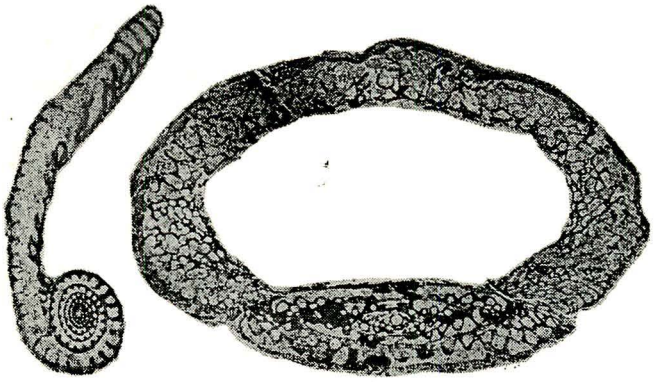
ISSN 0031-0204

日本古生物学會報告・紀事

Transactions and Proceedings of the Palaeontological Society of Japan

New Series No. 114



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Palaeontological Society of Japan

July 15, 1979

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The fossil on the cover is *Nipponitella explicata* HANZAWA, an aberrant uncoiled fusulinacean from the Lower Permian Sakamotozawa Formation, southern Kitakami, Northeast Japan.

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PALAEONTOLOGICAL SOCIETY OF JAPAN,
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Yayoi 2-4-16, Bunkyo-ku, Tokyo 113, Japan.
Sole agent: University of Tokyo Press, Hongo 7-3-1, Tokyo, Japan.

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 114, pp. 49-63, pls. 8, 9, July 15, 1979

701. ONTOGENIC STUDIES OF A FEW UPPER CAMBRIAN TRILOBITES FROM THE DEADWOOD FORMATION, SOUTH DAKOTA

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Abstract. The purpose of the present study is to illustrate the ontogenetic development of *Elvinia roemeri* (SHUMARD), *Cliffia typica*, n. sp., *Irvingella major* ULRICH and RESSER, and *Cameraspis convexa* (WHITFIELD). All of the studied materials were collected from the Deadwood Formation, *Elvinia* Zone, Upper Cambrian, located in the Black Hills, South Dakota. The result of this study indicates that the phylogenetic development of *Elvinia roemeri* and *Irvingella major* is closely related, that the morphogenesis of *Cliffia typica* is similar to those of *Ponumia obscura* and *Housia canadensis*, and that *Cameraspis convexa* is possibly an immediate derivative of the genus *Dunderbergia*.

Introduction

The ontogenic stages of *Elvinia roemeri* (SCHMARD), *Cliffia typica*, n. sp., *Irvingella major* ULRICH and RESSER, and *Cameraspis convexa* (WHITFIELD) are here described. The ontogenic sequences of the first two species are completely recovered; the second pair are incompletely known. The development is divided into five morphologic stages: anaprotaspid, metaprotaspid, paraprotaspid, early meraspid, and late meraspid, as proposed by the author in his earlier trilobite ontogenic studies (HU, 1970, 1971, etc.). The morphogenesis of *Elvinia roemeri* and *Irvingella major* are closely similar. They apparently developed from the same ancestor. The early ontogenies of *Cliffia typica*, n. sp., *Ponumia obscura* (LOCHMAN), *Housia canadensis* WALCOTT (HU, 1970) and *Aphelotoxon* sp. (unpublished materials) are comparable and bespeak possible common descent from a common ancestral stock. Since the late meraspis of *Cameraspis convexa* (WHITFIELD) is morphologically very similar to that of the genus *Dunderbergia*, it is presumably an immediate derivative of that trilobite.

The present materials were collected from the Deadwood Formation, *Elvinia* Zone, Upper Cambrian, located around the Black Hills, South Dakota while attending a summer camp in 1962. This summer camp was directed by Dr. Christian LOCHMAN-BALK, known Cambrian specialist of the New Mexico Institute of Mining and Technology. The author considers that it was a rare opportunity to participate in this field work, and now to have the present collections for study.

The author wishes to express his thanks to Dr. Christina LOCHMAN-BALK, for her guidance and the permission to

* Received Aug. 29, 1978; read June 9, 1979, at Tatsunokuchi.

study a part of her collections; and those especially relating to the present studies. Thanks also go to Dr. K. E. CASTER, University of Cincinnati, for reading the present manuscript. The figured specimens are all deposited in the Geology Museum, University of Cincinnati, Ohio (UCGM).

Systematic Paleontology

Family Elviniidae KOBAYASHI, 1935

Genus *Elvinia* WALCOTT, 1924

Elvinia roemeri (SHUMARD)

Pl. 8, figs. 1-28 and Text-fig. 1

Dikelocephalus roemeri SHUMARD, 1861, p. 220, 221.

Elvinia roemeri (SHUMARD): WALCOTT, 1924, p. 56; PALMER, 1965, pl. 3, figs. 9, 11, 14, 16, p. 44. (synonymy up to date.)

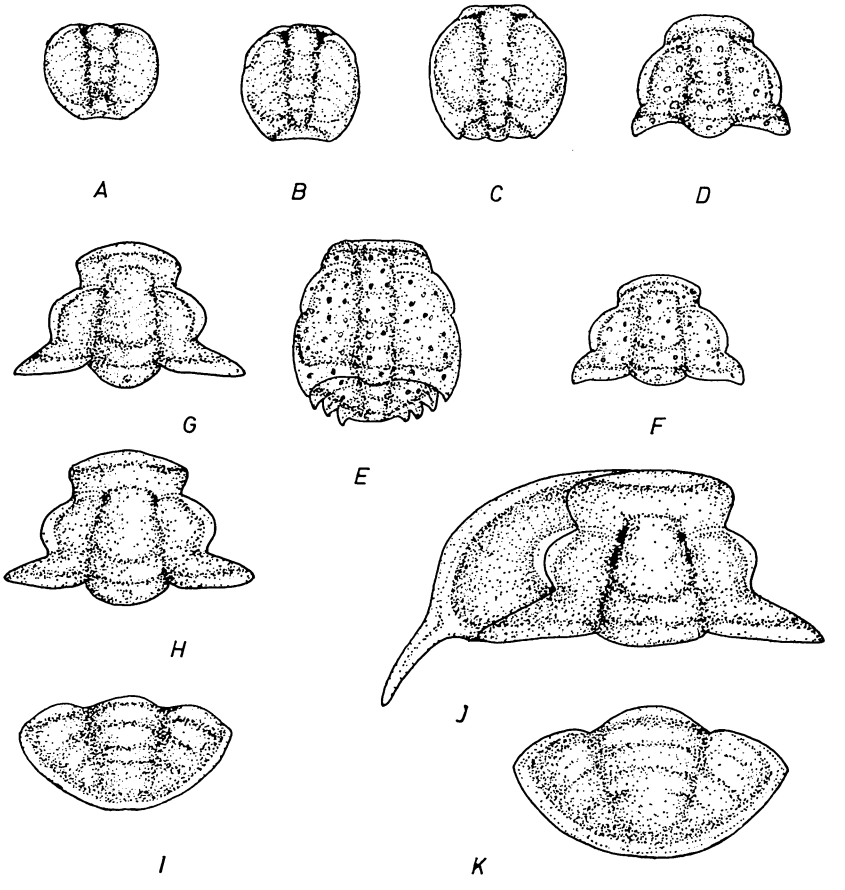
Remarks.—The present species is a common member in the *Elvinia* Zone, Upper Cambrian. The materials here studied were collected from several localities in the general region of the Black Hills, South Dakota. They are all identical. The ontogenic sequences are comparable with those reported by LOCHMAN and HU (1960), from materials collected in the Wind River Mountains, Wyoming. However, the Wyoming sequences are incomplete.

A complete trilobite specimen (pl. 8, fig. 21) was collected from Brownsvill junction, about 2 miles south of Deadwood city. It is a greenish gray, thinly bedded shale. The specimen is about 8mm long and has 10 thoracic segments, a slightly deformed cephalic shield, and a complete pygidium. Dr. J. L. WILSON of Rice University has suggested that it is possibly a parabolinoid trilobite, since the cephalon has a broad glabella, and a transverse oval pygidium unlike that of *Elvinia*. But since the specimen was recovered from the same shale bed bearing *Elvinia roemeri* as seen on pl. 8, figs. 22, 25, 28, and show only minimal differences, the author would at least temporarily assign them to the same species. The similarities in this instance between *Elvinia* and *Parabolinoides* are possibly due to compaction and deformation of the shale matrix.

Occurrences.—Galina, Brownsville junction, Little Elk creek, Boxelder, Nemo, and Dark canyon, along the east side of the Black Hills, between Deadwood and Rapid city, South Dakota.

Elvinia roemeri (SHUMARD), ontogeny

Metaprotaspid stage (Pl. 8, figs. 1-8 and text-fig. 1A, B).—The shield is about 0.25-0.35 mm in sagittal length, moderately convex, well defined into axial and pleural lobes by dorsal furrows; the axial lobe is expanded forward, and subdivided into five axial segments by faint furrows; the first axial segment is the frontal lobe, which is large, rounded nodose, convex, well delimited by a pair of small but distinct pits at the sides, and a pair of superciloid ridges is expanded laterally from the anterolateral margin; the second to third axial segments are two pairs of well defined lobes; the fourth axial segment is rather faint, and the fifth is the smallest and round; the pleural lobe is less broad than the axis, convex; a pair of palpebral ridges extends from the lateral margin of the frontal lobe behind the frontal pits, and runs posterolaterally to end at the mid-transverse line of the shield; a narrow border is faintly defined by a marginal furrow, and shows a short fringe along the posterior shield margin. The skeletal surface is faintly granulated.



