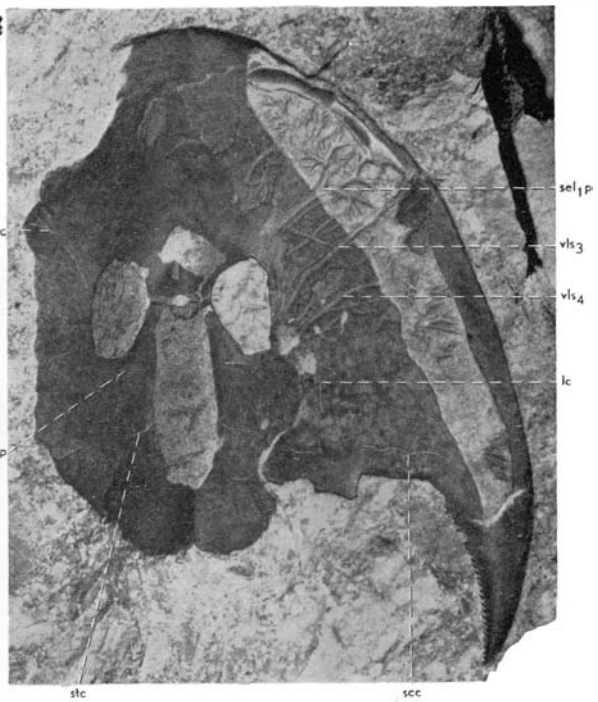
1


cac
cac
splx

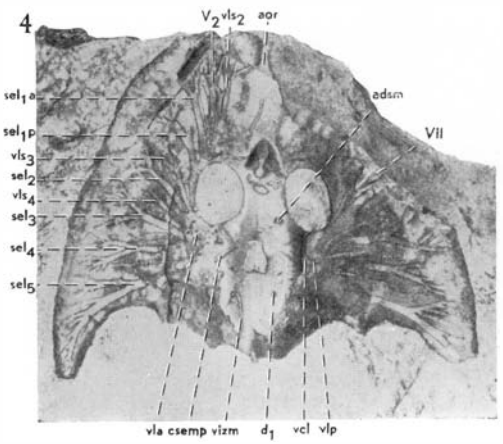
2


cac
casc
radc
iac

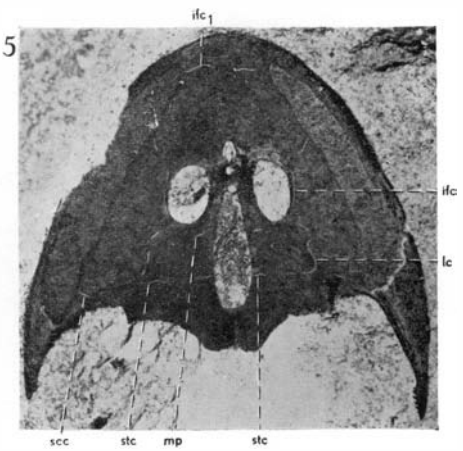
3

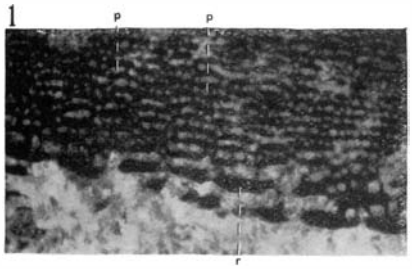

sel1p
ifc
vls3
vls4
lc
mp
stc
scc

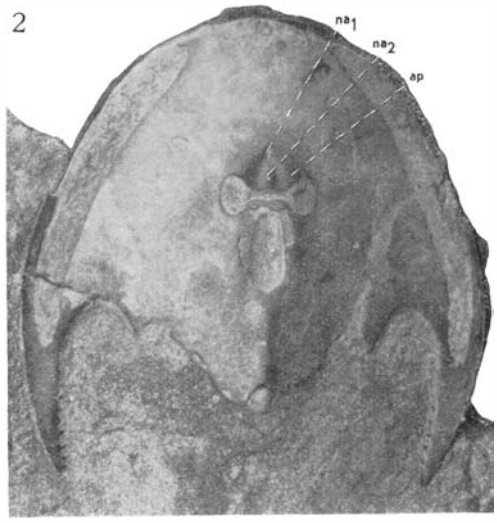
4

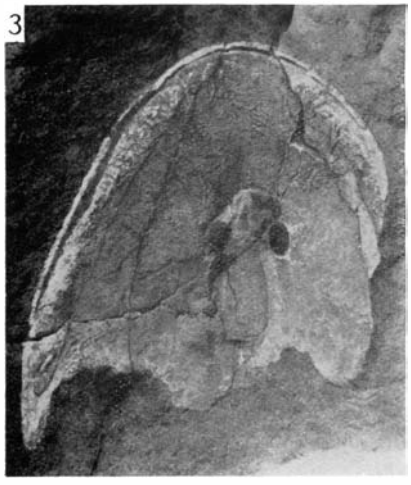

V2
vls2
aor
sel1a
adsm
sel1p
VII
vls3
sel2
vls4
sel3
sel4
sel5
vla
csemp
vizm
d1
vcl
vlp

5


ifc1
ifc
lc
scc
stc
mp
stc


1
p
p
r


2
na1
na2
ap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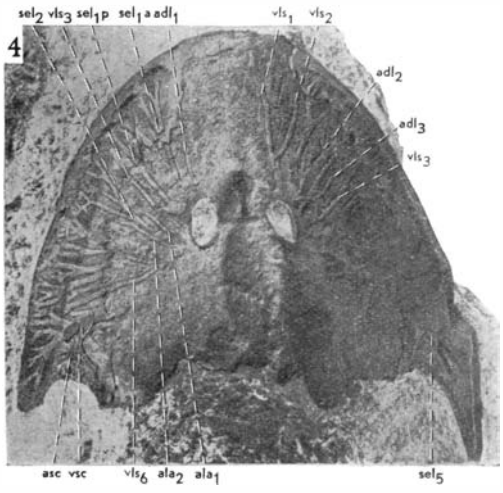
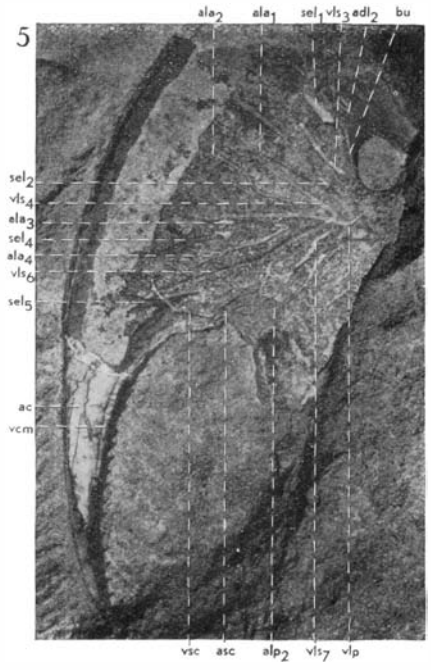
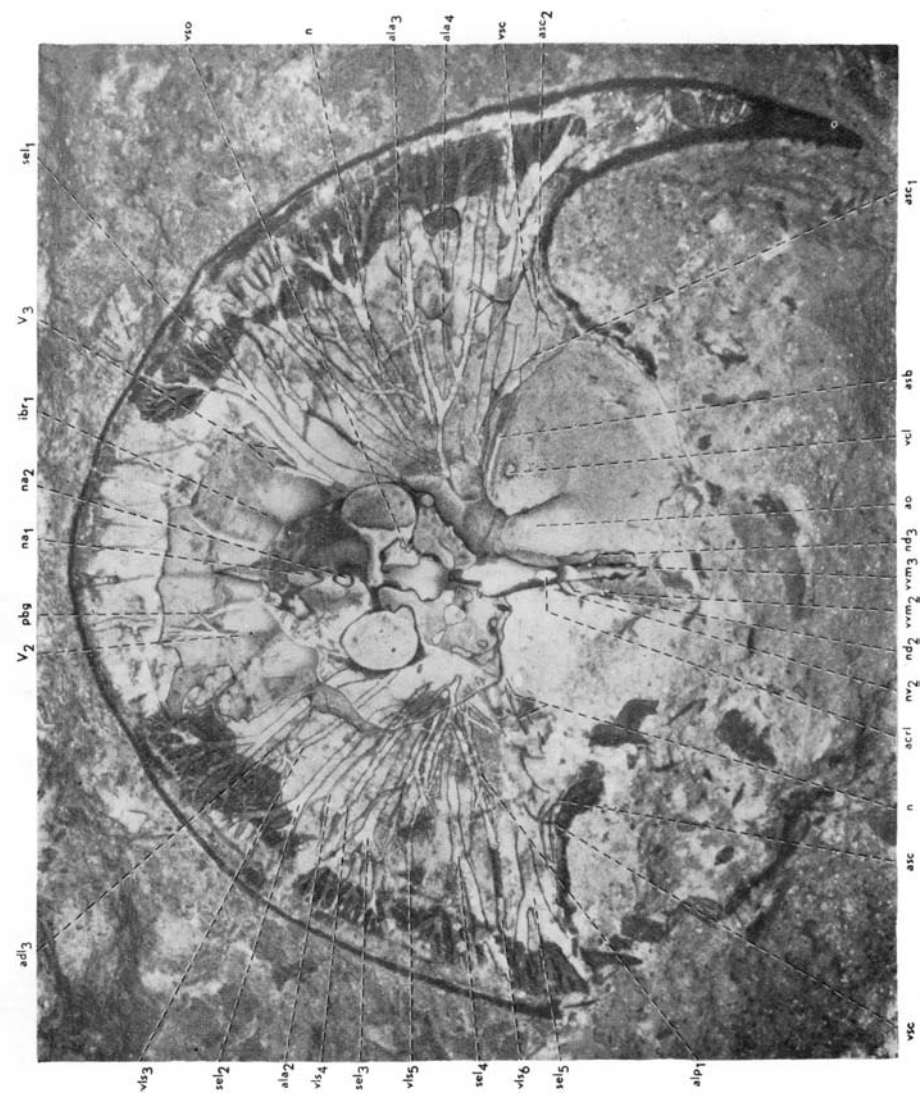
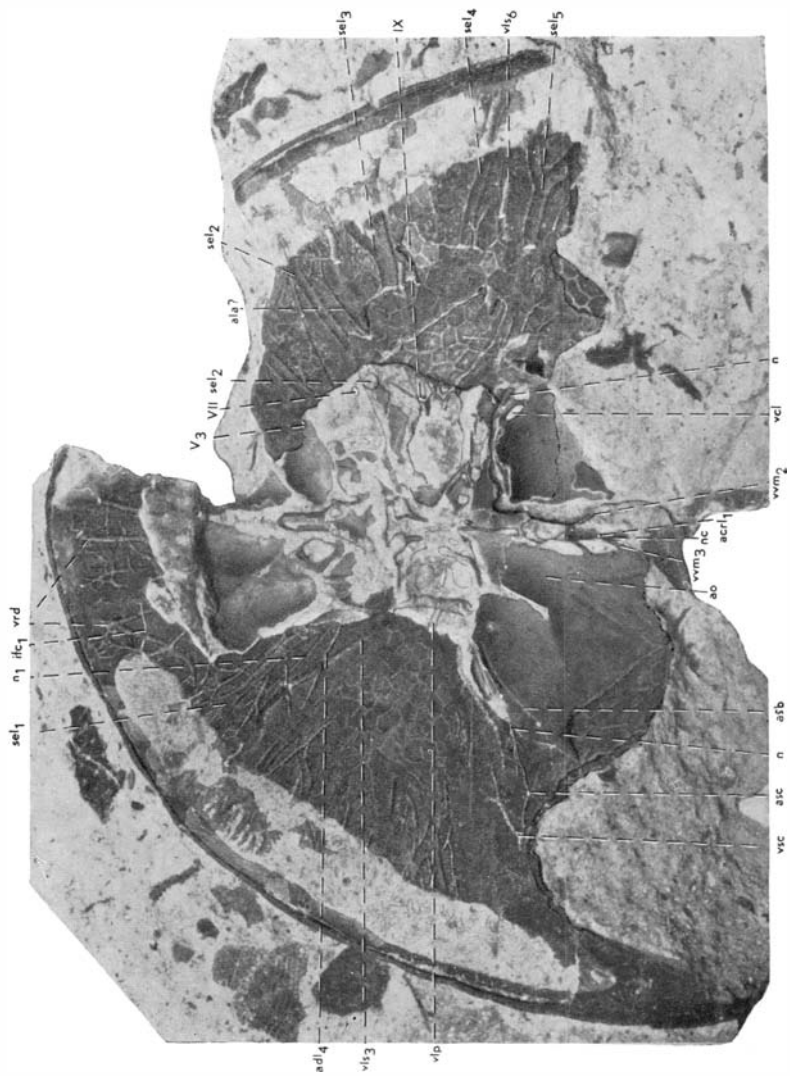
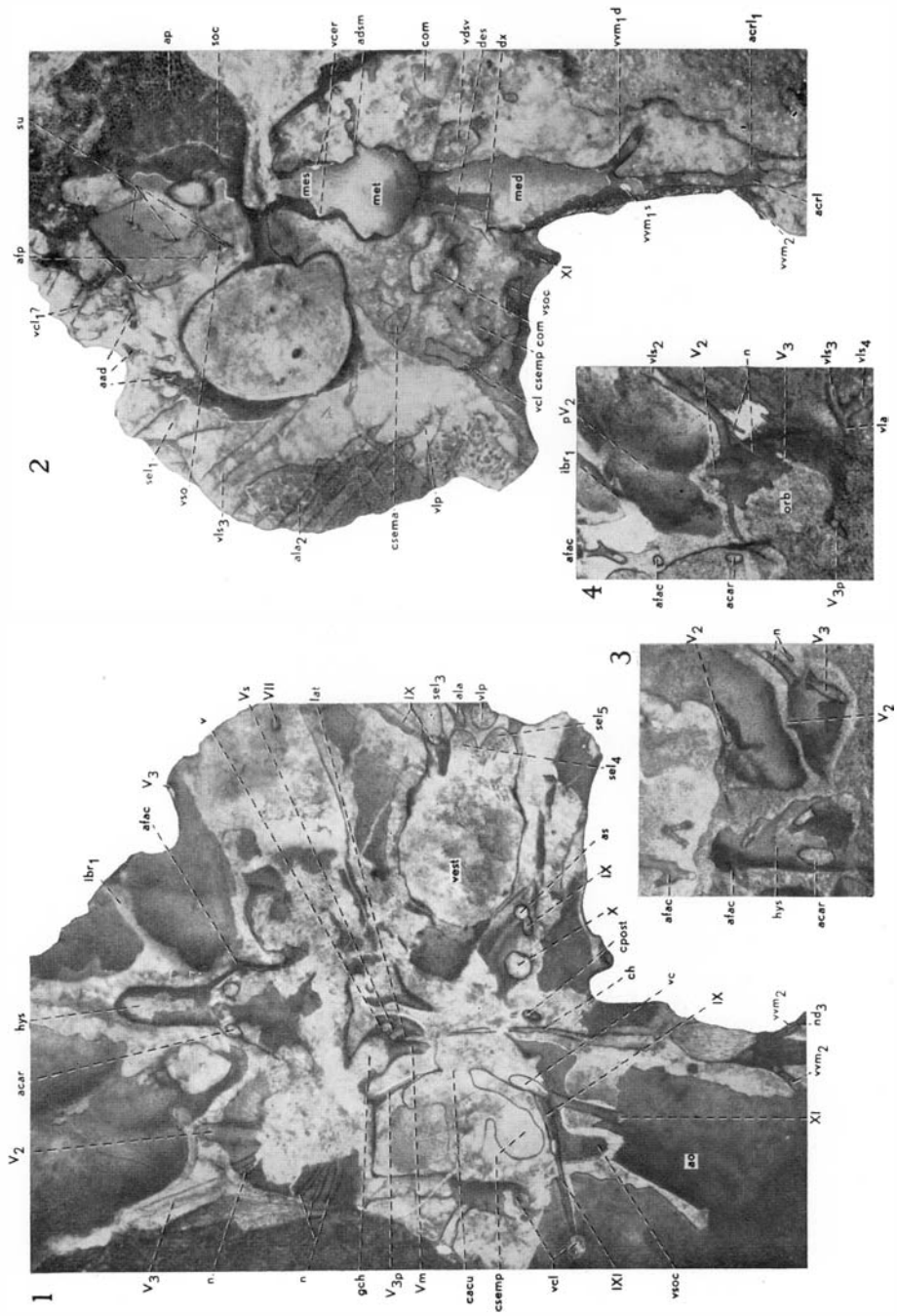

4
sel2 vls3 sel1p sel1a adl1
vls1 vls2
adl2
adl3
vls3
asc vsc
vls6 ala2 ala1
sel5

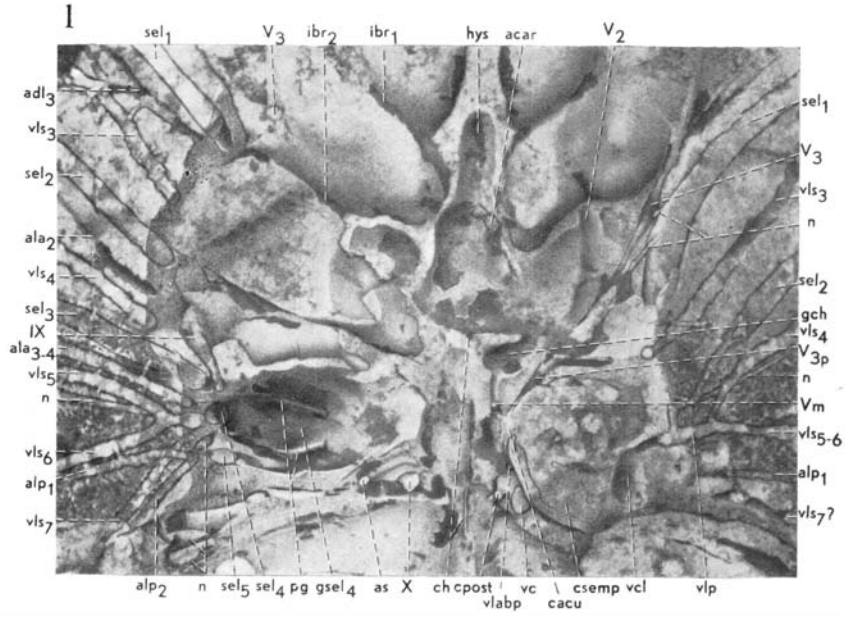

5
ala2 ala1 sel1 vls3 adl2 bu
sel2
vls4
ala3
sel4
ala4
vls6
sel5
ac
vcm
vsc asc alp2 vls7 vlp


vso
n
ala3
ala4
vsc
asc2
sel1
V3
ibr1
na2
na1
V2 pbg
adl3
atc1
atb
vcl
ao
nd3
vvm3
vvm2
nd2
nv2
acrl
n
asc
vsc
vls3
sel2
ala2
vls4
sel3
vls5
sel4
vls6
sel5
alp1

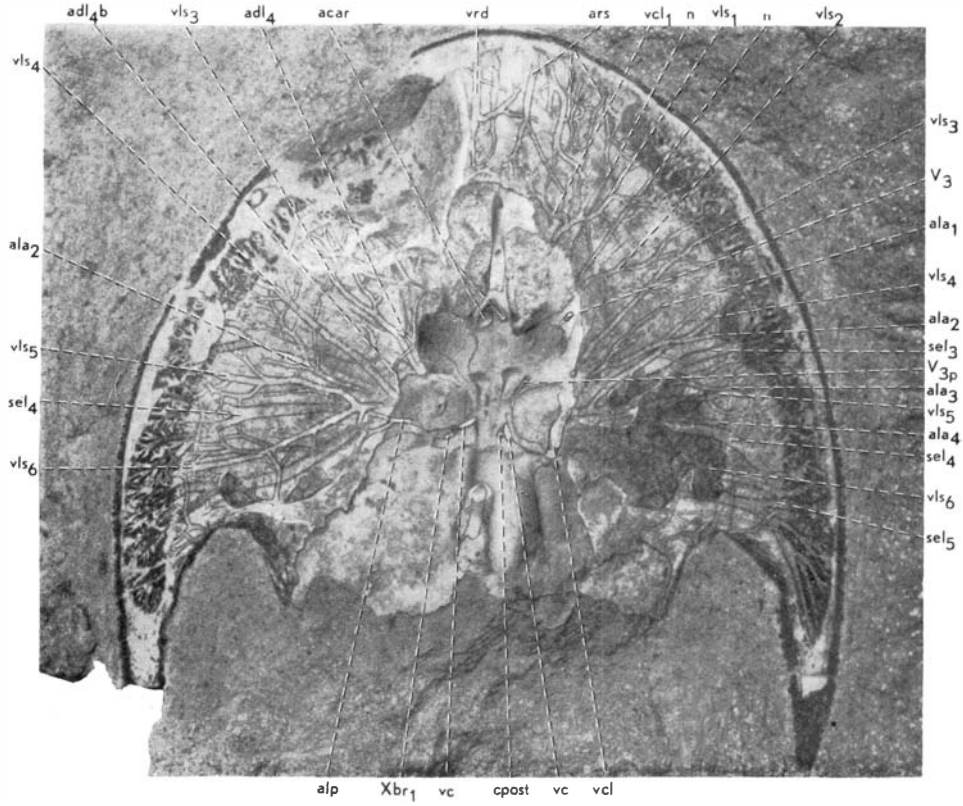

sel3
IX
sel4
vls6
sel5
sel2
ala?
V3
VII sel2
n
vcl
vvm2
acr1
nc
vvm3
ao
sel1
n1
ifc1
vrd
asb
n
asc
vsc
adl4
vls3
vlp

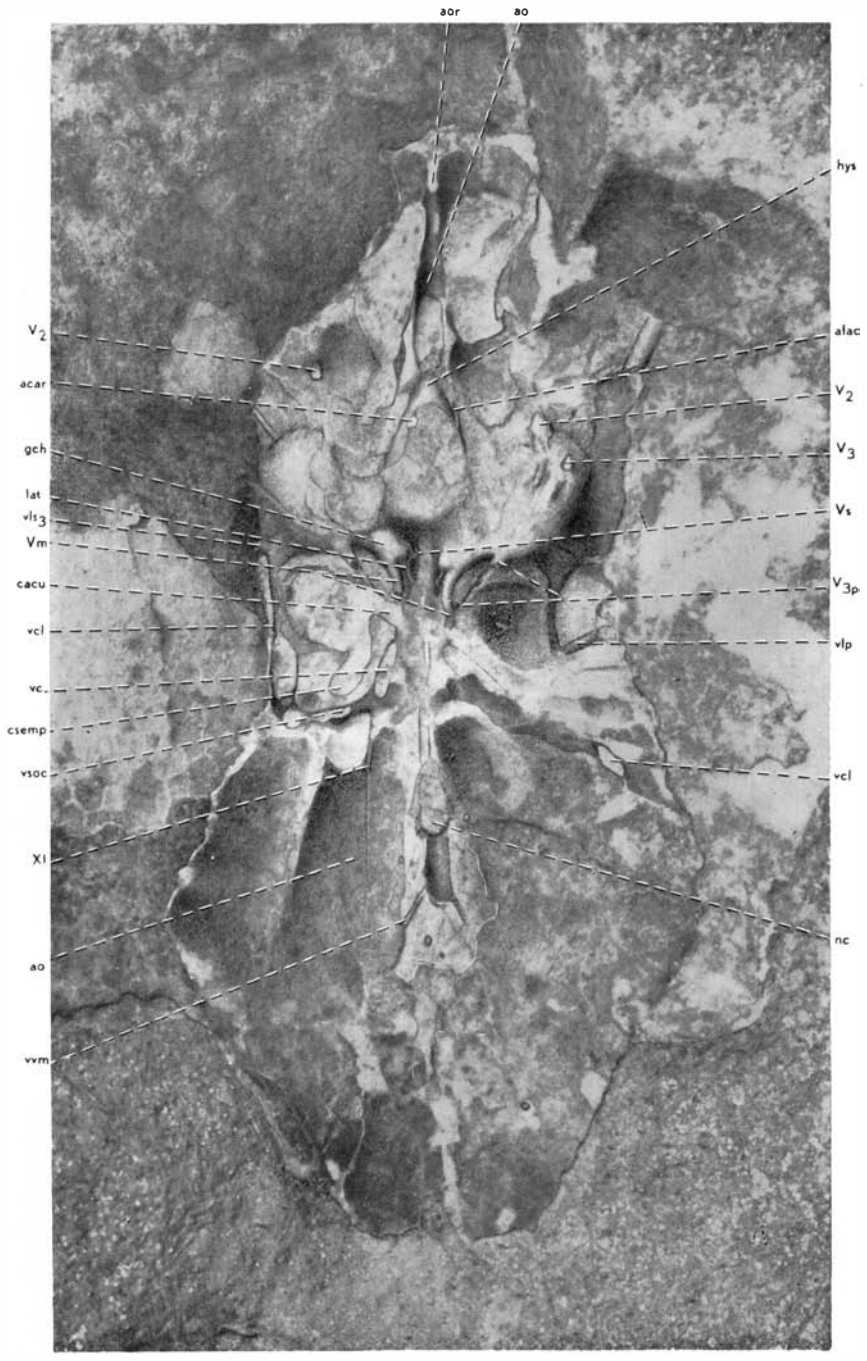

1
2
3
4
V2
acar
hys
V3
n
gch
V3p
Vm
cacu
csemp
vcl
IXI
vsoc
ibr1
alac
V3
Vs
VII
lat
IX
sel3
ala
vlp
sel5
sel4
vest
as
X
cpost
ch
vc
vvm2
nd3
XI
su
alp
vcl1?
ead
sel1
vso
vls3
ala2
csema
vlp
ap
soc
mes
met
vcer
adsm
com
vdsv
des
dx
med
vcl csemp com vsoc
vvm1 d
vvm1 s
vvm2
acrl1
acrl
pV2
ibr1
orb
vls2
vls3
vls4
vla
V3p
hys

1

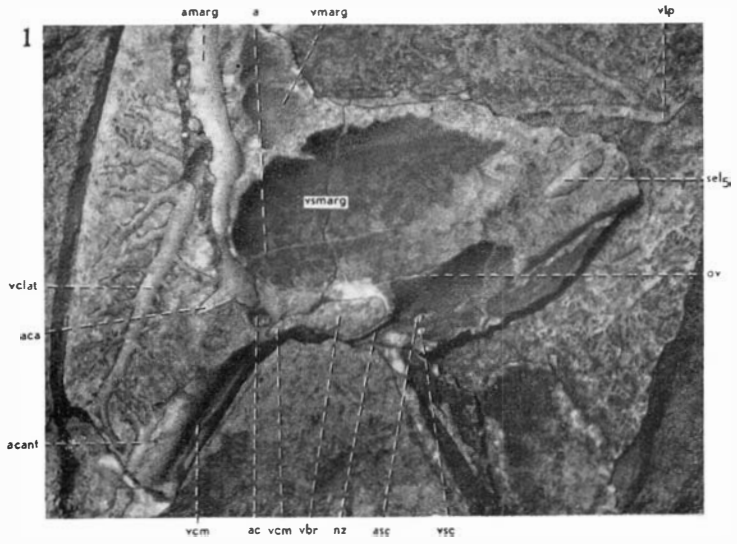

sel1
V3
ibr2
ibr1
hys
acar
V2
adl3
vls3
sel2
ala2
vls4
sel3
IX
ala3-4
vls5
n
vls6
alp1
vls7
sel1
V3
vls3
n
sel2
gch
vls4
V3p
n
Vm
vls5-6
alp1
vls7?
alp2
n
sel5
sel4
pg
gsel4
as
X
ch
cpost
vc
vlabp
cacu
csemp
vcl
vlp

2


adl4b
vls3
adl4
acar
vrd
ars
vcl1
n
vls1
n
vls2
vls4
ala2
vls5
sel4
vls6
vls3
V3
ala1
vls4
ala2
sel3
V3p
ala3
vls5
ala4
sel4
vls6
sel5
alp
Xbr1
vc
cpost
vc
vcl


aor
ao
hys
alac
V2
V3
Vs
V3p
vlp
vcl
nc
V2
acar
gch
lat
vls3
Vm
cacu
vcl
vc
csemp
vsoc
XI
ao
vvm

1

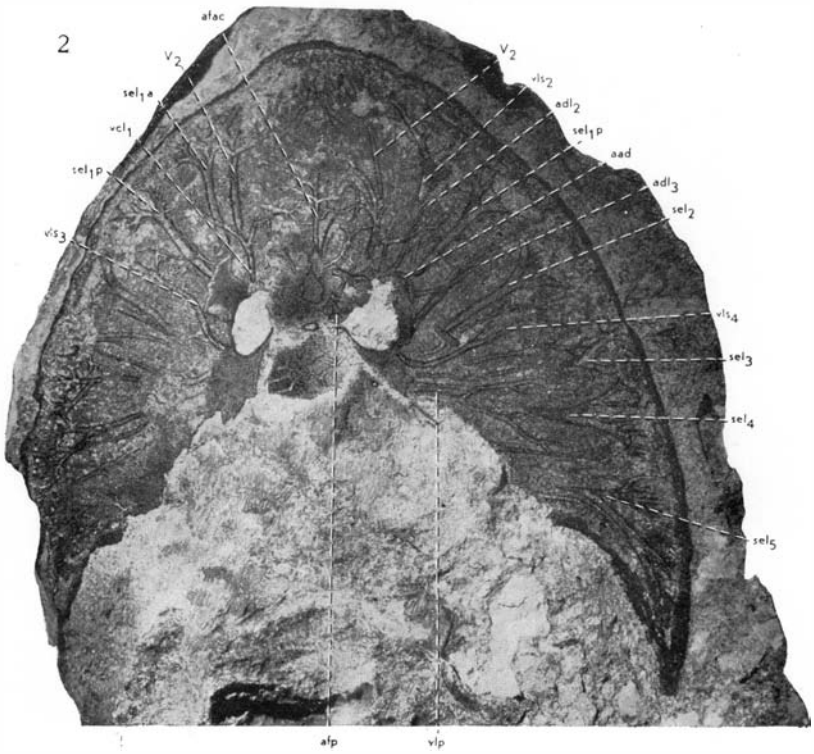

amarg
a
vmarg
vlp
sels
vsmarg
vclat
ov
aca
acant
vcm
ac
vcm
vbr
nz

2

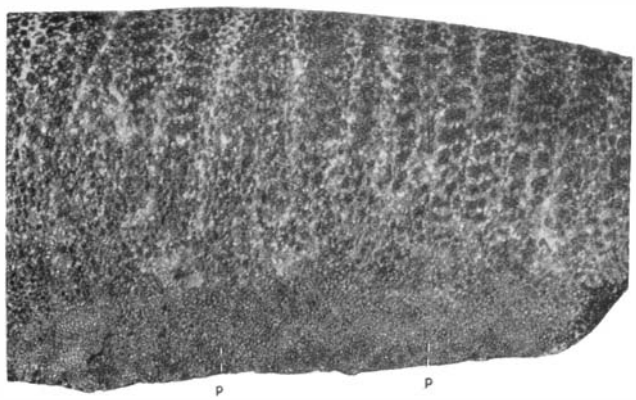

na2

1

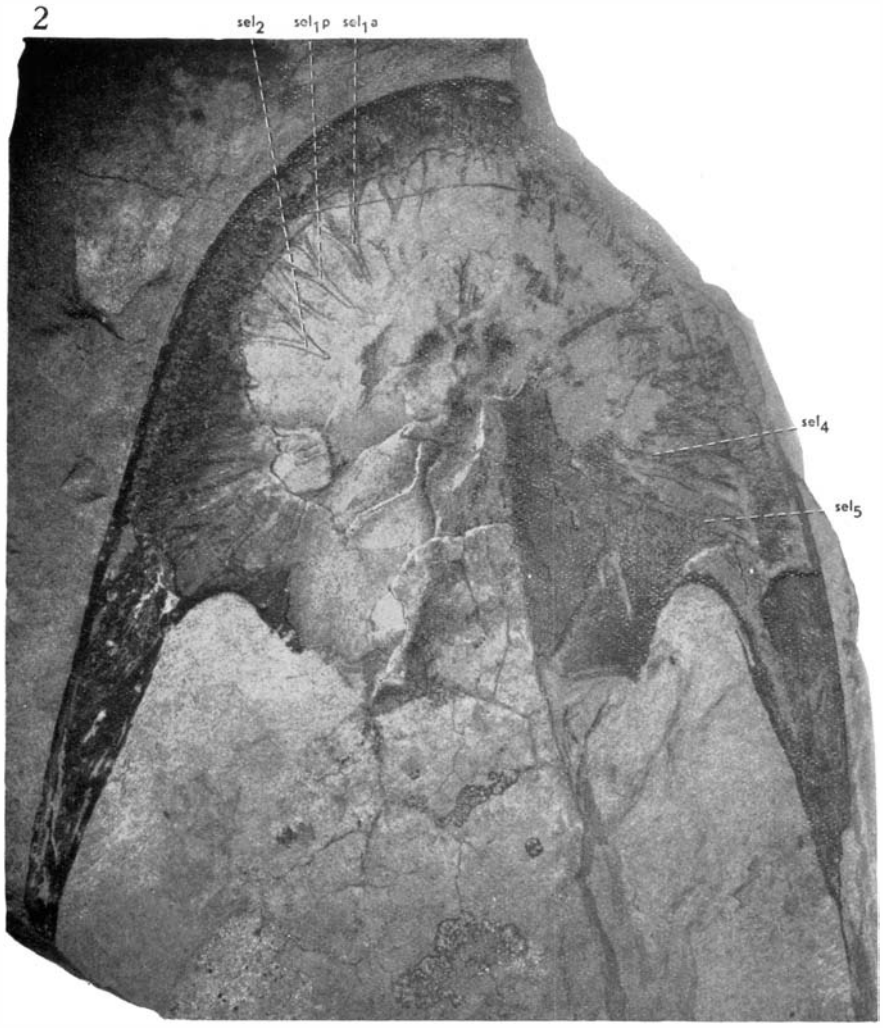
2


afac
V2
sel1a
vcl1
sel1p
vls3
V2
vls2
adl2
sel1p
aad
adl3
sel2
vls4
sel3
sel4
sel5
afp
vlp

