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ACTINOLEPIS SPINOSA N. SP. (ARTHRODIRA) FROM THE EARLY DEVONIAN OF LATVIA

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ABSTRACT—*Actinolepis spinosa* n. sp. from the Early Devonian (Siegenian) of western Latvia, USSR, is rather close to the Middle Devonian type species *A. tuberculata* Agassiz. In its fused preorbitals *Actinolepis* is similar to *Bollandaspis* from the early Emsian of Belgium. Gnathalia are known only in few actinolepids. In *A. spinosa* anterior and posterior superognathalia and the inferognathal are described. The roughly triangular posterior superognathal resembles that of *Dicksonosteus arcticus* Goujet, and the long and slender inferognathal is close to the equivalent plate in an undetermined actinolepid from Utah figured by Denison (1958).

INTRODUCTION

The majority of actinolepids occur in the Lower Devonian, but the genus *Actinolepis* has been an exception to this, with two Middle Devonian species from the Baltic region having been described. These are the type species, *A. tuberculata* Agassiz (Eifelian), and *A. magna* Mark-Kurik (Givetian). The new Early Devonian (Siegenian) species from the same region described here shows that the stratigraphic range of the genus is longer than was known previously. Outside of the Baltic region there are other representatives of *Actinolepis*. One of them occurs in the Middle Devonian Vstrechnenskaya Regional Stage of Severnaya Zemlya. Another species closely related to *Actinolepis* ranges from the Lower Devonian Wood Bay Formation into the Middle Devonian Grey Hoek Formation of Spitsbergen (Mark-Kurik, 1973; Ørvig, 1975).

Actinolepis spinosa n. sp. is based on a specimen from the same core sample from the Ventspils boring in western Latvia that yielded the acanthodian recently described by Schultze and Zidek (1982) as *Latviacanthus ventspilsensis*. The same sample also contains a portion of the squamation of an elasmobranch of *Ohiolepis*-type (V. Karatajūtė-Talimaa, pers. comm.). The fish remains are preserved in dark gray-siltstone. The *Actinolepis* specimen is compressed and split so that its major part is attached to one of the core pieces; the counterpart contains the impression of the fish and the gnathalia seen in dorsal and lingual views, respectively.

SYSTEMATIC PALEONTOLOGY

Suborder ACTINOLEPINA
Family ACTINOLEPIDAE Gross, 1940
Genus *ACTINOLEPIS* Agassiz, 1844

ACTINOLEPIS SPINOSA, new species
(Figs. 1–4)

Holotype—Skull and trunk-shield, Pi 1094a, b, Institute of Geology, Acad. Sci. Estonian SSR, Tallinn.

Type Locality and Horizon—Latvia, Ventspils boring D3, depth 237 m; Ķemeri Regional Stage, Siegenian, Lower Devonian.

Diagnosis—Small *Actinolepis*. Length of skull-roof approximately 2.5 cm. Nuchal plate relatively narrow and long, its radiation center placed in the posterior portion of the plate; breadth–length index of the sculptured portion is 57. Anterior ventrolateral with shallow pectoral embayment and middle transverse ventral canal (mtvc). Spinal plate has anteriorly pointed hook-like spinelets on its outer margin.

Etymology—Latin, *spinosus*, in reference to the spinelets on the margins of the spinal plate.

Description

Actinolepis spinosa is a small placoderm. The length of the specimen Pi 1094a, b measures 3.8 cm from the anterior margin of the rostropineal plate to the posterior edge of the trunk-shield.

The skull-roof (Figs. 1a, 2, 3a, 4) is mainly preserved as an impression, with a total length of about 2.5 cm. The pineal pit (p. pin) in the posterior portion of the rostropineal plate (R+P), and the fused preorbitals (PrO) are characteristic of *Actinolepis*. Supraorbital sensory-line canals (soc) begin at the radiation center of this compound plate. The right postorbital plate (PtO) is partly visible from under the inferognathal plate (IG). The central plates (C) show the central canals (cc) extending from the postorbital plates to their radiation centers, and short middle and posterior pit-lines (mp, pp). Shallow incisions in the posterior portion of the relatively narrow nuchal plate (N) mark the places where the occipital cross-commissure (occ) extends from the margins of the plate to its radiation center. The breadth–length index of the sculptured portion of this plate is 57. Two canals, the infraorbital (ioc) and postmarginal (pmc), meet on the marginal plate (M). A poorly preserved small plate situated posterolaterally to the marginal plate is evidently the post-

