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A NEW TRIASSIC BRACHIOPOD FAUNA FROM HOKKAIDO, JAPAN

by

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(with 7 plates)

Abstract

A new brachiopod fauna is described from loose material in central Hokkaido, Japan. Three of the forms present are attributed to the genera *Canadospira, Robinsonella* and *Piarorhynchia.* A Carnian age is provisionally suggested, though no faunas of this age are known elsewhere in Japan. The biogeography of the forms is briefly discussed.

Introduction

During a visit by the senior author to Sapporo in 1981, Professor Minato showed him specimens that had been collected long before in central Hokkaido, together with sections and other preparations he (M.M.) had made of some of these specimens.

They were collected in the Hidaka Mountains, along the upper course of the Yuabe stream (Yuabe-no-sawa) which is one of the small branches of the River Sorachi in the Kanayama district of central Hokkaido at 142°27′7″E and 43°4′8″N. The fossils were found by Dr. M. Sanbonsugi in the course of the mapping for his thesis in 1936. According to his unpublished thesis (1937) and a personal communication (1982) there were a few thin lenticular limestones intercalated in diabasic tuff not far from where he found the brachiopods in a float of limestone and tuff material. However, no brachiopods were found in situ. The brachiopods are generally not well preserved in external form, but some of the internal structures are excellent.

The matrix preserved inside the brachiopods shows a coarse packstone (pl. 3, 4 & 7) with large, mostly angular fragments in a carbonate mud matrix. There are scattered ostracods and rounded echinoderm fragments. Most of the specimens show geopetal infilling with sediment, the remainder of the shell being occupied by secondary crystalline calcite (pl. 7). All these features suggest a shallow shelf environment with rapid sedimentation. Diagenesis is only indicated by local patches of recrystallization, with agrading neomorphic spar.

All the specimens are preserved in the Department of Geology and Mineralogy in Hokkaido University, Sapporo, Japan.

Systematic Palaeontology

Canadospira canadensis Logan

(pl. 1, fig. la-d; Pl. 2, 3 & 4)

As its name implies, this species was originally described by Logan (1967) from

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Canada. His specimens came from the Carnian of the arctic archipelago. It was subsequently recorded and figured by Dagis (1974, p. 125-6) from the Carnian of the northeast corner of the Soviet Union.

There are several specimens of this species in the Hokkaido collection. They are small, broad forms reaching about 2 cms in width. Their wide straight hinge-lines are slightly shorter than the maximum width of the shell and their general shape is roughly semicircular (pl. 1, figs. la-c). The massive ventral beak is orthoclinal in form with a high cardinal area and delthyrium set back at right angles from the hinge-line. The valves carry about 16 strong, unbranched, rounded costae, which extend from the beak to the anterior margin. The fold and sulcus are smooth, or almost so and sometimes slightly asymmetrical in form. The fibrous, punctate nature of the shell is excellently preserved (pl. 2, figs. 1 & 2). The punctae are arranged in diagonal rows in a somewhat irregular manner.

Unfortunately only some of the internal structures are available, in particular the inside of the ventral beak. Other structures, notably the spiralia must be presumed to have broken away in the coarse matrix. Particularly clear are the dental lamellae (pl. 3 & 4) which are essentially parallel, until they diverge dorsally to join the straight hinge-plates. Between them is a prominent median septum which arises from a stout base and extends dorsally almost as far as the hinge-plates. In one section (pl. 4) one of the dental lamellae is seen to be produced into a narrow tooth, which is separated by a deep groove from the adjacent thick hinge-plate. The thickness of the latter plate may, however, be exaggerated by the obliquity of the section.

Superficially this spiriferinid looks very much like the late Triassic genus *Zugmayerella* (by which name it was first provisionally called). It is interesting to note in this connection that Jing and Fang (1977) described a new species *Z. yueliangpingica* from the Upper Triassic of Yunnan Province in south-west China. However, though probably closely related, the two genera are quite distinct in internal structures. Both Pearson (1977, figs. 4-7) describing forms from Alpine Europe and Dagis (1974, fig. 99) describing forms from the Caucasus, show that in *Zugmayerella* the dental lamellae characteristically fuse with the median septum ventrally and diverge from it dorsally. In *Canadospira*, on the other hand, the ventral median septum extends dorsally separate from and parallel to the dental lamellae. This is clearly shown in plate 3.