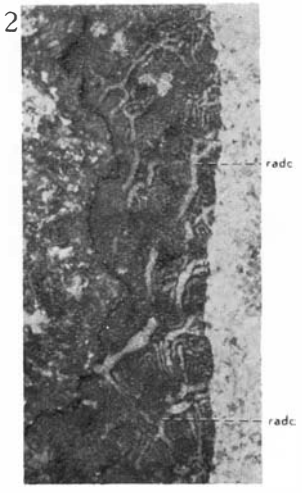
1

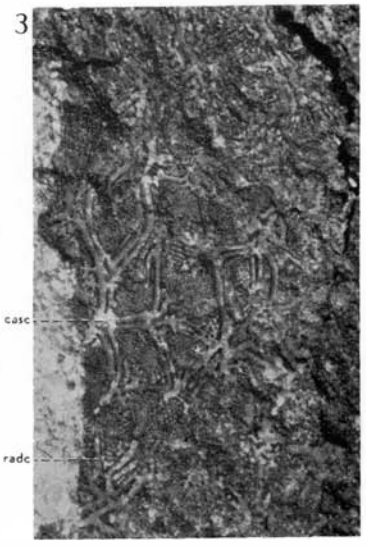


2

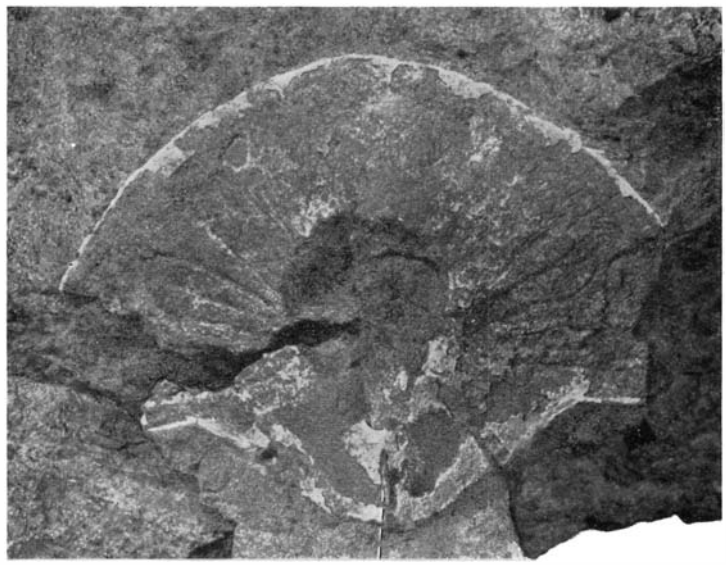



1

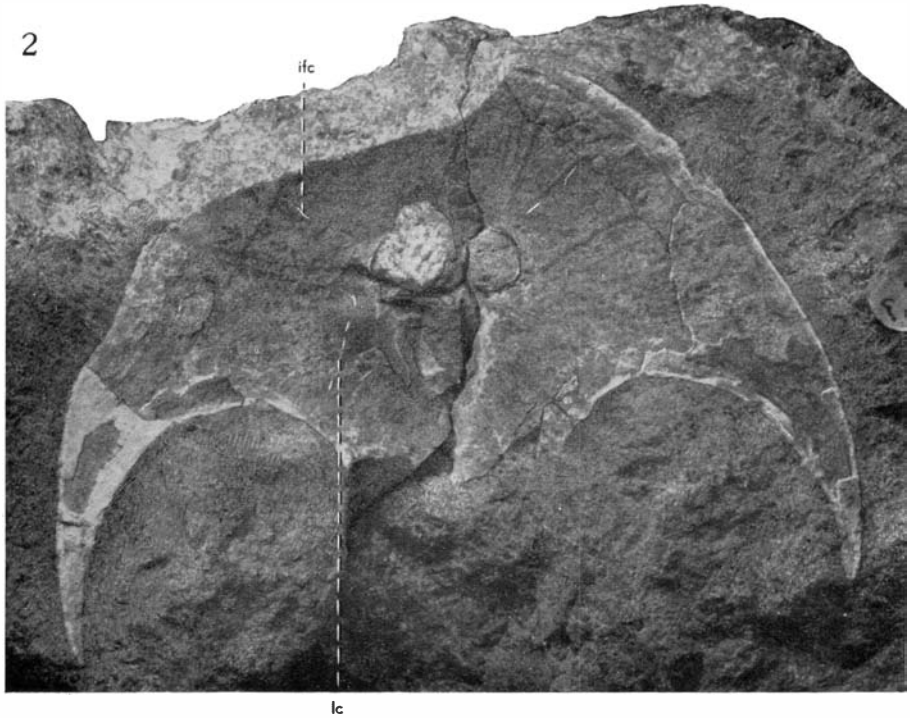

2
radc
radc

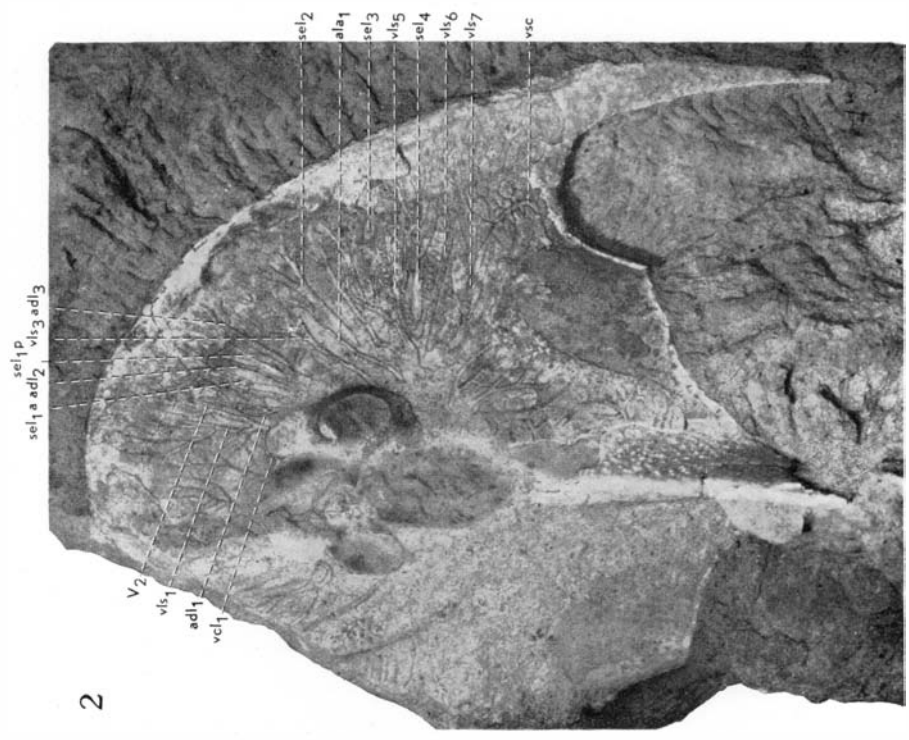

3
casc
radc

1

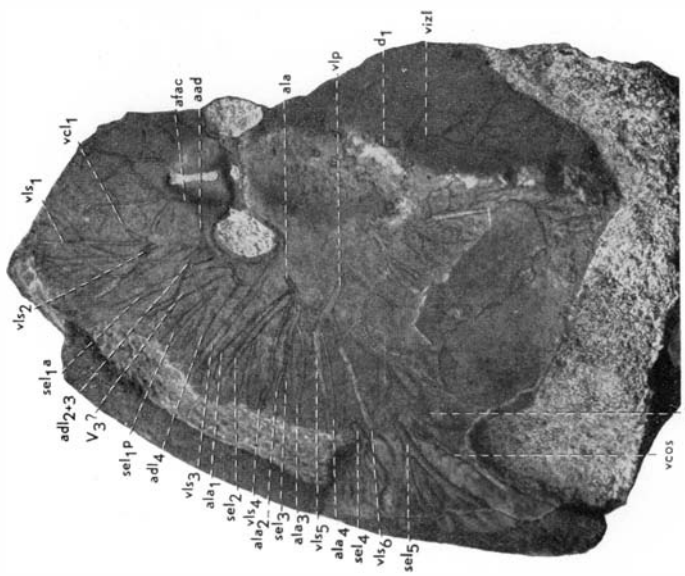


2

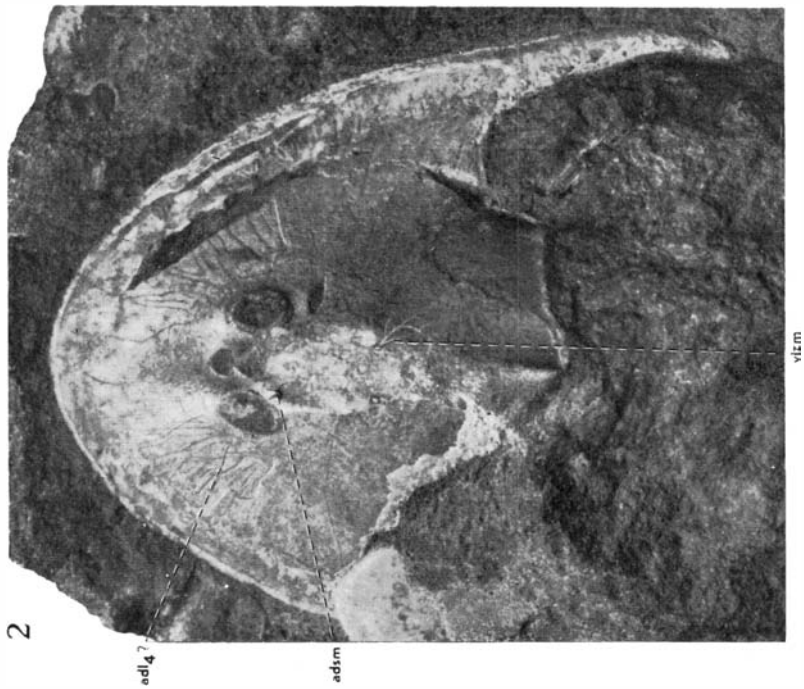


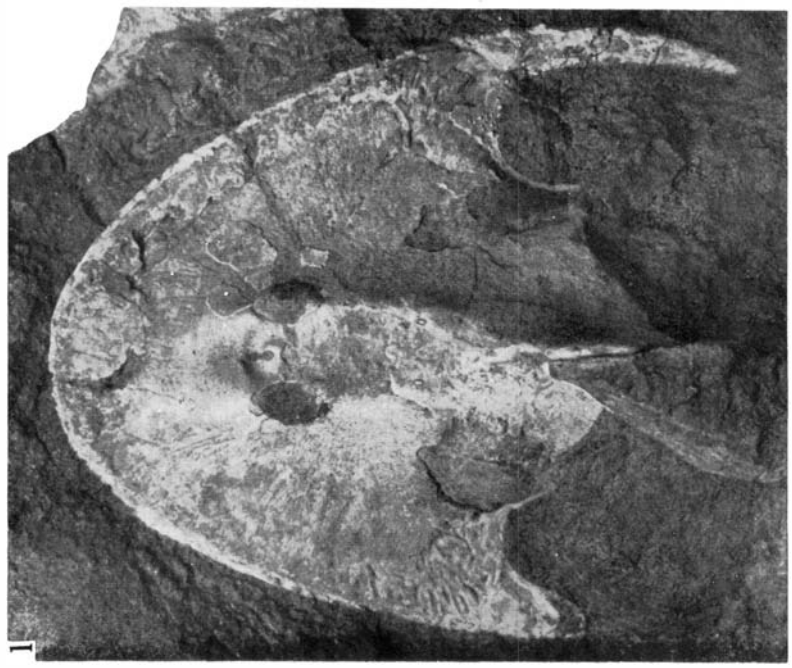

sel2
ala1
sel3
vls5
sel4
vls6
vls7
vsc
sel1p
sel1a adl2
vls3 adl3
V2
vls1
adl1
vcl1

2


afac
aad
ala
vlp
d1
vizl
vcl1
vls1
vls2
sel1a
adl2+3
V3?
sel1p
adl4
vls3
ala1
sel2
vls4
ala2
sel3
ala3
vls5
ala4
sel4
vls6
sel5
vcos
vsc

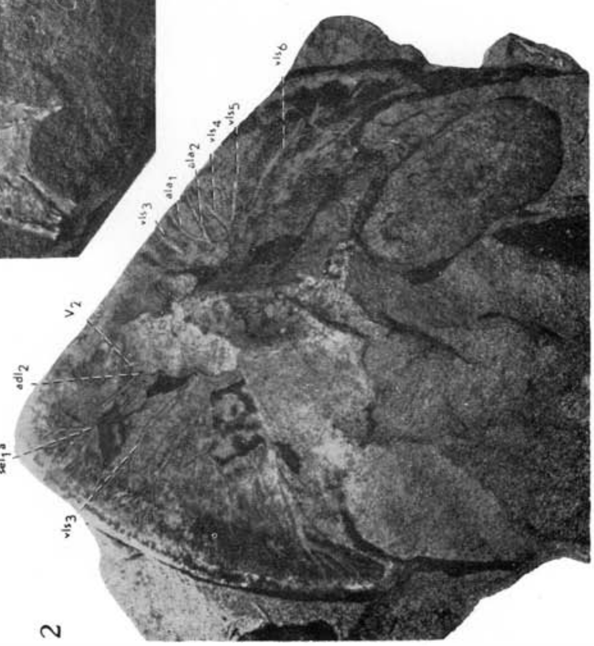
1


2
adl4?
adsm
vlzm


1

3

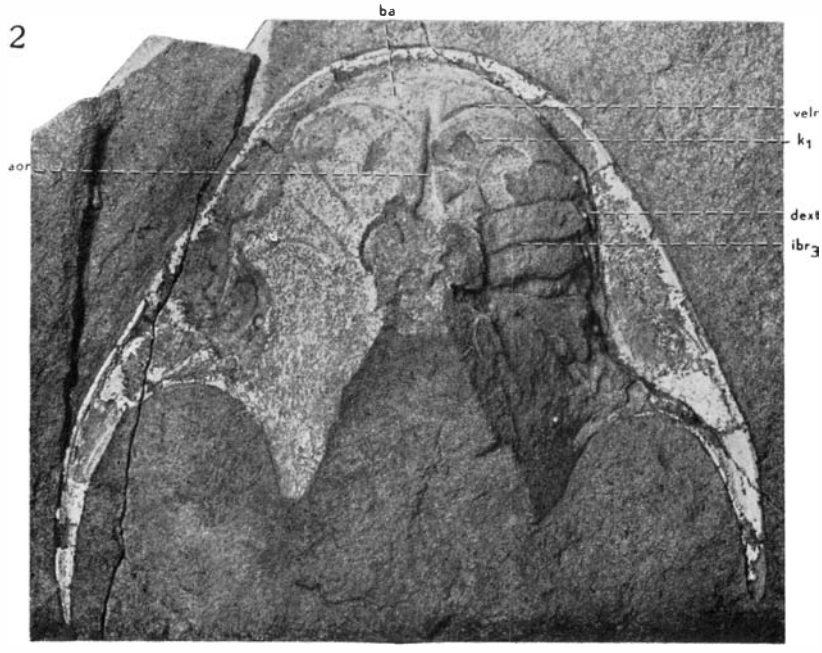
1

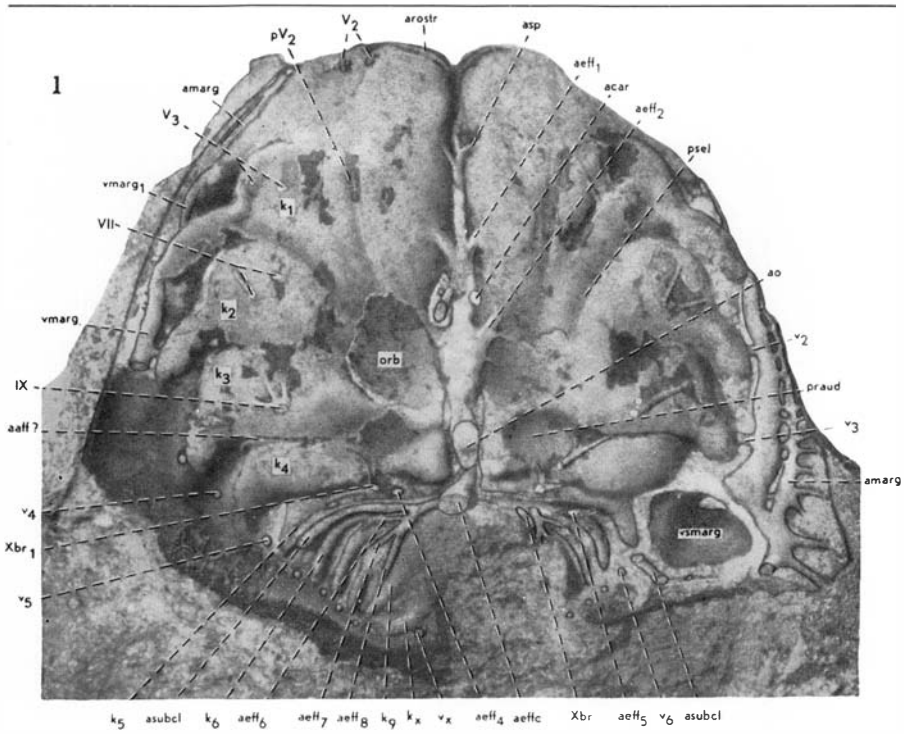


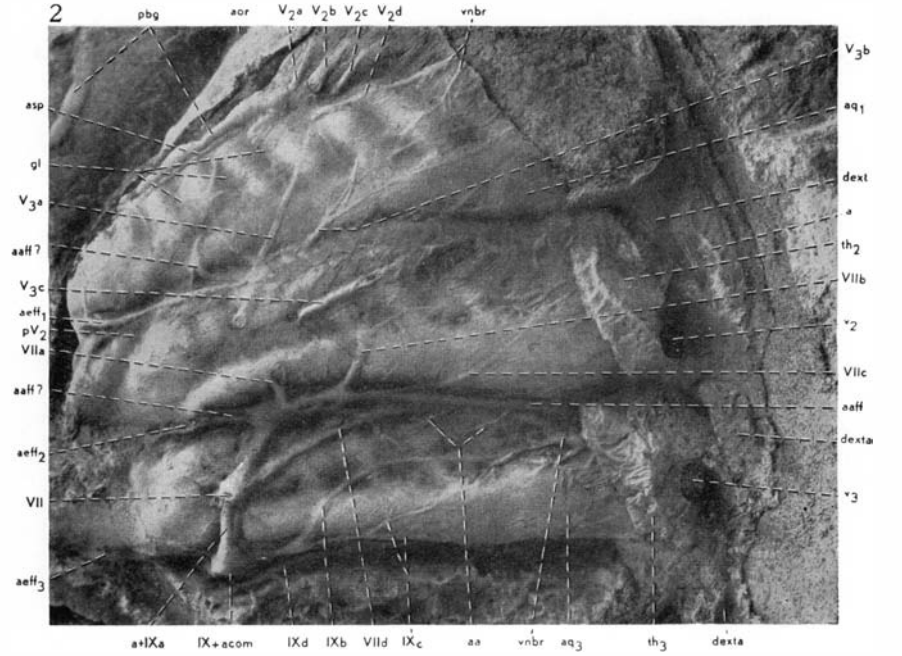
2

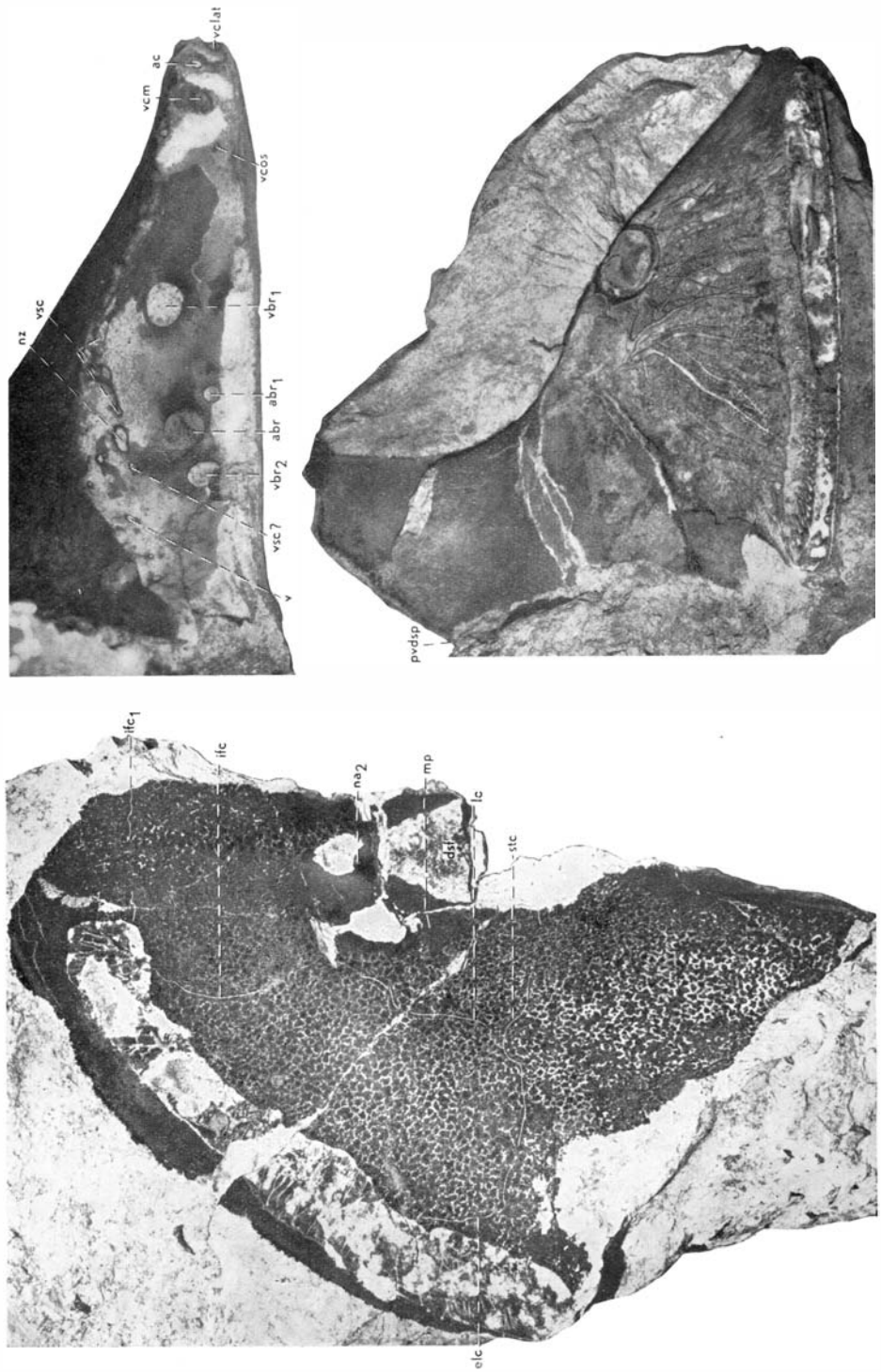
1

2



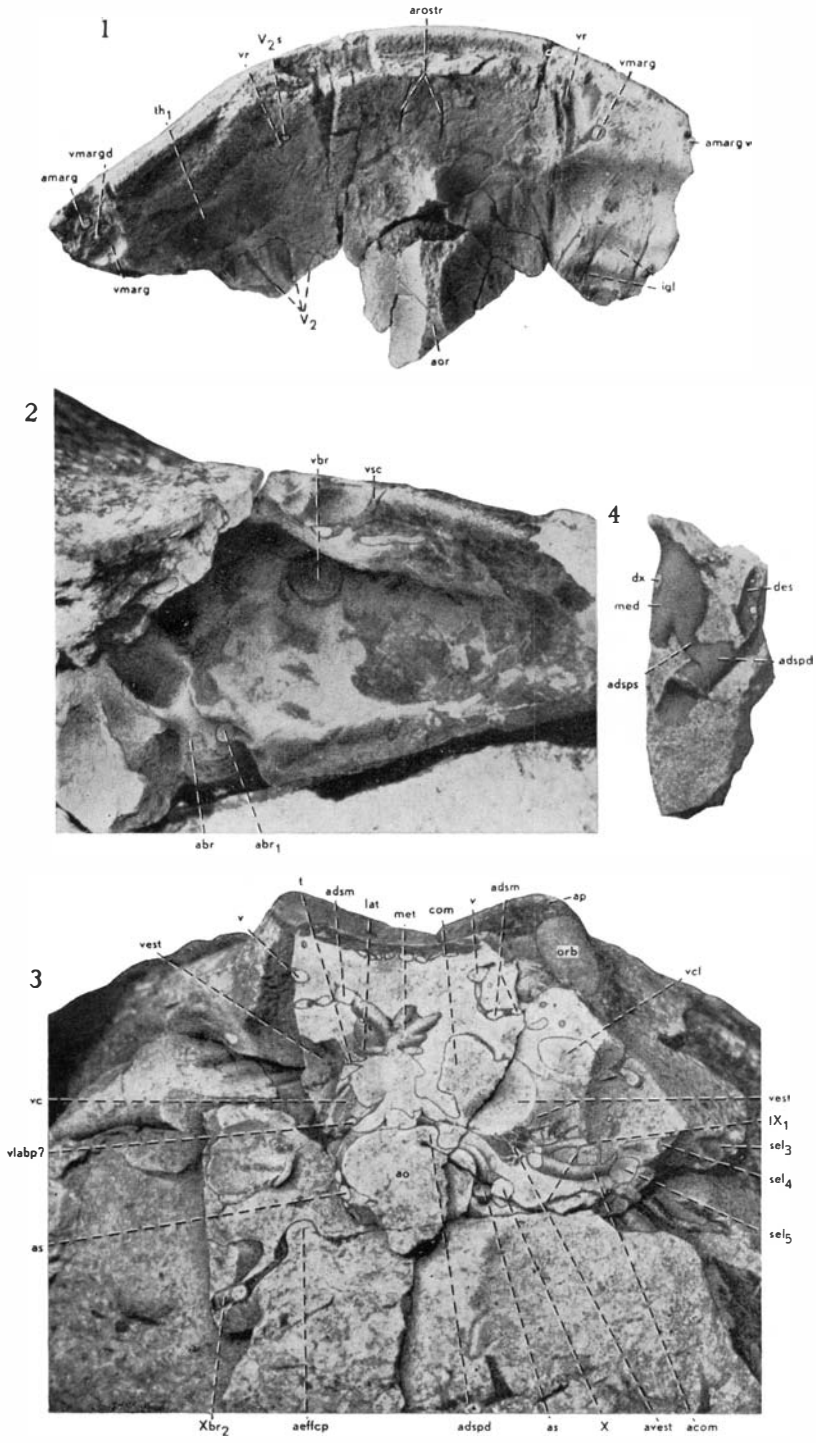

1
pV2
V2
arostr
asp
aeff1
acar
aeff2
psel
amarg
V3
vmarg1
k1
VII
ao
vmarg
k2
orb
v2
IX
k3
praud
aaff?
v3
k4
amarg
v4
vsmarg
Xbr1
v5
k5 asubcl k6 aeff6 aeff7 aeff8 k9 kx vx aeff4 aeffc Xbr aeff5 v6 asubcl


2
pbg
aor
V2a V2b V2c V2d
vnbr
V3b
asp
aq1
gl
dext
V3a
a
aaff?
th2
V3c
VIIb
aeff1
pV2
v2
VIIa
VIIc
aaff?
aaff
aeff2
dexta
VII
v3
aeff3
a+IXa IX+acom IXd IXb VIId IXc aa vnbr aq3 th3 dexta


vclat
ac
vcm
vcos
nz
vsc
vbr1
abr1
abr
vbr2
vsc?
v
pvdsp
ifc1
ifc
na2
mp
lc
dst
stc
elc


1
vls1
adl1
vls2
vcl1
adl2
vls3
ala1
vls4
ala2
alp
d1
vsd1
adspd
vsd4
2
vbp
arostr
pbg
V2
V2a
V2b
V2c
V2d
vr
vmarg
th1
V2b
gl
V3b
igl
ard1
aeIII1
asp
aeIII2
VIII
aeIII3
aeIII4
X1
Xbr1
vmarg
V3
aq1
th2
aq2
aaH
vnbr
th3
aq3
IX+acom
Xbr1a
ibr4
vvs
avs
asubcl
3
aeIII4
Xbr2-3
aeIII5
asubcl
aX
alc
apw
a1X
Xbr3
a2X

Pl. 29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arostr
V_2 s
vr
vr
vmarg
th_1
amarg v
vmargd
amarg
igl
vmarg
V_2
aor
2
vbr
vsc
abr
abr_1
4
dx
des
med
adspd
adsps
3
t
adsm
lat
met
com
v
adsm
ap
v
vest
orb
vcl
vc
vest
IX_1
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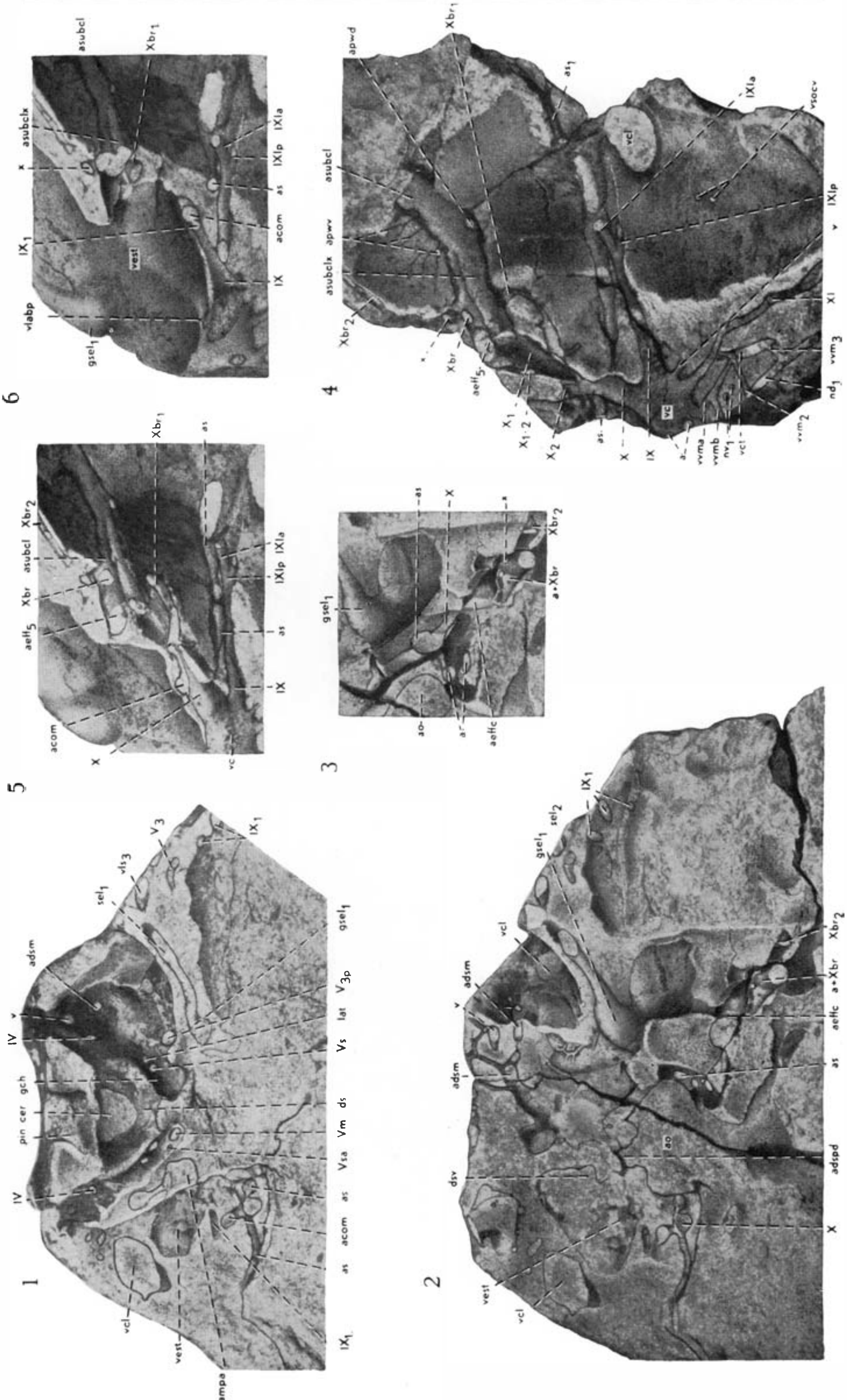
sel_4
as
sel_5
Xbr_2
aeffcp
adspd
as
X
avest
acom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Xbr_1
asubclx
x
IXlp
IXla
as
acom
IX_1
vest
IX
vlabp
$gsel_1$
5
acom
x
$aeff_5$
Xbr
asubcl
Xbr_2
Xbr_1
as
IXlp
IXla
IX
vc
3
$gsel_1$
as
X
Xbr_2
a+Xbr
aeffc
ar
ao
4
apwd
Xbr_1
as_1
asubcl
vcl
IXla
vsocv
asubclx
apwv
IXlp
Xbr_2
Xbr
$aeff_5$
X_1
X_{1-2}
X_2
as
X
IX
vc
vvma
vvmb
nv_1
vcl
vvm_2
nd_1
vvm_3
XI
v
1
IV
pin
cer
gch
v
adsm
sel_1
vls_3
V_3
IX_1
$gsel_1$
V_{3p}
lat
Vs
ds
Vm
Vsa
as
acom
vcl
vest
ampa
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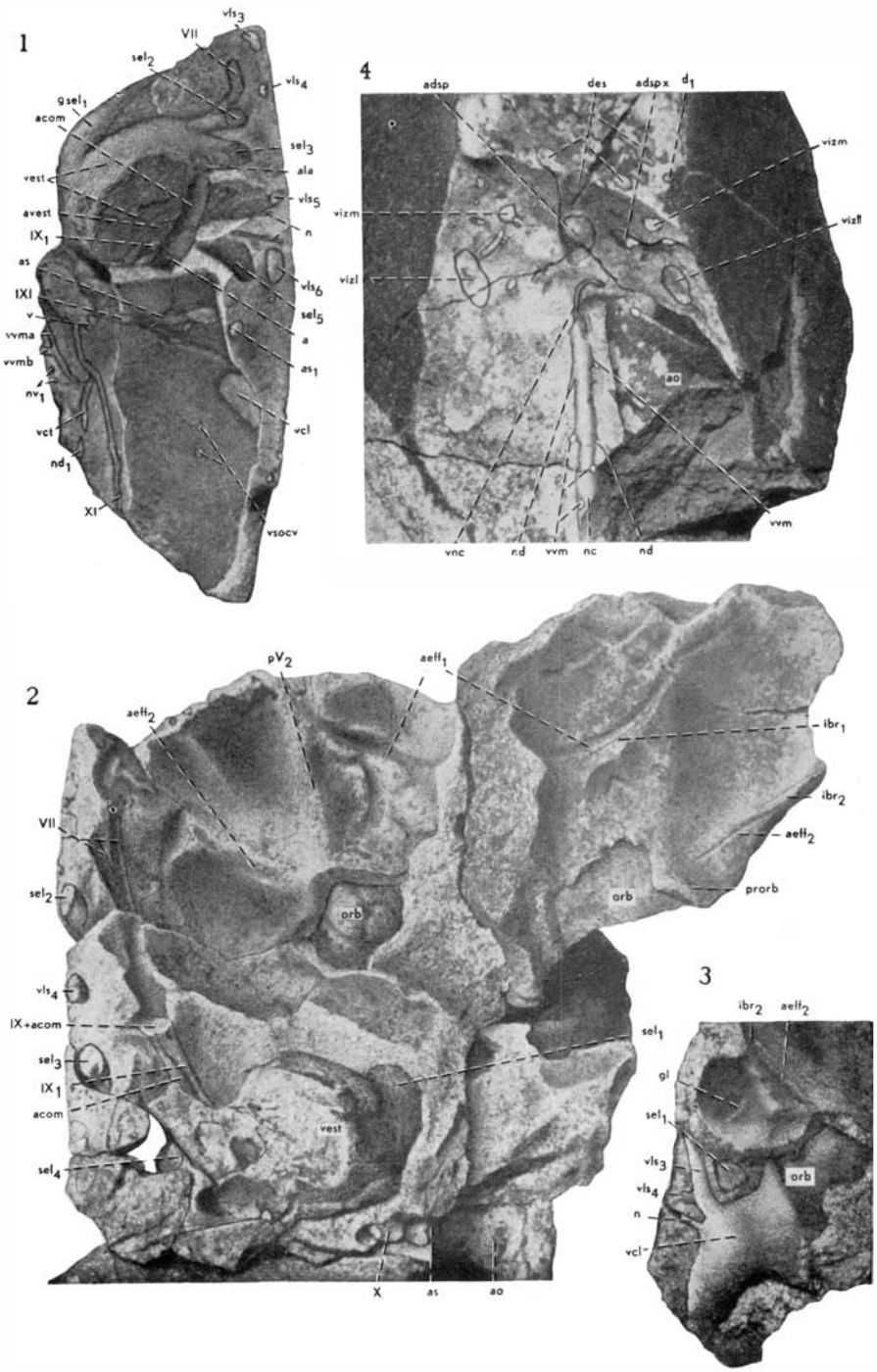
vcl
$gsel_1$
sel_2
Xbr_2
a+Xbr
aeffc
as
ao
adspd
X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vls3
VII
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acom
sel3
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vls5
avest
n
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as
vls6
IXl
sel5
v
a
vvma
as1
vvmb
nv1
vcl
vct
nd1
XI
vsocv
4
adsp
des
adspx
d1
vizm
vizl
ao
vvm
vnc
nd
nc
2
pV2
aeff1
aeff2
ibr1
ibr2
VII
orb
sel2
prorb
vls4
IX+acom
sel3
IX1
acom
vest
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ao
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sel1
gl
vls3
orb
vls4
n
vcl

3

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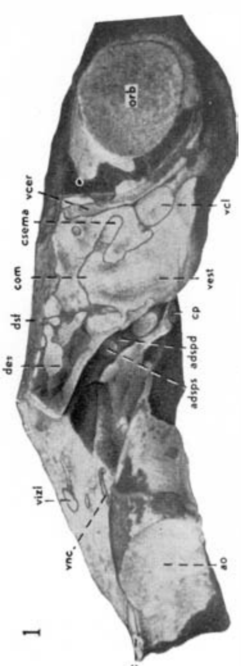
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adsps
des
vizl
vnc
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ao