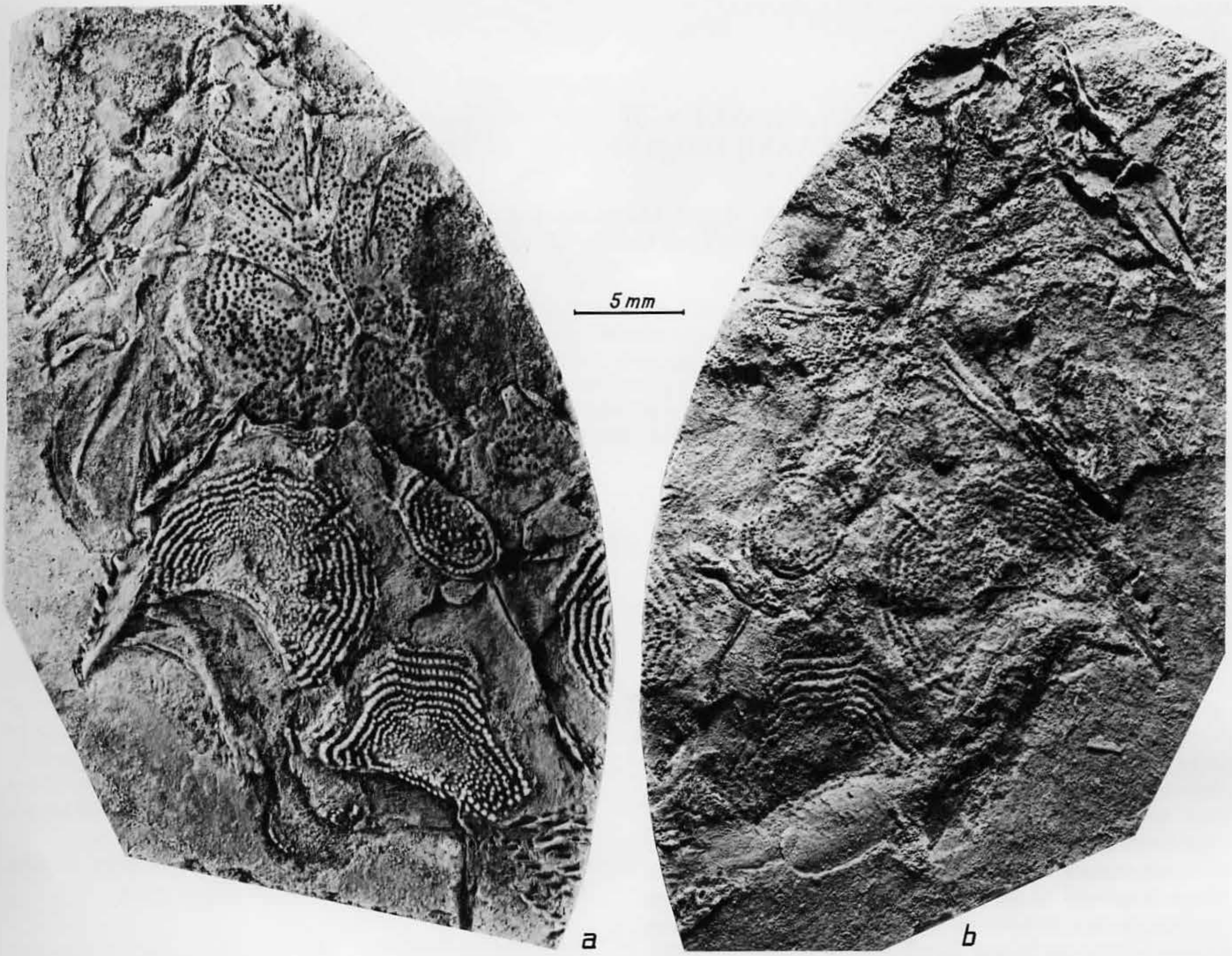

FIGURE 1. *Actinolepis spinosa* n. sp., holotype, Latvia, Ventspils boring D3, depth 237 m; Lower Devonian, Ķemeri Regional Stage. **a**, skull and trunk-shield, Pi 1094 a; **b**, counterpart, Pi 1094 b.

marginal (PM), and the postmarginal canal continues on this plate.