This character also serves to distinguish this genus from numerous other Triassic genera monographed by Dagis and from the wellknown early Jurassic spiriferinid *Spiriferina*. All species of the latter genus as monographed in an unpublished thesis (Thomas, 1978) show the dental lamellae converging on the median sptum from the ventral margin and then diverging again distally. We do not know of any other spiriferinid in the Triassic or Jurassic with this particular structure.

Spiriferinids gen. et sp. indet.

Two or possibly three other spiriferinid species are present in the fauna but are not sufficiently well preserved to make possible even generic identification. They are similar in form to *Canadospira canadensis* but differ in ornamentation. The most

distinctive of them is one with curved costae and an exaggerated long and high fold bearing strong rounded costae (pl. 1, figs. 2a-b). This may be referable to Dagis's related genus *Boreiospira* or to one of several other forms, but it is impossible to be certain without details of internal structures.

Robinsonella sp. nov.

(pl. 1, figs. 3a-c; pl. 5, pl. 6; 7)

Most of the rhynchonellids from Yuabe-no-sawa appear to be attributable to this Triassic genus which was originally described by Moiseev (1936) from the Norian of the Caucasus and was later considerably revised, with details of internal structures, by Dagis (1963 & 1974). They are certainly referable to the subfamily Cirpinae by reason of their marked planareas, pre-falcifer type crura, the absence of a septalium and the reduced nature of the dorsal median septum. The specimen (s) are typically 2.3 cm long, 2.2 cm wide and 1.5 cm thick in the adult stage.

Externally this is a fairly "ordinary" looking rhynchonellid (pl. 1, fig. 3a-c) apart from the flattening on either side of the beak to produce the planareas and the corresponding absence of an interarea beneath the beak. Unfortunately details of the delthyrial area are not clear.

The numerous rounded costae only start beyond a posterior smooth area which extends about 50 mm from the beak. This does not appear to have been caused by mechanical wear. The costae extend to the posterior margin. They are simple (i.e. unbranched) and fairly sharp. There are about 18 to 20 of them on each valve.

The anterior uniplication is strong and rectangular, but barely disturbs the profile of the shell as a distinct fold. It carries about 7 costae of an exactly similar nature to those on the flanks of the shell. Enlargements of the shell surface (pl. 5) show the typical impunctate, fibrous structure of a rhynchonellid, with some indication of the typical *Schuppenpanzerstruktur* in the form of closely packed triangular terminations of the fibre bundles.

Plate 6 shows 8 serial sections of one specimen. The internal structures have probably been damaged soon after death in a high energy environment (hence a single dental lamella only appears in one section, No. 5). However, the structures generally are fairly well preserved and show several distinctive features. Noteworthy are the great reduction of the lateral umbonal cavities, the almost complete absence of a dorsal median septum (seen only in Plate 6, section No. 7), the very distinctive dorsally-directed crural bases, seen in sections 6 to 11, and the short pre-falcifer type crura, seen in section 12. It should also be noted that the dorsal hinge-plates remain joined (sections 5 & 6), in an anterior direction, until after the formation of the crural bases. Unfortunately the internal structures of the ventral beak are not preserved, where one would hope to see the distinctive cirpinid deltidial plates, but otherwise the characters are all those of this unusual subfamily which is known to range from the Norian to the Toarcian (Ager, Childs & Pearson, 1972). Undoubtedly that subfamily belongs to the family Wellerellidae, which ranges back into the Palaeozoic but there is a gap in the

record here which this Japanese form may help to fill.

Ager & Westermann (1963) doubtfully recorded early members of the subfamily in the Carnian of Canada and Gaetani (personal communication 1969) claimed members as low as the Upper Anisian and Lower Ladinian in Yugoslavia. Obviously the six genera recorded in the Norian must have diverged from a common ancestor before that time (see Ager, Childs & Pearson, fig. 3).

The Hokkaido form resembles known species of *Robinsonella* in external form and is certainly closer to it, for example, than to the closely related genus *Euxinella.* In some details it resembles the genus *Moisseievia* (also described by Dagis 1963 from the Norian of the Caucasus) notably in having very reduced lateral cavities and posterior smoothness, but otherwise the two forms are quite distinct.

This last character of posterior smoothness is perhaps the most significant. It is not known in any of the described species of *Robinsonella*, which is why this is tentatively regarded as a new species. On the other hand the probable ancestor of all these forms in the Palaeozoic — *Wellerella* — is wholly smooth. Though one hesitates to cite the much discredited evolutionary views of S.S. Buckman in this connection, it is worth commenting that he always regarded posterior smoothness as a "primitive" character in Mesozoic rhynchonellids and this view has not been wholly disproved. It may therefore be at least hypothesized that this form is an early, i.e. pre-Norian member of the genus *Robinsonella.*

Piarorhynchia sp.