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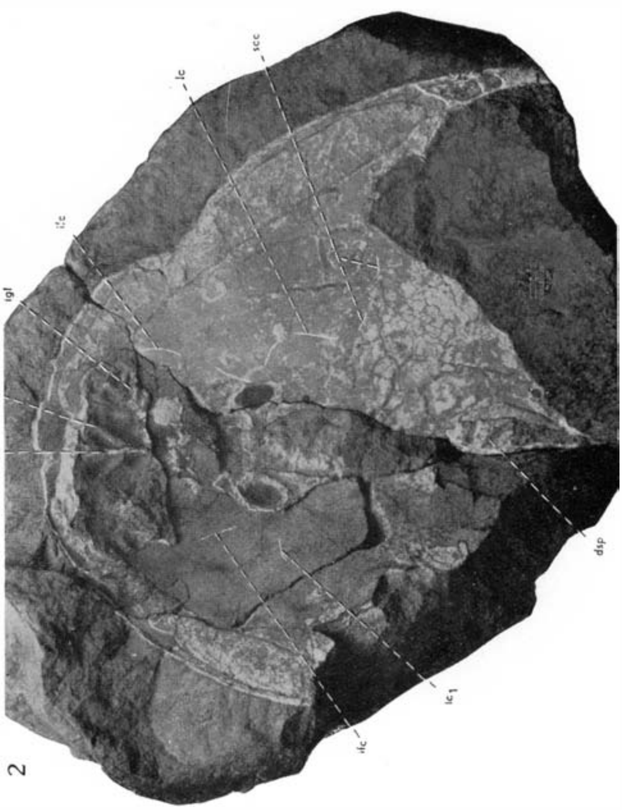
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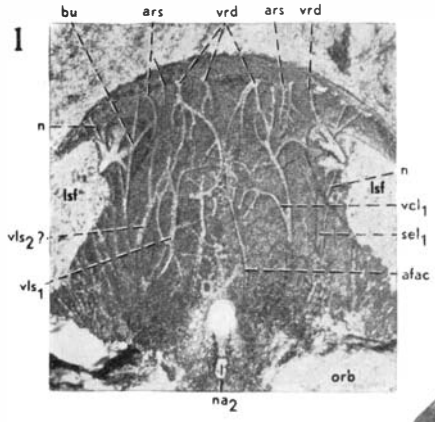
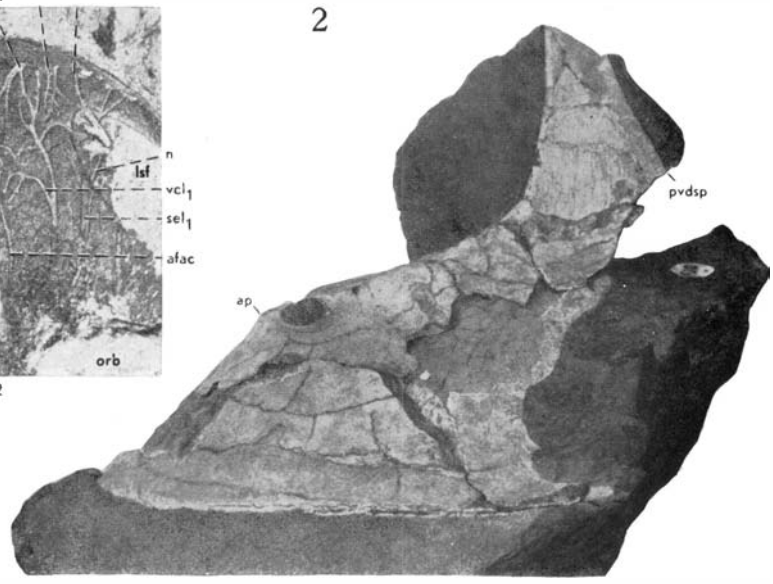

1
bu
ars
vrd
ars
vrd
n
lsf
lsf
n
vcl1
sel1
afac
vls2?
vls1
orb
na2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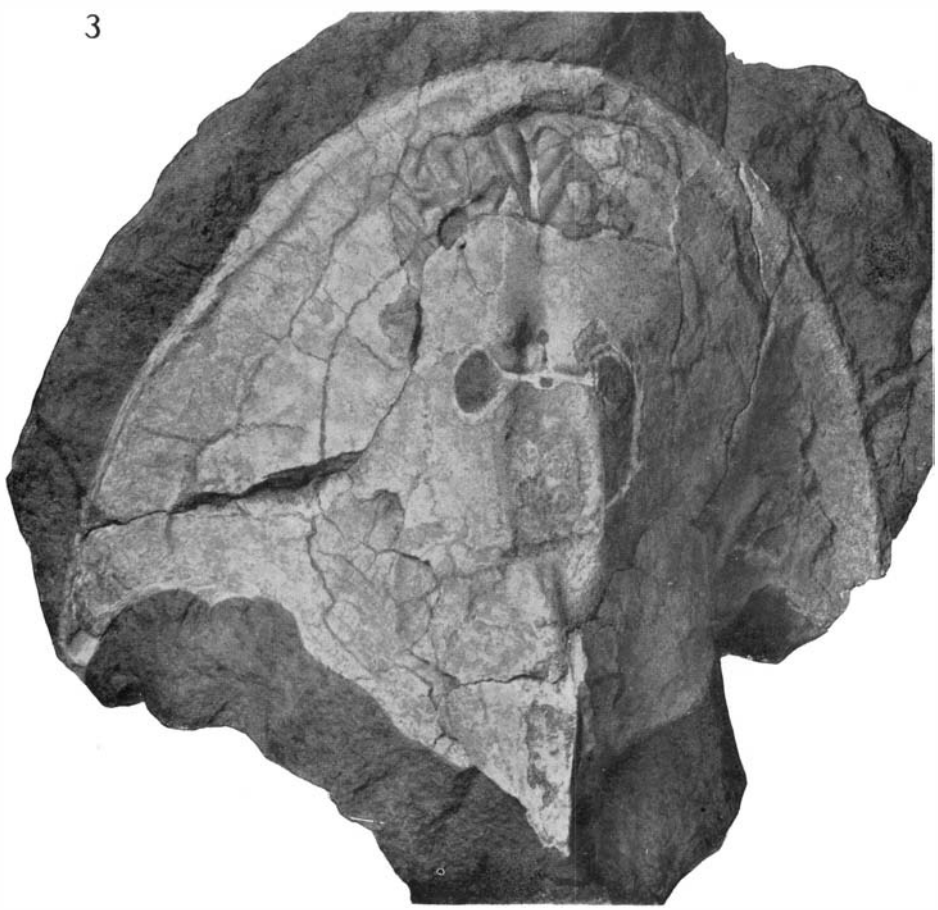
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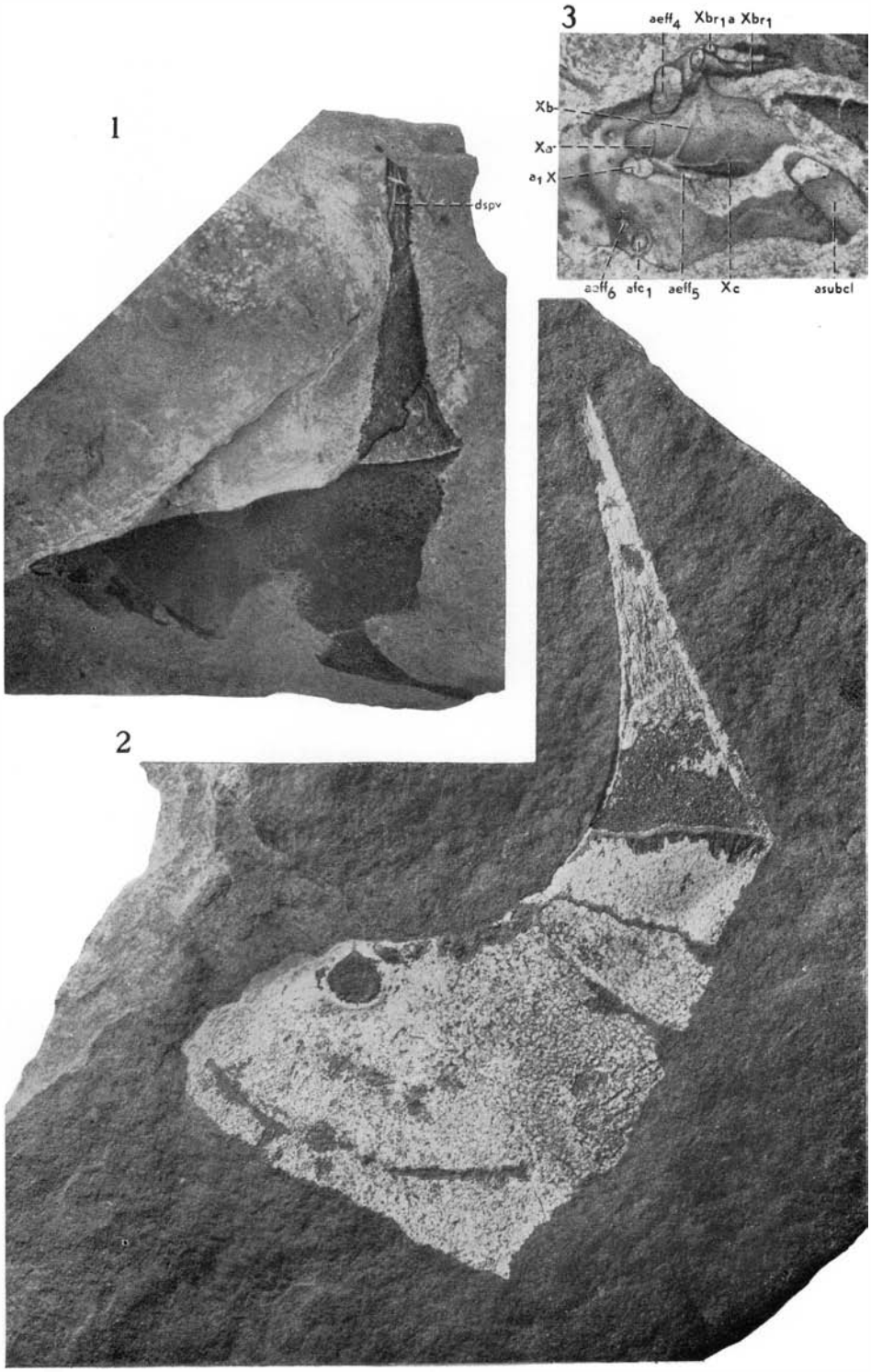
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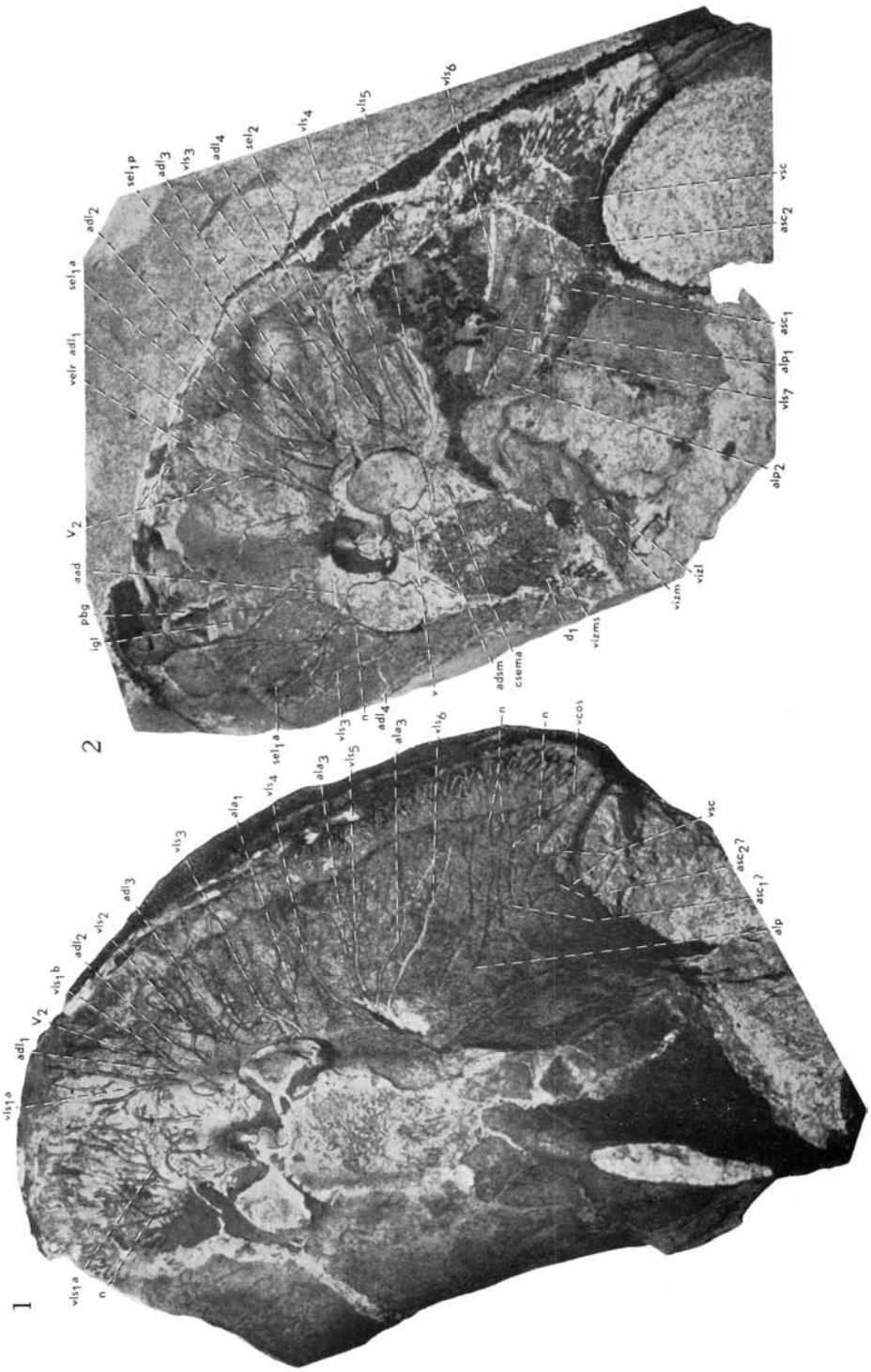
Xbr1
Xb
Xa
a1X
aeff6
afc1
aeff5
Xc
asubcl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V2
vls1b
adl2
vls2
adl3
vls3
ala1
vls4
sel1a
ala3
vls5
adl4
vls6
n
vcos
vsc
asc2?
asc1?
alp
sel1p
adl3
vls3
adl4
sel2
vls4
vls5
vls6
adl2
sel1a
velr adl1
V2
aad
pbg
igl
vizm
vizl
vizms
d1
adsm
csema
vls7
alp1
asc1
alp2
asc2
vsc


vds?
vsop
afp
afac
V1?
vcl1
vls1a
V1?
adl1
V2
adl2
ams
vls1b
n
vls2
n
adl3
vls3
n
vmarg
n
ala1
n
ala2
vls4
ams
ala3
vms
vls5
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ala4
vls6
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n
vls7
n
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n
vcos
vsc<
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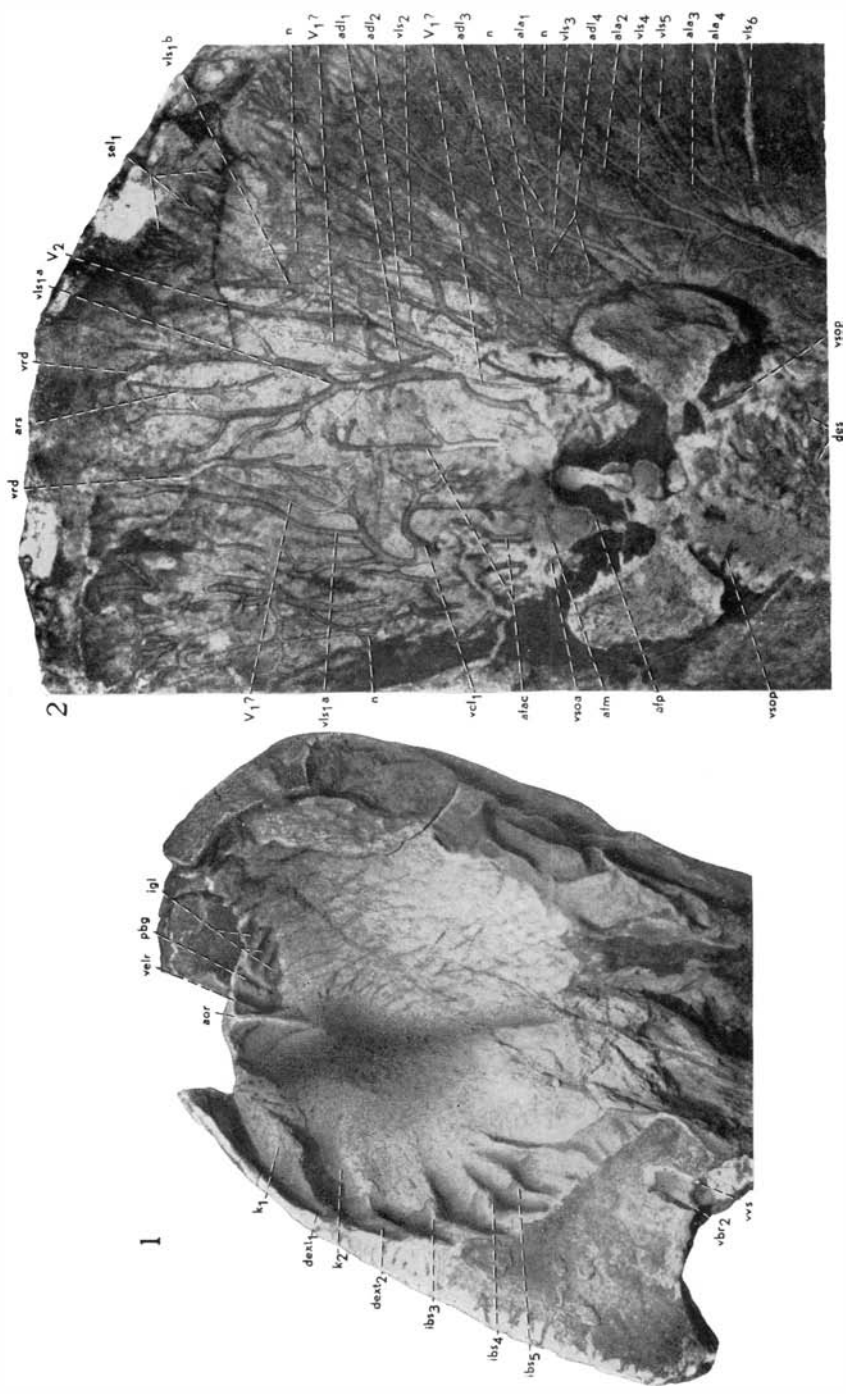
asc1?
adp1
alp2


2
n
V1?
adl1
adl2
vls2
V1?
adl3
n
ala1
n
vls3
adl4
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vls5
ala3
ala4
vls6
vls1b
sel1
V2
vls1a
vrd
ars
vrd
vsop
dss
V1?
vls1a
n
vcl1
alac
vsoa
alm
afp
vsdp
1
velr
pbg
igl
aor
k1
dext1
k2
dext2
ibr3
ibr4
ibr5
vbr2
vvs

1
V2
V3p
gch
ch
Vm
V3p
cacu
vc
ampp
IXl
vcl
cpost
XII
XId
V3
vest
as ?
asb ?
IXla
IXlp
vcl
IXl
X
cpost
XI
adspp
adspa
adspp
2
3
sel5
vsc
asb ?
X
cpost
Xa
as ?
X
Xb
vcl
asb ?
IXla
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vcl
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v
XId
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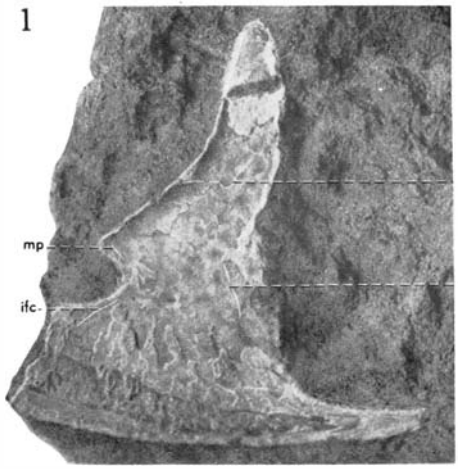
des
as
a1

1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stc
ifc

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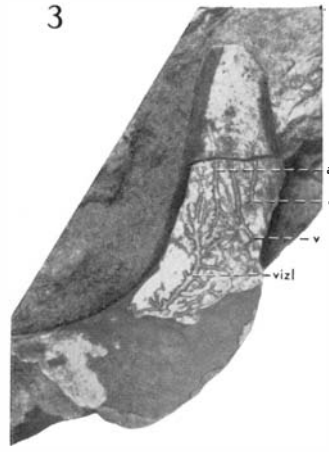
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adspps
v
vizl

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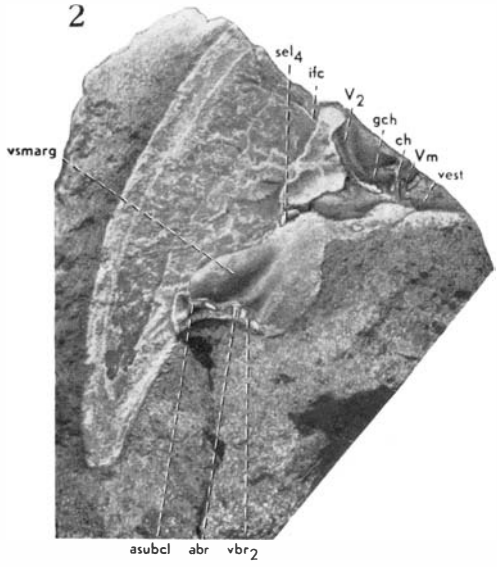
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gch
ch
Vm
vest
vsmarg
asubcl
abr
vbr2

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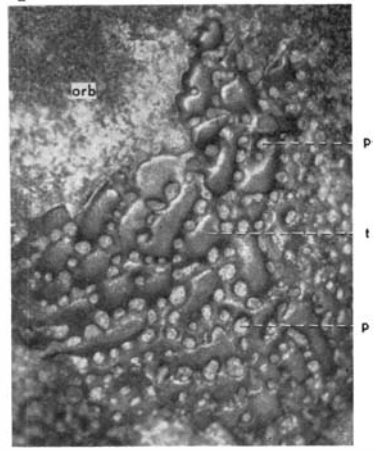
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p
t
p

5


r
t

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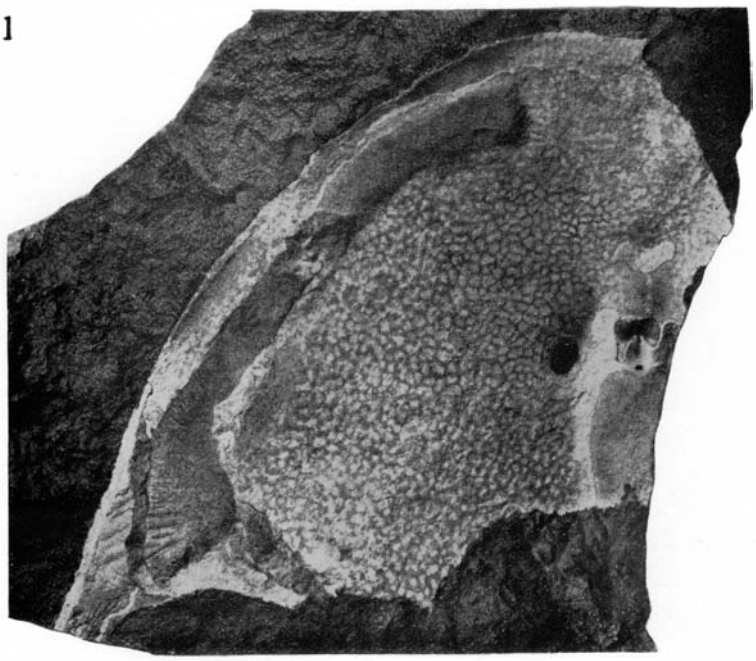

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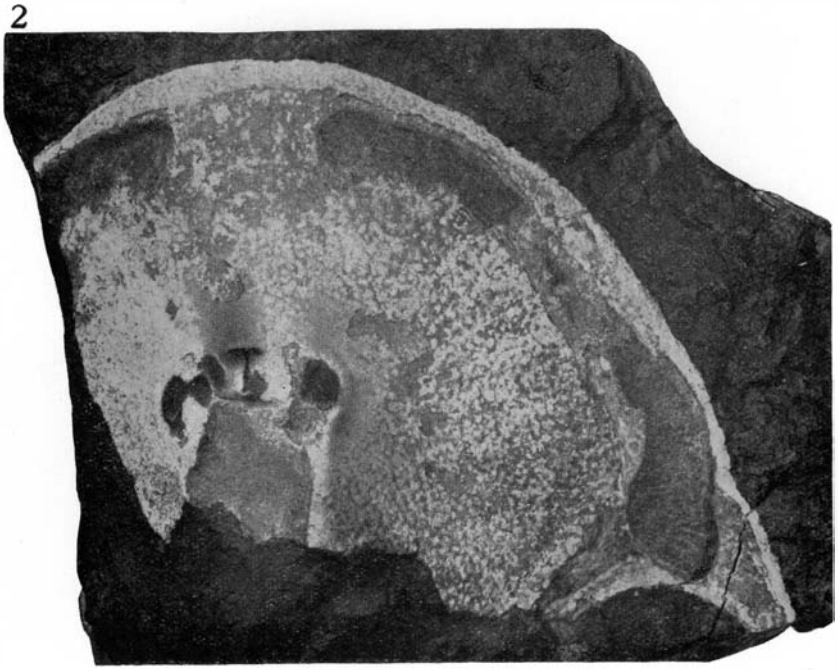

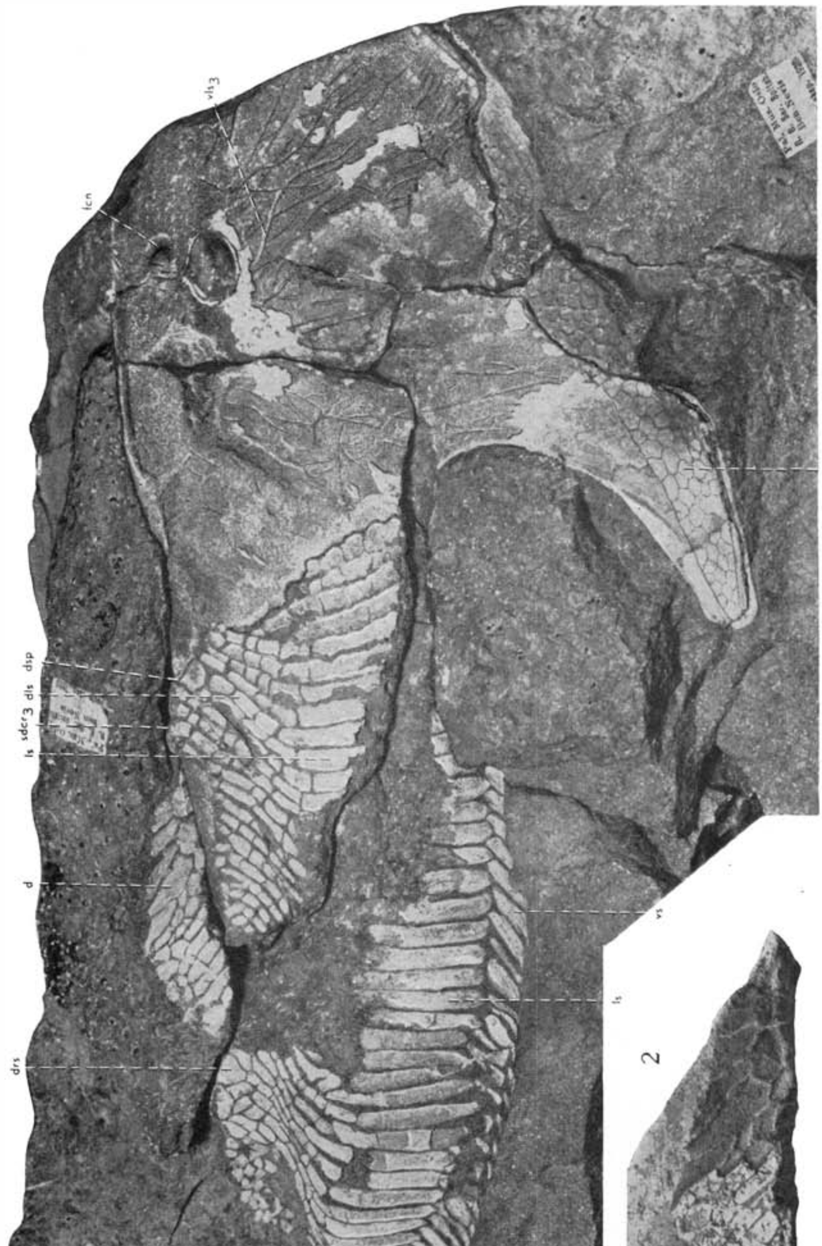

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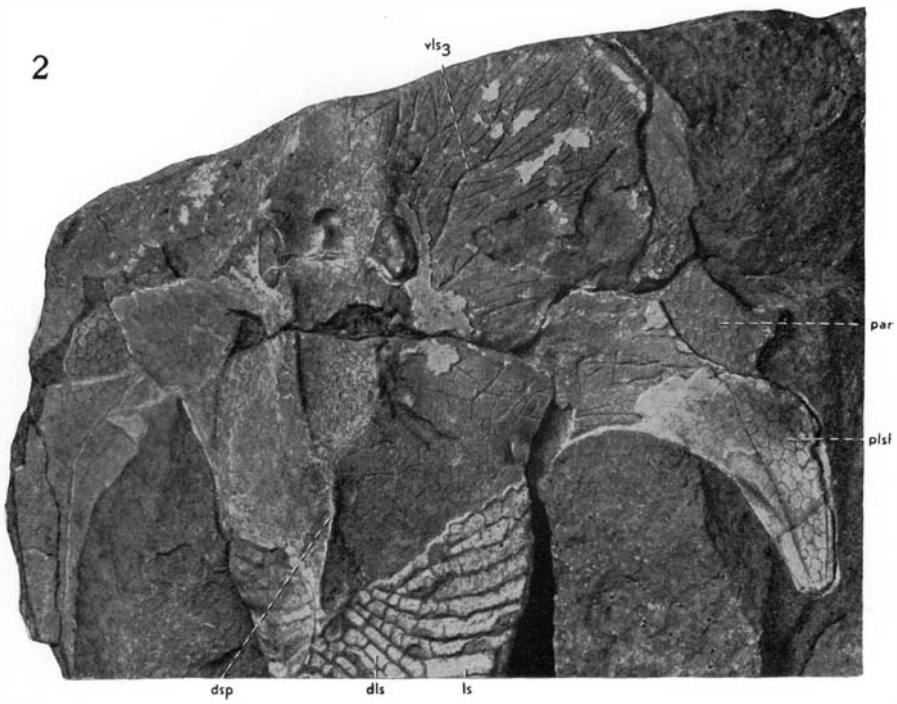

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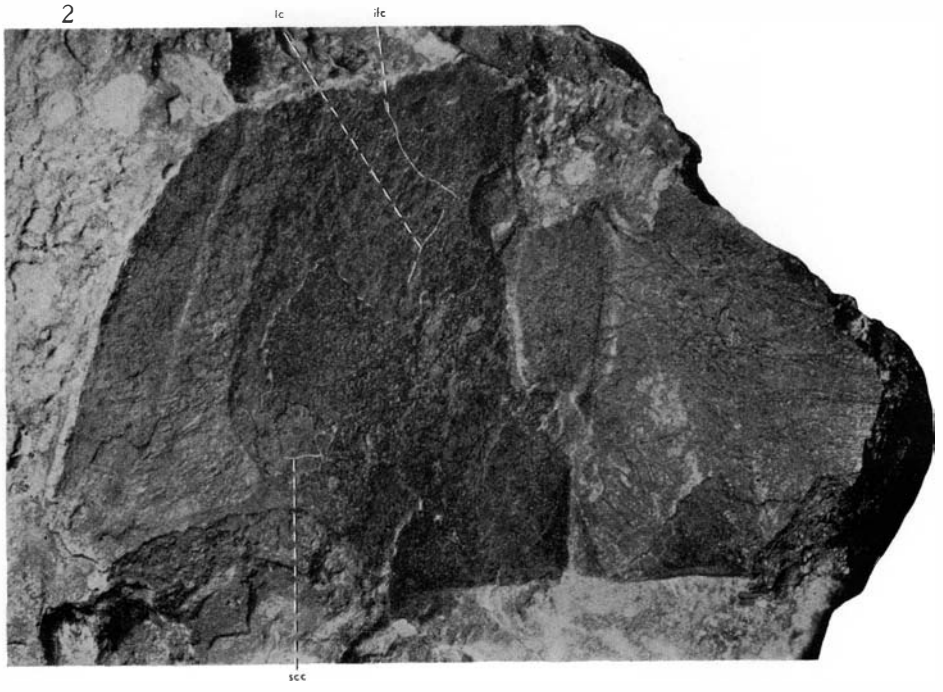

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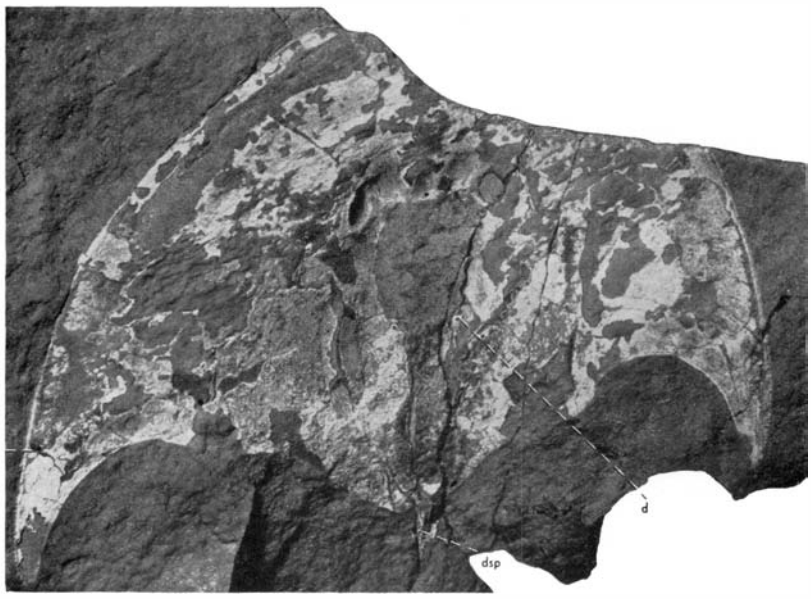

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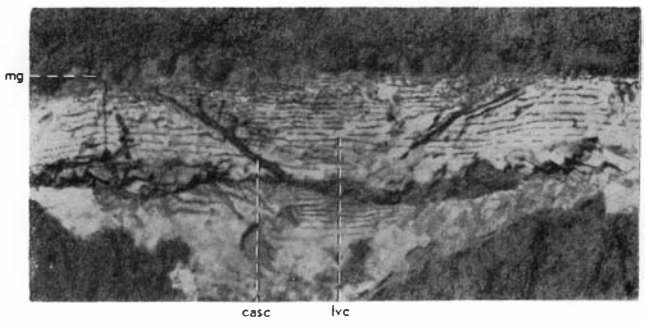

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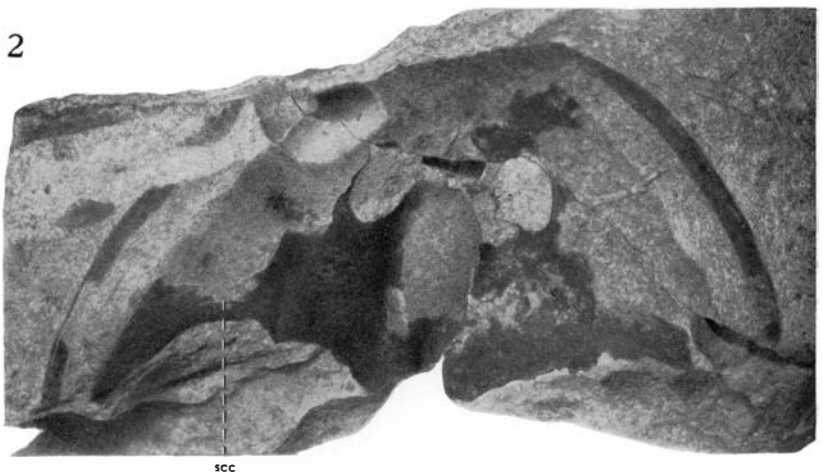

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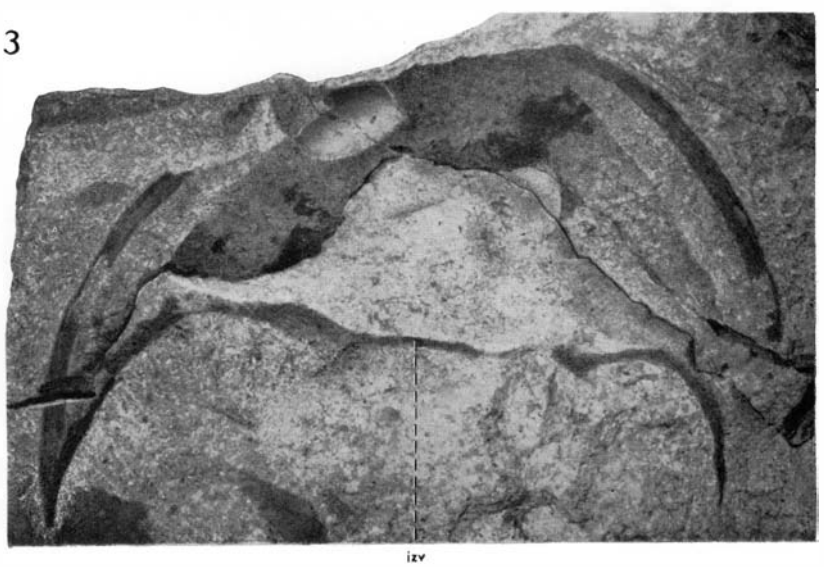