The cheek plates (Figs. 1a, 2) are exposed in medial view. Fragments are preserved of the suborbital plate (SO). One of these fragments shows the shape and position of the suborbital process and together with the postorbital plate permits restoration of the configuration of the orbital opening (or, Fig. 4). The right postsuborbital plate (PSO) is somewhat removed from its natural position. The curved postsuborbital canal (psoc) crosses this plate. The large submarginal plate (SM) has a groove (gr. hm) that widens anteriorly and extends from its radiation center to the anterior margin of the plate. This groove is likely to have been occupied by the hyomandibula (cf. Goujet, 1975, figs. 4, 7).

The anterior and posterior superognathals (Figs. 1–3) are somewhat incomplete, but can be restored from their fragments and impressions. The anterior superognathal (ASG) is an elongate, ventrally convex plate with a narrow anterior process. On the crushed dorsal surface small openings (0.1–0.2 mm in diameter) are arranged in rows. These are the exposed pulp cavities of the teeth. Anterior rows of teeth were exposed during preparation of the right and left anterior superognathals (Fig. 3c). The teeth are conical, slightly curved, particularly those situated along the anterior process. They resemble hollow, pointed, thin-walled tubercles, but their microstructure has not yet been studied. Height of the teeth ranges from 0.1 to 1.1 mm. The teeth seem to be grouped into at least two dental fields: one anterior (dfa), the other posterior (dfp; see Ørvig, 1980). The anterior field shows eight teeth rapidly decreasing in size. The posterior superognathal (PSG) is roughly triangular and ends with a posterior process. The plate is flat except for the elevated margin opposing the anterior superognathal. A depression (dp) extends almost parallel to the labial margin in the posterior two-thirds of the plate. The lingual margin thins into a lamina (la). Two teeth could be freed from the rock (Fig. 3c). It is quite probable that the posterior superognathal plates bear numerous teeth like the anterior superognathals.

The inferognathal (IG) is restored in lingual view (Fig. 3d). The plate is long and shallow, its length approximating the combined lengths of both superognathal elements. The dorsal and ventral margins are almost parallel. Teeth resemble those of the anterior superognathal. Anterior and posterior dental fields (dfa, dfp) can be distinguished. The first one consists of five teeth, the most anterior one being the largest (1.1 mm high). A ridge (r) extends roughly parallel to the bases of these teeth. In the posterior field three indistinct tubercles and ten teeth increasing backward in size can be counted on both inferognathals. There are probably more teeth in the posterior field. The ventral margin of the plate (la_1) is thin. It is higher anteriorly and shallower in the middle of the inferognathal, forming a groove for the meckelian cartilage.

The trunk-shield (Figs. 1, 2, 4) is visible in ventral view. Some portions of the anterior lateral (AL), anterior and posterior dorsolaterals (ADL, PDL), and median dorsal (MD) are exposed from under the ventral wall of the shield, although the configurations of these plates cannot be established. The somewhat incomplete posterior lateral plate (PL) is short and high and narrows anteriorly. The ventral wall when restored (Fig. 4b) shows all the plates characteristic of actinolepids. The anterior and posterior medioventrals (AMV, PMV) are rather short and wide. Judging by its impression in the rock (Fig. 1b) the middle transverse ventral canal (mtvc) extending from the anterior ventrolateral plate continues on the anterior medioventral. The impression of the interolateral plates (IL) shows the presence of the anterior transverse ventral canals (atvc). The posterolateral margin (la, Fig. 2, 4b) of the anterior ventrolateral plate (AVL) is unsculptured and the pectoral embayment shallow. The spinal plate (Sp) is relatively short. Its free spine is slightly shorter than the contact line of the spinal and anterior ventrolateral plates. Prominent hook-like and anteriorly pointed spinelets are situated in the anterior portion of the outer margin of the spinal plate. The spinelets on the margins of the free spine are much shorter and indistinct.