One specimen from Hokkaido is doubtfully referred to this genus, which was revised by one of us (Ager, 1962) and by Pearson (1977). Only external features are known, but show the characteristic globose, smooth shells of many species of this long-ranging genus, with faint, rounded costae only appearing near the anterior margin. The obscure dorsal muscle scars are comparable to those figured by Buckman (1918). The Japanese form may be attributable to the long-ranging species *P. juvenis* (Quenstedt) which was doubtfully recorded by Pearson (1977) from the Rhaetian or more likely to *P. hamiltonensis* (Smith) from the Carnian of Alaska (Smith, 1927) and Canada (Ager & Westermann 1963.)

Alternatively this might just possibly belong to the late Triassic genus *Halorelloidea* which was originally differentiated from its close relation *Halorella* by Ager (1959) and later (1968) shown to be very widespread around the world in rocks of Carnian and Norian age. However, this is unlikely by reason of the form of the hinge-line and the absence of any sign of the opposing sulci which are normally a feature of the Halorellinae.

Conclusions

The most confident dating of this fauna is undoubtedly that provided by *Canadospira canadensis*, which has only previously been described from the Carnian, both in Asia and North America.

All the described species of *Robinsonella* and its related genera such as *Euxinella* and *Hagabirhynchia* come from the Norian (Dagis, 1963; Ager, Childs & Pearson, 1972). However, as indicated in that work, they must range back into earlier strata. Gaetani (personal communication 1969) has found members of the same sub-family as low as the Upper Anisian and Lower Ladinian in Yugoslavia. Since the form of *Robinsonella* found in Hokkaido has distinctive (possibly "primitive") characters not found in any described species, it may be reasonable to attribute it to an earlier, i.e. pre-Norian form.

Piarorhynchia is well known to be a long-ranging genus, extending at least from the Anisian (Bittner, 1890) to the Toarcian (Ager, 1962). The form from Hokkaido cannot be determined accurately but appears to be not unlike species described by Smith (1927) from Alaska and later by Ager & Westermann (1963) from the Carnian of British Columbia.

There is also the negative evidence of the absentees. There is no doubt that the spiriferinid and the cirpinid fix the fauna firmly in the late Triassic or earliest Jurassic. The absence of many well-known forms seems to eliminate the latter as does the absence of distinctive Norian and Rhaetian forms such as *Rhynchonellina* (and its relations), *Austrirhynchia*, *Rhaetina* and notably the sudden Norian burst of *Halorella* and *Halorelloidea* around the world, even though these forms do occur in earlier strata.

It is also noteworthy that the Hokkaido fauna contains none of the forms described by Tokuyama (1957a & b) from the Upper Triassic elsewhere in Japan. It is concluded that most of these are later in age than this assemblage, though Tokuyama's species of *Spiriferinoides* (1957b) may be roughly contemporaneous.

Sun Dong-li (1980) noted the abundance of spiriferinids (including *Canadospira* and *Boreiospira*) in the Carnian of his "North Realm" of China and contrasted such assemblages with those of the Tethyan region.

We therefore conclude that this new fauna from Hokkaido is very probably late Triassic in age and may be provisionally attributed to the Carnian. It forms an interesting connecting link between the faunas of the Eurasian continent and those of North America.

Acknowledgements

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Explanation of Plates

Plate 1, figs. 1a-b. *Canadospira canadensis* Logan. Register Nos. U.H.R. 30282, 30284, 30285 & 30286 respectively. All ×2.

figs. 2a-b. Spiriferinid gen. et sp. indet. (? *Boreiospira* sp.). Register No. U.H.R. 30288. Both ×2.

figs. 3a-c. *Robinsonella* sp. nov. Dorsal, ventral & anterior views respectively. Register No. U.H.R. 30281. All ×2.

Plate 2, figs. 1 & 2. *Canadospira canadensis* Logan. Close-up of the shell showing fibrous structure and arrangement of punctae. ×130 & ×150 respectively.

Plate 3, figs. a-f. *Canadospira canadensis* Logan. Serial transverse sections of specimen No. 30282, showing internal structures of vental beak including dental lamellae and median septum. figs. a-d ×6.8; figs. e-f ×22.

Plate 4. *Canadospira canadensis* Logan. Transverse section of ventral beak of the same specimen (No. 30282) showing one of the dental lamellae prolonged into a narrow tooth with adjoining groove and thick hinge-plate. ×22.