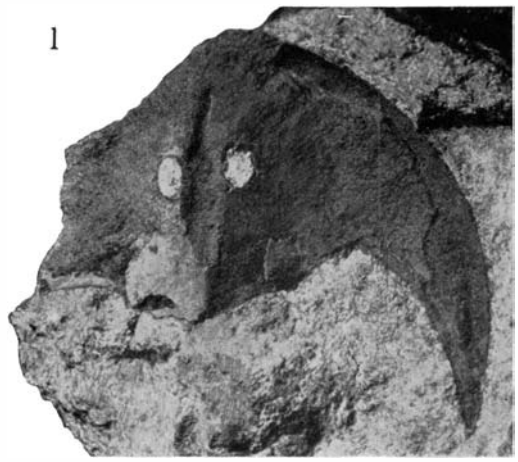
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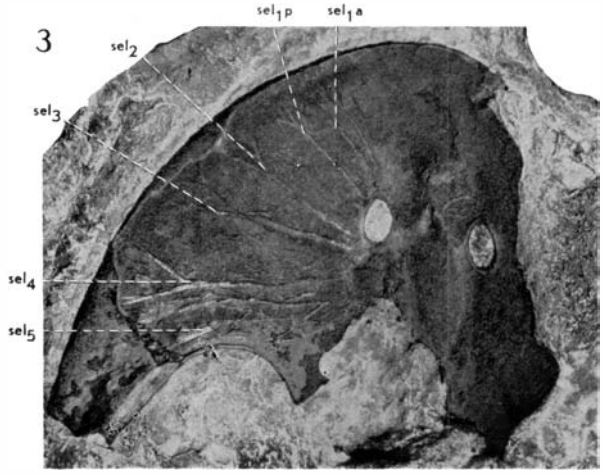
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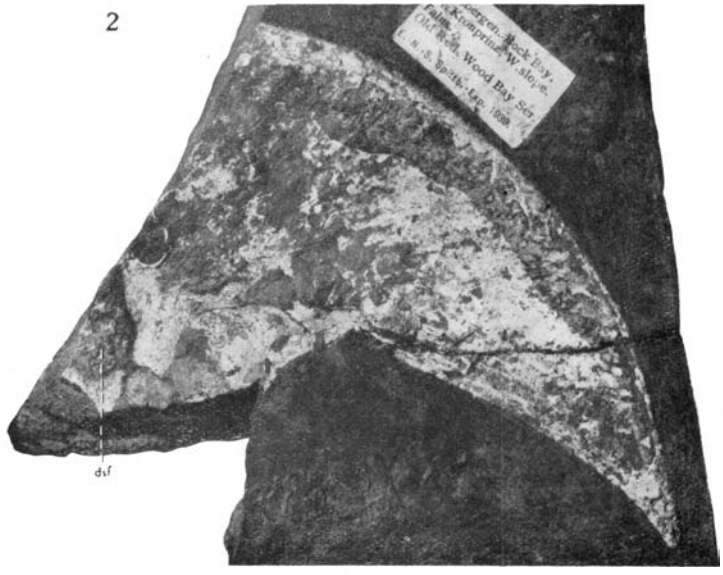
sel1a
sel2
sel3
sel4
sel5

1

2

1

2



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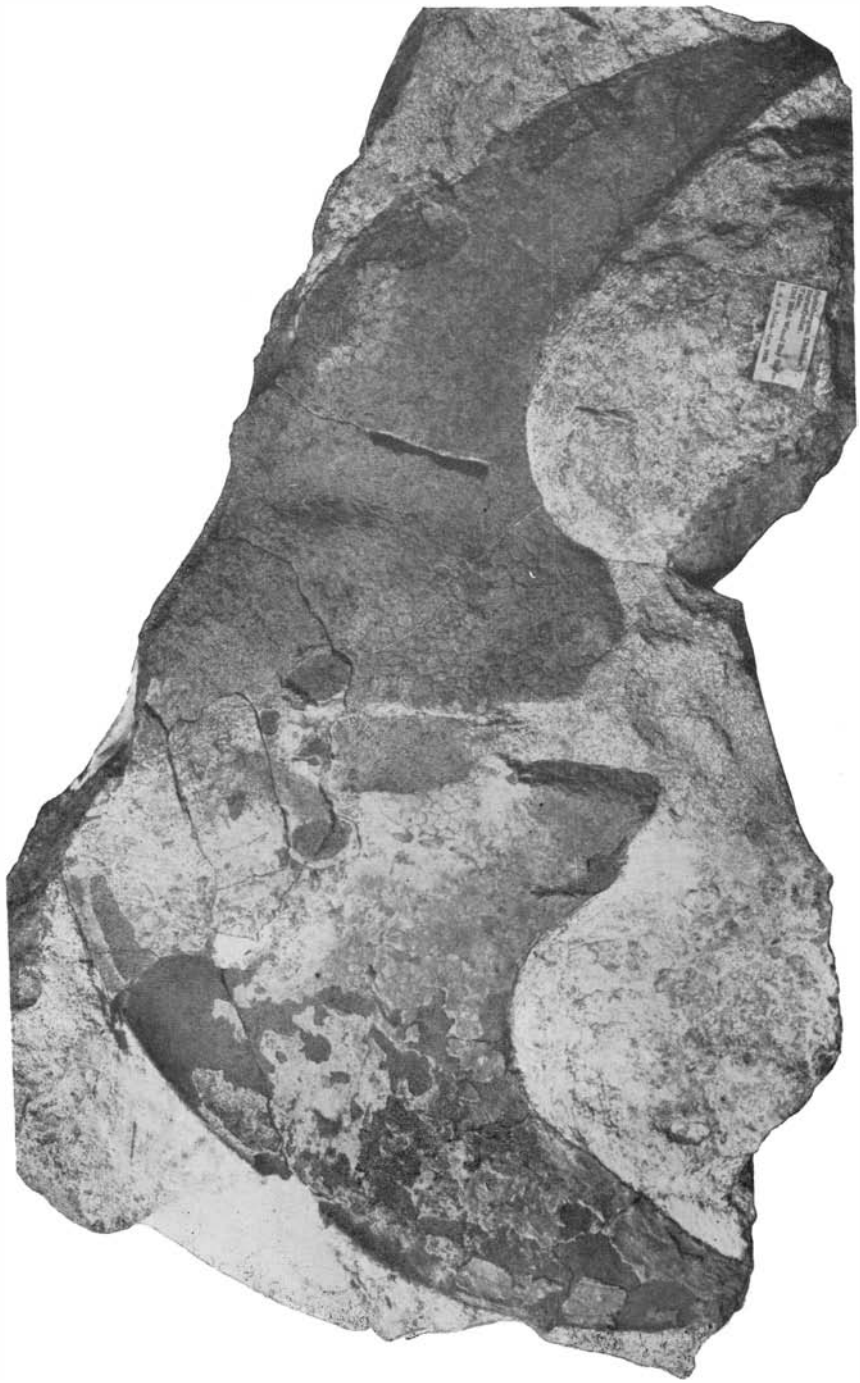

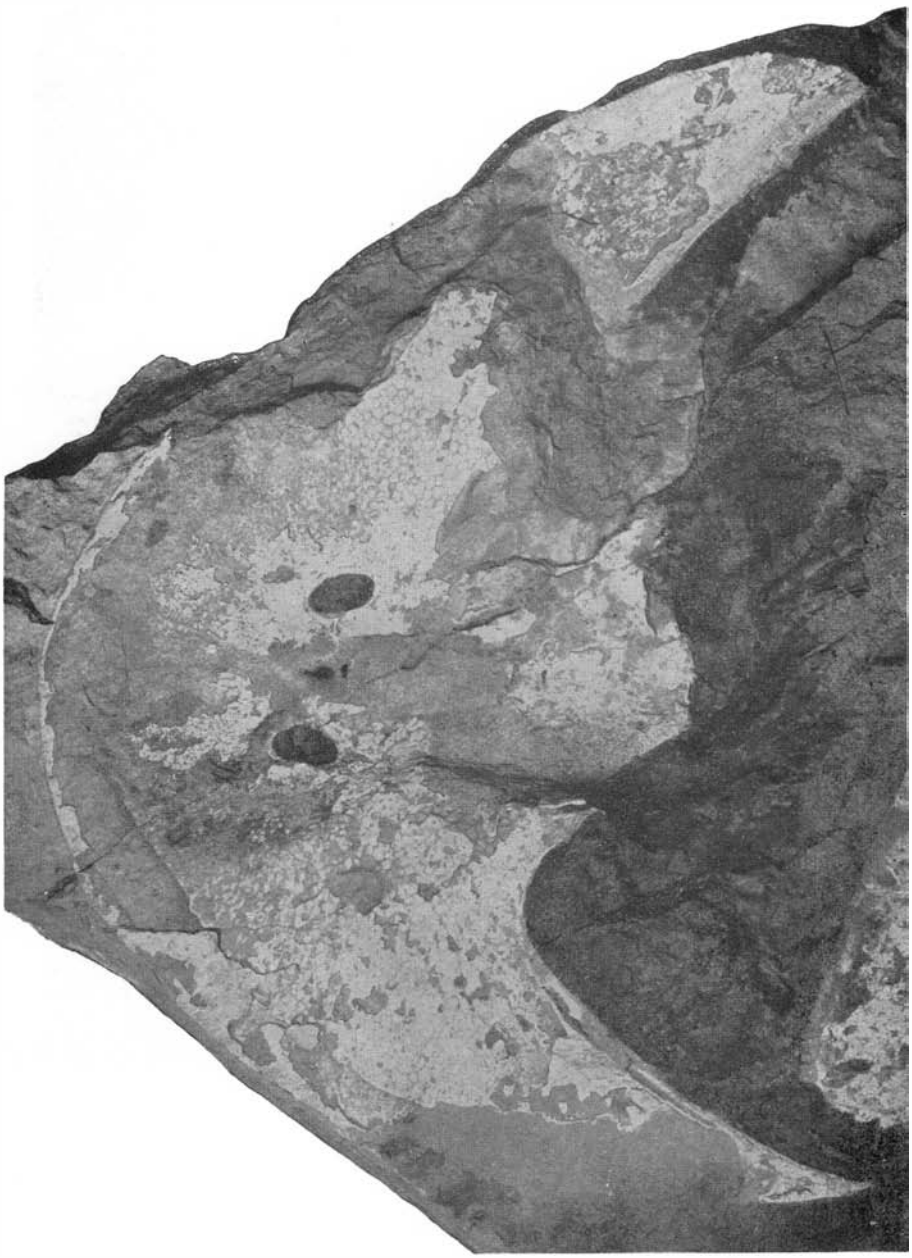

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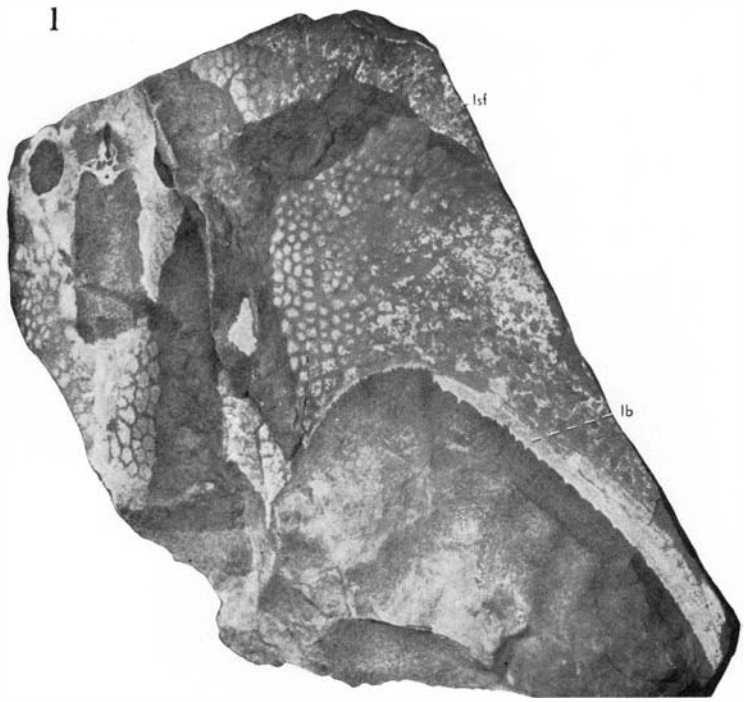

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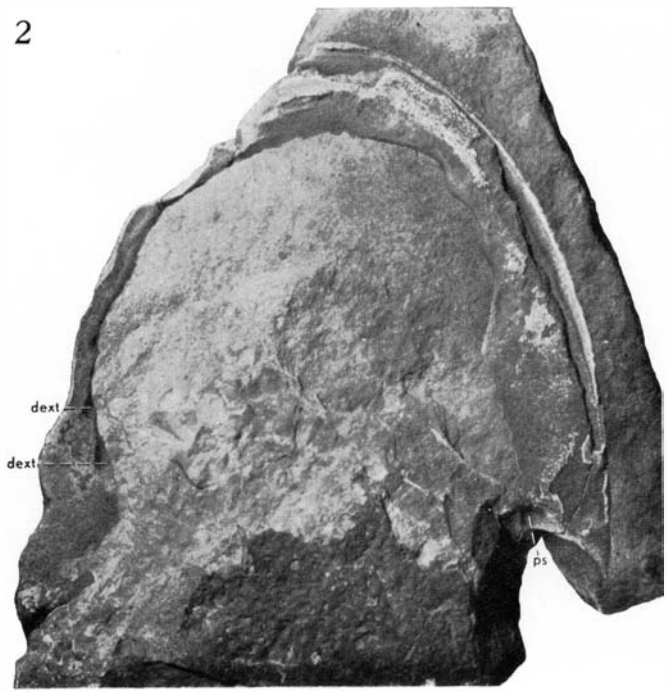

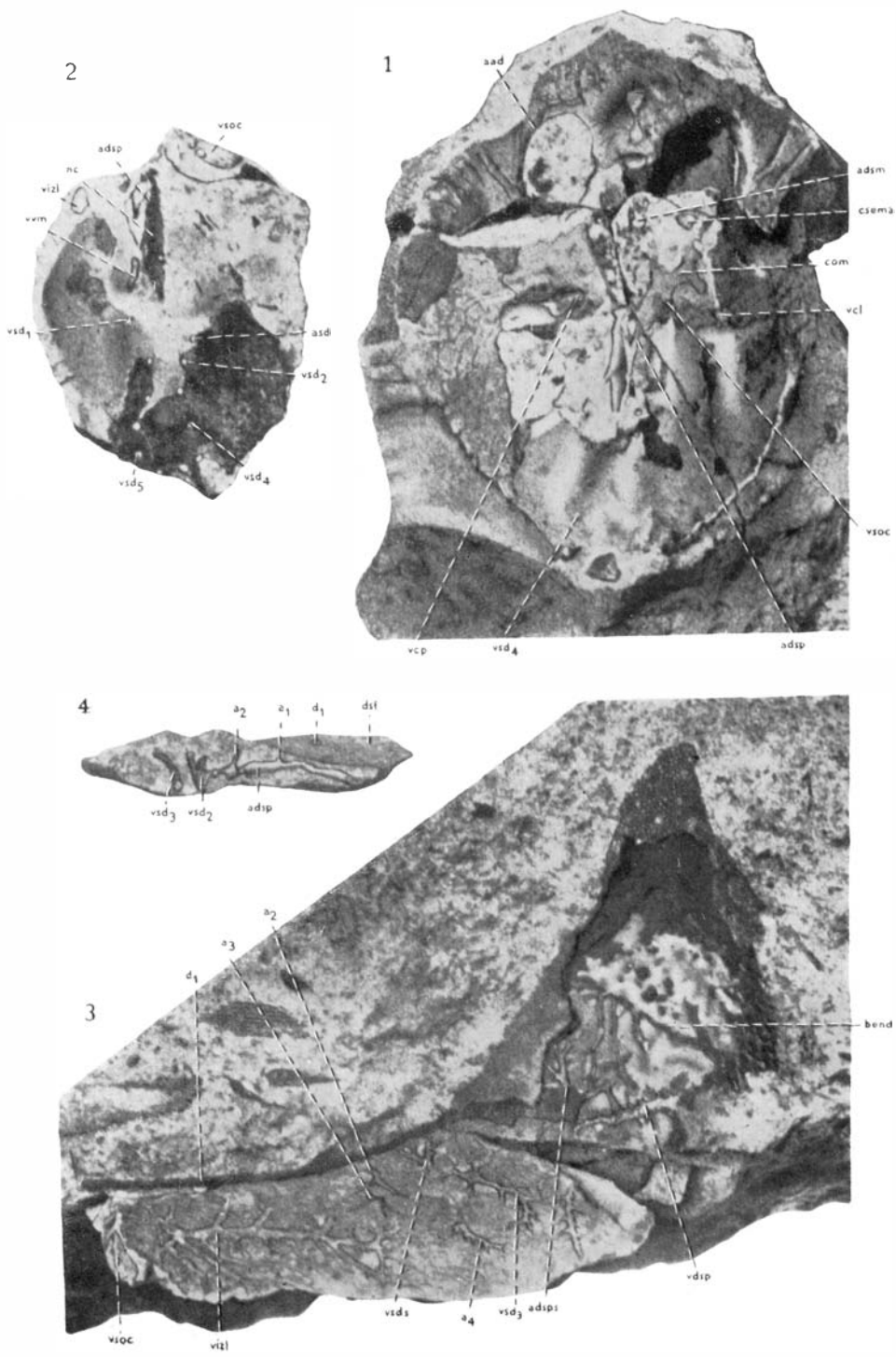
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vsd2
vsd5
vsd4
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adsm
csema
com
vcl
vsoc
vcp
vsd4
adsp
4
a2
a1
d1
dsl
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vsds
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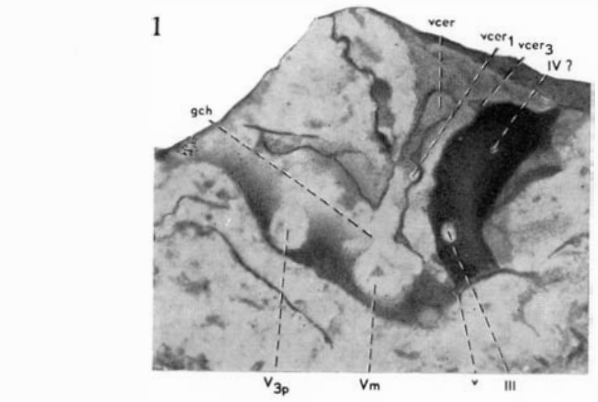
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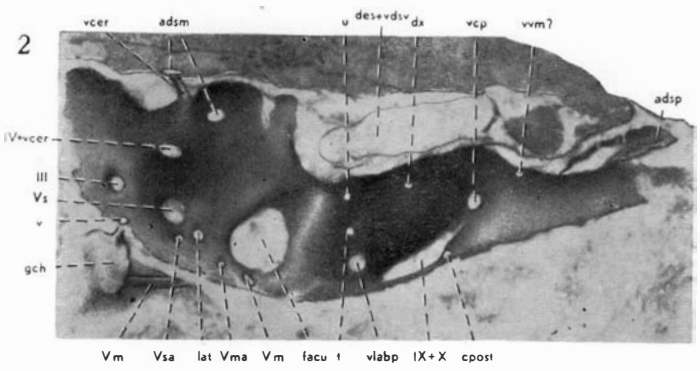
vcer1
vcer3
IV ?
gch
V3p
Vm
v
III


2
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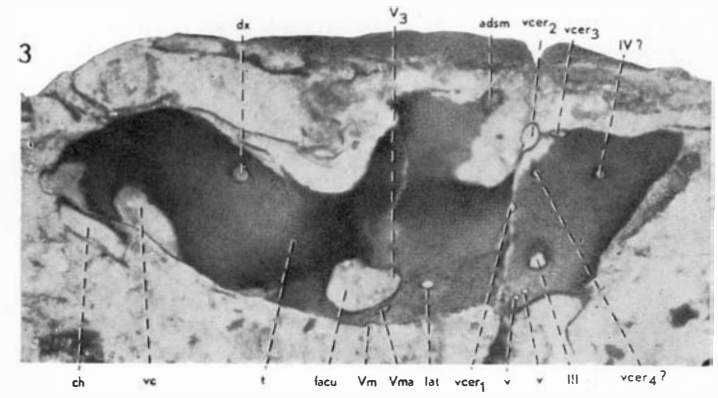
adsm
u
des+vdsv
dx
vcp
vvm?
adsp
IV+vcer
III
Vs
v
gch
Vm
Vsa
lat Vma
Vm
facu
t
vlabp
IX+X
cpost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V3
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vc
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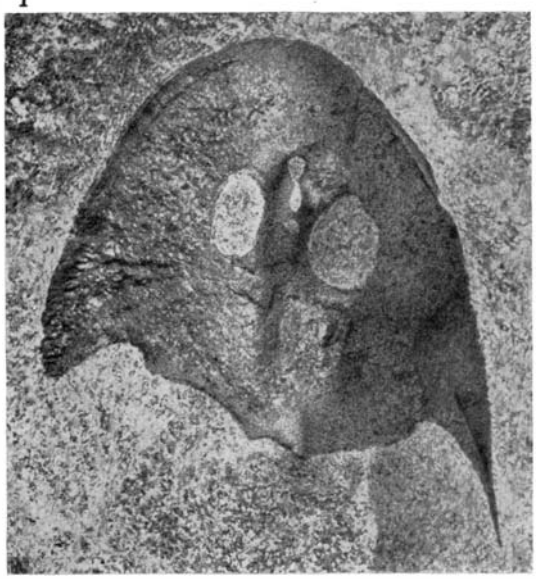
facu
Vm
Vma
lat
vcer1
v
v
III
vcer4 ?

1



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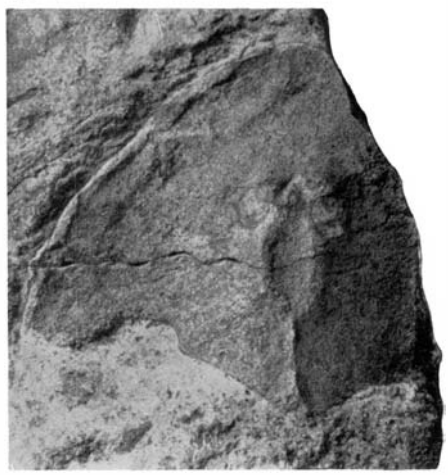

2


2
1
ala1
vms
ala3
vls5
adl3
n
adl4
n
vls3
n
ala2
ala4 ?
vizl
aiz
vls7
asc1 ?
asc
vsc


sel1p
ams
vms
vls3
ams
vms
sel2
vls4l
ala2
vms
sel3
ala3
vls5
sel4
vmsd
vcom
sel1a
ala1
n
vls4m
alp?
vls7
vizl
aiz
vls6
vcm
vsc
asc
asc1?


VII
sel3
sel4
sel5
vls6
vls7
V3
sel1p
sel1a
V2m
V2l
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adl2
V3
adl3
scl2
VII
sel3


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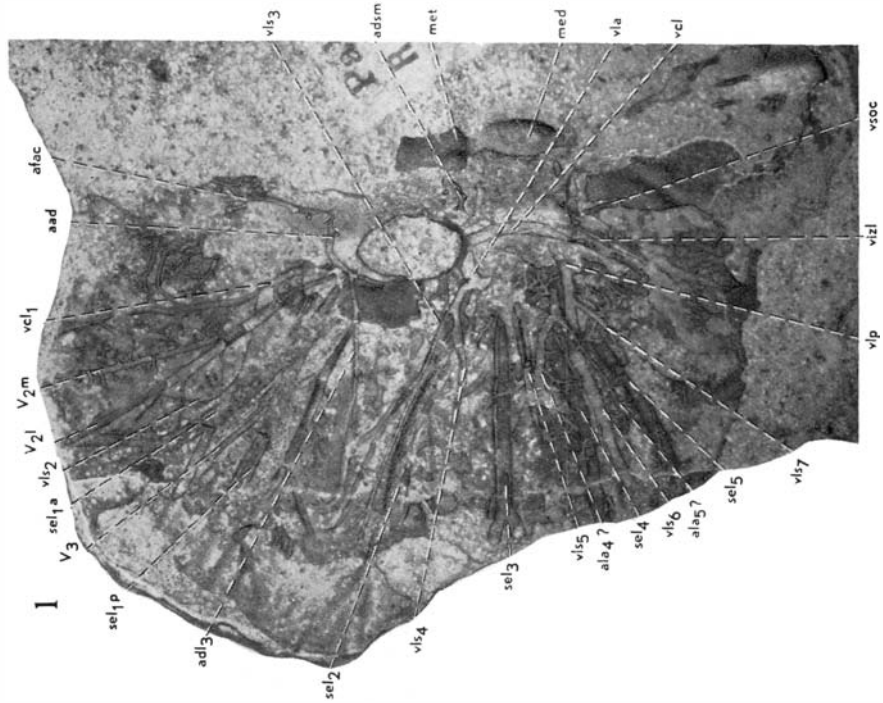
stc
lc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V3
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V2l
V2m
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adl3
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sel3
vls5
ala4 ?
sel4
vls6
ala5 ?
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vls7
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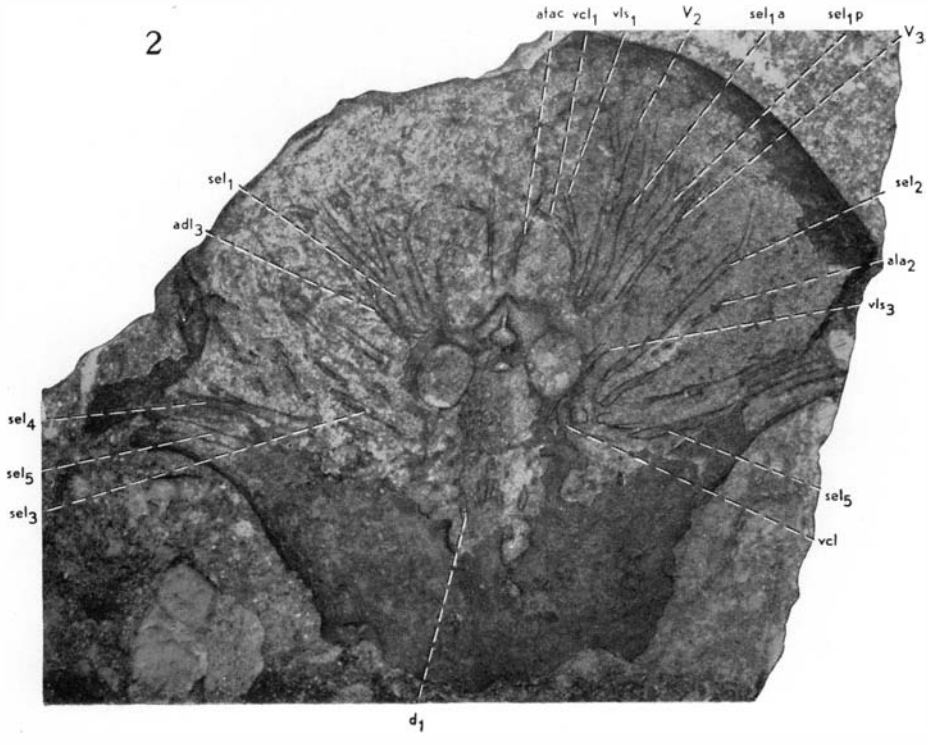
vizl
vsoc
vls3
adsm
met
med
vla
vcl

1

2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V2
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V3
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sel2
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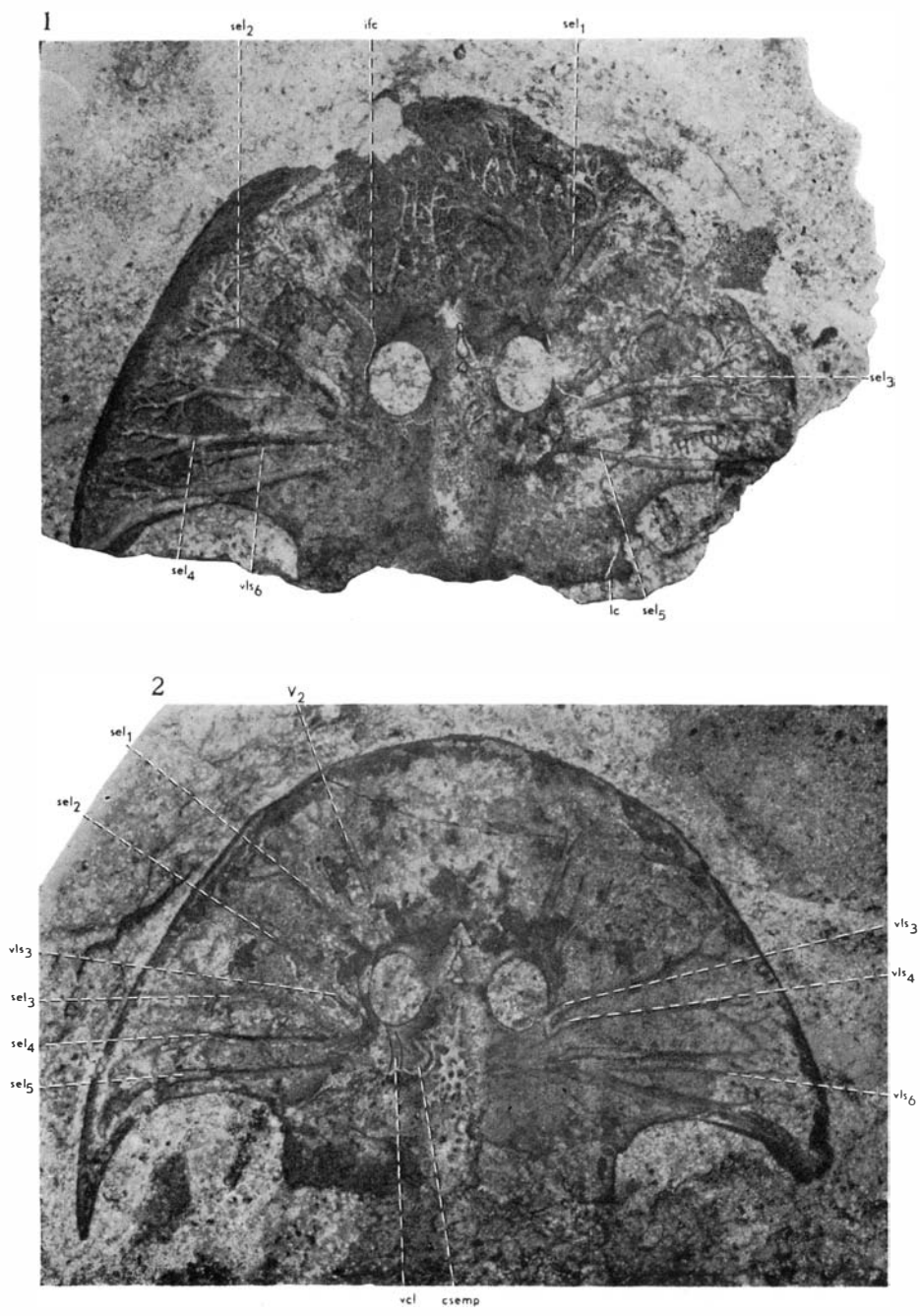
ala2
vls3
sel4
sel5
sel3
sel5
vcl
d1


1
sel2
ifc
sel1
sel3
sel4
vls6
lc
sel5
2
V2
sel1
sel2
vls3
sel3
sel4
sel5
vls3
vls4
vls6
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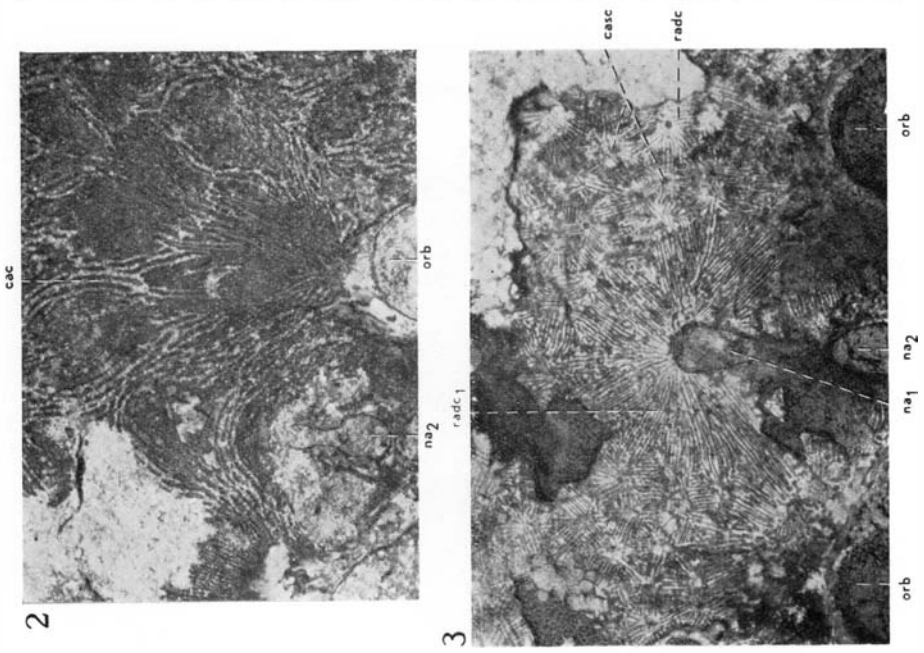
csemp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orb
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radc1
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casc
radc
orb
na2
na1
orb
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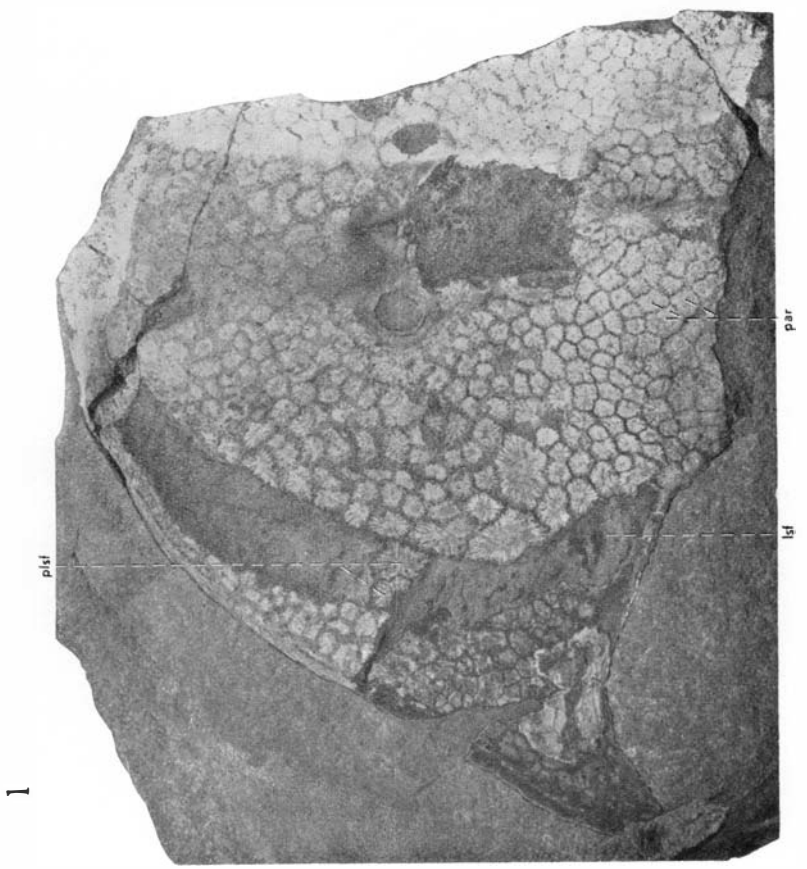
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par
lsf
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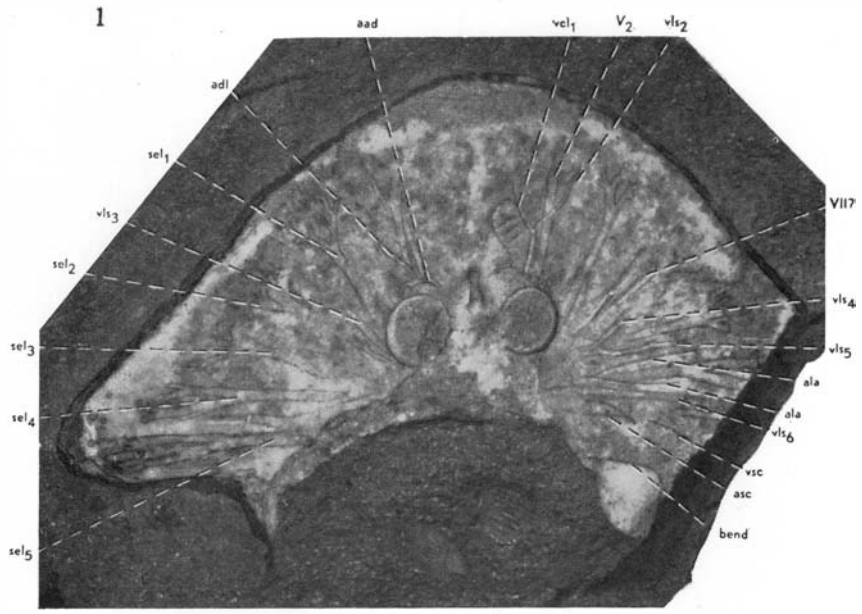
sel1p
pclsf
sel1a
V2

1


aad
vel1
V2
vls2
adl
sel1
vls3
VII?
sel2
vls4
sel3
vls5
ala
sel4
ala
vls6
vsc
asc
bend
sel5