Text-fig. 1. *Elvinia roemeri* (SHUMARD)

A, B, two metaprotaspides, showing the formation of the forth axial ring and the presence of the rudimentary protopygidium, ×44; C, E, paraprotaspides, showing the morphogenesis of the protopygidium, ×48, ×29; D, an early meraspid cranidium, showing the presence of the anterior border, ×20; F, G, two late meraspid cranidia; note the increase of the preglabellar field, ×8, ×6; H, an early holaspid cranidium, ×3.5; J, an holaspid cranidium associates with left side librigena, ×2; I, K, a small and a large pygidium, ×3. (All drawings were made from photographs.)

The main morphogenesis of the instars during the present stage is: the earliest instar has the axis composed of a large frontal lobe, two pairs of medium sized central bodies, an incompletely developed fourth axial ring, and a terminal portion—the occipital ring; during the late period the two pairs of central lobes are fused, and the fourth axial ring is well elevated, and therefore the axial lobe contains five well-developed axial segments; the posterior shield margin is gently and bent inwardly and shows no pygidial segment.

Paraprotaspid stage (Pl. 8, figs. 9-11 and text-fig. 1C, E).—The shield is round to

oval in outline, moderately convex, and is about 0.35-0.45 mm in length (sag.); the axial lobe is distinctly demarked by dorsal furrows, expands forwardly from the occipital ring or is slender and fusiform with a rounded anterior first axial segment; the second to fourth segments are transverse oval and convex; the terminal segment is the occipital ring which is the smallest segment; the paired anterior pits are distinctly demarked at the sides of the frontal lobe, and continue with a pair of lateral furrows that separate the anterior brim into a pair of superciloid ridges from the pleural lobe; the pleural lobe is about the same width as the axis or slightly wider and convex along the anterior margin; the narrow palpebral ridge is located in front of the midline of the shield (tr.), and curves anterolaterally; the posterior lateral lobe of the fixigena is surrounded by a narrow marginal border and a pair of short-based postfixigenal spines; there is a small transverse protopygidium at the posterior shield margin, and shows one or two well-marked segments. The instar surface is covered by medium-sized granules.

During the present stage, the shield is differentiated into a cranidium and a protopygidium and the narrow anterior border appears; the pygidial segments increase in number; the facial suture is turned on to the dorsal surface; the posterior fixigena broadens in width with a pair of short posteriorly directed fixigenal spines. The skeletal granules become coarser than in the earlier form. This stage correlates with "series of meraspids" by LOCHMAN and HU (1960) (pl. 96, figs. 43, 44 only).

Early meraspid stage (Pl. 8, figs. 12-16 and text-fig. 1D).—The cranidium is trapezoidal in outline, convex, and about 0.70-0.90 mm in length (sag.); the glabella is slenderly cylindrical, tapering forward, and has four well-defined glabellar segments; the first glabellar segment is large and quadrate, and the second to fourth ones are transverse oval; the occipital ring is roundly subtriangular, convex, arches posteriorly, and bears a minute median-node; the dorsal furrow is distinctly demarked; the convex anterior border arches forward, and is well delimited by a frontal furrow; the broad triangular fixigena is convex, and has the narrow elevated palpebral lobe located at the second glabellar segment (tr.); the short anterior facial suture is convergently convex, and the posterior one is laterally divergent, and is straight to barely convex; the posterior fixigenal border is deeply defined by a border furrow and is about the same width as the occipital ring. It is (tr.) convex, and directed slightly posteriorly at its extreme end. The skeletal surface is covered by medium-sized granules, and sparsely by coarse ones.

The morphogenesis of the instars during the present stage is: the anterior border increases in width; the glabella becomes slenderly cylindrical; the facial sutures are diagonally cutting the cranidial margin to form a regular trapezoid; the palpebral lobe moves posteriorly from the nearly anterior border to the second glabellar segment (tr.), and is well defined by the palpebral furrow. This stage agrees with LOCHMAN and HU's (1960) "series meraspids" (pl. 96, figs. 39, 42 only).

Late meraspid stage (Pl. 8, figs. 17, 18 and text-fig. 1F, G).—The cranidium is trapezoidal in outline, convex, about 1.0 to 1.5 mm in sagittal length; the glabella is truncatoconical, tapers slightly anteriorly, and is divided into four glabellar segments; the anterior two glabellar segments are defined by shallow and

faint glabellar furrows; the third to fourth glabellar segments are deeply delimited by furrows which are concave posteriorly, distinct, and transversely U-shaped; the occipital ring is convex, medium-sized, distinctly defined by the occipital furrow and bears a minute median tubercle; the dorsal furrow deepens posteriorly and shallows across the anterior glabellar margin.

The narrow preglabellar field is present in front of the glabella. It slopes downward from the anterior glabellar margin and is well delimited by the frontal furrow; the narrow sickle-shaped anterior border is convex, and arches forward; the fixigena is slightly narrower than the glabella (tr.), convex, has the medium-sized palpebral lobe located on the second glabellar furrow (tr.). It is narrowly elevated and distinctly defined by the palpebral furrow; the elevated posterior fixigenal border is about the same width as the occipital ring. The anterior facial suture is slightly convergent-convex, and the posterior one is divergent-posteroiaterlaly and convex.

During the present stage, the glabellar furrows are complete; the glabella increases its width; the preglabellar field widens; the fixigena becomes narrower; the granules reduce in size. This stage correlates well with LOCHMAN and HU's (1960) "early holaspid cranidium" (pl. 96, figs. 40, 41 only).

Figured specimens. — Metaprotaspides, UCGM. 43372a-g.

Paraprotaspides, UCGM. 43372h-j.

Early meraspid cranidia, UCGM. 43372k-o.

Late meraspid cranidia, UCGM. 43372p, q.

Holaspid cranidia, UCGM. 43372r-w.

Librigenae, UCGM. 43372x, y.

Pygidia, UCGM. 43372z, a'.

Family Komaspiidae KOBAYASHI, 1935

Genus *Irvingella* ULRICH and RESSER, 1924

Irvingella major ULRICH and RESSER

Pl. 8, figs. 29-36 and text-fig. 2

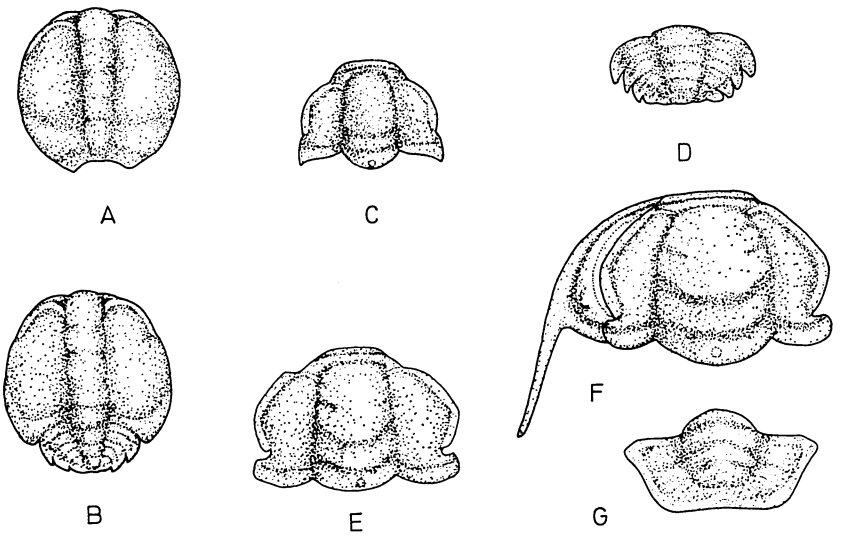
Irvingella major ULRICH and RESSER, in WALCOTT, 1924, p. 58, pl. 10, fig. 3; PALMER, 1965, p. 48, pl. 6, fig. 5, GRANT, 1964, p. 16, pl. 10, figs. 8, 9, 11. (synonymy up to date.)

Remarks.—The synonymy of the present species is given in detail by FREDERICKSON (1949), GAINES (1951), and PALMER (1965), and their opinions are accepted here. The present species is represented by a few skeletons, ranging from small to large size, from a single small piece of yellowish gray limestone. They are recognized as belonging to the same species, but represent an incomplete growth series.

Occurrences.—Moll section, near Bear Butte, about 6 miles southeast of Deadwood, South Dakota.