Two dark, oval, very finely hatched patches at the lateral margins of the trunk-shield are evidently some parts of the paired fins (p. f, pl. f, Fig. 2). An S-shaped bar 4.5 mm long lying in front of the remains of the pelvic fin represents the iliac process of the pelvic girdle (pelv). Behind the trunk-shield is a portion of the squamation. It consists of five rows of transversely elongated roof-shaped scales (sc) exposed from their internal side. The scales measure up to 1.5 mm across their greatest dimension.

Comparisons

This unique specimen of *Actinolepis spinosa* n. sp. is of small dimensions compared to material of *A.*

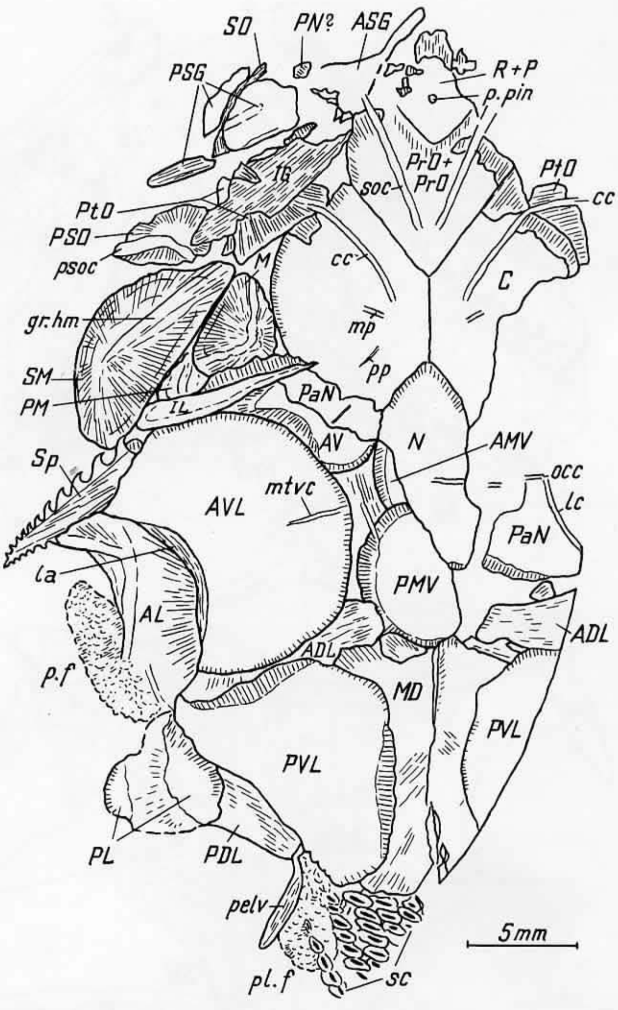

FIGURE 2. *Actinolepis spinosa* n. sp., skull and trunk-shield in ventral view, drawing of the specimen Pi 1094 a. Abbreviations: **ADL**, anterior dorsolateral; **AL**, anterior lateral; **AMV**, anterior medioventral; **ASG**, anterior superognathal; **AV**, anterior ventral; **AVL**, anterior ventrolateral; **C**, central; **IG**, inferognathal, **IL**, interolateral; **M**, marginal; **MD**, mediodorsal; **N**, nuchal; **PaN**, paranuchal; **PDL**, posterior dorsolateral; **PM**, postmarginal; **PMV**, posterior medioventral; **PN**, postnasal; **PrO**, preorbital; **PSG**, posterior superognathal; **PSO**, postsuborbital; **PtO**, postorbital; **PVL**, posterior ventrolateral; **R+P**, rostropineal; **SM**, submarginal; **SO**, suborbital; **Sp**, spinal; **cc**, central sensory-line canal; **gr. hm**, groove for hyomandibula; **la**, unsculptured posterolateral margin of AVL; **lc**, main lateral line; **mp**, middle pit-line; **mtvc**, middle transverse ventral canal; **occ**, occipital cross-commissure canal; **pelv**, lateral component of the pelvic girdle; **p. f**, pectoral fin; **pl. f**, pelvic fin; **pp**, posterior pit-line; **p. pin**, impression of the pineal pit; **psoc**, postsuborbital canal; **soc**, supraorbital canal; **sc**, scales.