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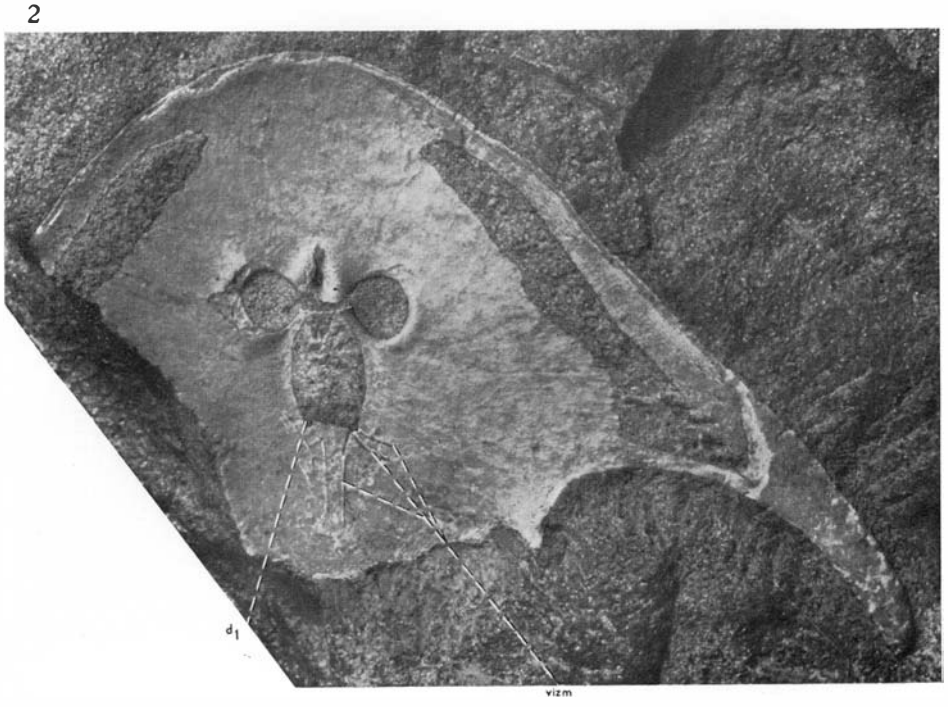
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vizm

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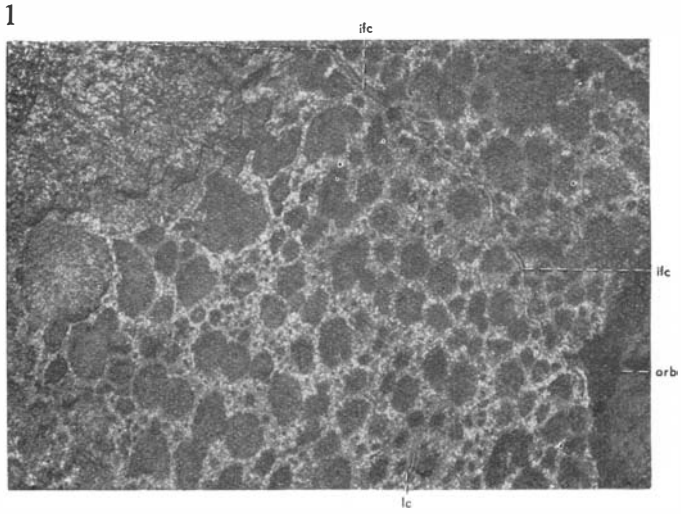
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ifc
orb
lc

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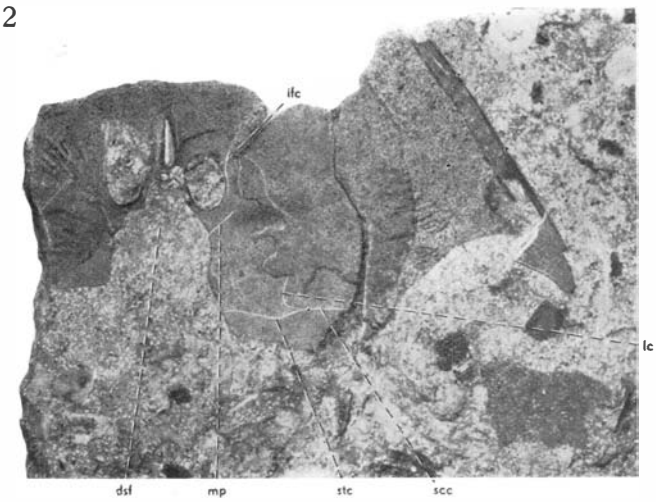
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mp
stc
scc

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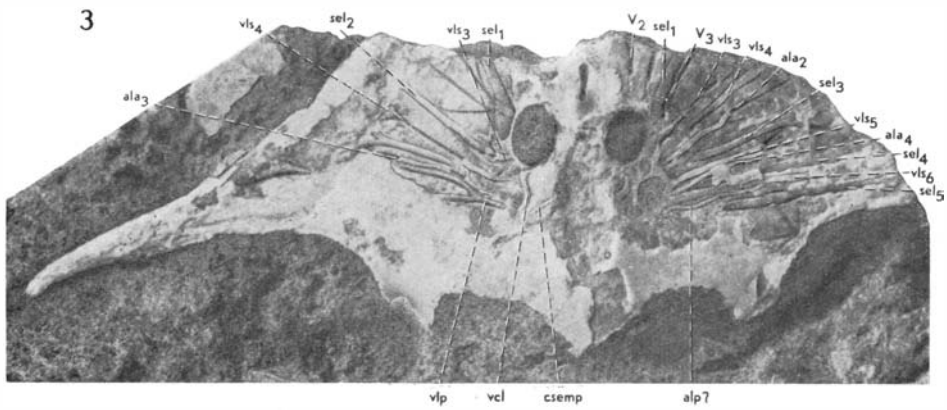
vls4
sel2
vls3
sel1
V2
sel1
V3
vls3
vls4
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sel3
ala3
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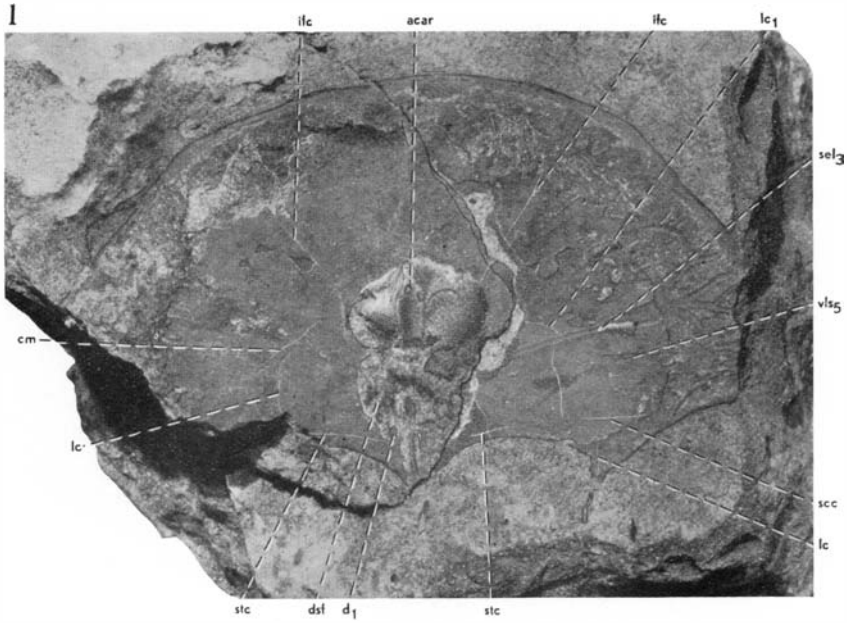
ala4
sel4
vls6
sel5
vlp
vcl
csemp
alp?

1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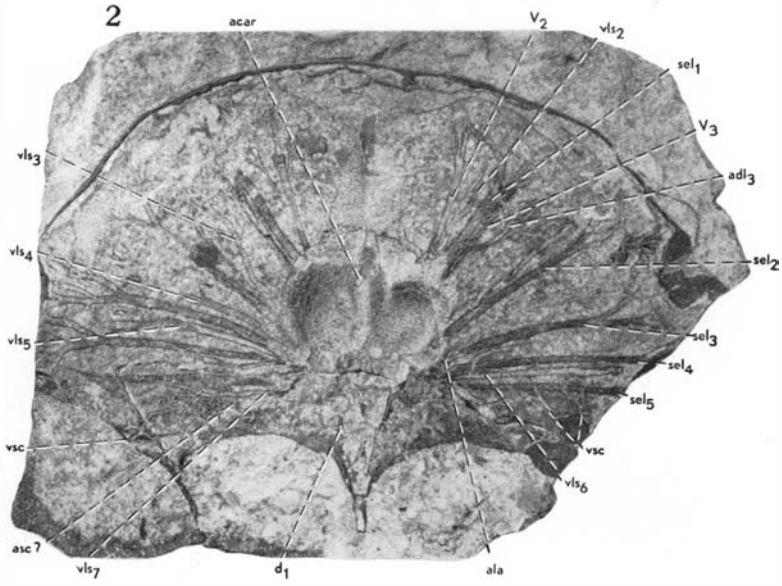
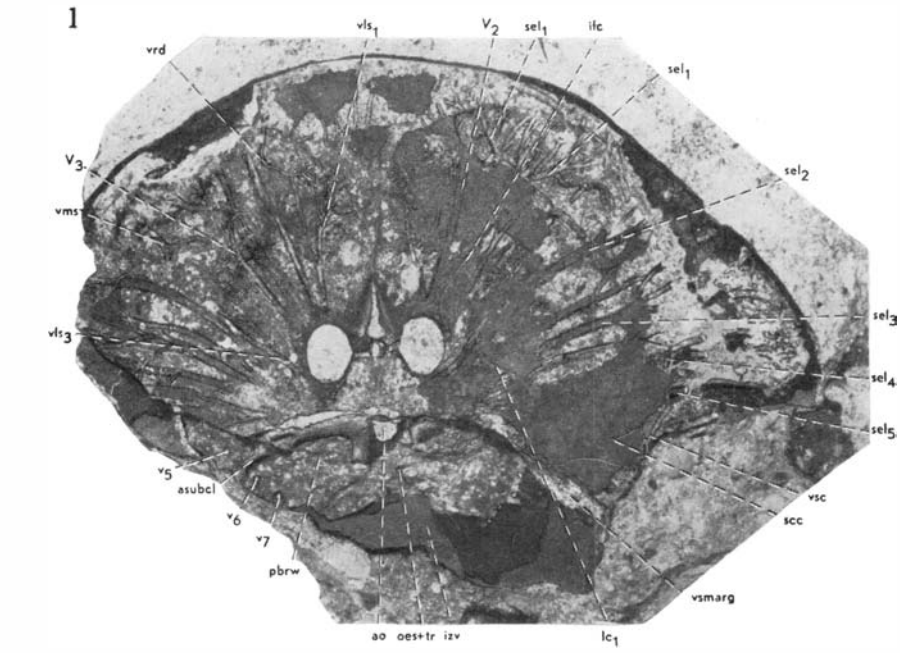
ifc
lc1
sel3
vls5
cm
lc
scc
lc
stc
dsf
d1
stc

2


acar
V2
vls2
sel1
V3
vls3
adl3
vls4
sel2
vls5
sel3
sel4
sel5
vsc
vsc
vls6
asc?
vls7
d1
ala


1
vls1
V2
sel1
ifc
vrd
sel1
V3
sel2
vms
sel3
vls3
sel4
sel5
V5
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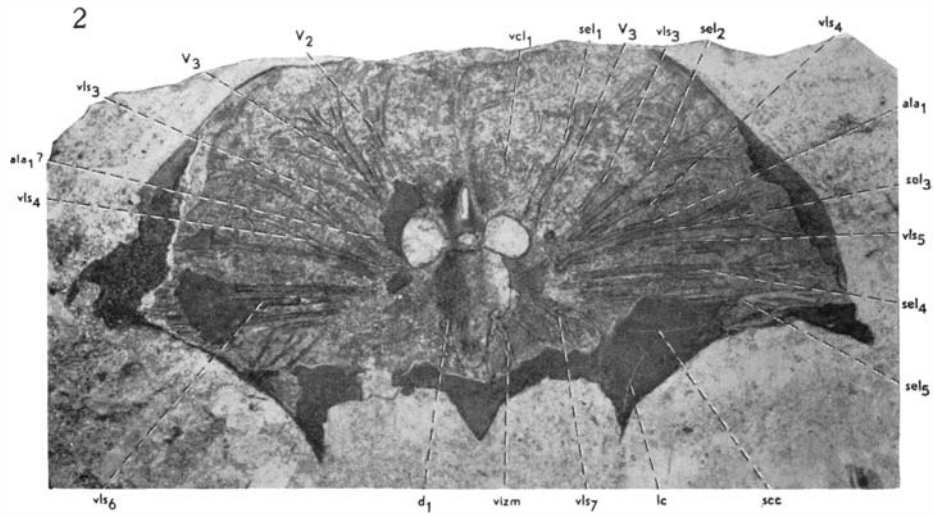
vsc
V6
scc
V7
pbrw
vsmarg
ao oes+tr izv
lc1


2
V2
vcl1
sel1
V3
vls3
sel2
vls4
V3
vls3
ala1
ala1?
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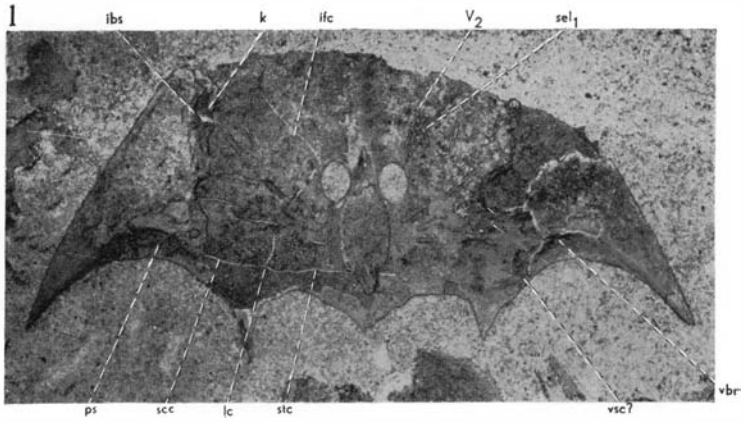
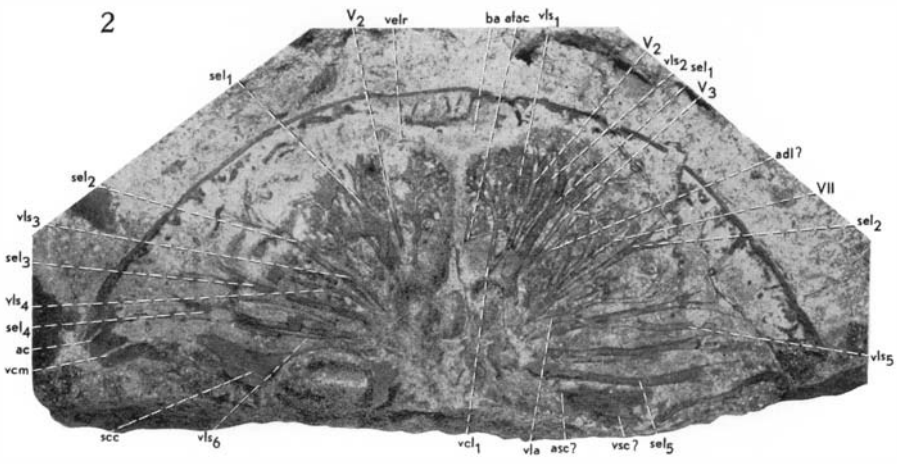
vls4
vls5
sel4
sel5
vls6
d1
vizm
vls7
lc
scc

1


ibs
k
ifc
V2
sel1
vbr
ps
scc
lc
stc
vsc?

2


V2
velr
ba afac
vls1
V2
vls2 sel1
V3
sel1
adl?
VII
sel2
sel2
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vls4
sel4
ac
vcm
vls5
scc
vls6
vcl1
vla asc?
vsc?
sel5

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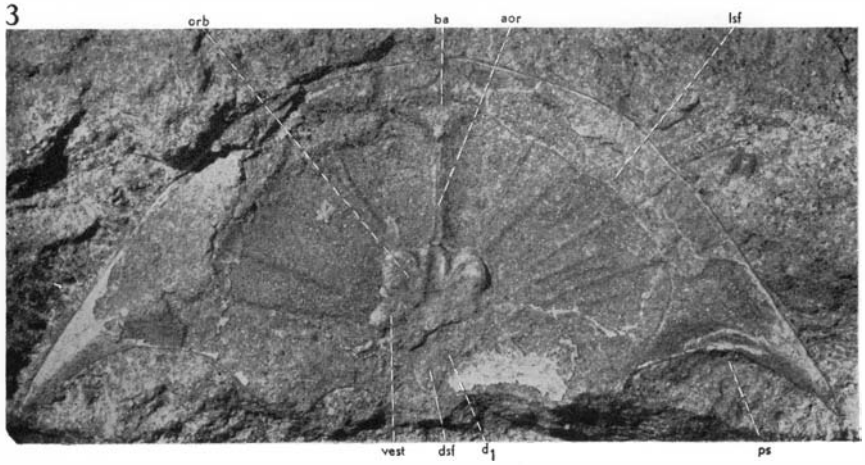
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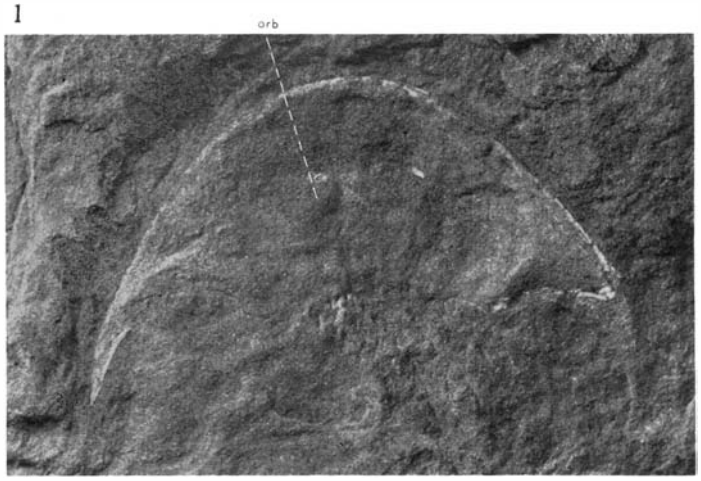
ba
aor
lsf
vest
dsf
d1
ps

1



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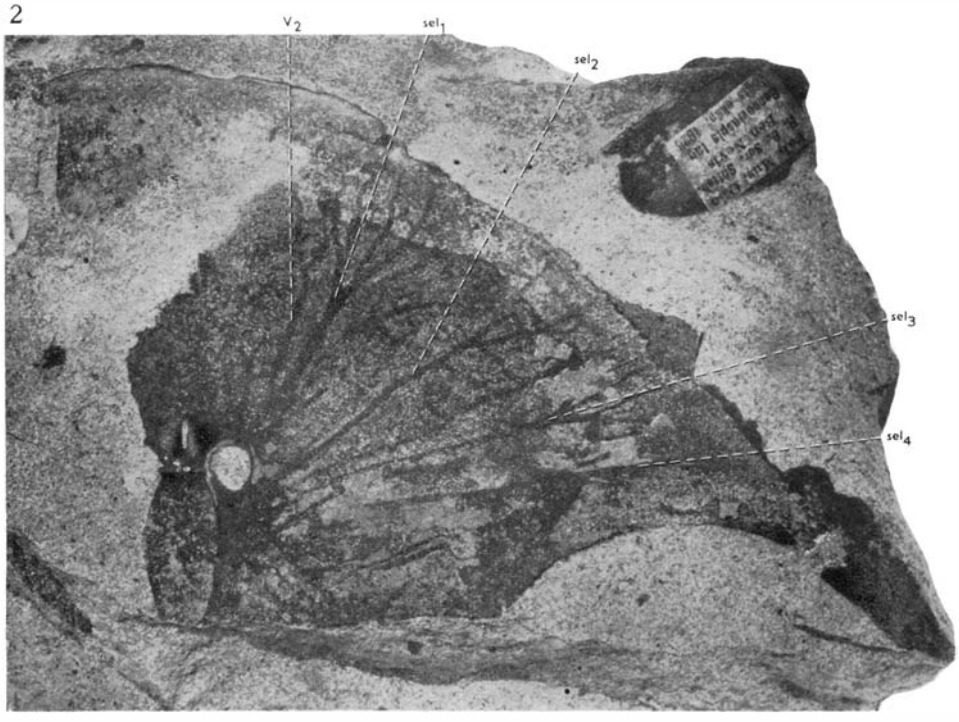

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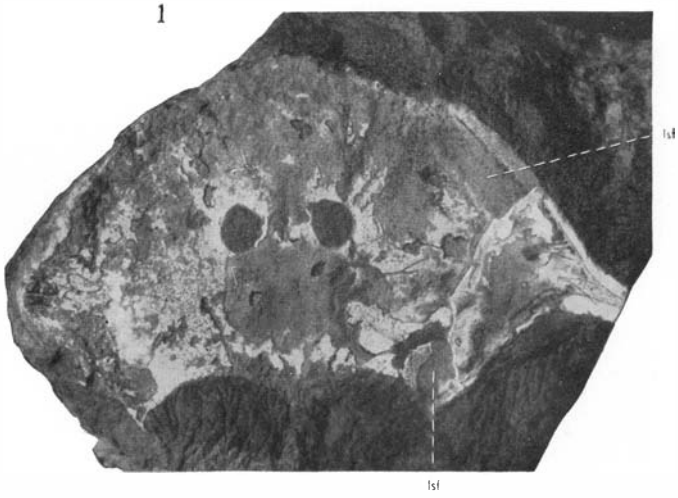

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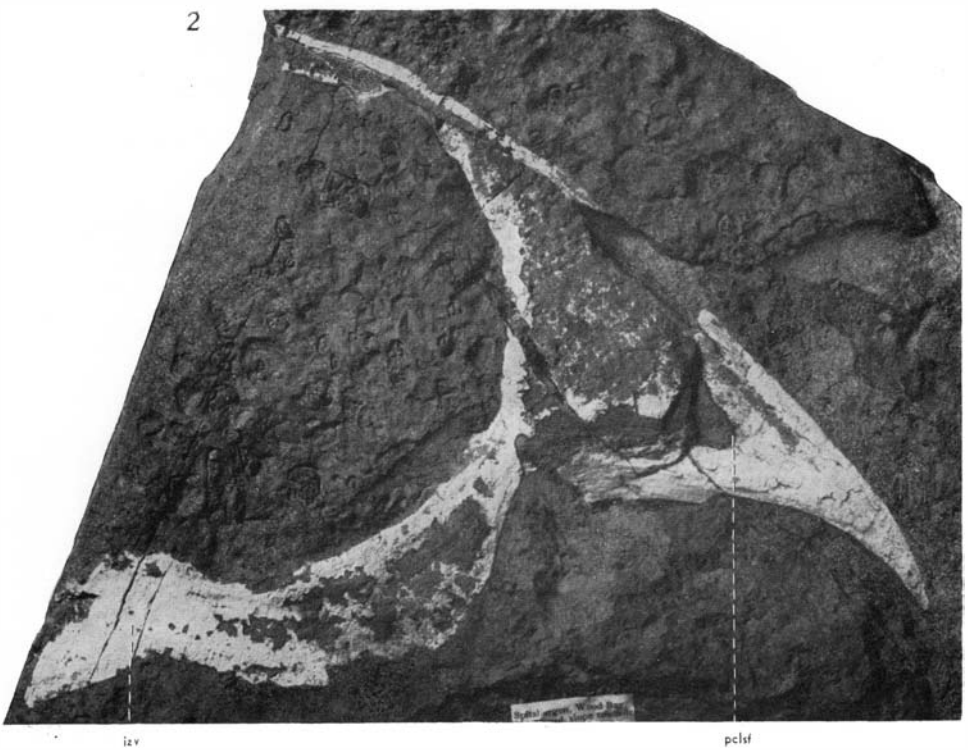

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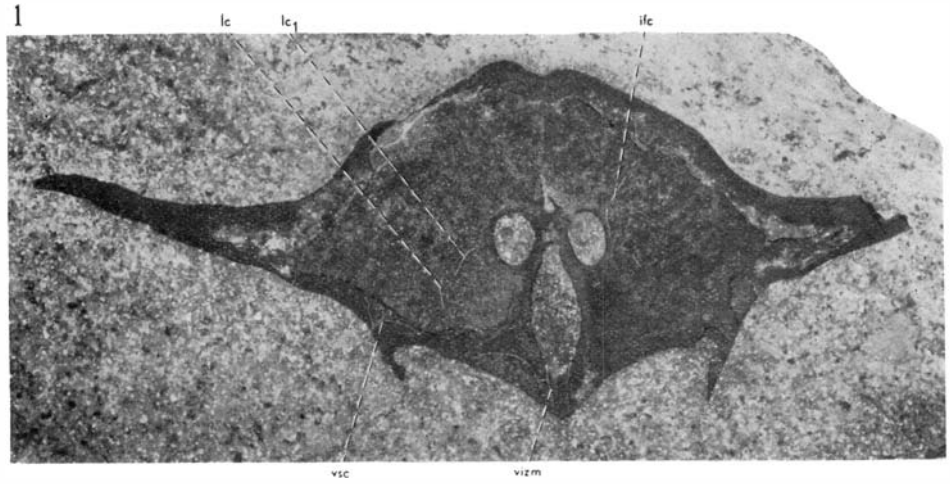

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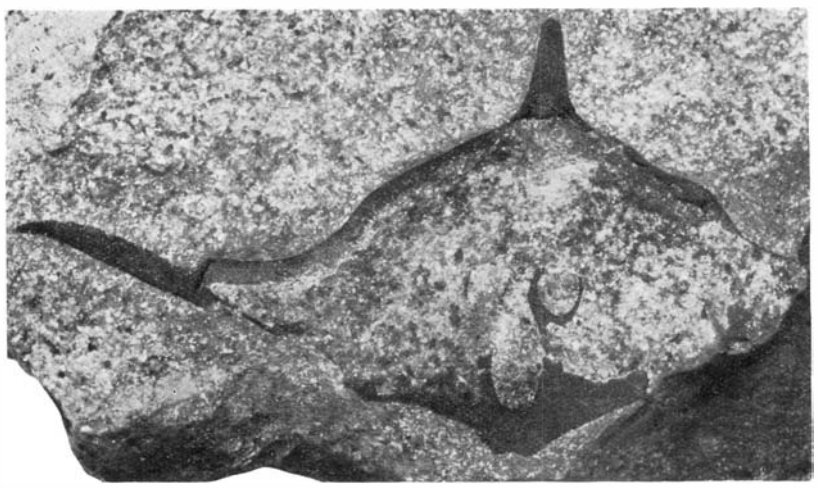

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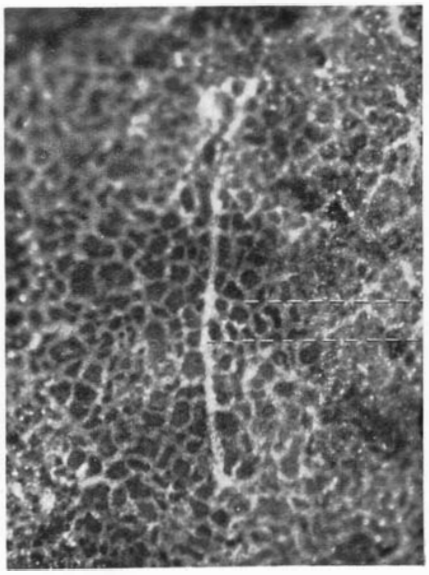
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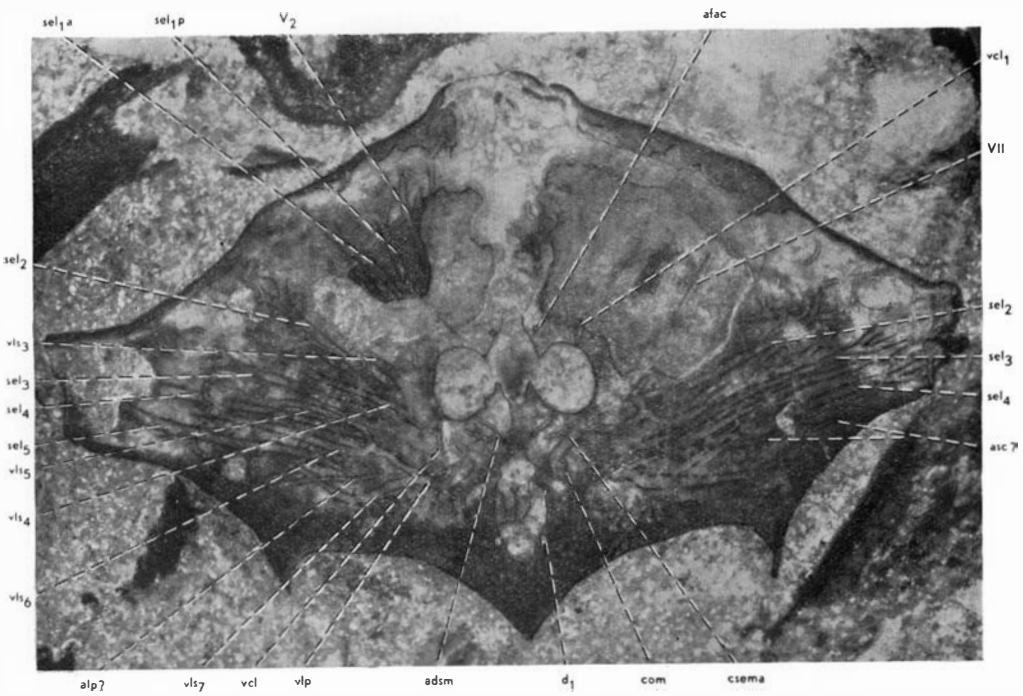
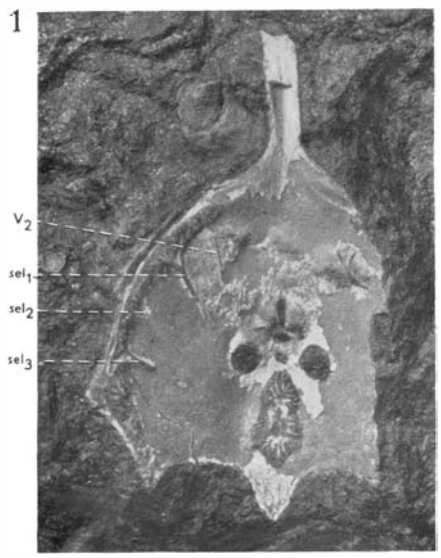
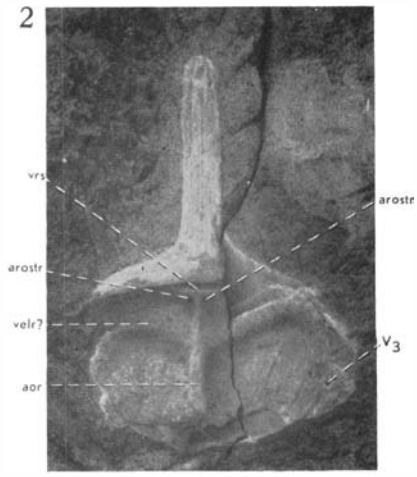
lc

2


sel1a
sel1p
V2
afac
vcl1
VII
sel2
vls3
sel3
sel4
sel5
vls5
vls4
vls6
sel2
sel3
sel4
asc ?
alp?
vls7
vcl
vlp
adsm
d1
com
csema


1
V2
sel1
sel2
sel3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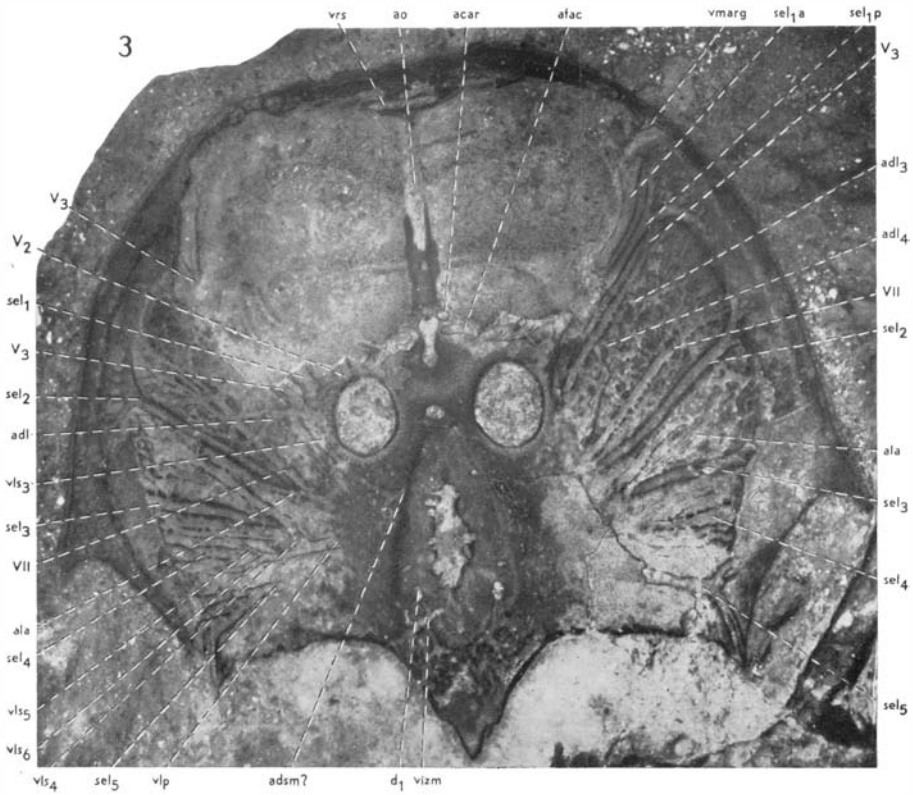
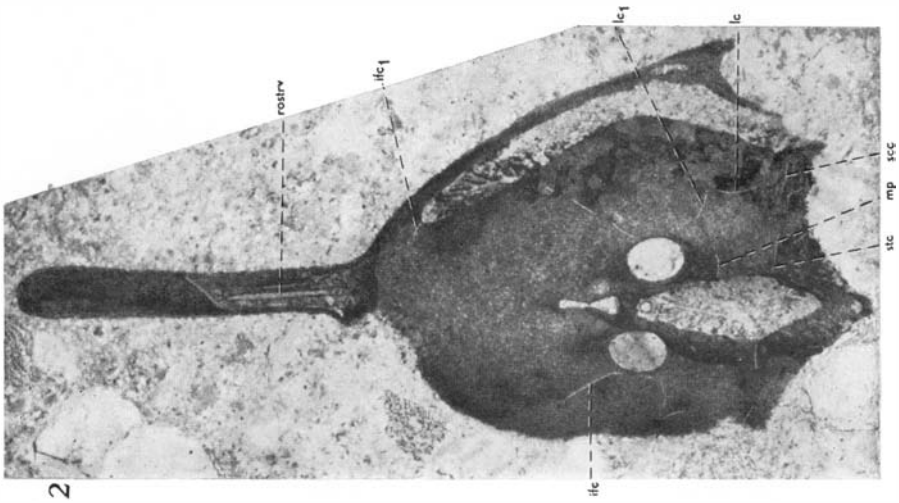
vrs
arostr
arostr
velr?
aor
V3

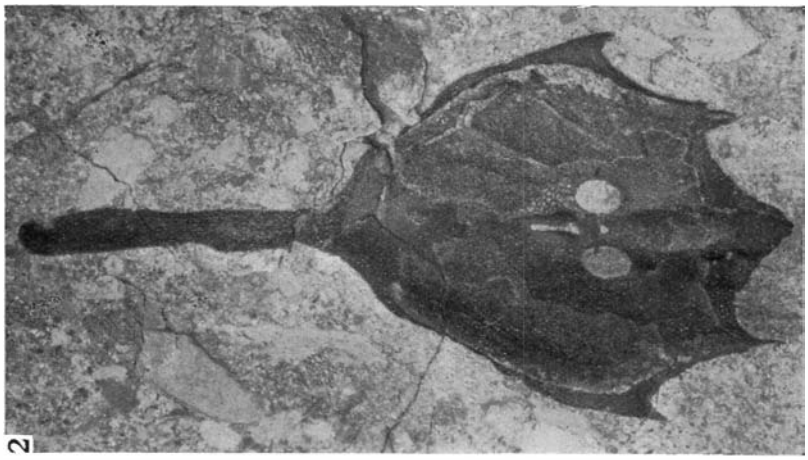

3
vrs
ao
acar
afac
vmarg
sel1a
sel1p
V3
V3
V2
sel1
V3
sel2
adl
vls3
sel3
VII
ala
sel4
vls5
vls6
adl3
adl4
VII
sel2
ala
sel3
sel4
sel5
vls4
sel5
vlp
adsm?
d1
vizm


rostrv
ifc1
lc1
lc
stc
mp
scc
ifc

2


rpr
V2
sel1
sel2
sel3
sel4
pbrw
nr

1



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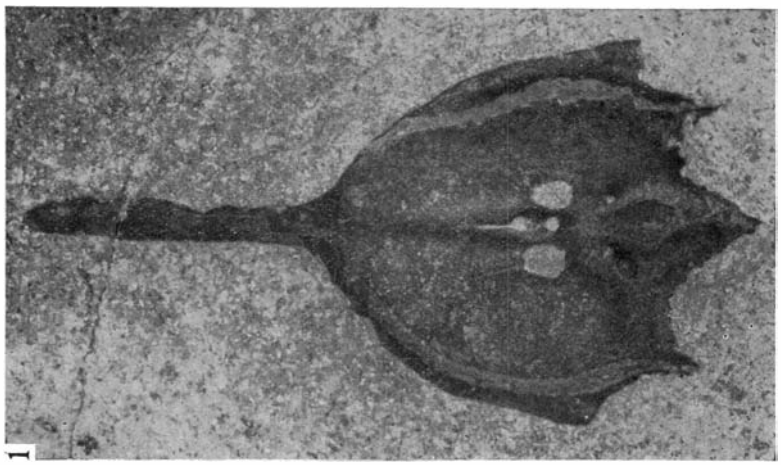