Irvingella major ULRICH and RESSER, ontogeny

Metaprotaspid stage (Pl. 8, fig. 28, and text-fig. 2A).—The shield is rounded to subrounded in outline, convex, and about 0.4 mm in sagittal length; the axis and the pleuron are distinctly defined by dorsal furrows; the axis is extended in the full length of the shield, cylindrical, slightly expanded anteriorly from the occipital ring, and divided into five glabellar segments by indistinct furrows; the anterior first glabellar segment is round, and continues with a pair of superciloid ridges from the anterolateral margin; it is well defined by a pair of distinct lateral pits; the second to fourth glabellar segments are transverse, faintly



Text-fig. 2. *Irvingella major* ULRICH and RESSER

A, a paraprotaspis, ×34; B, metaprotaspis, ×33; C, an early meraspid cranidium, ×15; D, an immature pygidium, showing a few dis-ankylosed segments, ×20; E, a late meraspid cranidium, showing a broad truncato-conical glabella, ×28; F, a mature cranidium associated with the left librigena, ×2; G, a pygidium, ×1.5. (All drawings were made from photographs; figs. F, E, were redrawn from PALMER, 1965, pl. 6, figs. 10, 11.)

defined by a central longitudinal furrow, so as to separate these segments into three pairs of round convex lobes; the dorsal, or occipital, ring is small, convex, triangular; the pleural lobe is convex, wider than the axis, and slopes downward along the margin; a pair of faint palpebral ridges extend behind the anterior pits, and anterolaterally to end at the first glabellar furrows (tr.); the posterior margin of the shield has a pair of short broad spines which project from the narrow flat border; the skeletal surface is covered by minute granules.

Paraprotaspid stage (Pl. 8, fig. 30, and text-fig. 2B).—The skeleton is elongate to oval, separated into cranidial and protopygidial shields by an arching foward suture, and is about 0.60 mm in total length (sag.); the cranidial shield is roundly trapezoidal and well defined by a dorsal furrow; the glabella is cylindrical, faintly divided into four glabellar segments; the occipital ring is transverse oval, convex; no median tubercle is recognizable; the pleural lobe of the fixigena is slightly wider than the axis, convex along the free margin; the medium-sized palpebral lobe is elevated, narrow, and situated in front of the mid-length of the glabella; the posterior fixigenal border is elevated, directed posterolaterally from the side of the occipital ring and ends in short, broad-based projection.

The protopygidium is semicircular and consists of 2-3 dis-ankylosed segments; the axis is convex, about the same width as the pleuron, conical, and tapers posteriorly; the pleural furrow is deeper than the interpleural groove, and curves posterolaterally from the dorsal furrow;

the margin is irregular, narrow and flat.

Early meraspid stage (Pl. 8, fig. 31, and text-fig. 2C).—The cranidium is trapezoidal in outline, convex, about 1.0 mm in sagittal length, with a deeply depressed dorsal furrow; the glabella is cylindrical, rounded anteriorly, convex, has two pairs of rather faint glabellar furrows and a deeply demarked third glabellar segmental furrow; the occipital ring is lenticular, convex both vertically and posteriorly; it bears a minute median tubercle; the narrow anterior border is elevated convex, faintly delimited by a frontal furrow, and has no median niche. The fixigena is convex, slightly narrower than the glabella between the palpebral lobe and the dorsal furrows; the palpebral ridge is narrow and long, sickle-shaped, distinctly demarked by the palpebral furrow and situated on the mid-length of the glabella (sag.); the anterior facial suture is short, convergent, and the posterior one is divergent-posterolaterally; the rear fixigenal border is distinctly impressed by a furrow which is narrow, elevated, and about the same width as that of the occipital ring (tr.). The surface of the cranidium is faintly granulated.

Late meraspid stage (Pl. 8, fig. 35 and text-fig. 2E).—The cranidium is nearly subtrapezoidal in outline, convex and has the dorsal furrow distinctly demarked; it is about 2.0 mm in sagittal length; the glabella is truncato-conical, convex above the fixigena and with the anterior two pairs of glabellar furrows indistinct; the third glabellar furrow and the occipital furrow are deeply demarked and transversely U-shaped; the medium-wide occipital ring is concave, lenticular (horizontal) and convex (vertical); the occipital tubercle is minute; the anterior brim is divided by a distinct frontal furrow into a narrow convex preglabellar field, and a narrow anterior border; there is no median notch on the anterior furrow. The fixigena is about two-thirds the width of the glabella, convex, with the maximal width on the transverse mid-line of the cranidium; the palpebral ridge is rather short, well elevated, and continues with a very long but narrow palpebral lobe. Both the anterior and posterior facial sutures are very short due to the presence of the long ocular lobe.

The immature pygidium (Pl. 8, figs. 32-34 and text-fig. 2D).—No adult pygidial skeleton was recovered except for a few early instars. The smallest pygidium is about 0.5 mm in sagittal length, semicircular in outline and consists of 5-6 dis-ankylosed freely articulated segments, and has the axis tapering posteriorly; the pleural lobe is wider than the axis, convex, and has the pleural band curving posteriorly, and ending into a pair of short broad spines; the interpleural furrow is deep and broad. These pygidia are judged as the meraspid form when compared with the adult form (MOORE, 1959, p. 295).

Remarks.—The ontogenic development of the present species is closely similar to that of *Elvinia roemeri* (SHUMARD); both have similar protaspides and meraspides, which probably indicates that they belong to the same super-generic level and have close phylogenetic relationship. Certainly this evidence would support common assignment to the Elviniidae.

Figured specimens. — Metaprotaspis, UCGM. 43375

Paraprotaspis, UCGM. 43375a.

Early meraspis, UCGM. 43375b.

Late meraspis, 43375f.

Immature, pygidia, UCGM. 43375c-e.

Cranidia, UCGM. 43375g.

Family Pterocephaliidae KOBAYASHI, 1936

Genus *Cameraspis* ULRICH and RESSER, 1926

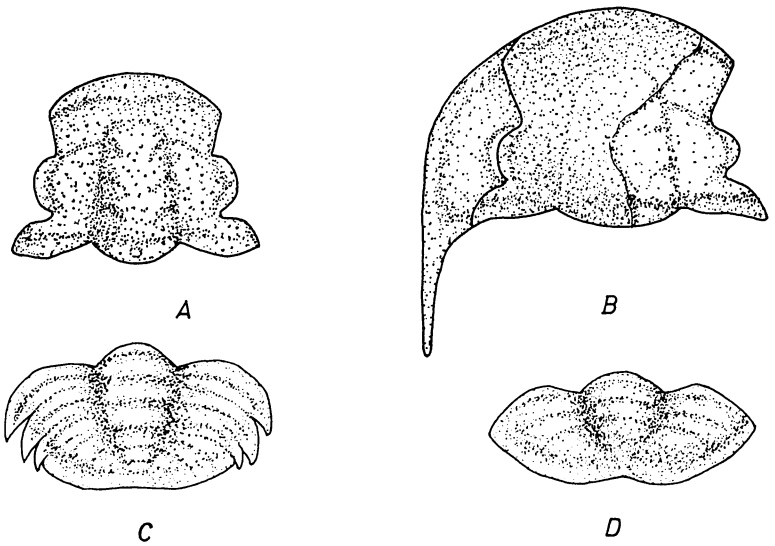
Cameraspis convexa (WHITFIELD)

Pl. 9, figs. 30-36 and text-fig. 3

Cameraspis convexa (WHITFIELD): GRANT, 1965, p. 140, pl. 10, fig. 6. (synonymy up to date.)

Remarks.—The present species is represented by a few small and large size cranidia and pygidia. The small cranidium is about 1.7 mm and the biggest is 8.3 mm in length (sag.). All show a continuous morphologic sequence. The smallest cranidium is assigned to the late meraspis. It is characterized by a subquadrate shield, conical glabella, and well impressed dorsal furrow. The dorsal furrows become shallower during its late growth stage (figs. 35-37). The surface of the skeleton is covered by coarse granules in the small instars but these become either much finer or absent during later growth periods. These instars are morphologically very similar to the genus *Dunderbergia*, a geochronologically slightly earlier trilobite. It seems likely that the genus *Cameraspis* is a direct descent of *Dunderbergia*.

A few early meraspid pygidia were also recovered. They are all characterized by 5-6 segments, semicircular in outline and convex; a few of the anterior segments are non-ankylosed, and the posterior ones are fused as a terminal plate (pl. 9, figs. 31-33); the axis is conical, tapering posteriorly, and well divided by ring-furrows; the posterior marginal border is narrow and flat and the anterior ones are spinous; the spines



Text-fig. 3 *Cameraspis convexa* (WHITFIELD)

A, an immature cranidium ×3; B, an adult cranidium associated with the left librigena, showing both of the internal and external skeletal surfaces, ×6; C, an early immature pygidium articulated with two thoracic segments, ×20; D, an holaspid pygidium, ×3. (All drawings were made from photographs, except fig. C, which was redrawn from LOCHMAM and HU, 1960 and GRANT, 1965.)

are the lateral projections of the freely articulated anterior segments or the thoracic segments.

LOCHMAN and HU (1960) reported a few early instars supposedly pertaining to this form from the Wind River Mountains, Wyoming (pl. 96, figs. 10, 12, 17), which show a broader and shorter glabella, and a wider preglabellar field. This is possibly an erroneous interpretation.

Occurrence.—Rapid creek section, Dark canyon, about 2 miles southwest of Rapid City, South Dakota.

Figured specimens.—Cranidia, UCGM. 43376d-g.

Pygidia, UCGM. 43376a-c, 43376.

Family Solenopleuridae ANGELIN, 1854

Genus *Cliffia* WILSON, 1951

Cliffia typica, n. sp.