tuberculata Agassiz and *A. magna* Mark-Kurik. The length of the skull-roof of the first species is approximately 2.5 cm; the average lengths for the others are 8–10 and 10–17 cm, respectively. The plates of *A. spinosa* correspond in size to those of the smallest *A.*

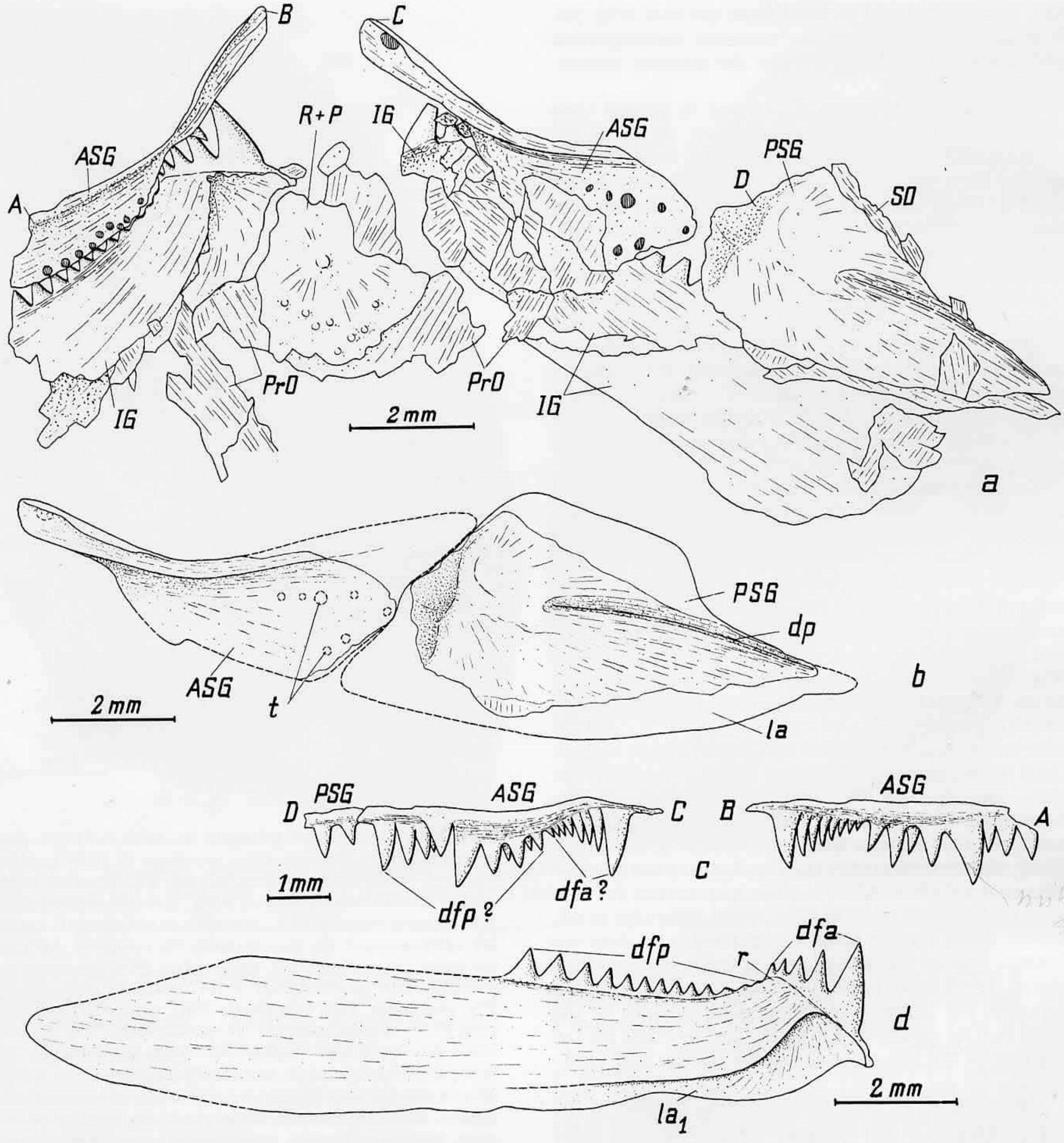

FIGURE 3. *Actinolepis spinosa* n. sp. **a**, Anterior portion of the skull, dorsal view, inferognathal in lingual view, drawing of Pi 1094 b; **b**, restoration of the right superognathals, dorsal view; **c**, anterior superognathals, anterior view (A–D), two teeth are of the right posterior superognathal; **d**, restoration of the left inferognathal, lingual view. Abbreviations: **ASG**, anterior superognathal; **IG**, inferognathal; **PSG**, posterior superognathal; **dfa**, **dfp**, anterior and posterior dental fields; **dp**, depression on the dorsal surface of PSG; **la**, lingual margin of PSG: $\mathbf{la_1}$, ventral margin of IG; **r**, ridge on the lingual surface of IG: **t**, exposed pulp cavities of the teeth; for other abbreviations see Figure 2.

tuberculata individuals (see Mark-Kurik, 1973, figs. 2B, 4C). The presence of tubercles of the second generation indicates, however, that the fish may not be a juvenile. The skull-roof is comparatively short anteriorly. In its general proportions and perhaps in the position of the orbital openings it is reminiscent of the skull-roof in the *Actinolepis*-like form from Spitsbergen (Mark-Kurik, 1973, fig. 8E). Nevertheless, in *A.*

spinosa both the skull-roof and particularly the nuchal plate are narrower than in the Spitsbergen form. Also the radiation center of this plate is situated in its posterior portion, and on the paranuchal the radiation center is placed closer to the geometrical center of the plate.