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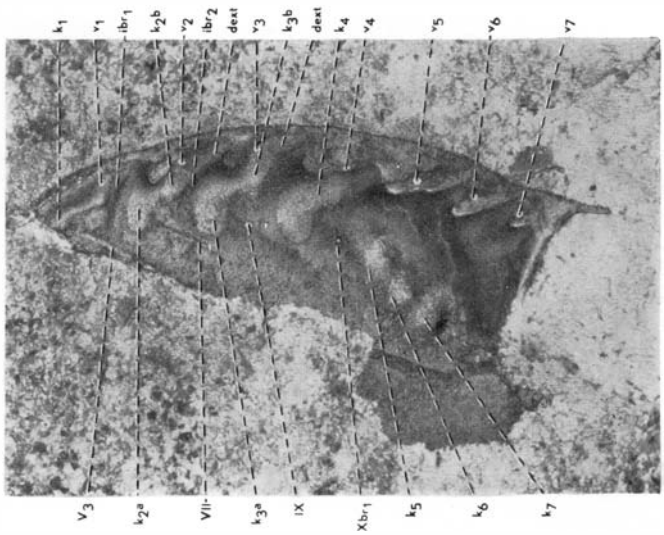
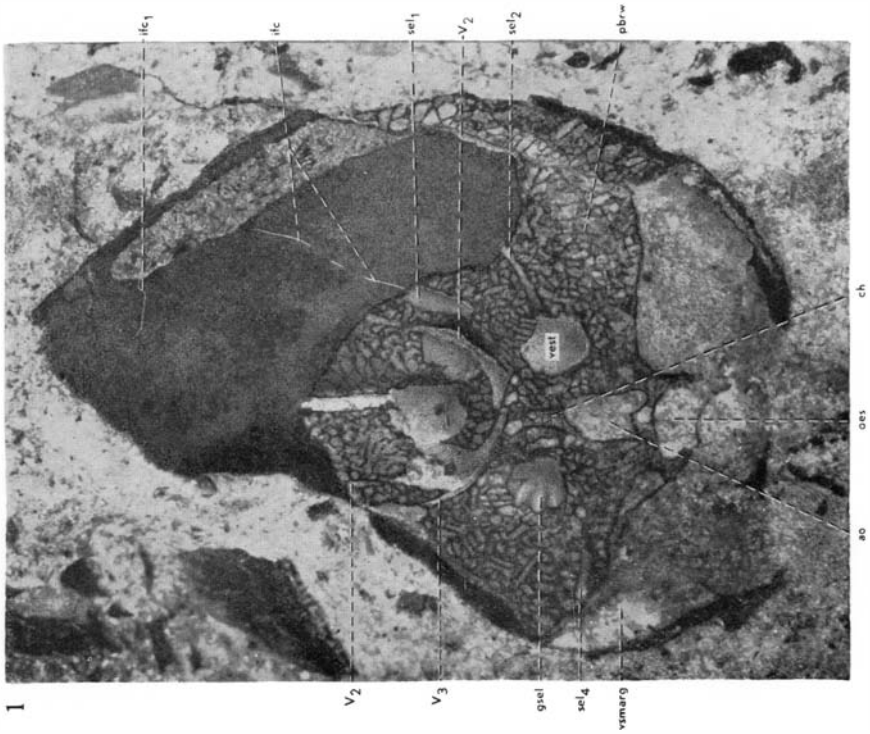
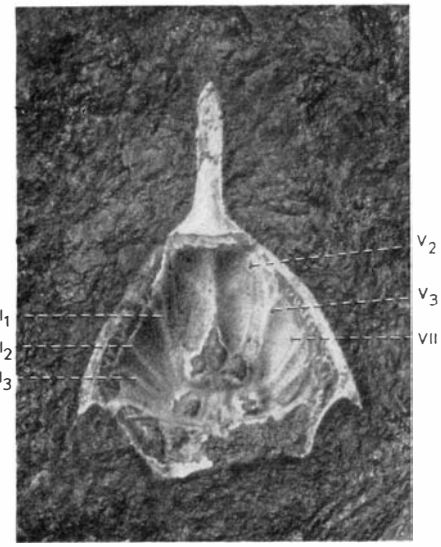

k1
v1
ibr1
k2b
v2
ibr2
dext
v3
k3b
dext
k4
v4
v5
v6
v7
v3
k2a
VIII
k3a
IX
Xbr1
k5
k6
k7

2


ifc1
ifc
sel1
v2
sel2
pbrw
vest
ch
ges
ao
v2
v3
gsel
sel4
vsmarg

1

1



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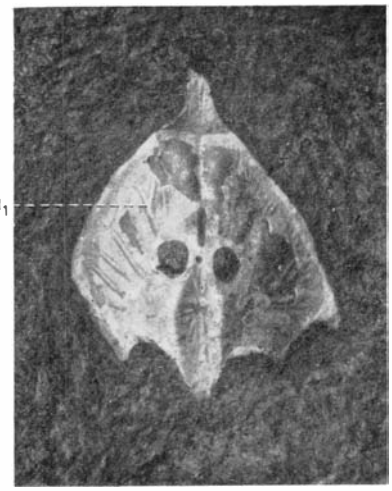

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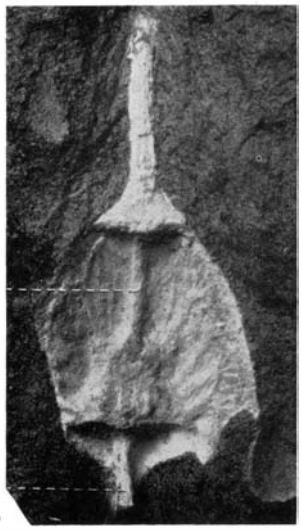

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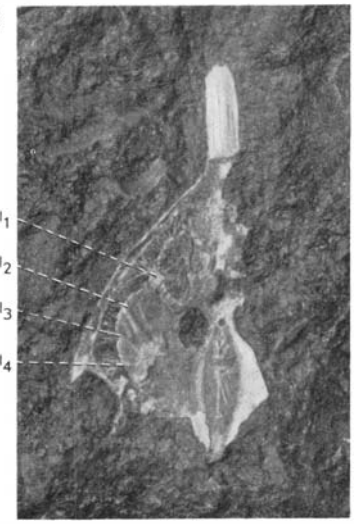
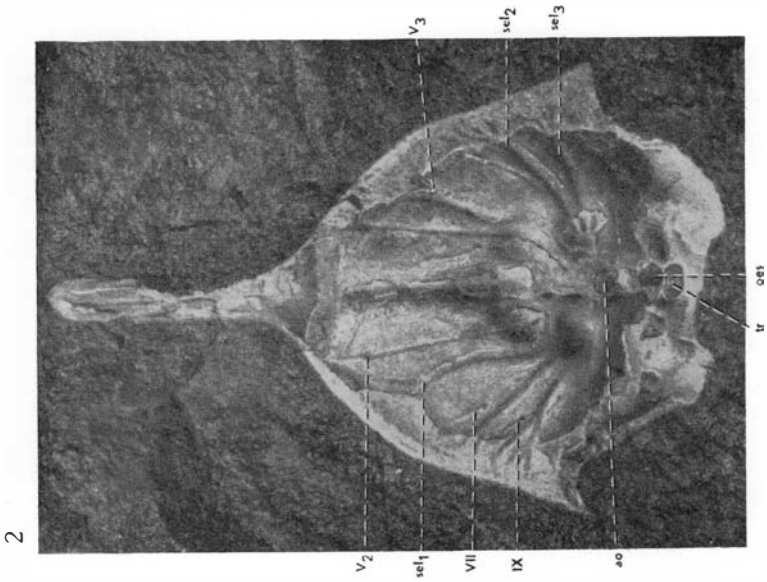
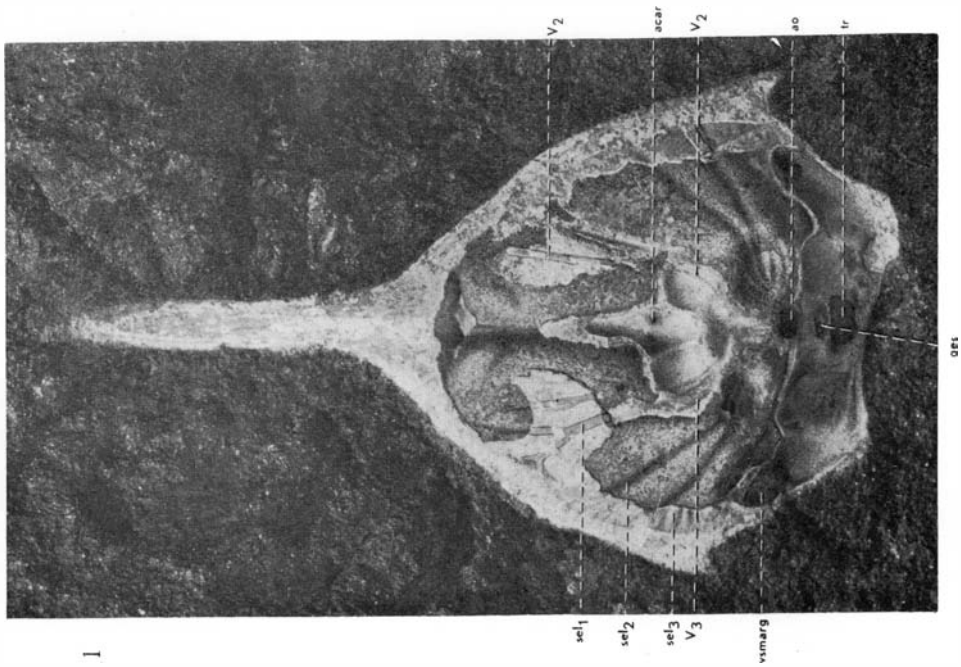



V3
sel2
sel3
oes
tr
V2
sel1
VII
IX
ao

2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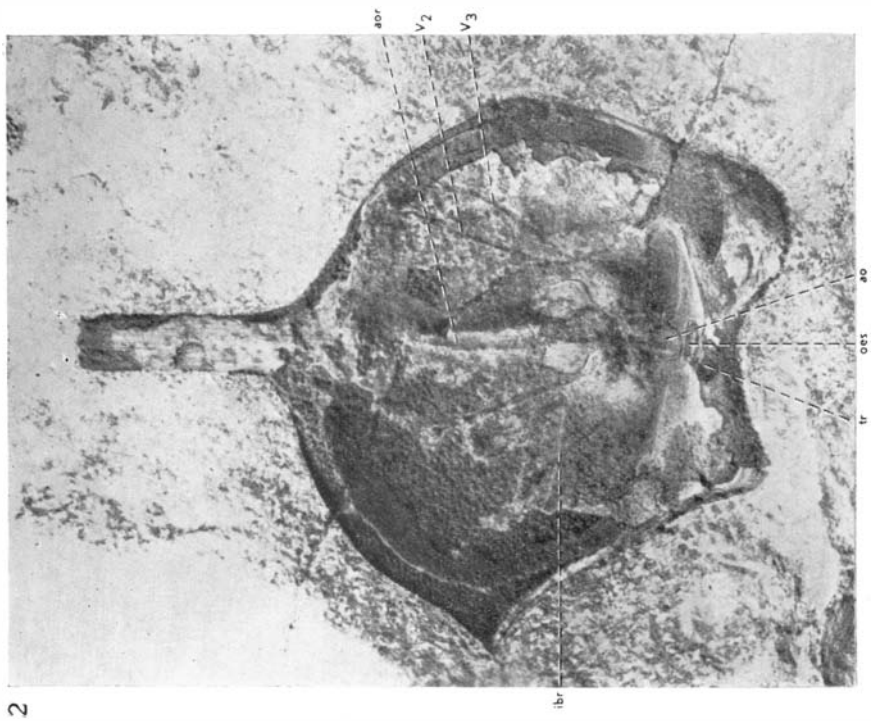
acar
V2
ao
tr
oes
sel1
sel2
sel3
V3
v.marg

1



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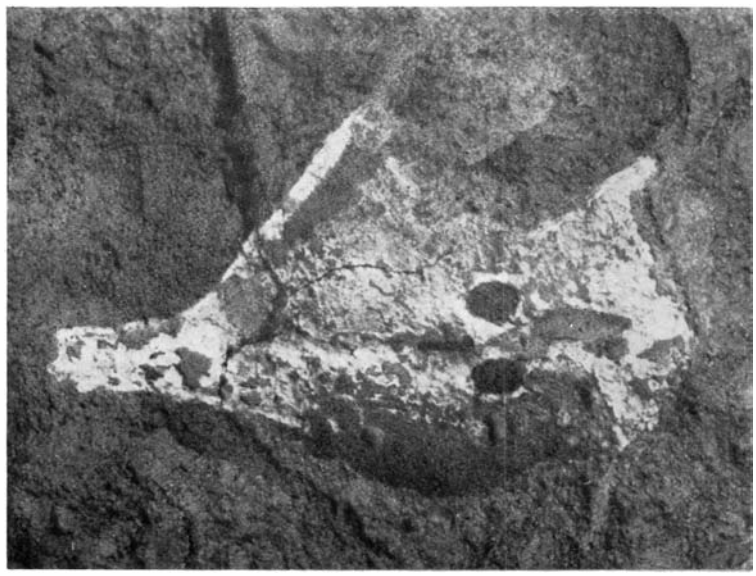

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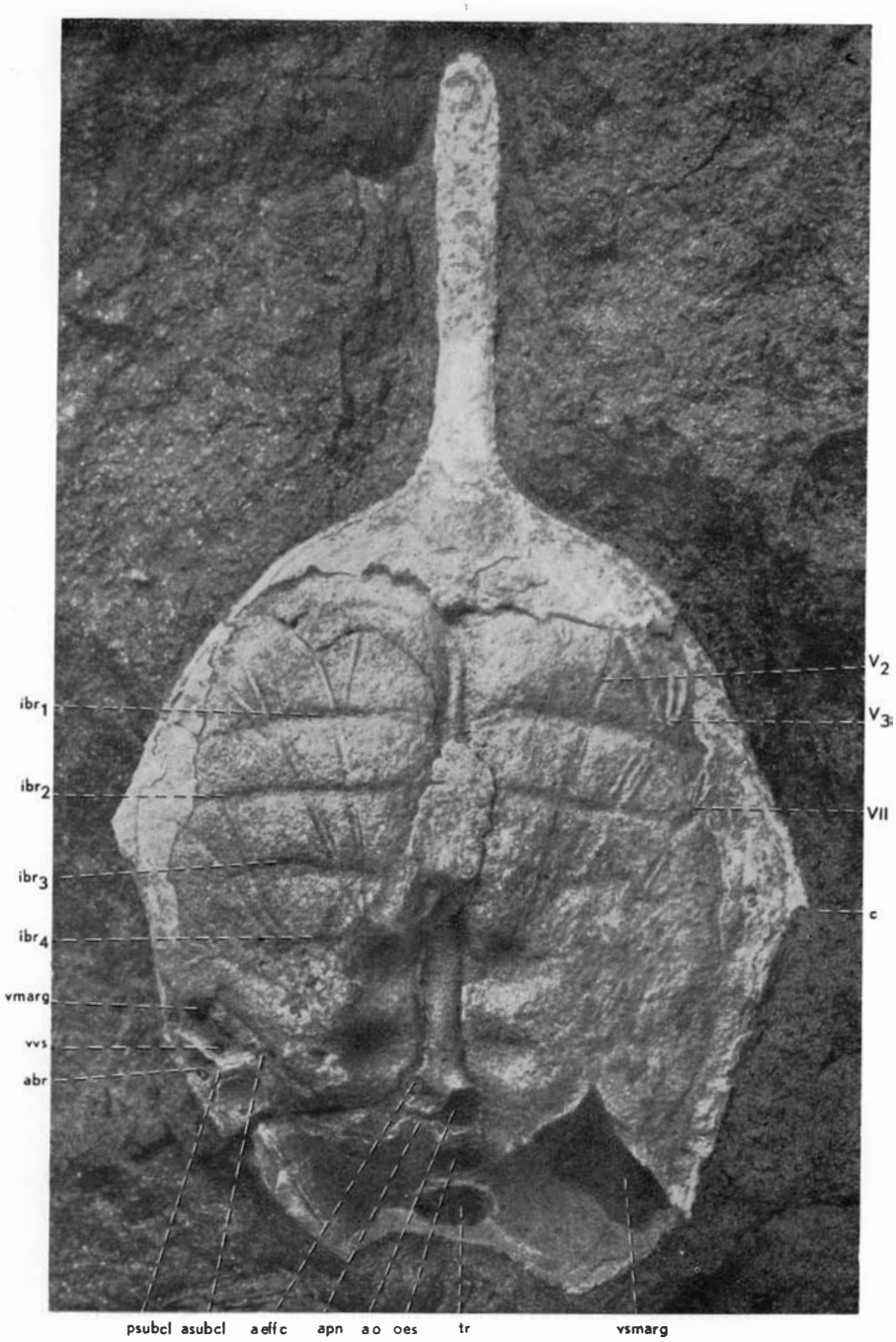
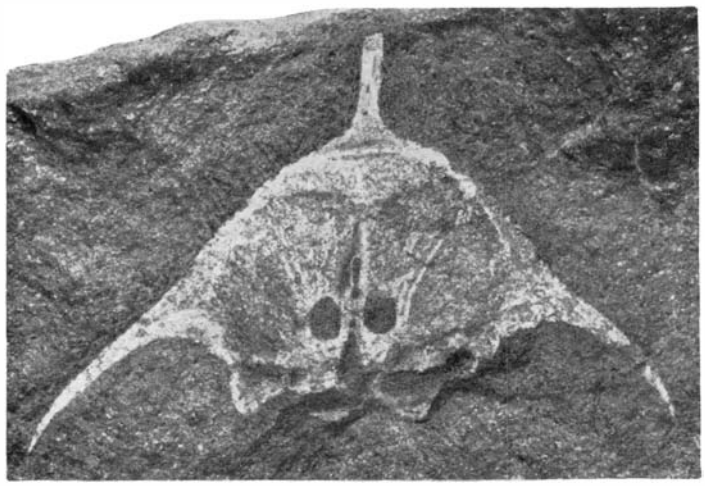

ibr1
ibr2
ibr3
ibr4
vmarg
vvs
abr
V2
V3
VII
c
psubcl
asubcl
aeffc
apn
ao
oes
tr
vsmarg

1



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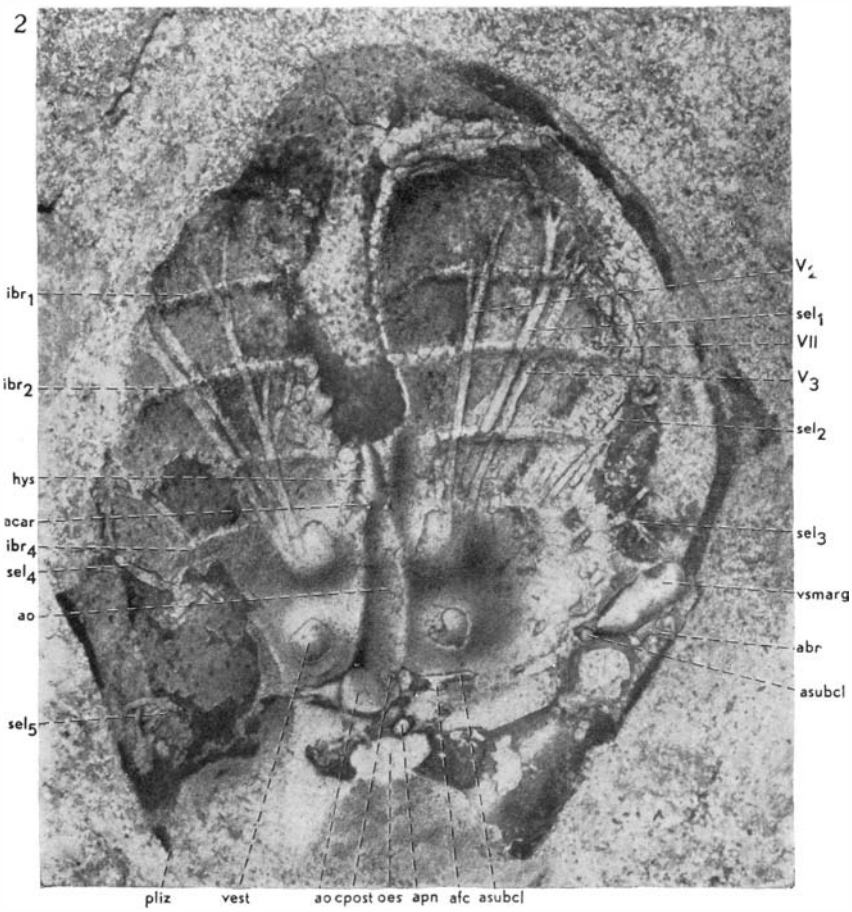
ibr1
ibr2
hys
acar
ibr4
sel4
ao
sel5
V2
sel1
VII
V3
sel2
sel3
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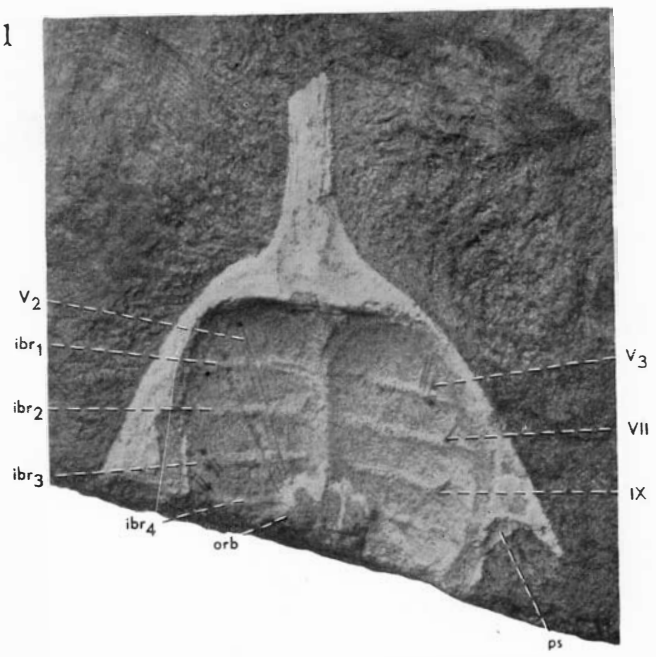
abr
asubcl
pliz
vest
ao
cpost
oes
apn
afc
asubcl

1



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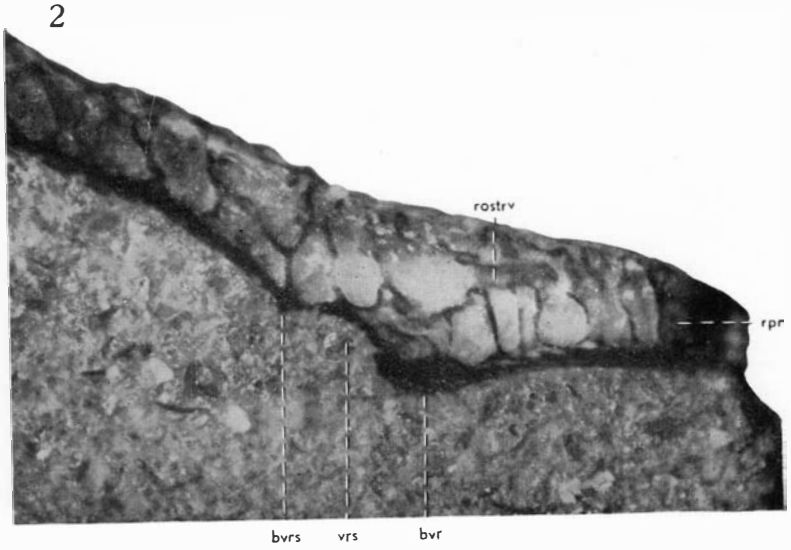

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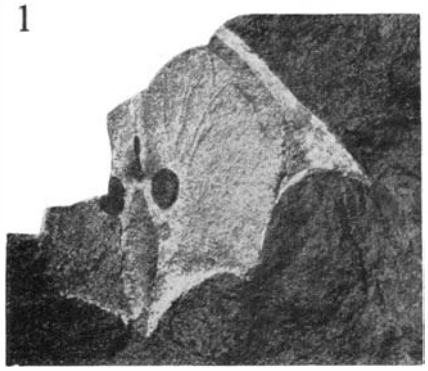

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2

5

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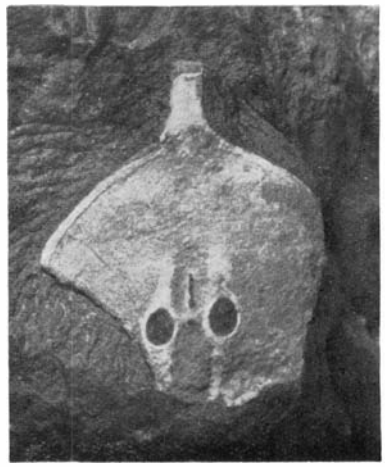

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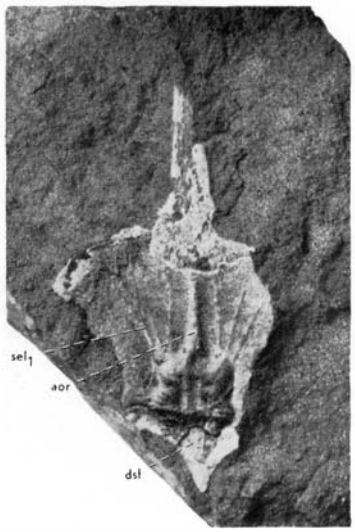
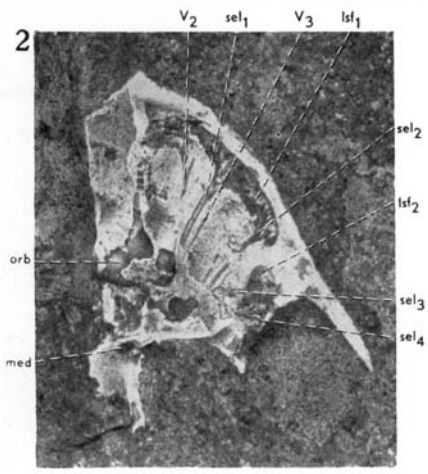
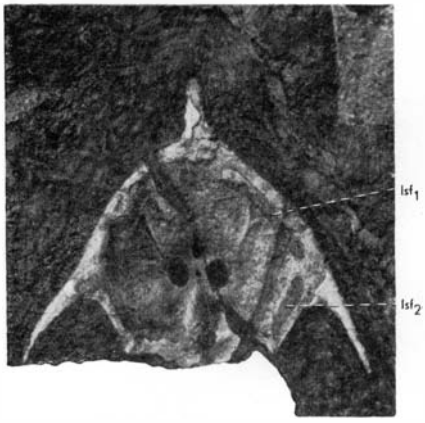

sel1
aor
dsf

2


V2
sel1
V3
lsf1
sel2
lsf2
orb
sel3
sel4
med

3


lsf1
lsf2

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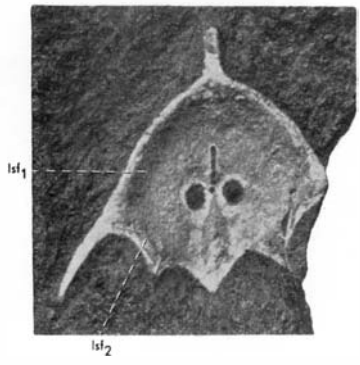
lsf1
lsf2

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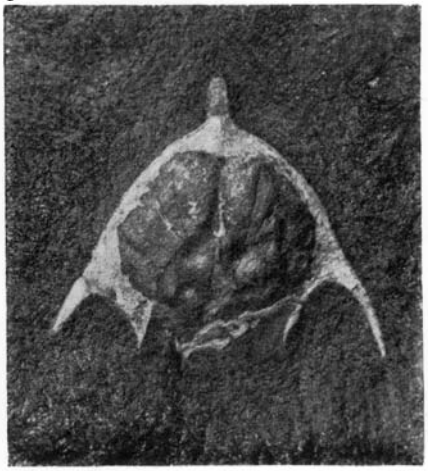

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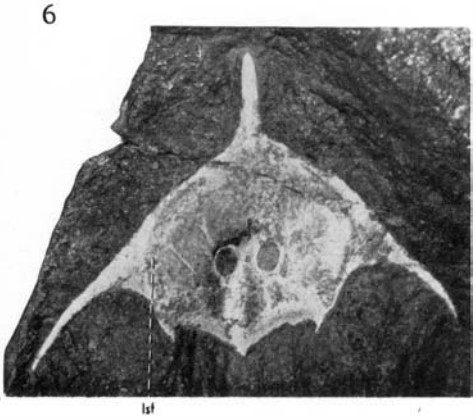
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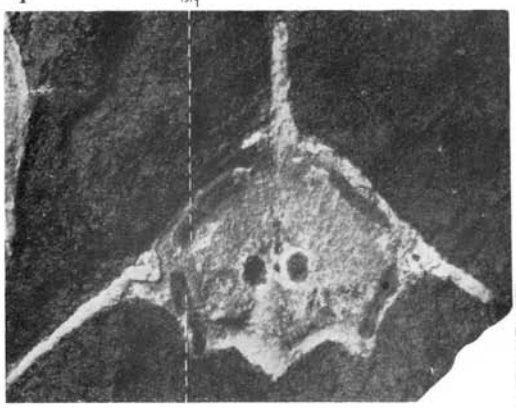
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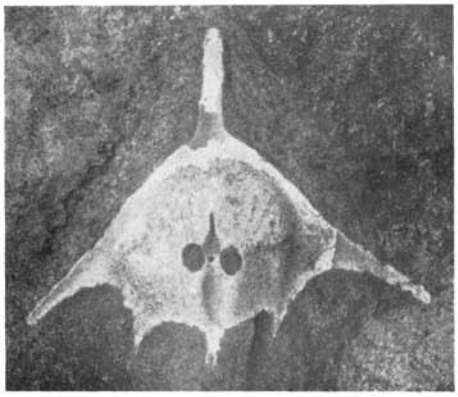