Pl. 9, figs. 1-29 and text-fig. 4

Diagnosis.—Cranidium trapezoidal in outline, moderately convex; glabella short, broad, conical, and marked with three pairs of glabellar furrows; occipital ring bearing a medium-sized occipital spine; preglabellar field less than one-half the length of glabella, convex, distinctly defined by frontal furrow; the anterior border narrow, crescentic, convex, arching forward; palpebral lobe about one-third the width of glabella: palpebral lobe small, situated on the midline of glabella (tr.). Librigena crescentic, elongate, convex; genal spine medium-sized. Pygidium rhomboid, containing more than three segments.

Description.—The cranidium is trapezoidal in outline, moderately convex, and has the distinctly defined V-shaped dorsal furrow; the glabella is medium-wide, conical, convex, and marked by three pairs of very distinct glabellar furrows; the first pair of glabellar furrows is short and faint, and is located at about the same level as the palpebral ridges, or slightly posteriorly; the second and the third ones are deeper, shorter, and gently directed centroposteriorly; the crescentic, or transverse lenticular, occipital ring is convex, and bears a broadly based, small, posteriorly directed occipital spine; no mediam occipital node is known; the preglabellar area is moderately convex, about one-third the length of the glabella, and well defined by a frontal furrow; the anterior border is narrowly crescentic, convex, and arches forward; the concave frontal furrow has no median embayment; the fixigena is about one-half the width of the glabella, convex, has the medium-sized palpebral lobe situated between the second and third glabellar furrows (tr.); the palpebral lobe is well defined by a furrow, elevated, and continues with the faintly elevated palpebral ridge directed obliquely to the anterolateral glabella; the posterior fixigena is medium-wide, convex, slopes downward from the dorsal furrow, and the convex border is about the same width as the occipital ring or narrower.

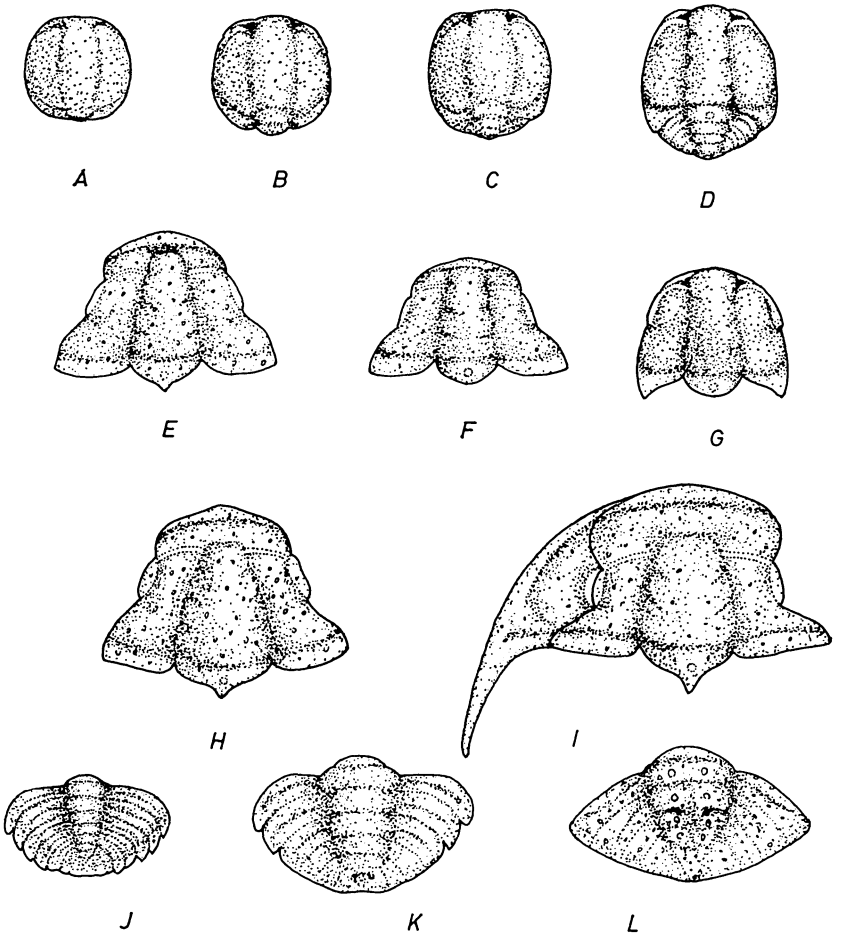
The librigena is elongate, moderately convex; the medium-wide ocular platform is gently convex, and more than twice as wide as the lateral border (sometimes considerably broader); the medium-sized ocular ring is forwardly situated in the inner free margin—the facial suture line; the round, convex, lateral border is medium-wide, well defined by a broad lateral furrow; the lateral and posterior librigenal furrows are not connected at the genal angle; the genal region is flat and extends into a medium-sized genal spine.

The pygidium is rhomboidal in outline and convex along the axis; the axial lobe is conical, tapering posteriorly, and

does not extend the full length of the pygidium; it is divided by furrows into three convex rings, and a small terminal portion; the dorsal furrow is medium deep; the pleural lobe slopes downward from the dorsal furrow and is about the same width as the axis; two to three deep pleural furrows are seen, and the interpleural grooves are faint.

The skeletal surface is covered by medium-to-coarse granules, and irregular radial ridges are developed both on the preglabellar field and the platform.

Remarks.—The present species is re-



Text-fig. 4. *Cliffia typica*, n. sp.

A, anaprotaspis, ×52; B, metaprotaspis, ×52; C, D, two paraprotaspides, showing the presence of the rudimentary pygidium, ×24, ×37; G, a paraprotaspid cranidium, ×32; F, an early meraspid cranidium, ×28; E, H, two late meraspid cranidia; notice the widening of the preglabellar field, ×25, ×26; I, a mature cranidium associated with left librigena, ×8; J, K, L, a growth series of pygidia, showing the disappearance of thoracic segments and the presence of the pygidial plate, ×20. (All drawings were made from photographs.)

presented by numerous early instars and mature skeletons which show a continuous growth sequence; the largest cranidium is about 2.0 mm in length and the small protaspis is 0.24 mm in length (sag.). This species differs from the type species *Cliffia lataegenae* (WILSON) by the shallower dorsal furrow, narrower preglabellar field and fixigena; the palpebral lobe is of lower elevation, and the pygidium is broader.

Occurrence. — Boxelder section, near Nemo, about 8 miles northwest of Rapid City, South Dakota.

Cliffia typica, n. sp., ontogeny

Anaprotaspid stage (Pl. 9, fig. 1 and text-fig. 4A).—The shield is flat or gently convex, nearly dome-shaped, round to subround, about 0.24 mm in sagittal length; it is without distinct dorsal furrows, except for a rather faint depression along the axial region, which suggests the position of the axial lobe; the axis is slender fusiform, tapering both anterior and posterior from the mid-length of the axis; no distinct frontal pits or superciloid ridges are known; the skeletal surface is smooth or faintly granulated.

Metaprotaspid stage (Pl. 9, figs. 2, 3 and text-fig. 4B).—The shield is oval, moderately convex, about 0.25-0.35 mm in length (sag.); the slender fusiform axis is faintly delimited by a dorsal furrow; it tapers slightly both anteriorly and posteriorly from the mid-line of the axis (tr.); no distinct axial segments of frontal pits are recognizable; the posterior margin of the shield bears a small transverse median lens-shaped area, which suggests the possible position of the occipital ring. The skeletal surface is covered by minute granules.

Paraprotaspid stage (Pl. 9, figs. 4-12 and text-fig. 4C, D, G).—The shield may or may not bear a protopygidium; it is subround to trapezoidal in outline, convex; the complete paraprotaspid shield is about 0.35 mm in length from the anterior cephalic to the posterior protopygidal margins; the largest cranidium may sometimes measure as much as 0.50 mm in length (sag.); the axis or the glabella is slenderly conical, tapering anteriorly without a distinct segmental furrow, except that certain specimen shows three to four pairs of faint depressions near the dorsal furrows; the frontal pits are rather faint; the pleura or the fixigena is about the same width as the axis; no palpebral ridges are recognizable only on larger cranidia; the protopygidium is transverse lenticular to subtriangular, convex, composed of one to three well differentiated pygidial segments, and slopes downward rapidly from the posterior cranidial border. The surface is faintly granulated.

During the present stage of morphogenesis, the protopygidial segments increase in number, the palpebral lobe and the ocular ridges appear, the dorsal furrow becomes deeper, and the fixigena increases in width.

Early meraspid stage (Pl. 9, figs. 13-16 and text-fig. 4E).—The cranidium is trapezoidal in outline, convex, and about 0.25-0.65 mm in sagittal length; the dorsal furrow is deep and V-shaped in cross-section; the glabella is conical, convex, tapering anteriorly and has a rounded anterior margin; a pair of delicate glabellar furrows are visible, of which the anterior first two pairs are short and nearly horizontal, and the third is long and directed posterolaterally from the dorsal furrow; the narrow crescentic occipital ring is convex both dorsally and posteriorly, marked off deeply from the glabellar base by a distinct occipital

furrow, and bears a minute median tubercle; a narrow convex preglabellar field appears in front of the glabella; it has a median depression in the earlier instars but smoothes out laterally; the cranidial surface is covered by both coarse and faint granules.

During the present stage, the glabella metamorphoses from slender conical to broad conical, the preglabellar field from narrow to broad; the fixigena becomes narrower. It is differentiated from earlier stage by the presence of the preglabellar field, conical glabella, and the coarse granules.