Plate 5. *Robinsonella* sp. Close-up of shell showing fibre bundles in longitudinal view (above) ×60; and in both longitudinal and transverse view (below) ×250. The left-hand side of the lower picture shows the characteristic *Schuppenpanzerstruktur.*

Plate 6. *Robinsonella* sp. Eight serial transverse sections of the posterior part of a shell showing the hinge and crural structures. All ×c.7. The small figures indicate the approximate distance of the section from the posterior end in mm.

Plate 7. *Robinsonella* sp. Enlargement of the last section on Plate 6 showing structure of crura, nature of matrix and geopetal infilling with secondary calcite. × c.14.4.


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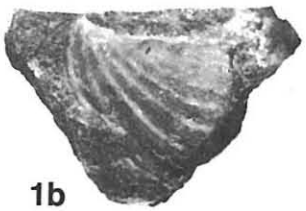
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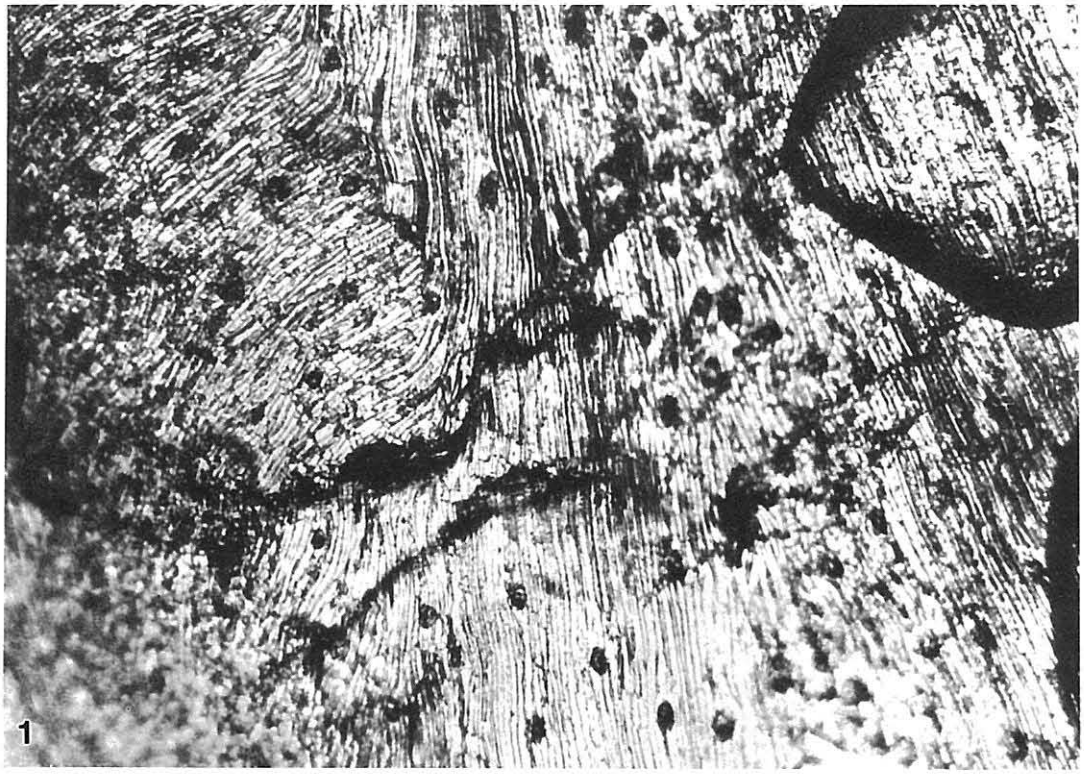
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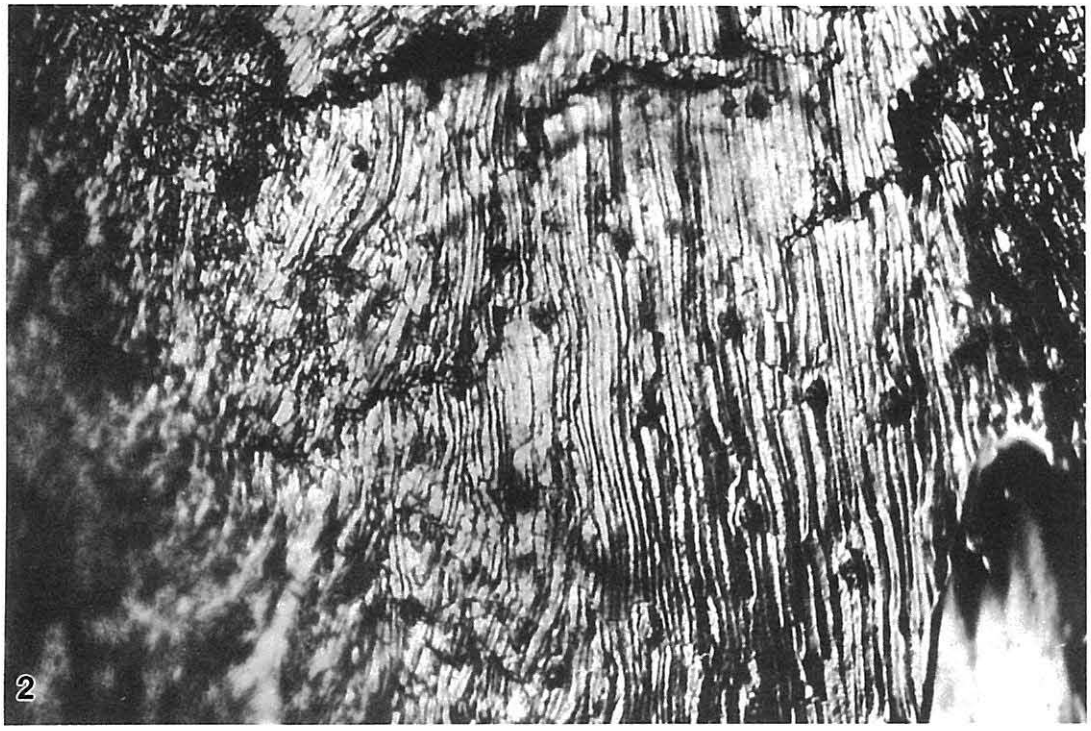
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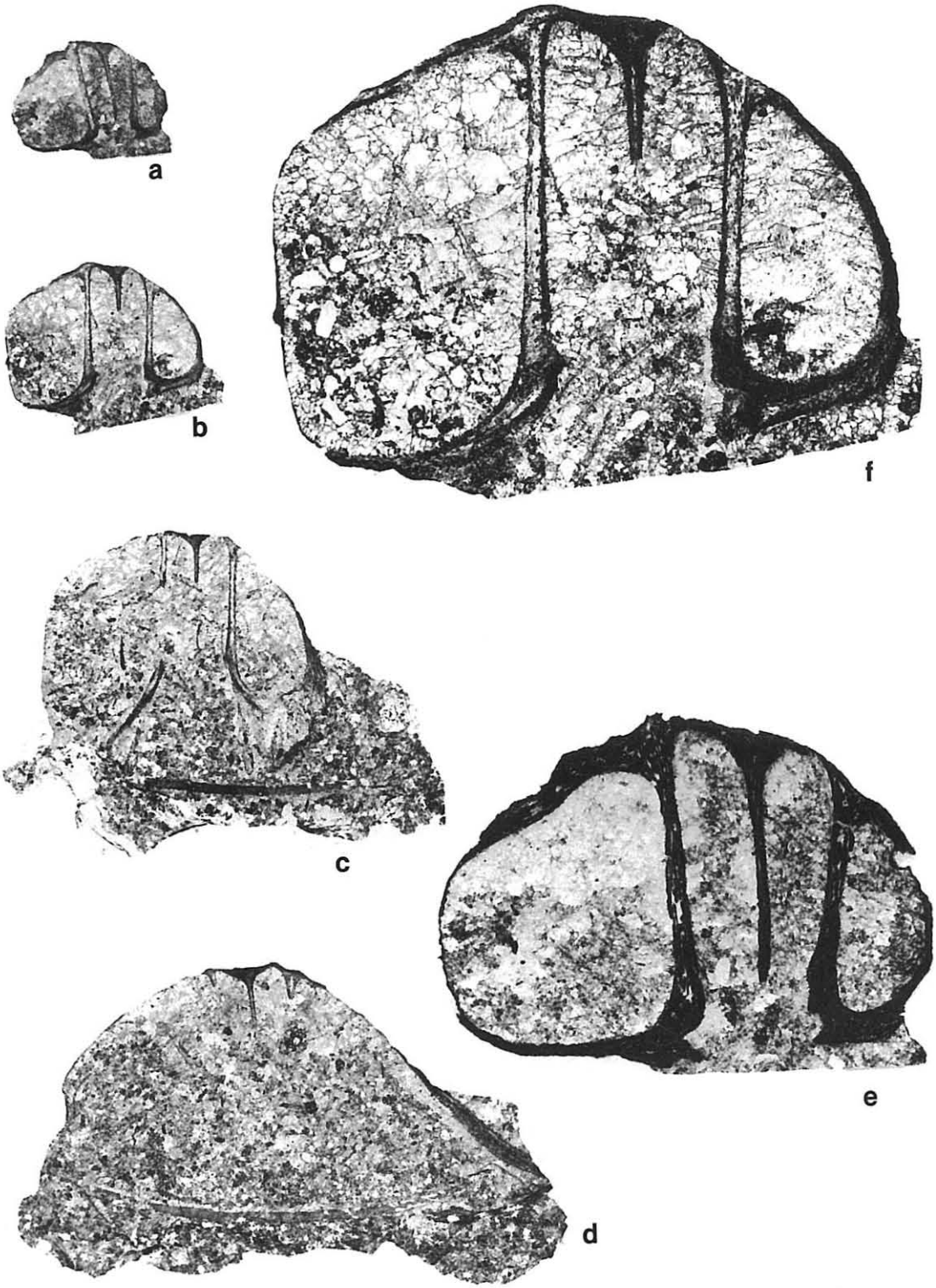
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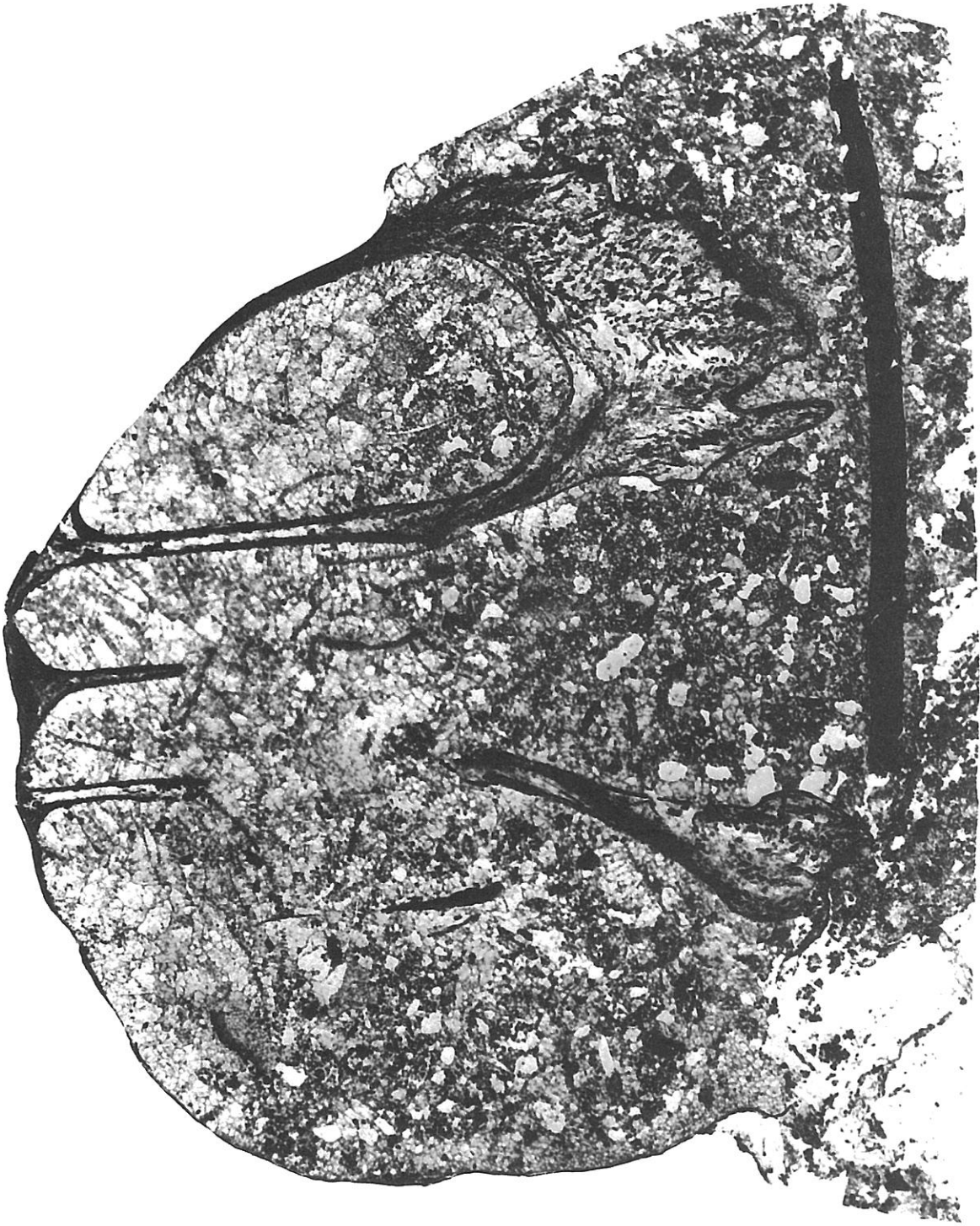