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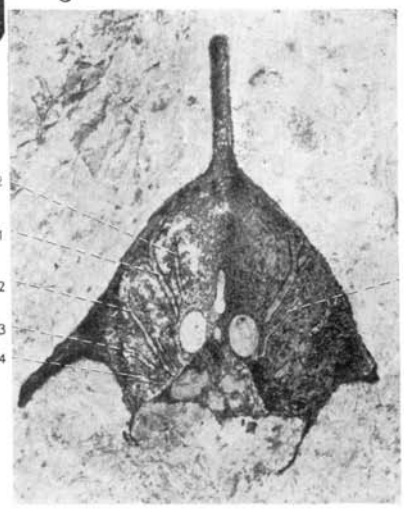
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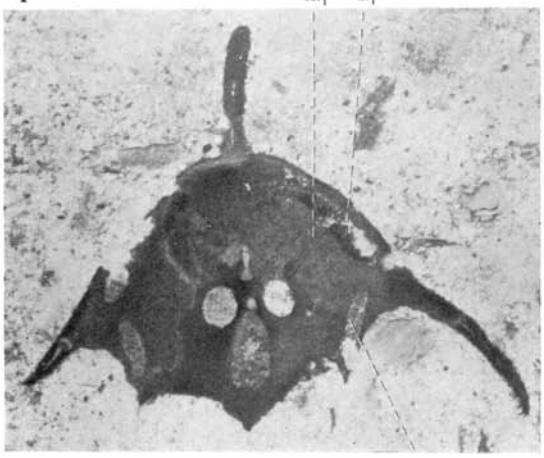
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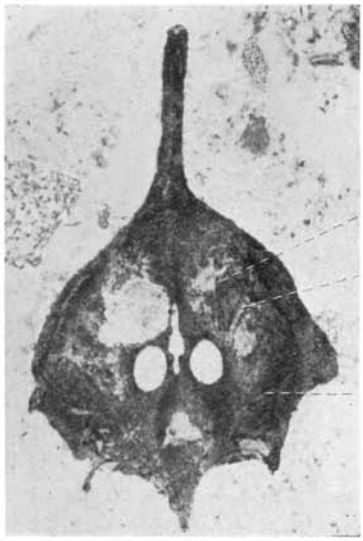
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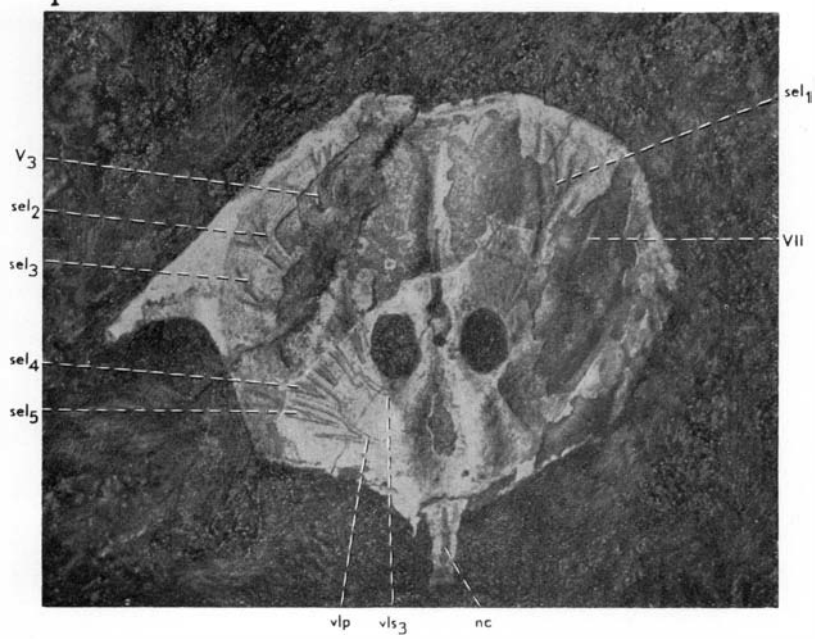
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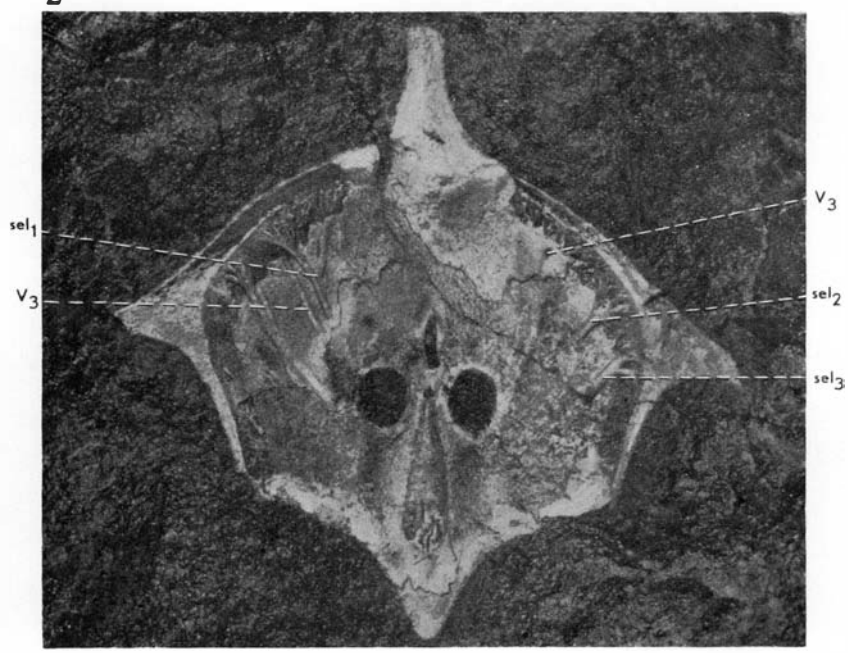
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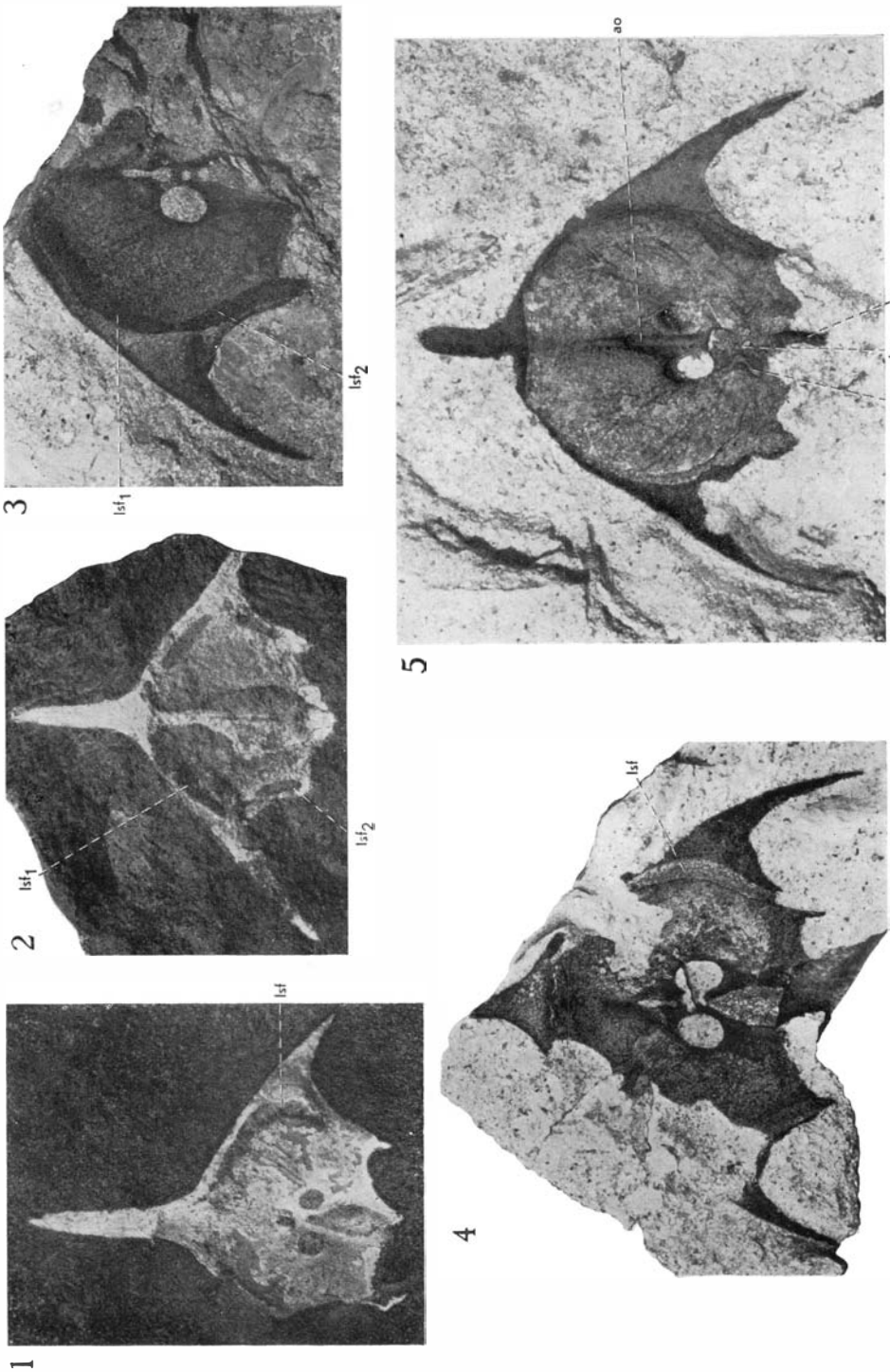
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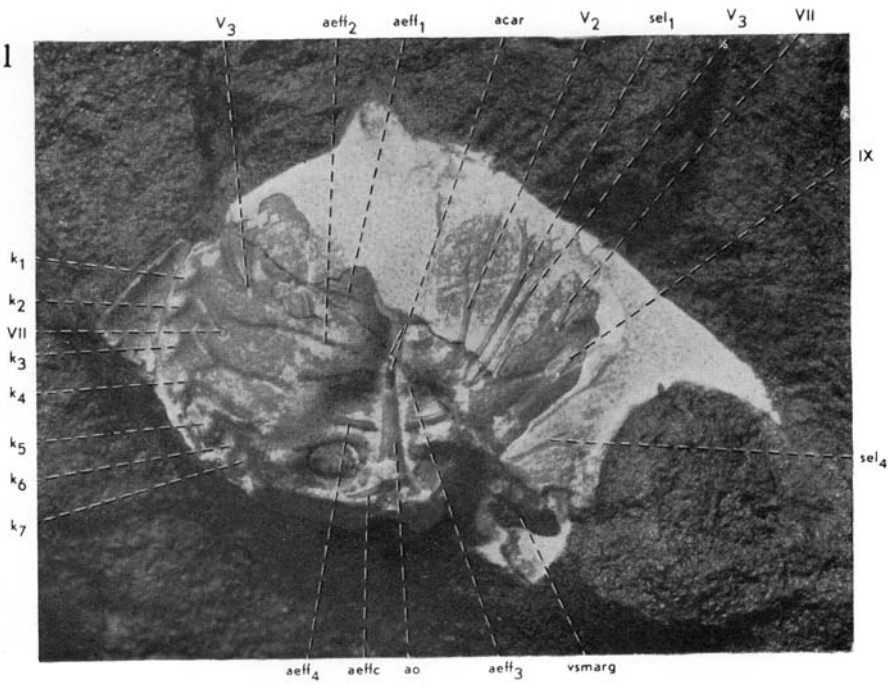
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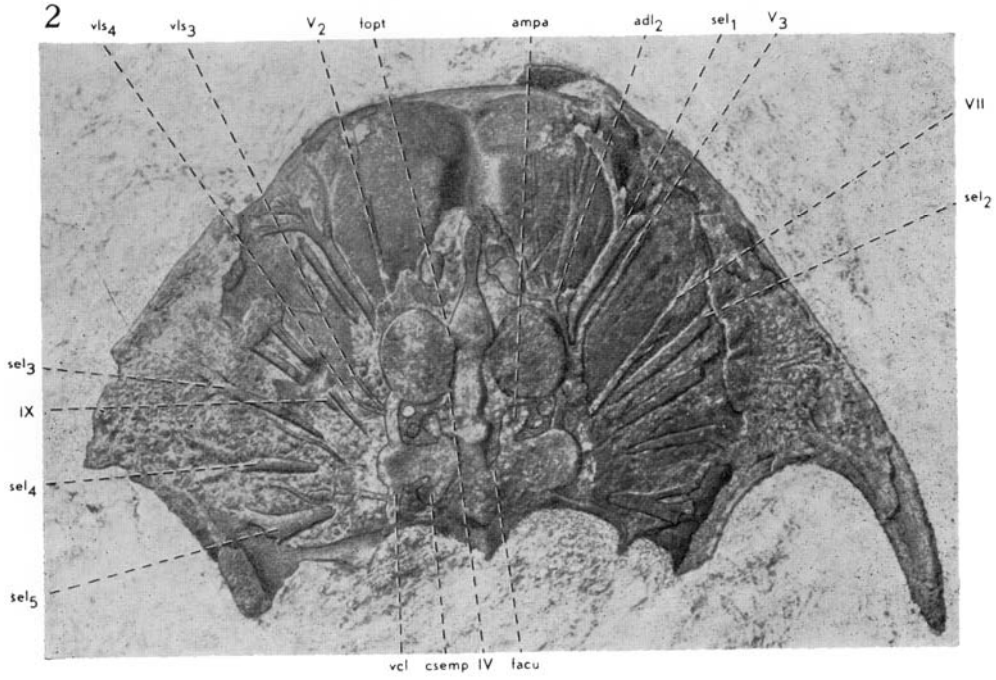
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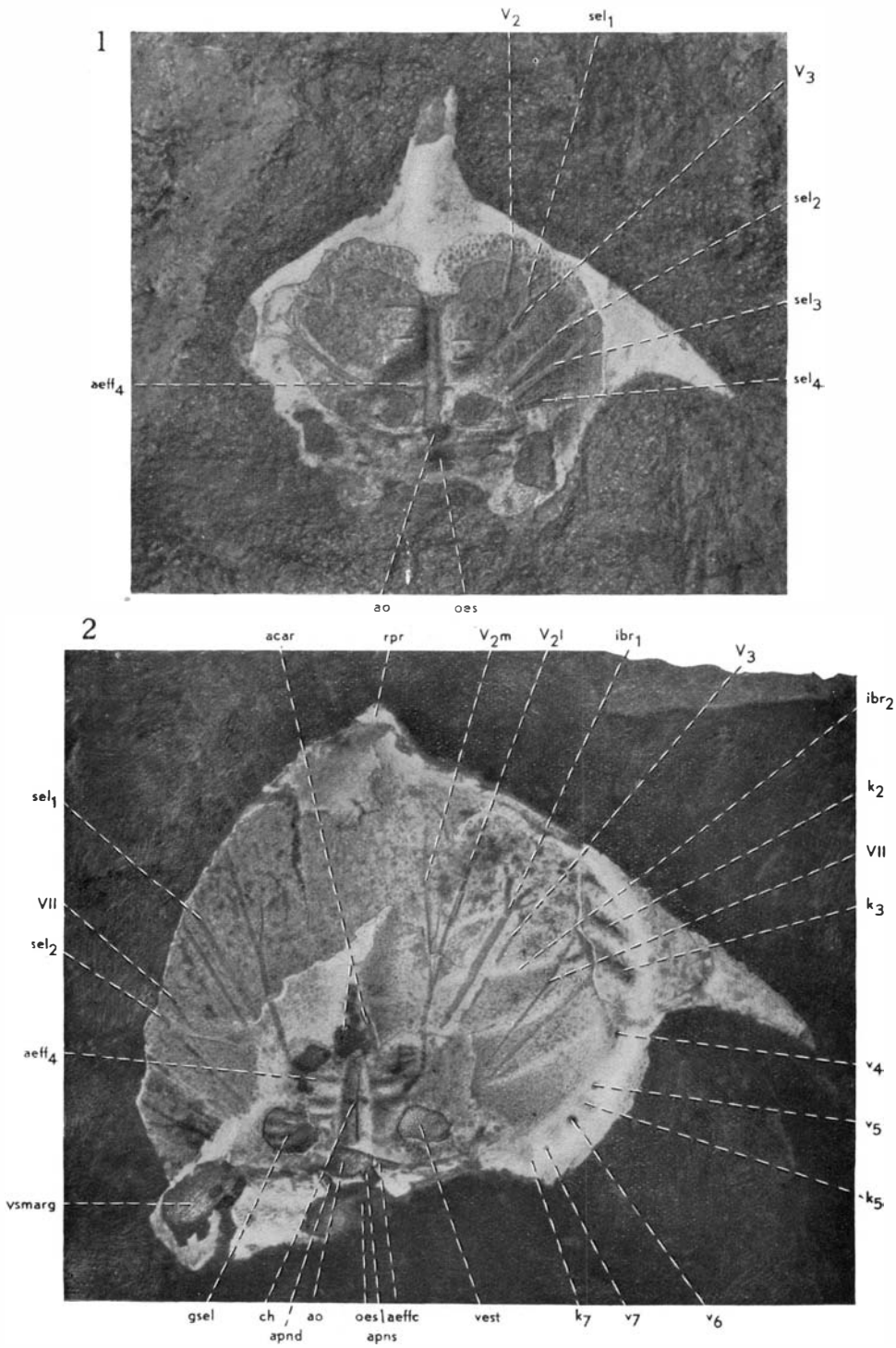
IV
facu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V3
ibr2
sel1
k2
VII
VII
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sel2
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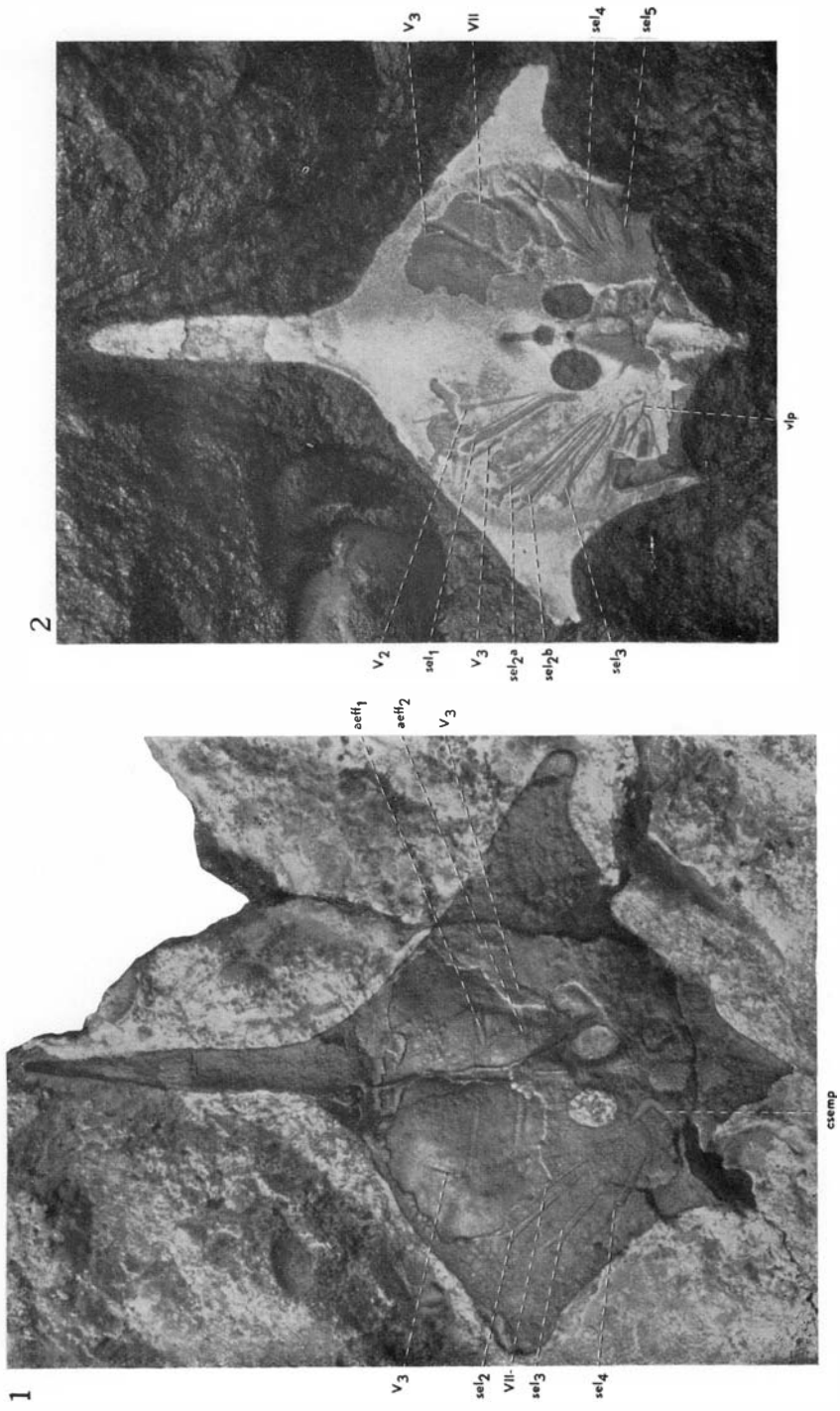
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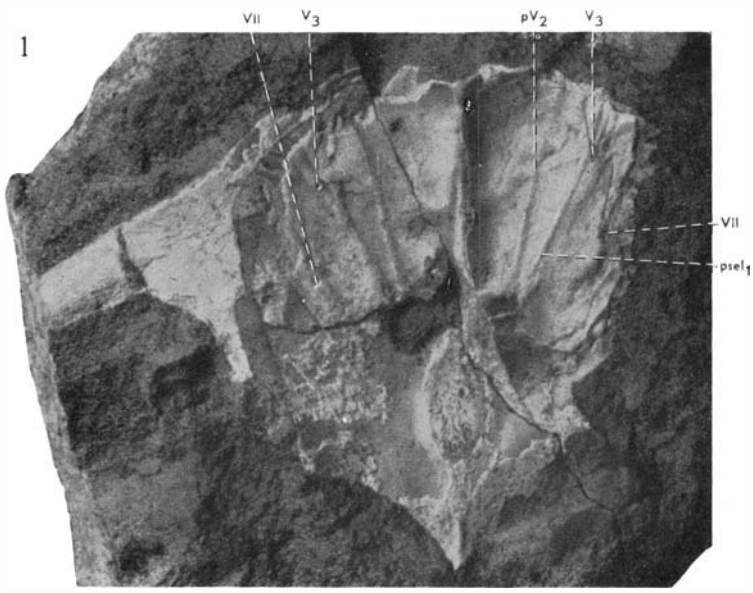
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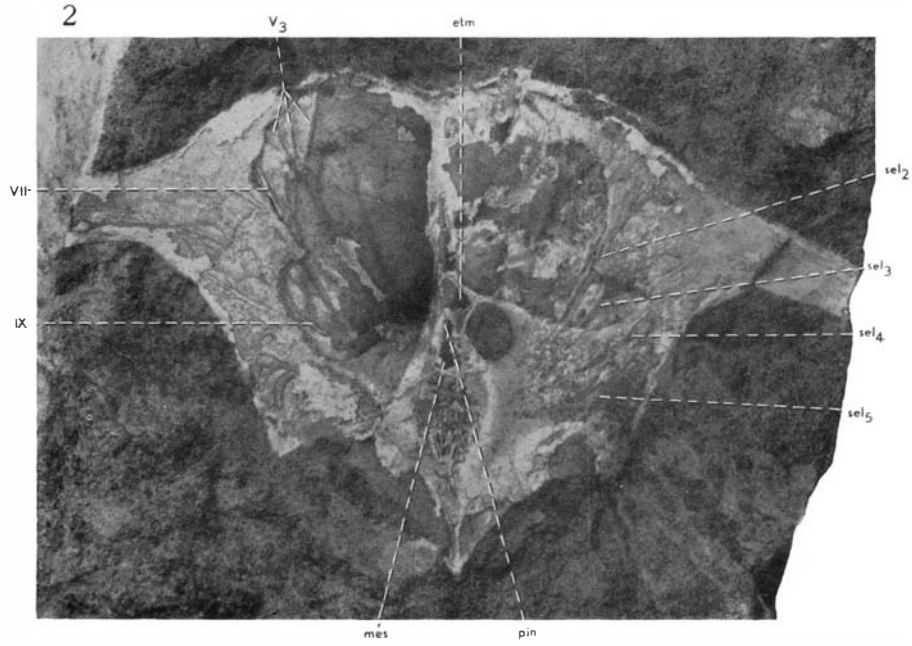
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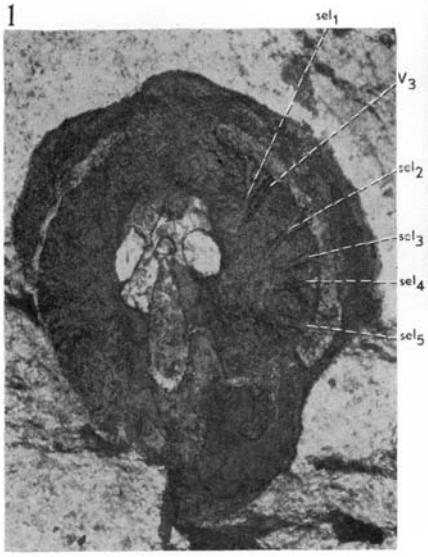
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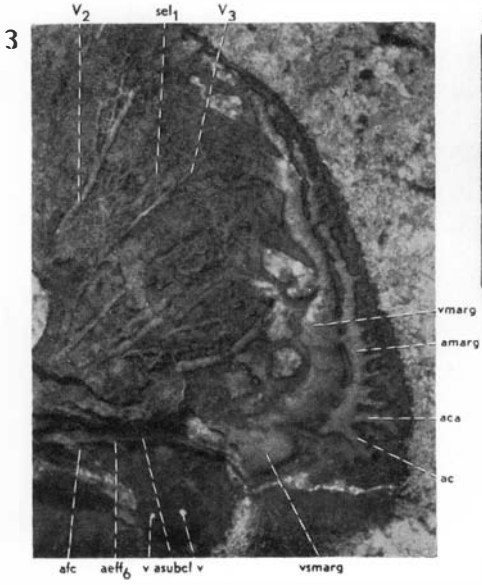
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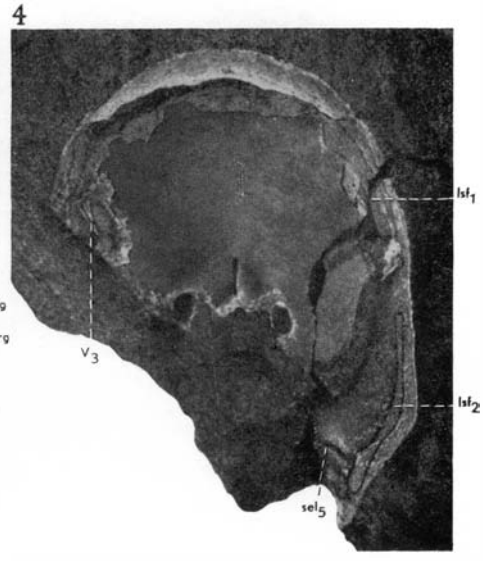
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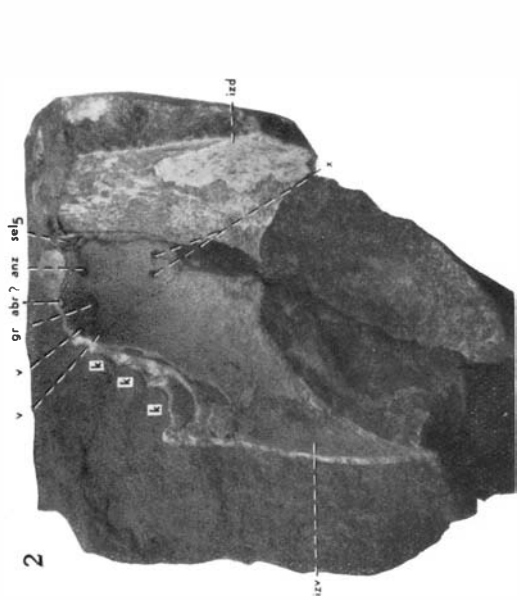
lsf2
sel5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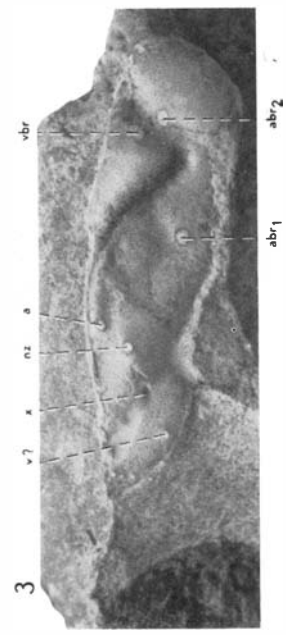
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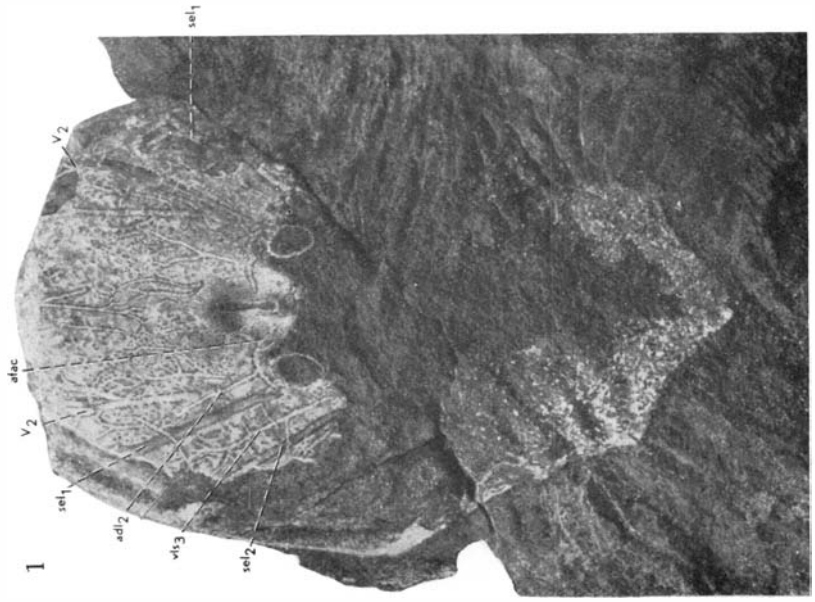
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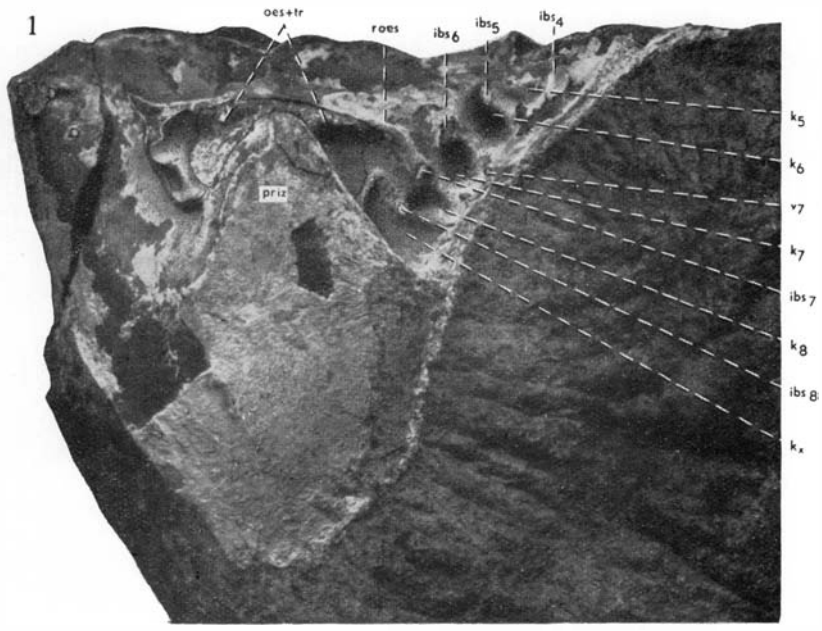
vis3
sel2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ibs 5
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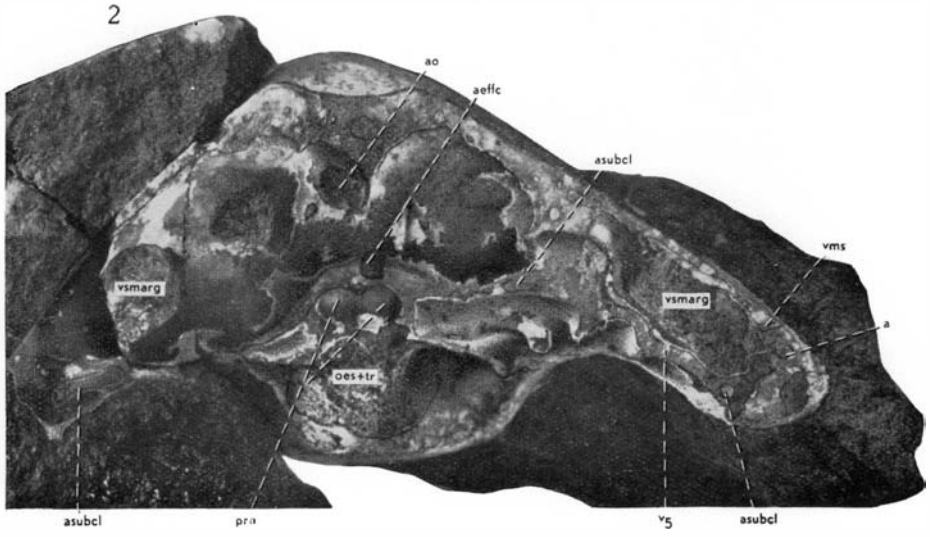
priz
k 5
k 6
v 7
k 7
ibs 7
k 8
ibs 8
k x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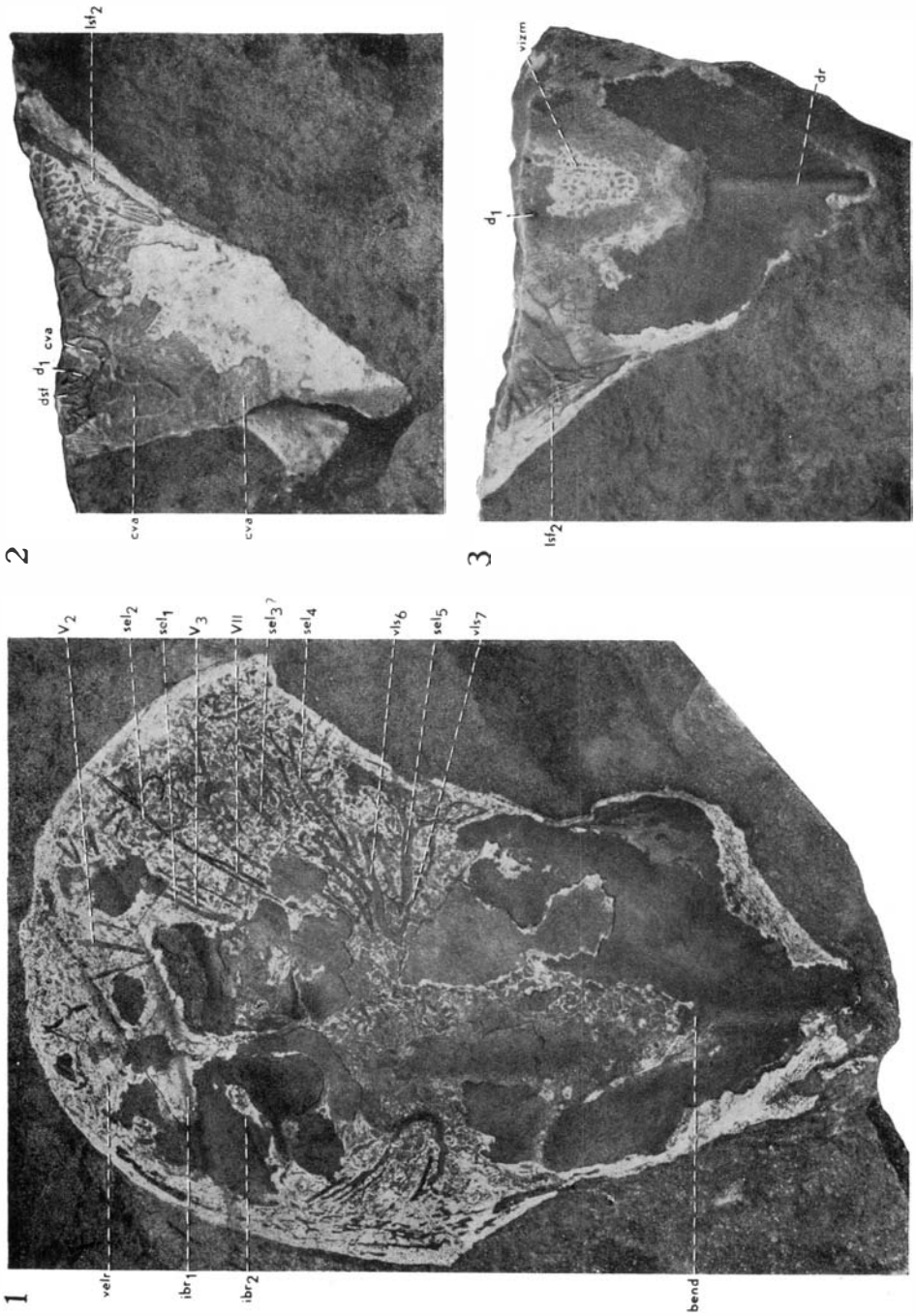
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ibr2
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V2
sel2
sel1
V3
VII
sel3?
sel4
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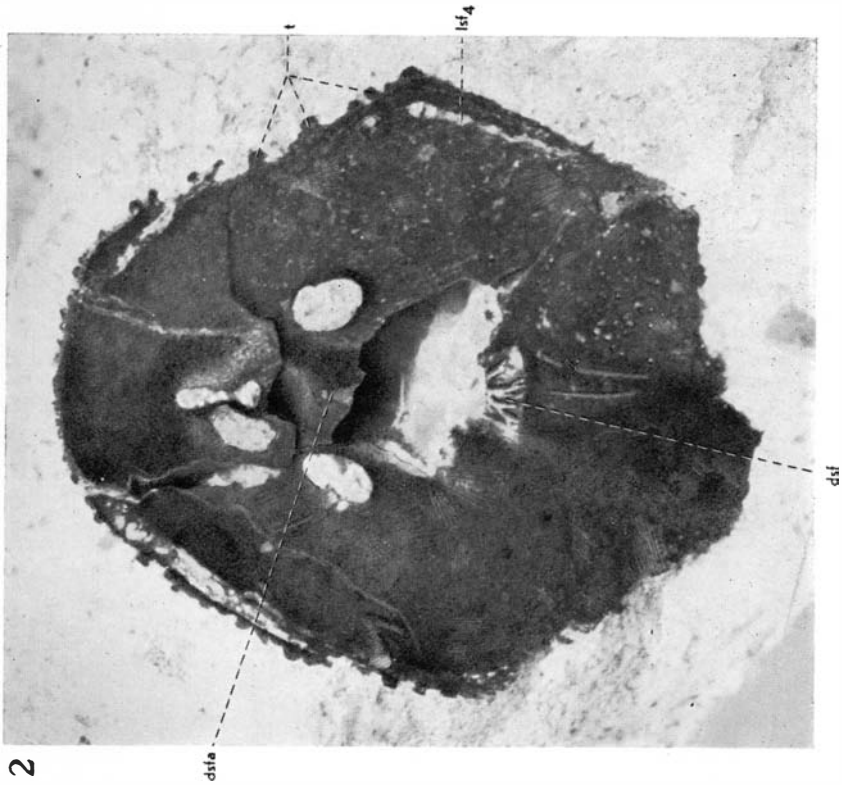
dr
lsf2



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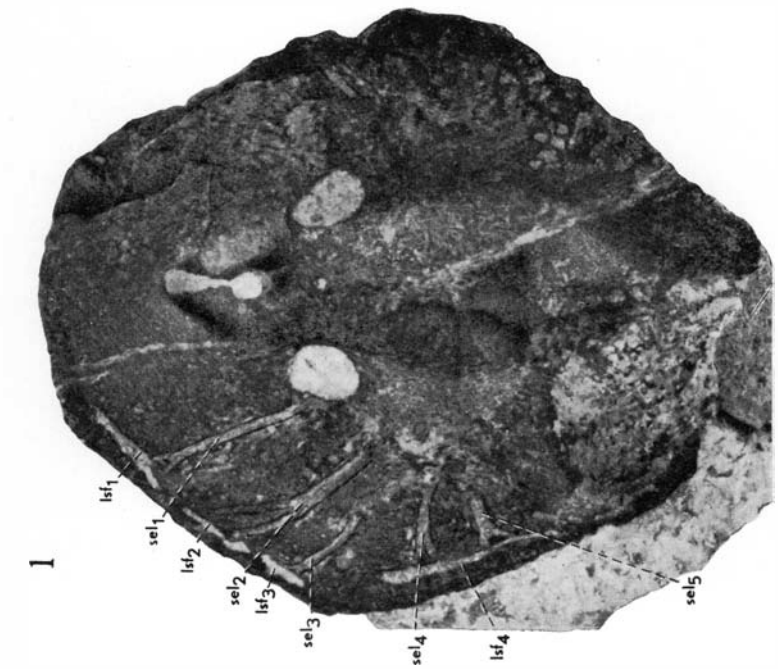