Late meraspid stage (Pl. 9, figs. 17-20 and text-fig. 4E, H).—The cranidium is of regular trapezoidal outline, convex, with distinctly impressed dorsal furrow, it is about 0.70-0.85 mm in length (sag.); the glabella is slender conical, tapering rapidly from the anterior first glabellar furrows; the first glabellar segment is roundly quadrate; the second to fourth ones are transversely elongate, convex, well separated by glabellar furrows; the occipital ring is convex both vertically and posteriorly; there is possibly a minute median tubercle; a narrow, elevated anterior border appears in front of the glabella, and arches forward; the fixigena is about the same width as the glabella between the palpebral lobe and the dorsal furrow; the narrow, less ele-

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Explanation of Plate 8

Figures 1-28. *Elvinia roemeri* (SHUMARD)

1-8. a growth series of metaprotaspides, showing the differentiation of the glabella and the pleural lobes, and the completion of the glabellar segments. 1, ×44, UCGM. 43372; 2, ×44, UCGM. 43372a; 3, ×44, UCGM. 43372b; 4, ×44, UCGM. 43372c; 5, ×40, UCGM. 43372d; 6, ×50, UCGM. 43372e; 7, ×50, UCGM. 43372f; 8, ×50, UCGM. 43372g.

9-11. paraprotaspides, showing the presence of the protopygidium. 9, ×48, UCGM. 43372h; 10, ×48, UCGM. 43372h; 10, ×48, UCGM. 43372i; 11, ×48, UCGM. 43372j.

12-16. a few early meraspid cranidia, showing the presence of the anterior border. 12, ×29, UCGM. 43372k; 13, ×20, UCGM. 433721; 14, ×24, UCGM. 43372m; 15, ×20, UCGM. 43372n; 16, ×20, UCGM. 43372o.

17, 18. two late meraspid cranidia, showing the development of the preglabellar field and the completion of the glabellar furrows. ×9, UCGM. 43372p; ×8, UCGM. 43372q.

19-24. several small and large sized cranidia, showing the broadens of the glabella and the difference between shale and limestone specimens. 19, ×6, UCGM. 43372r; 20, ×3.5, UCGM. 43372s; 21, a slightly deformed complete shale specimen, showing the animal body has 10 thoracic segments, ×5, UCGM. 43372t; 22, ×2, UCGM. 43372u; 23, ×3.5, UCGM. 43372v; 24, ×2, UCGM. 43372w.

25, 27. a large and a small sized librigenae. 25, ×1.6, UCGM. 43372x; 27, ×11, UCGM. 43372y.

26, 28. a shale and a limestone pygidia. ×3, UCGM. 43372z; ×3, UCGM. 43372a′.

Figures 29-36. *Irvingella major* ULRICH and RESSER

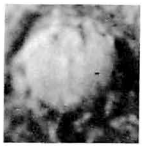
29. a complete early metaprotaspis, ×34, UCGM. 43375.

30. an incomplete paraprotaspis, ×33, UCGM. 43375a.

31. an early meraspid cranidium, showing the cylindrical glabella, ×15, UCGM. 43375b.

32-34. three well preserved meraspid pygidia. 32, ×20, UCGM. 43375c; 33, ×20, UCGM. 43375d; 34, ×20, UCGM. 43375e.

35, 36. a late meraspid and an holaspid cranidia, showing the truncato-conical glabella. ×28, UCGM. 43375f; ×2, UCGM. 43375g.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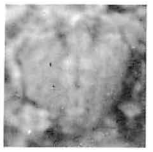
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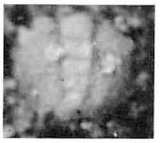
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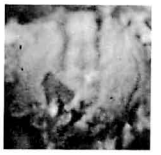
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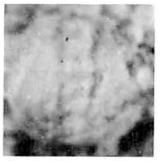
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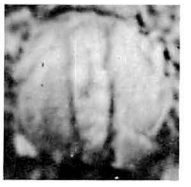
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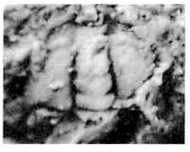
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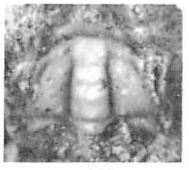
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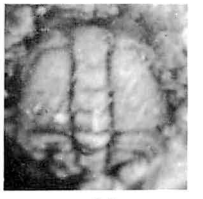
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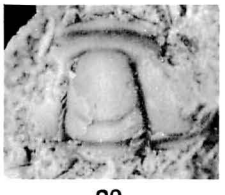
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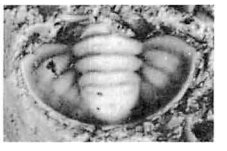
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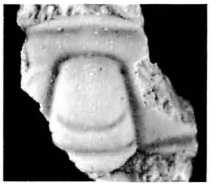
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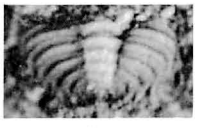
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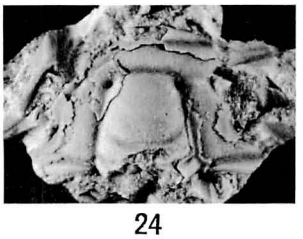
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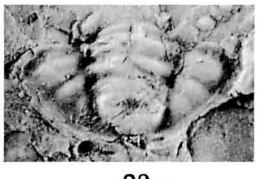
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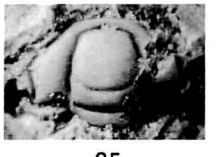
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vated, palpebral lobe is faintly impressed by a palpebral furrow, which is situated at the same elevation as the first glabellar furrow (tr.); the palpebral ridge is faintly divided and is directed obliquely from the palpebral lobe to the side of the anterolateral glabellar margin; the anterior facial suture line is convergently convex, and the posterior one is divergent-posteriorly and straight. The cranidial surface is faintly granulated.

During the present stage the anterior border changes from linear to the narrow sickle-shape, the glabella from slender to broad based conical; the fixigena decreases in width.

Growth of the pygidium.—The earliest known pygidium (pl. 9, fig. 24 and text-fig. 4J) is semicircular in outline, convex, and consists of about 6-7 freely articulated segments, it is about 0.50 mm in length (sag.); the segments are all deeply impressed by pleural furrows and extend laterally into a pair of short broad-based terminal spines; the conical axis tapers posteriorly and is distinctly separated by a ring furrow. This pygidium belongs possibly to the early meraspid stage. The next large pygidium measures between 0.8 and 1.0 mm (pl. 9, fig. 23 and text-fig. 4K); it is triangular or transverse rhomboidal in outline, convex, and consists of one or two free segments and a lenticular terminal pygidium; the pygidium bears 3-4 ankylosed segments; the axis is convex, elevated above the pleural lobe, and well demarked by furrows; the pleural lobe is about the same width as the axis and convex along the margin; neither marginal spine nor special border separation are known. This pygidium is assigned as the late meraspid stage.

Remarks.—The early instars of this species are closely similar to those of *Housia canadensis* WALCOTT, *Ponumia obscura* (LOCHMAN) (HU, 1970) and *Apheloxon* sp. (unpulished material). These genera are possibly common descendants of this ancestral stock.

Figured specimens.-Anaprotaspid shield, UCGM. 43373a; Metaprotaspides, UCGM. 43373b, c; Paraprotaspides, UCGM. 43373d-l; Early meraspides, UCGM. 43373m-p; Late meraspides, UCGM. 43373q-s, 43374c; Cranidia, UCGM. holotype, 43373, paratypes, 43373v-x; Librigenae, UCGM. 43373t, u; Pygidia, UCGM. paratypes, 43374, 43374a, 43374b.

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Explanation of Plate 9

Figures 1-29. *Cliffia typica*, n. sp.

1. anaprotaspis, showing the round shield without distinct differentiation of axial and pleural lobes. ×52, UCGM. 43373a.

2, 3. a broken and a complete metaprotaspides, showing the presence of the axial and pleural lobes. ×52, UCGM. 43373b. ×50, UCGM. 43373c.

4-12. several paraprotaspid shield; notice the presence of the protopygidium and the metamorphosis of the glabella, the early shield has the glabella cylindrical and the later ones are conical. 4, ×46, UCGM. 43373d; 5, ×45, UCGM. 43373e; 6, ×41, UCGM. 43373f; 7, ×40, UCGM. 43373g; 8, ×40, UCGM. 43373h; 9, ×37, UCGM. 43373i; 10, ×37, UCGM. 43373j; 11, ×30, UCGM. 43373k; 12, ×32, UCGM. 433731.

13-16. four early meraspid cranidia, showing the presence of the anterior border and the broadens of the posterior fixigenal border. 13, ×30, UCGM. 43373m; 14, ×26, UCGM. 43373n; 15, ×28, UCGM. 43373o; 16, ×28, UCGM. 43373p.

17-20. four late meraspid cranidia, showing the broadens of the preglabellar field. 17, ×25, UCGM. 43373q; 18, ×25, UCGM. 43373r; 19, ×23, UCGM. 43373s; 20, ×26, UCGM. 43374c.

21, 22. two librigenae; notice the long genal spine and the flat genal area. 21, ×20, UCGM. paratype, 43373t; 22, ×30, UCGM. paratype, 43373u.