The cheek and jaw plates of *Actinolepis spinosa* are of great interest because these plates are practically unknown in other *Actinolepis* species. An incomplete submarginal of *A. magna* (Mark-Kurik, 1973, fig. 9B, C) is shallower in comparison with the equivalent plate of *A. spinosa.* The groove for the hyomandibula is wider and shorter in *A. magna.* The gnathalia of *Actinolepis spinosa* are most similar to the gnathal elements in other arthrodires (actinolepids and phlyctaeniids). The posterior superognathal is similar in shape to that of *Dicksonosteus arcticus* (Goujet, 1975, figs. 3, 4; pl. 5, fig. 5a, b). The teeth in the latter are, however, suggestive of rounded tubercles. Sharp-pointed, conical teeth resembling those of *A. spinosa* can be seen on the margins of the posterior superognathal of *Phlyctaenius acadicus* (Heintz, 1933, pl. II, fig. 2). The long and shallow inferognathals of *A. spinosa* are reminiscent of the equivalent plates in undetermined actinolepids from Utah (Denison, 1958, fig. 101, and especially fig. 101F). Two dental fields can be distinguished in all these plates. The teeth vary in shape from sharp-pointed to blunt and tubercle-like.

The ventral wall of the trunk-shield in *A. spinosa* is somewhat shorter than in *A. tuberculata,* and much shorter than in *A. magna* (see Mark-Kurik, 1973, figs. 5A, 13). In general, it is closest to the ventral armor of the *Actinolepis*-like form from Spitsbergen (Ørvig, 1975, fig. 4B). This actinolepid and *A. spinosa* possess the middle transverse ventral canal (mtvc), which is lacking in other *Actinolepis* species. The anteriorly pointed hook-like spinelets on the outer margin of the spinal plate seem to be unique to *A. spinosa.* In *A. tuberculata* such spinelets may occur on the inner margin of the free spine (Gross, 1940, fig. 15D; Mark-Kurik, 1973, fig. 4C, E), but in one case they are present also on its outer margin (Obruchev, 1964, pl. I, fig. 10). It is noteworthy that they are absent in a small specimen of *A. tuberculata,* comparable in size to *A. spinosa* (Mark-Kurik, 1973, fig. 4C).