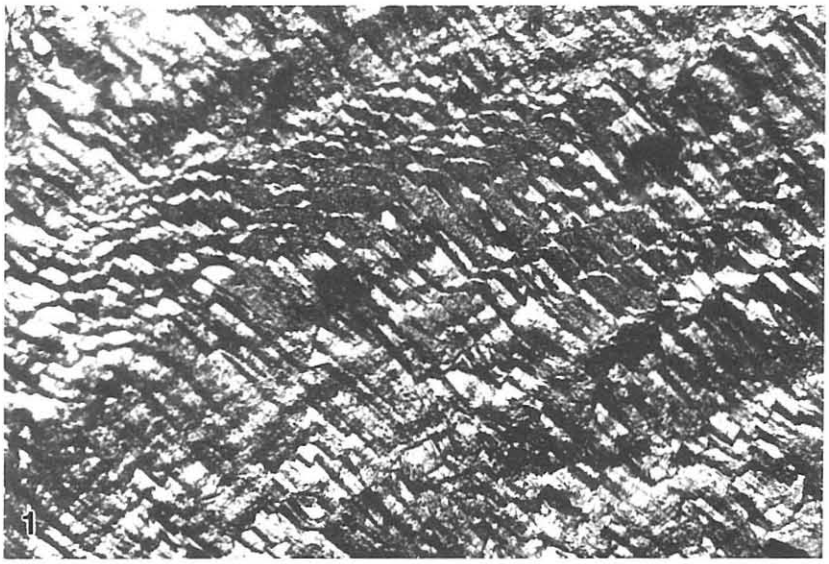
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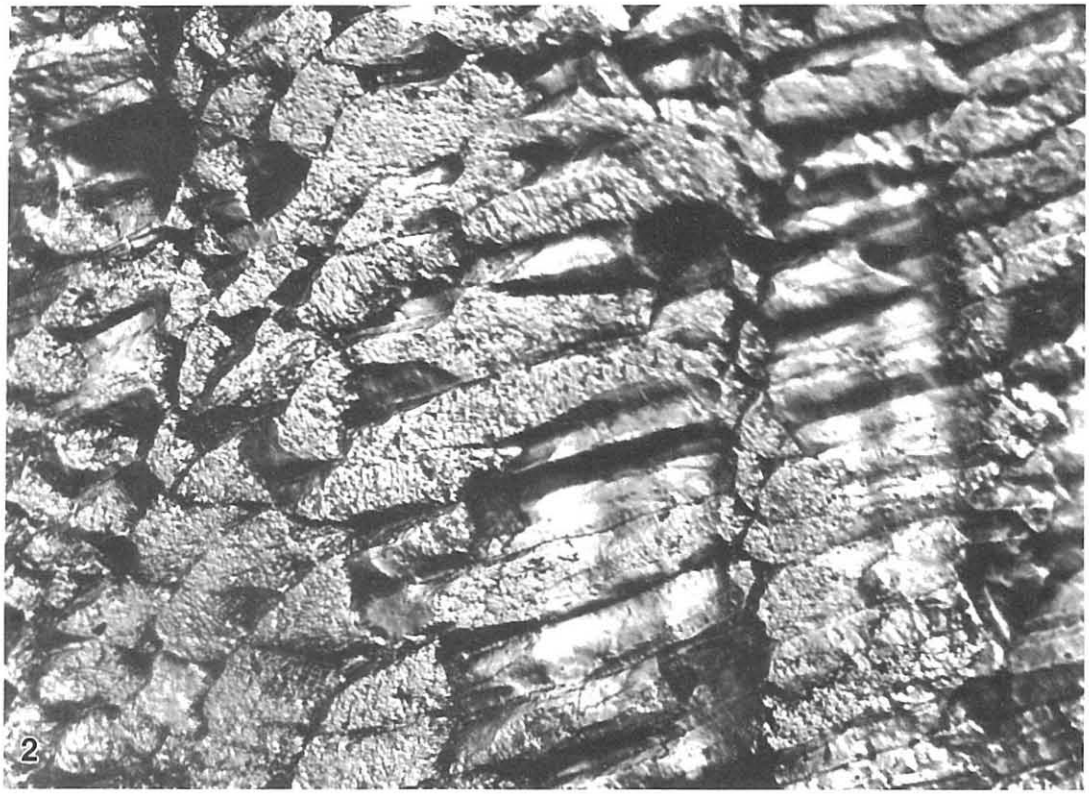