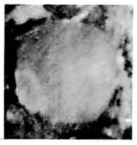
23-25. two meraspid and an adult pygidia, showing the morphogenesis during their different stages. 23, ×20, UCGM. 43374; 24, ×20, UCGM. 43374a; 25, ×20, UCGM. paratype, 43374b.

26-29. four incomplete cranidia; notice the short glabella and the small palpebral lobe. 26, ×10, UCGM. paratype, 43373r; 27, ×9, UCGM. paratype, 43373w; 28, ×8, holotype, UCGM. 43373; 29, ×12, paratype, UCGM. 43373x.

Figures 30-37. *Cameraspis convexa* (WHITFIELD)

30-33. a growth series of meraspid pygidia, showing the ankylosis of the pygidial segments and the freely articulated thoracic segments. 30, ×20, UCGM. 43376; 31, ×20, UCGM. 43376a; 32, ×20, UCGM. 43376b; 33, ×20, UCGM. 43376c.

34-37. four cranidia, showing the morphogenesis from the late meraspid to adult stages. 34, ×10, UCGM. 43376d; 35, ×6, UCGM. 43376e; 36, ×4, UCGM. 43376f; 37, ×3, UCGM. 43376g.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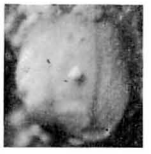
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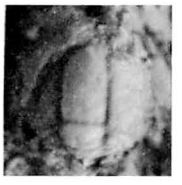
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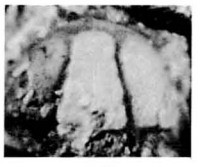
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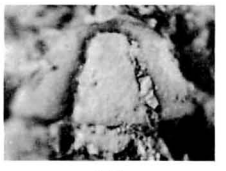
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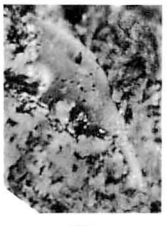
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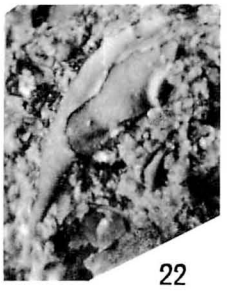
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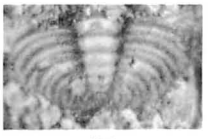
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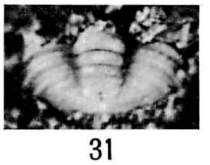
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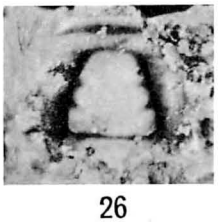
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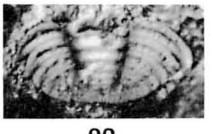
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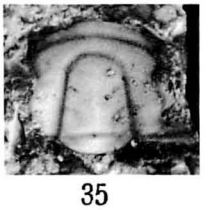
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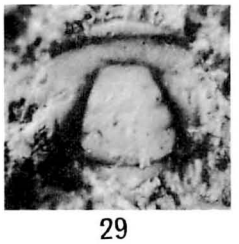
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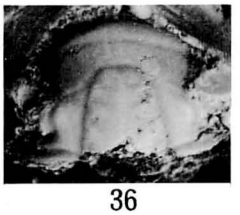
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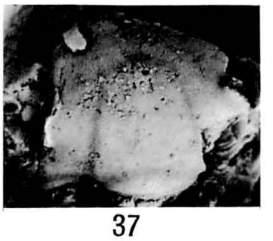
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若干の南ダコタ Deadwood 層産後期カンブリア紀三葉虫の個体発生：*Elvinia roemeri* (SHUMARD), *Cliffia typica*, n. sp., *Irvingella major* ULRICH and RESSER ならびに *Cameraspis convexa* (WHITFIELD) の個体発生について記述した。前2者に関してはほゞ完全な発生各期の解析ができ，その結果 *E. roemeri* と *I. major* とはきわめてよく類似した経過をたどることから，共通祖先をもつグループに属することが明らかになった。*C. convexa* の後期メラスピスは *Dunderbergia* 属のそれと大変よく似ており，*convexa* がこの属からの直接の分枝であると考えてよい。*C. typica* の初期発生過程は *Ponumia obscura* (LOCHMAN), *Housia canadensis* WALCOTT, *Aphelotoxon* sp. などと比較でき，いずれも共通の祖先株をもつものとみられる。

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 114, p. 64, July 15, 1979.

SHORT NOTES

16. SOME NEWLY DISCOVERED LATE PERMIAN CORALS FROM THE MAIZURU GROUP*

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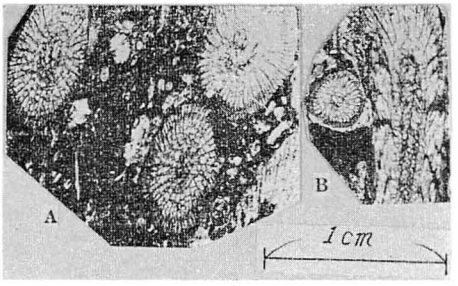
The Late Permian corals from the Maizuru Group were reported previously by YAMAGIWA (1960). Recently, the senior author has collected some more corals from this group at the following four localities in Maizuru City, Kyoto Prefecture:

Loc. 1 1.5 km SSE of Kawara, Maizuru City
Loc. 2 0.5 km S of Kinoshita, Maizuru City
Loc. 3 2.0 km SSW of Kinoshita, Maizuru City
Loc. 4 0.2 km N of Shiratori-toge, Maizuru City

Waagenophyllum (*Waagenophyllum*) *virgalense* (WAAGEN and WENTZEL) occurs in limestone lenses at Locs. 1 and 2, and *W.* (*W.*) sp. indet. in a conglomeratic rock at Loc. 3. Loc. 4 yielded *W.* (*W.*) aff. *pulchrum*, *Lophophyllidium*? sp. indet. and *Verbeekiella*? sp. indet. in a conglomeratic rock.

Of these, *Waagenophyllum* (*Waagenophyllum*) *virgalense* is associated with *Palaeofusulina* aff. *sinensis*—*Colaniella parva* fauna, and other fossils occurs in common with *Lepidolina kumaensis* fauna. According to ISHII, OKIMURA and NAKAZAWA (1975), the former fauna is younger than the latter fauna and indicates a Latest Permian age. These corals will be described in detail on another occasion.

This short paper presents the first report of a Late Permian coral faunule found together with the *Palaeofusulina* aff. *sinensis*—*Colaniella parva* fauna in Japan.



Text-fig. 1. *Waagenophyllum* (*Waagenophyllum*) *virgalense* (WAAGEN and WENTZEL) A: Transverse section. B: Longitudinal section. Locality: 0.5 Km S of Kinoshita, Maizuru City.

Thanks are due to Professor C. MITSUNO of Okayama University for his kind guidance and to Associate Professor Y. OKIMURA of Hiroshima University for his advice encountered on the foraminiferal fossils.

* Received March 28, 1979.

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Trans. Proc. Palaeont. Soc. Japan, N.S., No. 114, pp. 65-76, pls. 10, 11, July 15, 1979

702. A NEW GAUDRYCERATID AMMONITE FROM EASTERN HOKKAIDO (STUDIES OF THE CRETACEOUS AMMONITES FROM HOKKAIDO AND SAGHALIEN-XXXVII)

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Abstract. Since YOSHIDA's (1958) preliminary report, fairly numerous ammonite specimens have been collected from two localites in the Hamanaka area (eastern Hokkaido). They represent a new species of *Gaudryceras*, which is allied to *G. varicostatum* VAN HOEPEN in the septate shell but is distinguished by the persistency of *Vertebrites* type lirae up to the adult body-whorl. It was once provisionally called *Vertebrites* aff. *kayei* (FORBES), but it has the typical pattern of *Gaudryceras* suture and is distinct from *V. kayei* in its shell-form and surface ornamentation. This new species occurs in a sandstone bed belonging to the main part of the Akkeshi Formation [=N4] of the Nemuro Group. The ammonite-bearing bed is probably assigned to the upper part of the chronological equivalent [i.e. K6b] of the Maastrichtian in the Japanese scale.

Introduction

The Nemuro Group distributed in the eastern part of Hokkaido is chronostrigraphically interesting in that it ranges from the Campanian to Palaeocene and that the Cretaceous-Tertiary boundary should be located somewhere in the upper part of the sequence. Several species of ammonites have been reported from the group, without a full description and illustration.

This paper is to give a palaeontological description of one of the ammonite species, which occurred at two localities in the Hamanaka area. The specimens were collected on several occasions by S. YOSHIDA (in 1956), W. HASHIMOTO, S. YOSHIDA, S. KANNO etc. (in 1957), H. KIDO and T. MATSUMOTO (in 1958), and S. YOSHIDA and others (in 1963 and 1964).

Before going further, we thank Dr. Wataru HASHIMOTO, who provided us the collection of Tokyo Kyoiku Daigaku [TKD] [=Tokyo University of Education, now turned to be the University of Tsukuba] for our study, Mr. Hideo KIDO of the Japan Petroleum Exploitation Co. Ltd., Mr. Kojiro IWATA, Chairman of the Board of Education (Hamanaka-machi) and M. Tamiji ITO of Ponporoto, who helped us in the field work, Dr. Kazushige TANABE and Miss Kazuko HARA, who assisted us in preparing the plates and typescript, Dr. Ikuwo OBATA, Mr. C. W. WRIGHT, Dr. J. M. KENNEDY and Dr. M. V.