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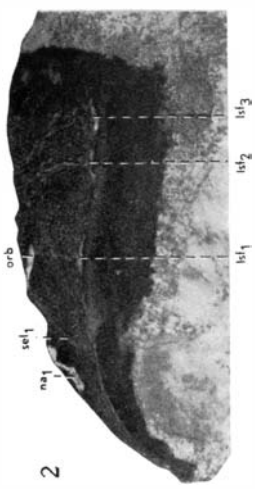
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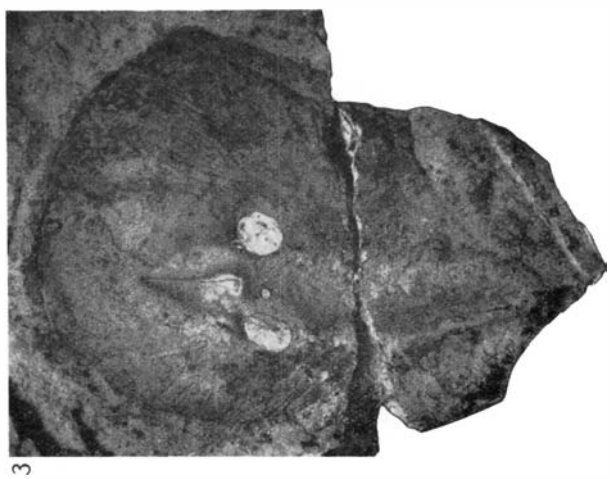
na_1
lsl_1
lsl_2
lsl_3
2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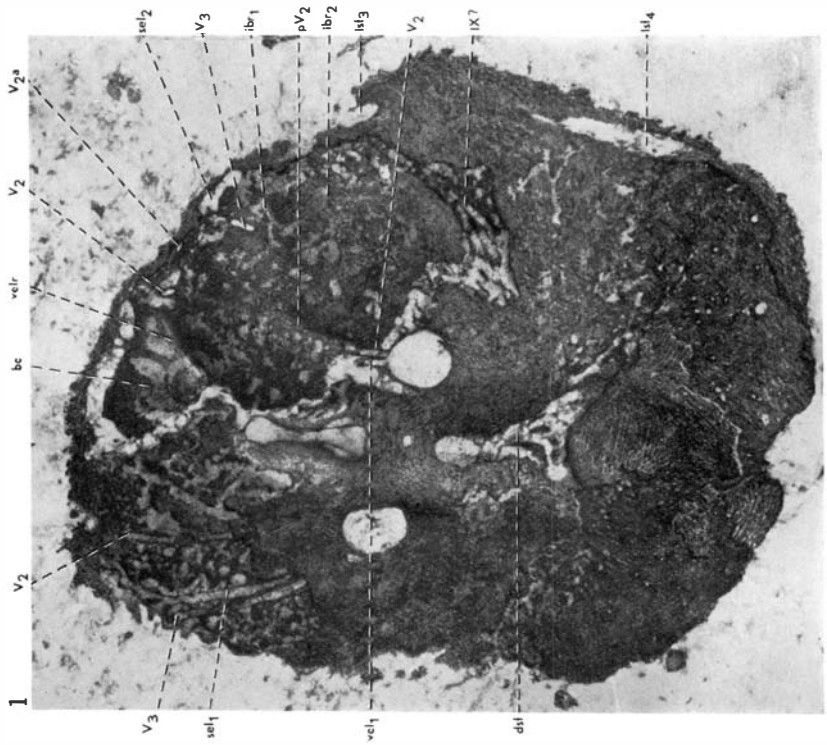
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pV_2
ibr_2
lsl_3
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V_{2a}
V_2
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1
V_3
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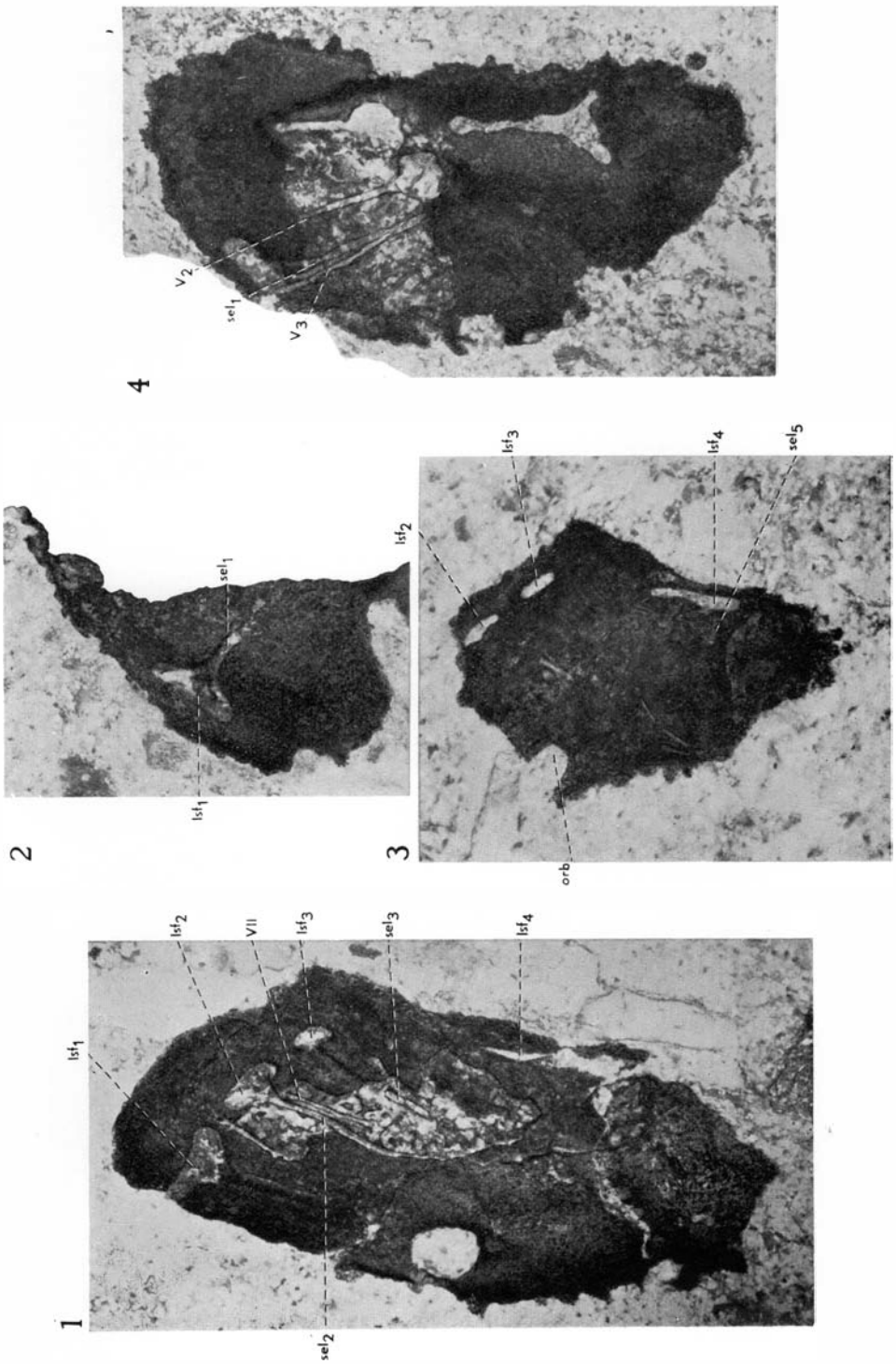
dsl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lsf4
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sel5
orb
4
v2
sel1
v3


1
lsf4


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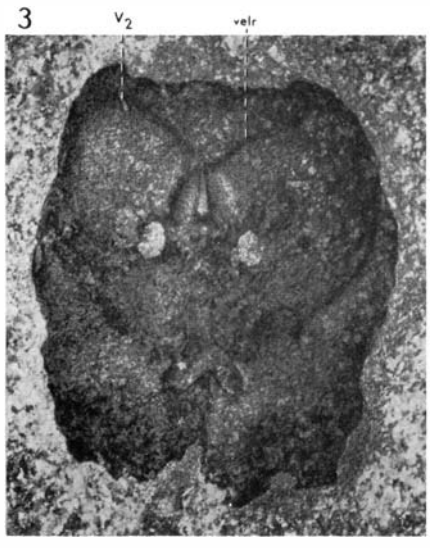
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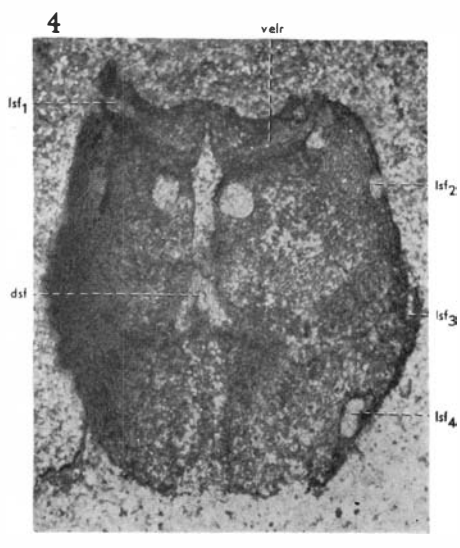
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dsf
lsf3
lsf4

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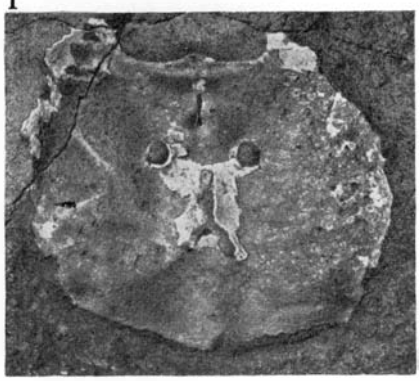

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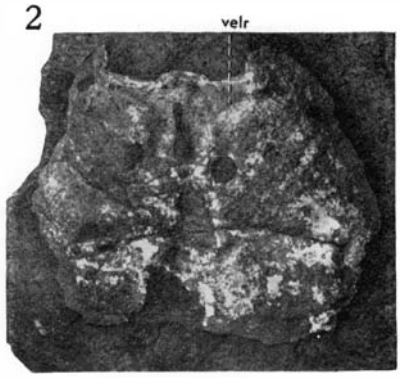

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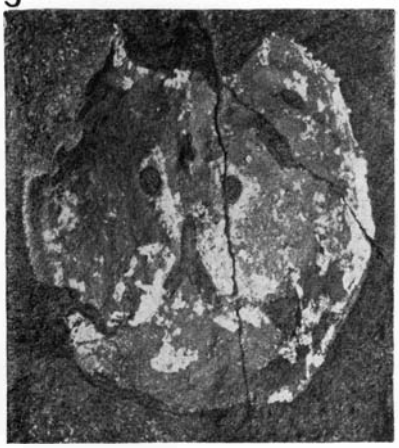

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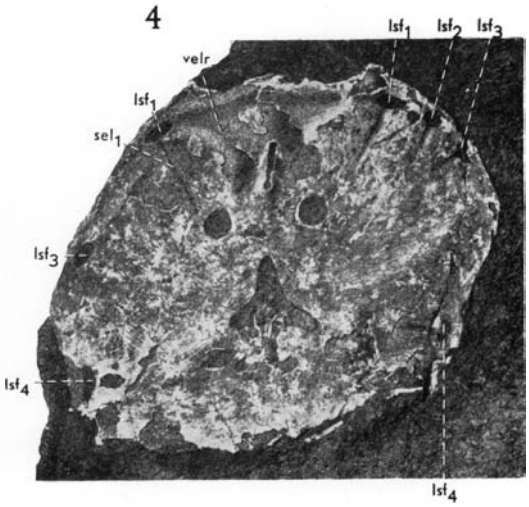


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V1?
V2
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V3
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sel2
vmarg
sel3
sel3
sel4
sel4
sel5
lsf3
bend
des
aiz1
aiz2
vizm
d1
vizl


V2
adl2
sel1
V3
adl3
vls3
sel2
vls4
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vmarg
adl1
V1?
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aad
alp
ala2
sel3
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vls5
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sel5


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vrs
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k1
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amargm?
vmarg
sel2
lsf1
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afac
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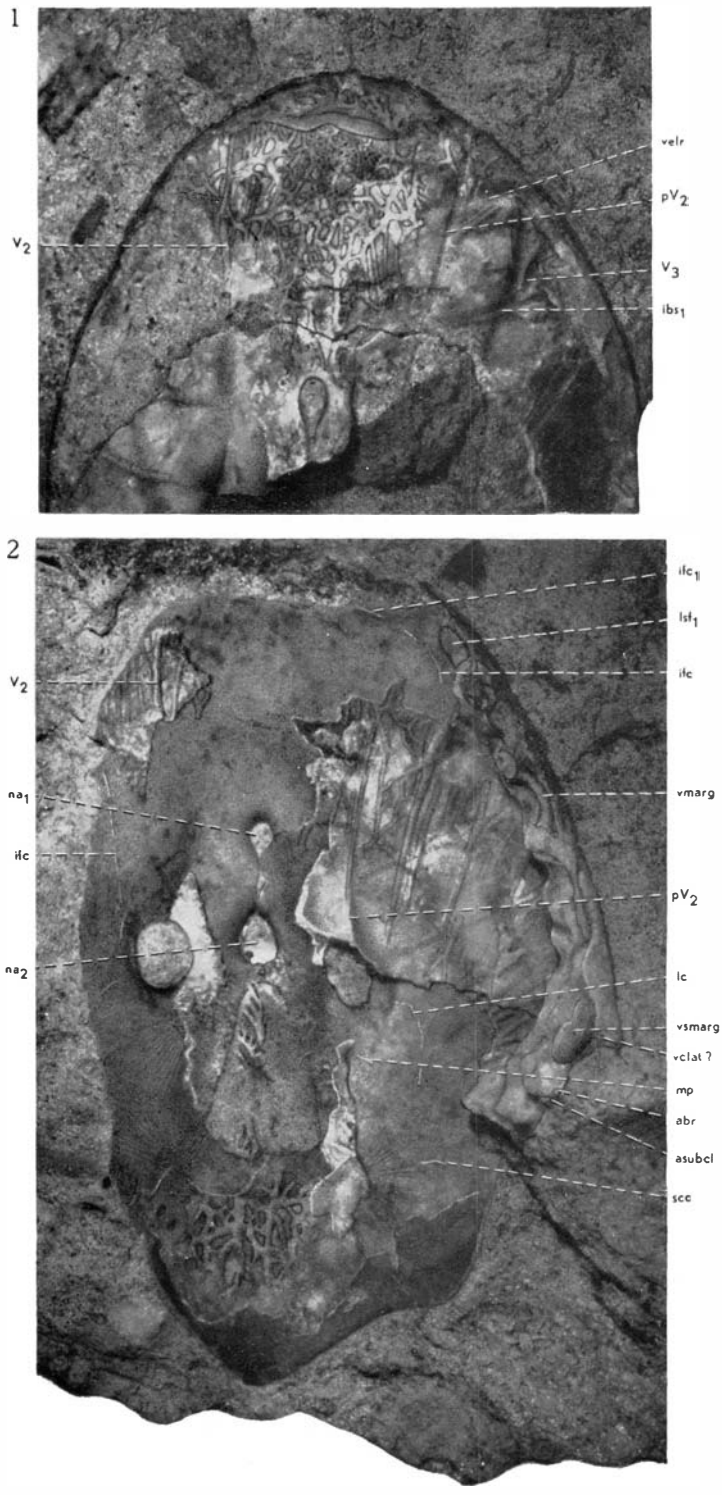
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V2
V3
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V2
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mp
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1

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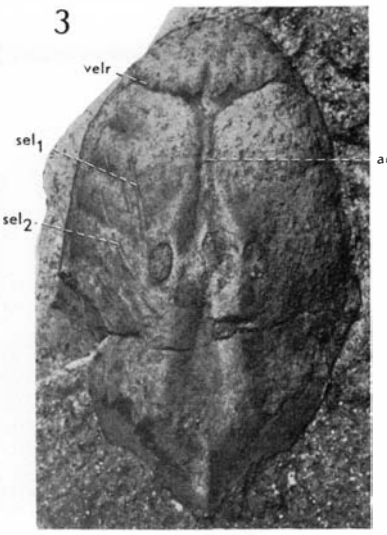

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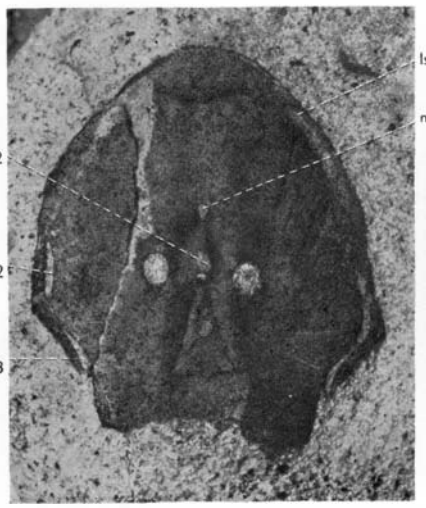

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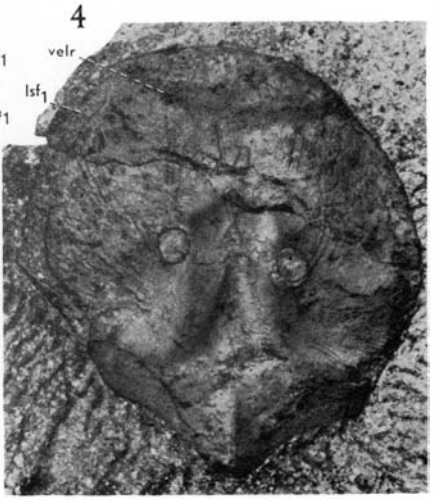

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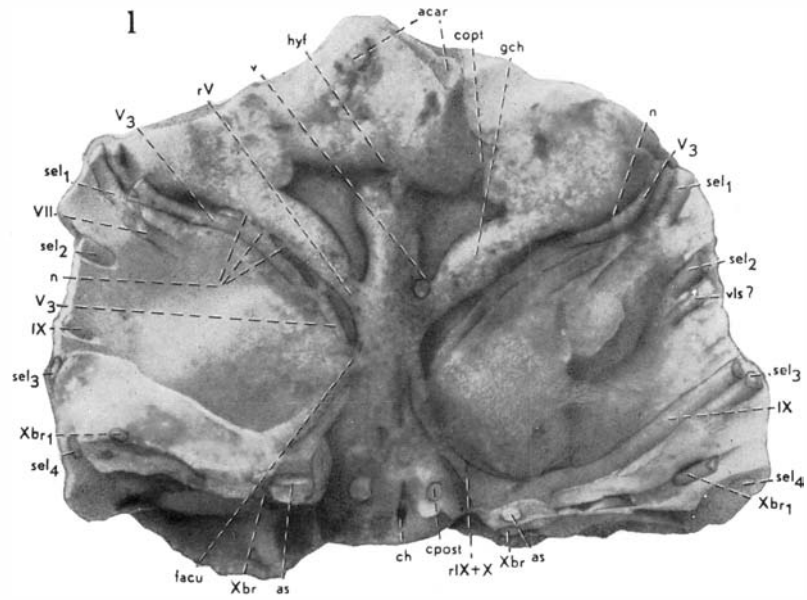
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VII
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V3
IX
sel3
Xbr1
sel4
facu
Xbr
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sel2
vls ?
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sel4
Xbr1

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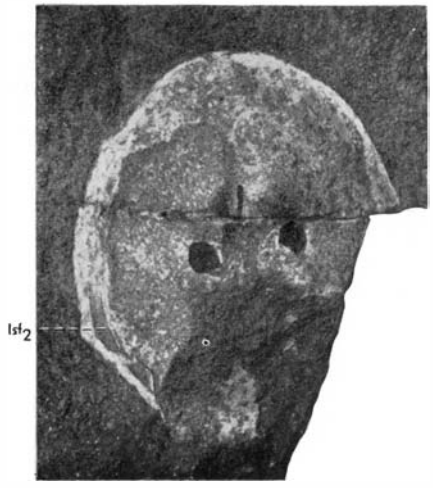
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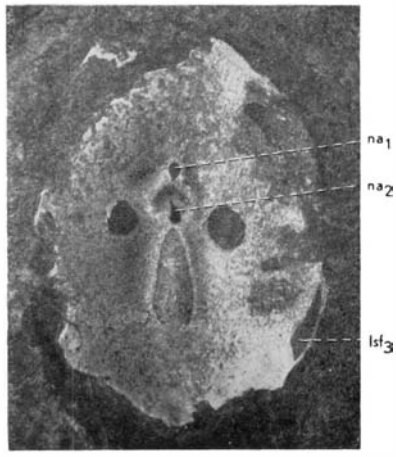
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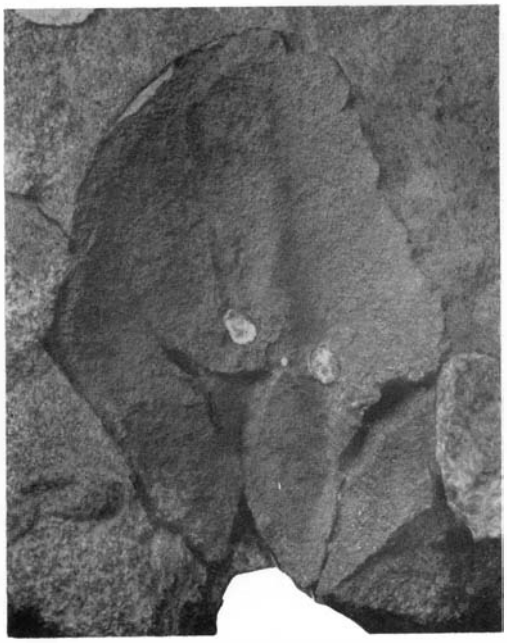

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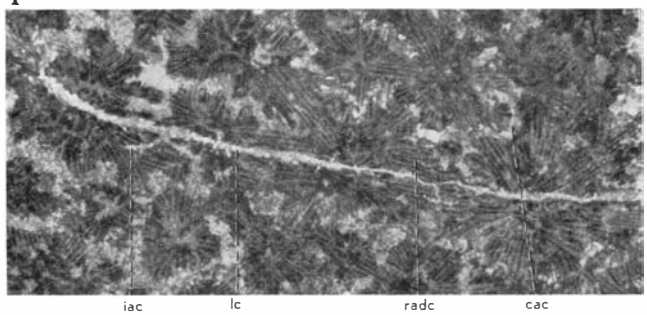
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radc
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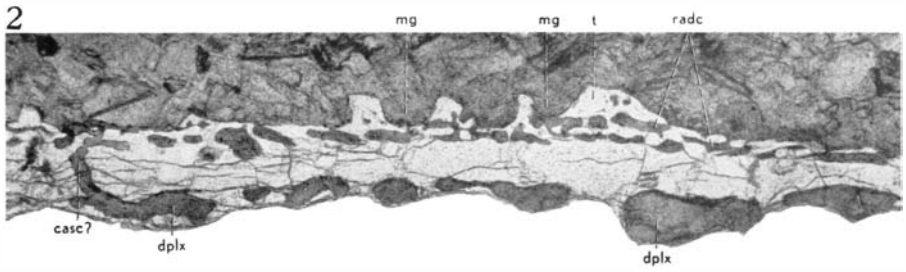
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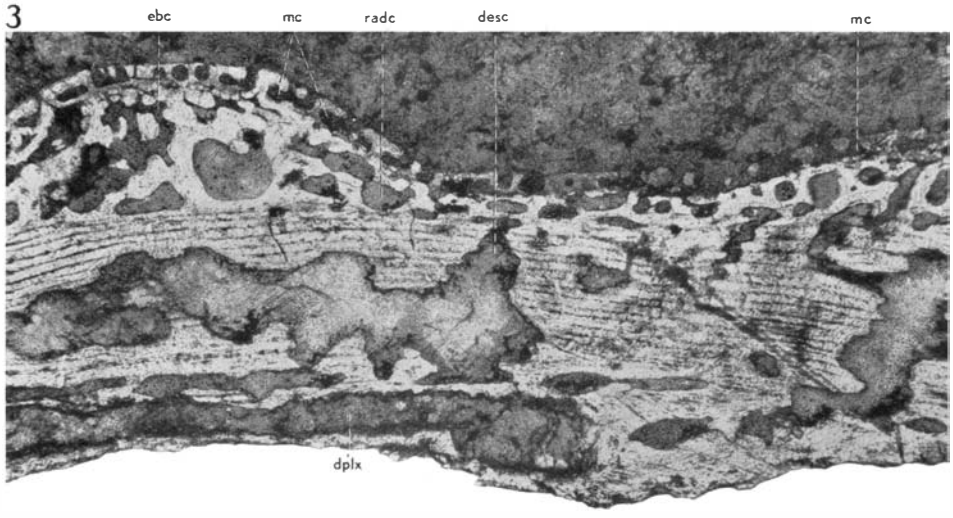
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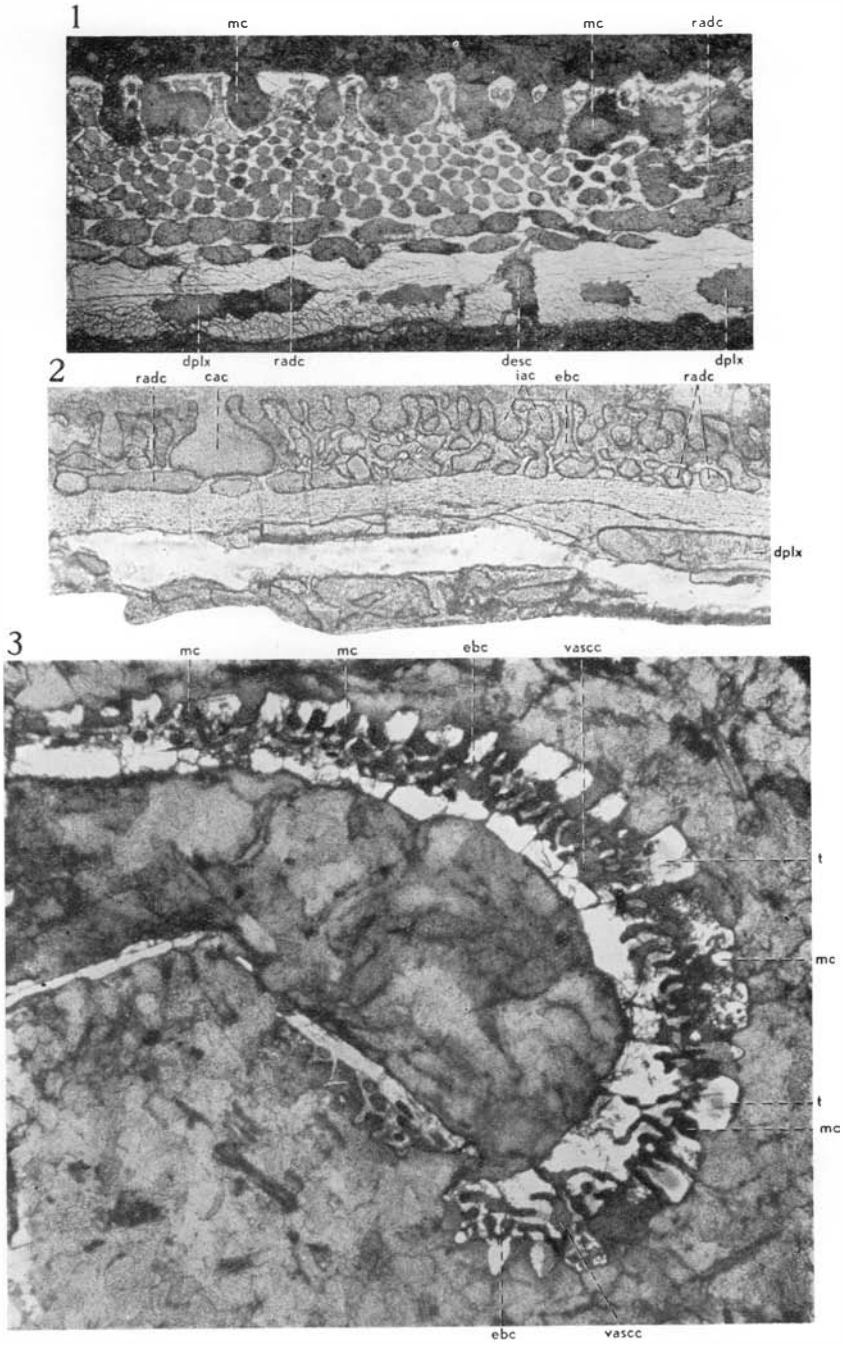
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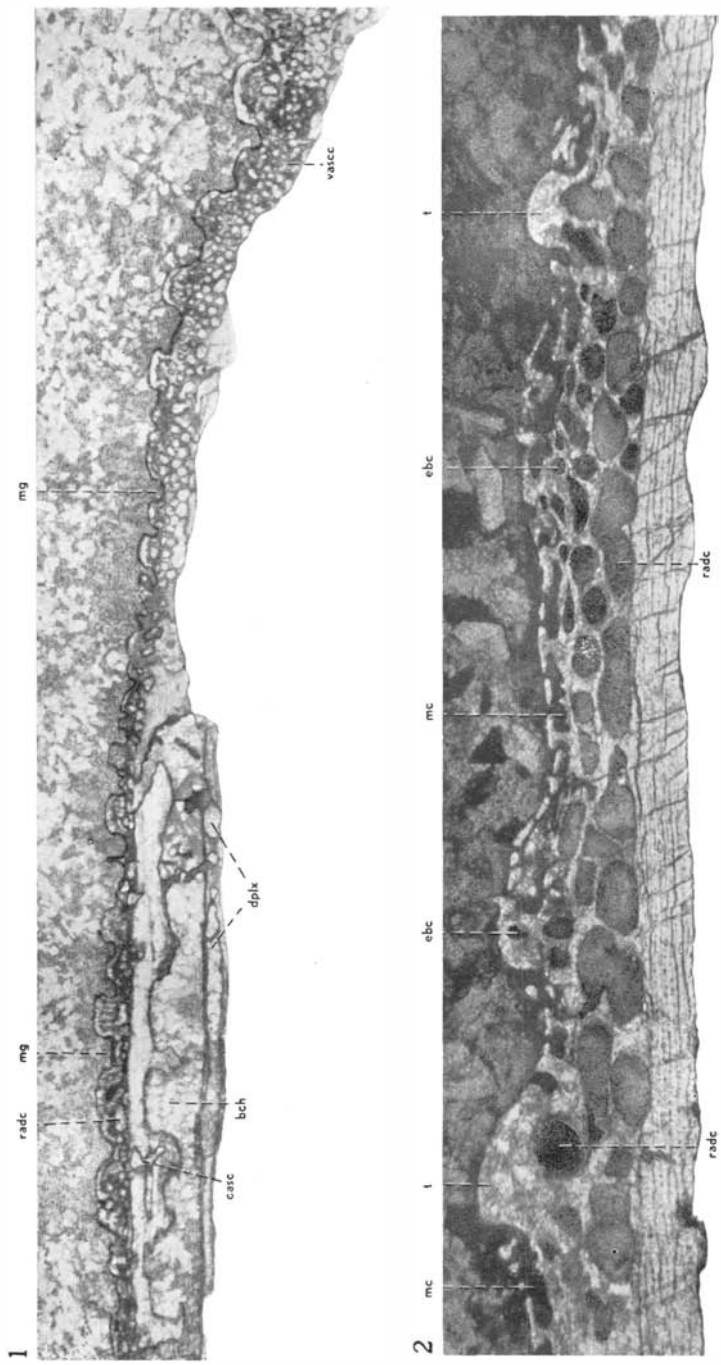
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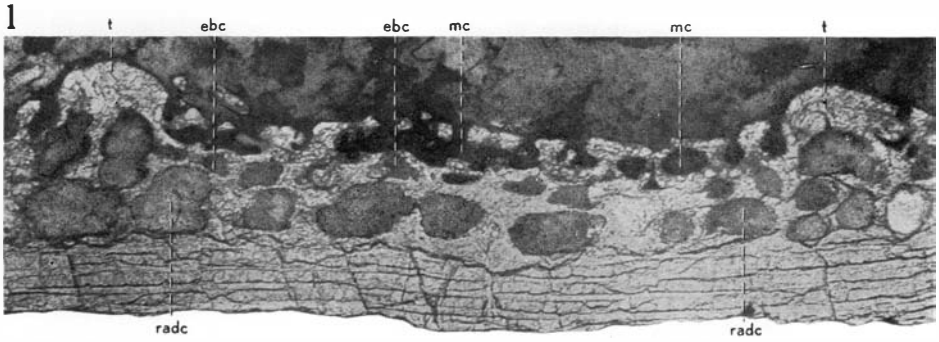
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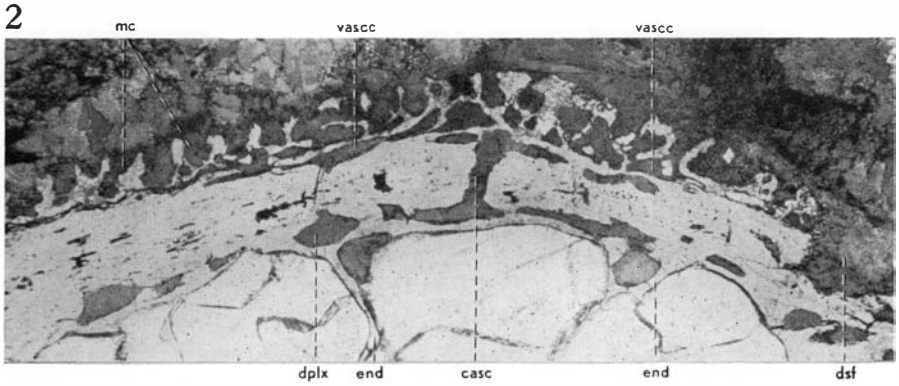
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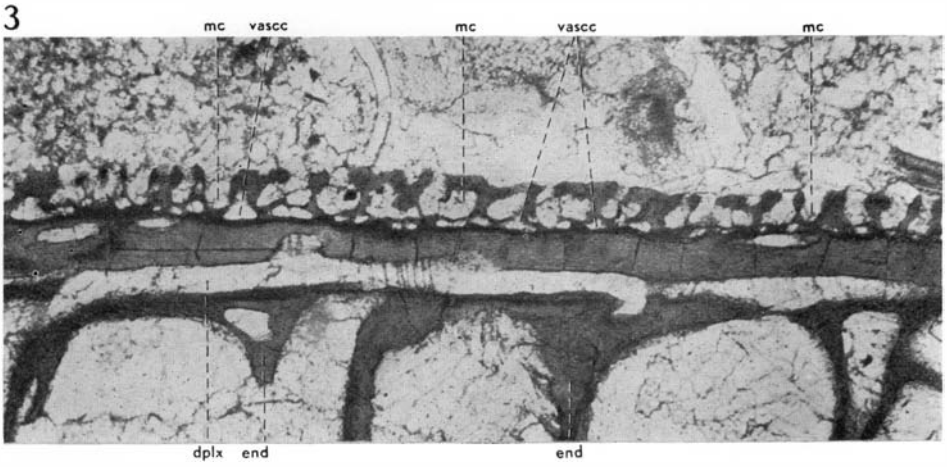
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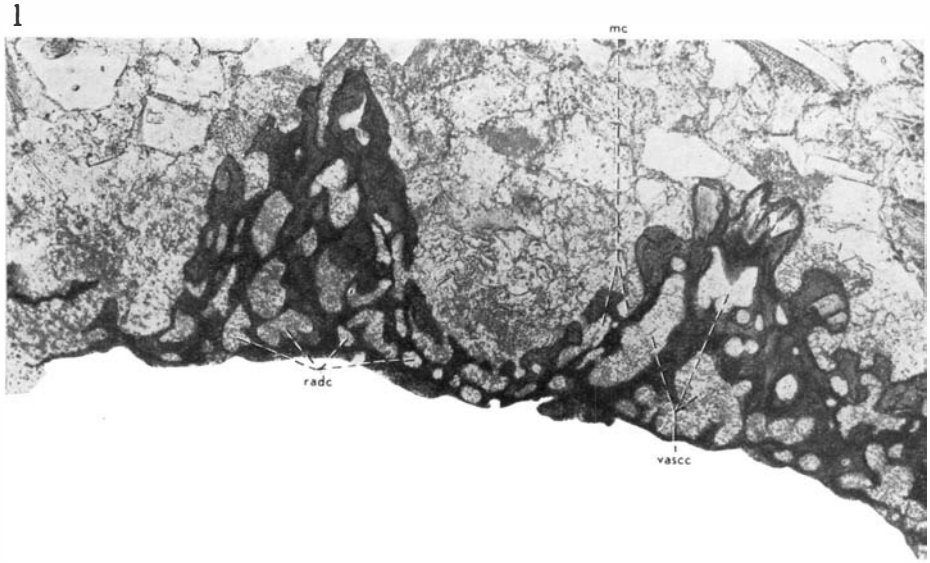

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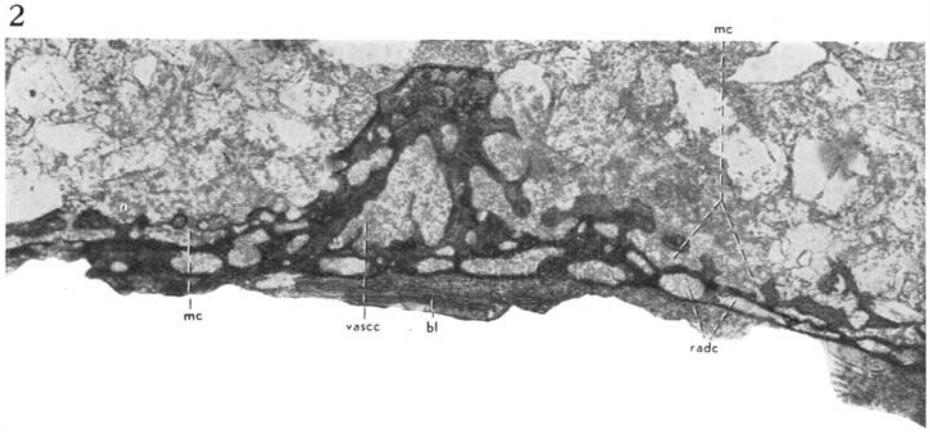

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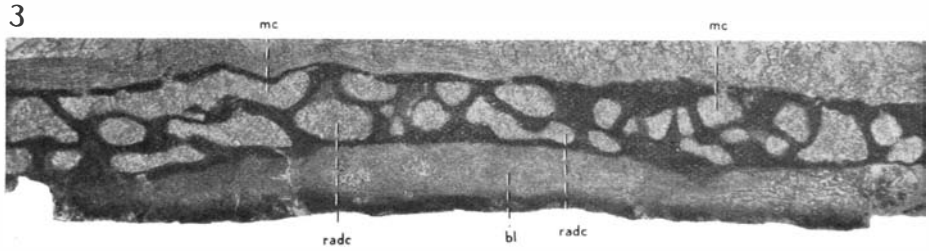

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