The post-thoracic squamation of *Actinolepis spinosa* shows some differences from that of *Sigaspis lepidophora* (Goujet, 1973, figs. 1B, 2, 3A; pl. 7, figs. 2–4). The scales are smaller, roof-shaped, and more numerous. There are two rows of dorsolateral and lateral scales in *Sigaspis,* but at least five rows in *A. spinosa.*

In summary, *Actinolepis spinosa* n. sp. does not differ much from *Actinolepis tuberculata* Agassiz, although these species come from the Siegenian and the Eifelian, respectively. A special feature of *Actinolepis,* the fusion of preorbitals into a compound plate, appears to be present also in the early Emsian form *Bollandaspis* from Belgium. In this actinolepid, however, the preorbitals, as well as the fused rostral and pineal plates, are short. The orbits hardly notch the skull-roof, and the postorbitals are of a different shape (see Schmidt, 1976, fig. 3A, B). The undetermined form from Spitsbergen mentioned above is apparently morphologically closer to *Actinolepis* than to *Bollandaspis.* The finds from Severnaya Zemlya show that evidently *Actinolepis* occurs in this region. *Actinolepis* thus has a considerable stratigraphical and geographical range: Lower and Middle Devonian (Siegenian–Givetian) of the Baltic region, Severnaya Zemlya, and Spitsbergen (?).

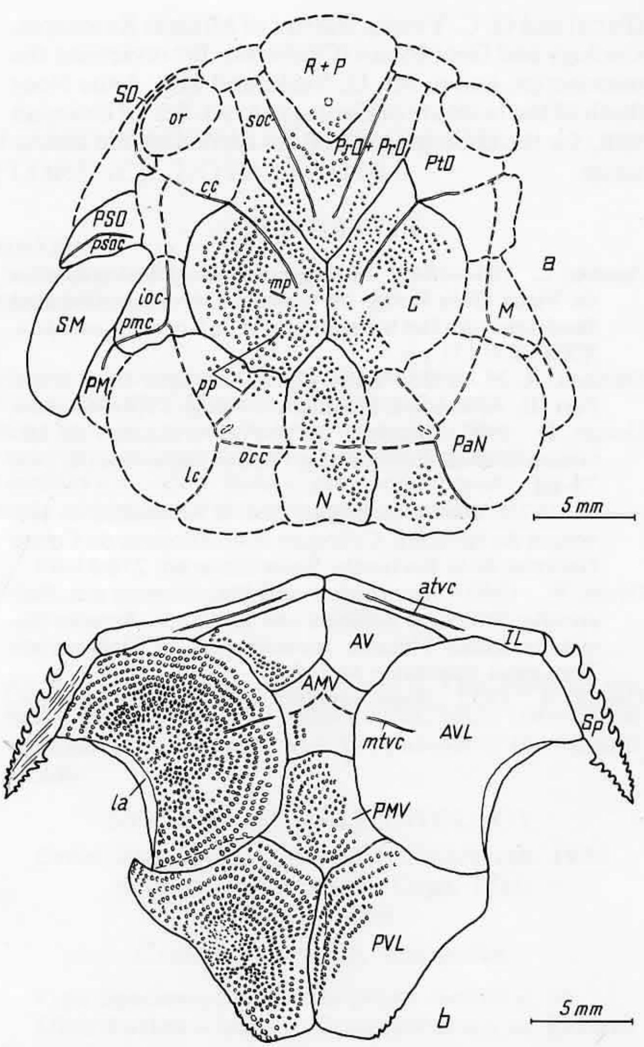

FIGURE 4. *Actinolepis spinosa* n. sp. **a**, Restoration of the skull-roof and left cheek plates; **b**, restoration of the ventral wall of the trunk-shield, in the right posterior ventrolateral plate the lateral lamina is flattened. Abbrēviations: **atvc**, anterior transverse ventral canal; **or**, orbital opening; **pmc**, postmarginal canal; for other abbreviations see Figure 2.

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