Received December 31, 1978; read October 14, 1978 at Yamagata.

HOWARTH, who kindly gave to one of us (T. M.) valuable information on some relevant species from Shikoku, New Zealand, South Africa, Europe and India, and Dr. Masayuki TASHIRO, who kindly identified some bivalve species from the ammonite bearing bed.

A part of the expenditures for this study was defrayed through the grant (No. 334043) in aid of the Ministry of Education, Science and Culture [*Monbusho*].

Note on Stratigraphy

The Nemuro Group is made up primarily of marine deposits of partly terrigenous and partly volcanogenic origin, about 3000 m thick, and stratigraphically subdivisible into six units, simply marked as units N0, N1, N2, N3, N4 and N5 in ascending order by MATSUMOTO (1970). As it is exposed for a considerable extent in eastern Hokkaido, many local formational names have been proposed by various authors, especially those of the explanatory texts of the geological maps (on scale 1 : 50,000).

The Hamanaka area, where the described ammonite species came, is in the geological map of "Kiritappu" [=Kiritap] (NAGAO et al., 1966) and the formational names in that sheet are indicated in Table 1.

Recently, KIMINAMI (1975-76) has accomplished an interesting sedimentological investigation of the Nemuro Group and also (1978) summarized its lithostratigraphy. His scheme in general agrees with MATSUMOTO's, although there are still some unsettled problems from a biostratigraphic viewpoint. Anyhow, these two schemes are also shown in Table 1, along with that of NAGAO et al.

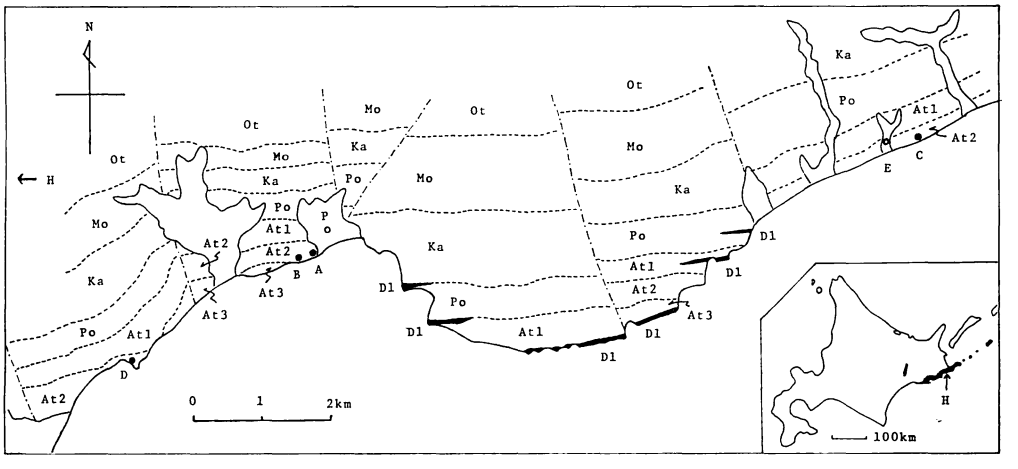
The ammonite specimens to be described in this paper were found from sandstones which are assignable to the lower member of the Akkeshi Formation of KIMINAMI i. e. the lower part of N4 of MATSUMOTO or the lower part of Member At 2 of NAGAO et al. (see Text-

Table 1. Stratigraphic division of the Nemuro Group
F.=Formation M.=Member

	NAGAO et al., 1966		MATSUMOTO, 1970	KIMINAMI, 1978	
Nemuro Group	Kiritappu F.		N5	Kiritappu F.	
	Akkeshi F.	At 3	N4	Tokotan F.	
		At 2		Akkeshi F.	Upper M.
					Middle M.
					Lower M.
		At 1	N3	Hamanaka F.	
	Poroto F.			Oborogawa F.	
	Karikan F.		N2	Monshizu F.	
	Monshizu F.				
	Otamura F.		N1	Otamura F.	
	(not exposed)		N0	Nokkamappu F.	

fig. 1). The Akkeshi Formation [N4] consists mainly of mudstone and sandstone alternating in various grades of thickness. In the eastern part of the outcropping area of the group, i. e., from Nemuro through Hamanaka to Akkeshi, slump structures are characteristically developed in the formation. One of the two fossil localities at Ponporoto, indicated as A in Fig. 1, is in a less disturbed bed of sandstone, but the other, indicated as B, about 250 m west of loc. A, is in a sandstone (of similar lithology) within the contorted sediments. The contained sandstone is contemporary with the host mudstone of the same formation and not derived from the underlying formations, as KIMINAMI (1975-76; 1978) discussed at length. The slump structures can be interpreted to have been caused by frequent intrusions of dolerite sills into the N0 to N4 formations, which took place when the sediments were unconsolidated and still contained much water, as suggested by pillow structures in the dolerite (see YAGI, 1968). The slump structures are absent or infrequent in the western area where the dolerite is poorly developed.

Among the guide species from the Nemuro Group, *Inoceramus* (*Sphenoceramus*) *schmidti* MICHAEL from N0 indicates K6a (Campanian) stage, *Inoceramus* (*Endocostea*) *shikotanensis* NAGAO and MATSUMOTO from N1 the lower K6b (probably the lowest part of the Maastrichtian), *Inoceramus* (s. l.) *kusiroensis* NAGAO and MATSUMOTO and *Pachydiscus* sp. from N2 mid-K6b (somewhere in Maastrichtian), and *Zelandites varuna japonica* MATSUMOTO and "*Pachydiscus subcompressus obsoletus* MATSUMOTO" from the upper part of the Senposhi Formation (either upper N3 or lower N4) the upper K6b.



Text-fig. 1. Geological map of the coastal area of Hamanaka, eastern Hokkaido (terrace deposits omitted)

Symbols of the formations (F.) in ascending order——Ot: Otamura F., Mo: Monshizu F., Ka: Karikan F., Po: Poroto F., At1-At3: Akkeshi F. (subdivided into three parts), Dl: Dolerite sill. Place names.——E: Esashito, H: Hamanaka (s. str.), P: Ponporoto. Ammonites localities A-D indicated by small solid circles. Inset at the lower right corner map of Hokkaido indicating the location of Hamanaka with H and the outcropping Nemuro Group with solid black.

On the other hand, N5 is certainly of Palaeocene age on the evidence of planktonic foraminifers from it [locally called the Chipomanai or the Kiritappu Formation] (ASANO, 1962; YOSHIDA, 1967). Therefore, the ammonites from the Akkeshi Formation [N4] must represent the upper part of the Maastrichtian equivalent (i. e. K6b) in the Cretaceous of Japan.

In addition to the gaudryceratid ammonite to be described below, YOSHIDA once collected an example of another ammonite species referable to "*Pachydiscus subcompressus obsoletus*" from the same member At 2 at a locality (C in Fig. 1) near Esashito about 8.5 km east of Ponporoto. The benthonic foraminifers from At 2 show an Upper Cretaceous faunal affinity and some species of them are common with those from At 3 (YOSHIDA *in* NAGAO et al., 1966, table 2). No planktonic foraminifer has been detected from the Akkeshi Formation of the Hamanaka area. ASANO (1962) once reported the occurrence of Danian planktonic foraminifers, *Globigerina compressa* PLUMMER, *G. daubjergensis* BRONNIMANN, *G. pseudobulloides* PLUMMER and *G.* cf. *triloculinoides* PLUMMER, from N4 [locally called the Choboshi Formation] at Ochiishi (southwest of Nemuro), but some ammonites have been found by us from the same member. ASANO's foraminifer specimens have not been illustrated and are now unfortunately missing, and no planktonic foraminifers have subsequently been detected from the same member. This is a questionable point, although Ochiishi is located outside of the Hamanaka area.

Palaeontological Description

Subclass Ammonoidea

Order Lytoceratida

Family Gaudryceratidae SPATH, 1927

Genus *Gaudryceras* DE GROSSOUVRE, 1894

Type-species:—*Ammonites mitis* HAUER, 1866 (designated by BOULE, LEMOINE and THÉVENIN, 1906, p. 11).

Remarks: — At present we follow WRIGHT and MATSUMOTO, 1954, in regarding *Neogaudryceras* SHIMIZU, 1934 (with type-species *G. tenuiliratum* YABE) as a synonym of *Gaudryceras*. The extremely fine lirae on the ventral part which are branched from and also inserted between the less fine lirae on the umbilical shoulder and inner lateral part of the whorl at the immature stage is one of the characteristic features of the subgroup of *G. tenuiliratum*, but was not mentioned by SHIMIZU. This character, which can be called the *Vertebrites*-like ornament, is not recorded with respect to *G. mite* and allied species. In *G. teuuiliratum*, it occurs in a limited period of the immature stage and is hardly observable unless the outer whorl is taken off. Therefore, it would be practically unwise to separate *Neogaudryceras* from *Gaudryceras* on this account. This *Vertebrites*-like ornament does appear in several species of *Gaudryceras* and very remarkably so (almost throughout growth) in the new species to be described below. In other words, this species could represent a subgenus of *Gaudryceras*, should the genus *Gaudryceras* be divided into subgenera on sufficient grounds. In this paper, however, we would not dare to propose the subgenus.