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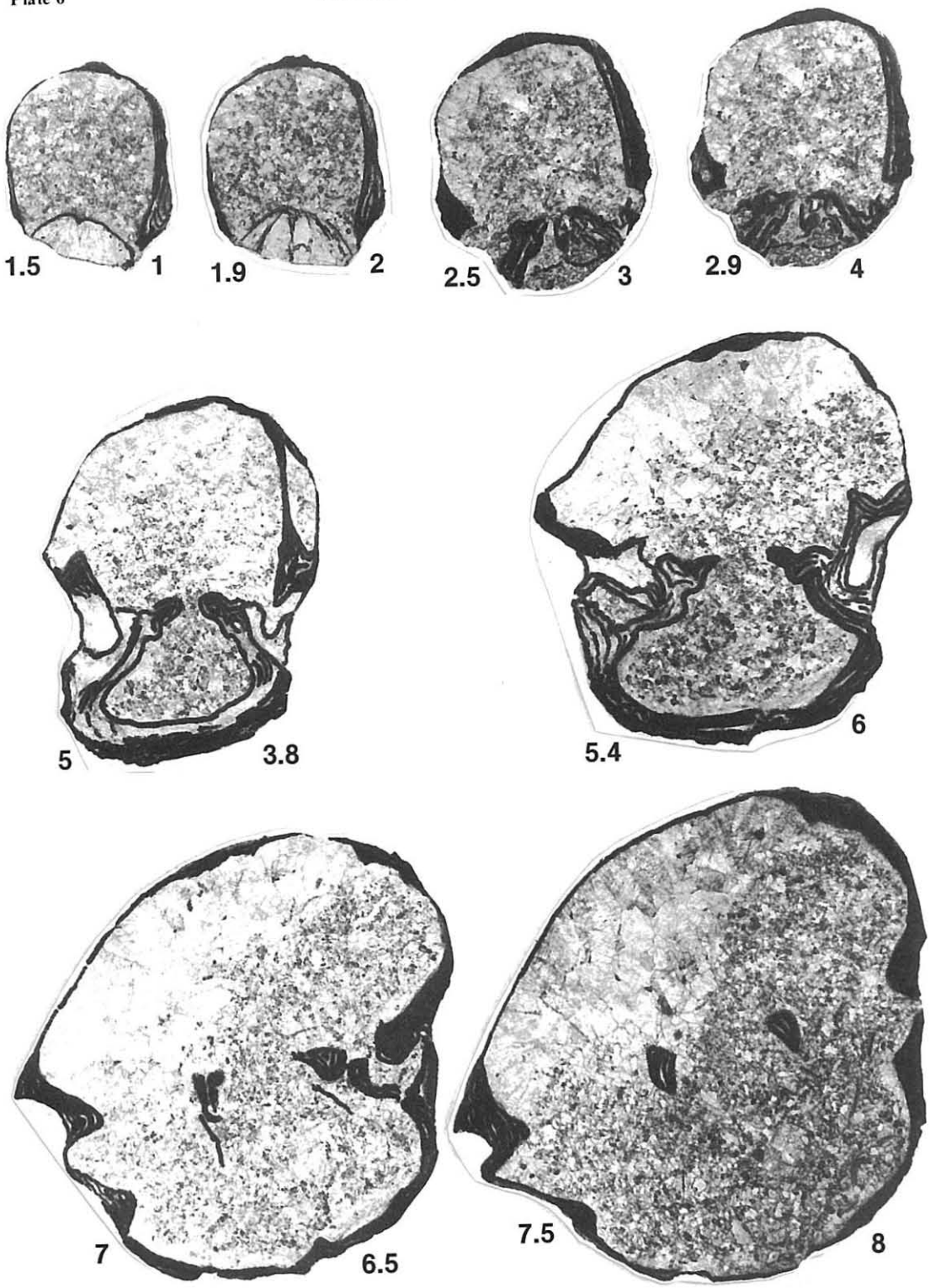
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