Gaudryceras hamanakense sp. nov.

Pl. 10, Figs. 1-3, Pl. 11, Figs. 1-2; Text-fig. 2.

Material:—Holotype, GK. H5873, consisting of the complementary two pieces.

i. e. (a) internal mould *plus* most of the shell and (b) external mould with some attached pieces of the shell, in calcareous sandstone obtained by H. KIDO and T. MATSUMOTO (1959-8-13) at point KU1056 of loc. A of Ponporoto, Hamanaka, eastern Hokkaido. Paratypes, YU. C7615-C7622 (coll. S. YOSHIDA), 4 specimens of TKD. 30480-30483 (coll. W. HASHIMOTO, S. YOSHIDA, S. KANNO, etc.) and GK. H5874 (Coll. KIDO and MATSUMOTO from point KU1057), GK. H5875 and H5876 (coll. W. HASHIMOTO, etc.) from the same bed of the same cliff (loc. A) as the holotype.

Also a number of specimens from loc. B of Ponporoto, are comparable with those from the type-locality.

Specific characters:—Shell of moderate size at the adult stage, about 100 mm in the maximum diameter. It consists of polygyral whorls: 9 septate ones *plus* the living chamber of about 300°.

In the immature shell, up to diameter of 45 mm or so, the shell is evolute, only the ventral part of the inner whorl being overlapped by the outer one, and has a wide umbilicus, which occupies about or even a little more than 50 percent of the entire shell diameter. The whorl is much broader than high at the early stage (e. g. B/H=2.0), increasing more rapidly in height with growth, and at or near the last part of the septate shell, at diameter of 55 mm or so, it is slightly broader than high (with B/H approximately 1.1). The whorl-section changes from a depressed crescent to a subcircular outline. It is broadest at a point somewhat below the middle of the whorl-height.

The last whorl increases moderately rapidly in height, becoming higher than broad, with a more narrowly arched venter, gently convex flanks and abruptly rounded umbilical shoulders. It overlaps about one third to nearly a half of the next inner whorl.

Constrictions are frequent mainly in the second whorl following the nepionic constriction. They are marked fairly regularly on the internal mould of the main part of the septate shell, numbering 4 per whorl. Each of them is accompanied behind by the rib, which is raised when the shell material is preserved. It runs obliquely forward around the umbilicus, especially remarkably so at about the umbilical shoulder, is slightly prorsiradiate on the main part of the flank, showing a gentle sinuosity, and crosses the venter with some convexity.

On the living chamber, the constrictions or the major ribs are of nearly the same frequency in its earlier part as in the preceding septate part, but becomes more frequent in its later part, numbering 4 within the last quarter whorl.

The surface of the shell is ornamented with numerous lirae which run in parallel with the constrictions. On the main part of the septate shell the lirae are sharp-headed and distinct on the umbilical wall, being separated by somewhat wider interspaces. At or near the umbilical shoulder somewhat finer intercalary lirae appear between the longer and more distinct ones. These lirae become finer and less raised as they go outwards and bifurcate on the flank, where they are intercalated by still more lirae. Thus, on the ventral part the surface of the shell has numerous, dense, extremely fine lirae. The number of the lirae are, for instance, in the last portion of the septate whorl within the distance (at mid-flank) as long as the whorl-height, about 12 on the umbilical wall, becoming as large as 120 on the venter. That is, the extremely fine lirae on the ventral part are about ten times as numerous as the lirae around the umbilicus. The lirae are well observable on the surface of the outer shell

layer but scarcely or hardly discernible on the inner shell layer. They are not impressed on the internal mould.

The outer surface of the shell of the living chamber has the same kind of lirae as above and the major ribs are covered with these fine lirae. Those on the umbilical wall are fairly coarse and may be very faintly impressed on the internal mould, but those on the ventral surface are kept extremely fine, dense and numerous.

Suture is of the same pattern as that of *Gaudryceras tenuiliratum* YABE (compare Fig. 2 of this paper with fig. 1e in MATSUMOTO, 1942).

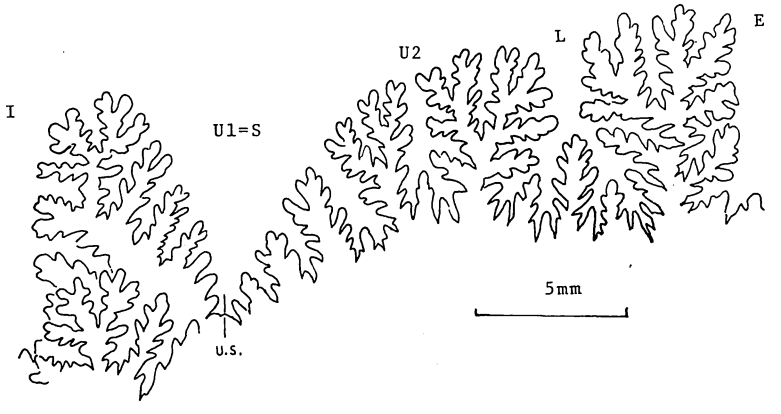
Remarks:—The living chamber of the holotype is somewhat secondarily compressed and partly detached. Other specimens of similar sizes (TKD. 30480, TKD. 30482, GK. H5875 and GK. H5876) have also a more or less deformed living chamber. The septate whorls of these specimens are not deformed.

YU. C7615 (Pl. 10, Fig. 2) is nearly as completely preserved as the septate part of the holotype, in showing the characteristic lirae and other features. Other specimens of similar or smaller sizes have less well preserved outer shell layers or are represented by internal moulds.

Even in the septate stages, there is some variation in the growth-rate of the whorl. For example, YU. C7616 and C7617 show a slightly slower growth and, accordingly, a wider umbilicus than YU. C7615 and GK. H5873 of the corresponding size. Whether the variation is normal or bimodal is not determined from the available number of specimens (see Table 2).

Table 2. Measurements (in mm.) of *G. hamanakense* sp. nov.

Specimen	Diameter	Umbilicus	Height	Breadth	B./H.
GK. H5873 (septate part)	55.0(1)	26.5(.48)	17.8(.32)	19.8(.36)	1.11
YU. C7615	59.0(1)	27.8(.47)	18.7(.31)	20.5(.34)	1.10
YU. C7616 (−60°)	57.0(1)	28.4(.50)	17.0(.29)	20.0(.35)	1.17
YU. C7617	53.5(1)	25.7(.48)	17.4(.32)	19.7(.37)	1.13
〃 (−90°)	46.0(1)	23.0(.50)	14.5(.31)	16.4(.35)	1.13



Text-fig. 2. *Gaudryceras hamanakense* sp. nov.
Suture at diameter=38.5 mm of an immature specimen, TKD. 30481. (T. M. *delin.*)

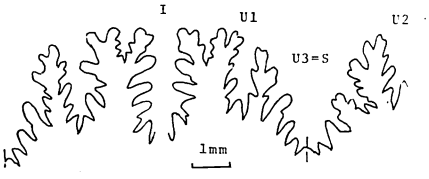
Comparison and discussion:—The immature shell of the present species resembles the holotype of *Gaudryceras varicostatum* VAN HOEPEN (1921, p. 7, pl. 2, figs. 10-12, text-figs. 3, 4), from Pondoland (South Africa) in its shell-form, constrictions, surface ornamentation and sutures.

According to KENNEDY (letter of 1978-8-9 in response to T. M.'s inquiry), HOEPEN's holotype is immature and the adult stage of the same species is represented by the holotype of *Gaudryceras cinctum* SPATH (1922, p. 118, pl. 9, fig. 3), which has stronger, coarser and more flexuous lirae on the outer whorl than those of the immature *G. varicostatum*. Thus, in the adult shell the specific distinction between *G. varicostatum* and *G. hamanakense* is clearly shown.

Gaudryceras tenuiliratum YABE, 1903, from the Coniacian and Santonian (and also Lower Campanian) of Japan and other areas of northern Pacific region, resembles the present species with respect to the character of the lirae on the immature whorl, but its outer whorls have not so much multiplied, extremely fine lirae on the ventral part as in the present species. Normally *G. tenuiliratum* has a narrower umbilicus than the present species. A form called var. *ornata* by YABE (1903, p. 24, pl. 3, fig. 2) is as widely umbilicate as the present species in the immature shell, but it has the same type of outer whorl as the normal form of *G. tenuiliratum*. In other words, *G. varicostatum* VAN HOEPEN emend KENNEDY may be closely related to nearly contemporary *G. tenuiliratum* through this variety. The species called *G. tenuiliratum* by JONES (1963, p. 26, pl. 10, figs. 1-3), from the Zone of *Pachydiscus kamishakensis* of southern Alaska, is distinct from true *G. tenuiliratum* and *G. hamanakense* in its coarser ribbing on the adult shell. Incidentally, the specimen from the Urakawa area illustrated by YOKOYAMA (1890, pl. 18, fig. 12) under *Lytoceras sacya* was designated as the lectotype of *G. tenuiliratum* (see MATSUMOTO, 1963, p. 29; also JONES, 1963, p. 28). It is preserved in Münich.

The present species was once provisionally called *Vertebrites* aff. *kayei* (FORBES) (MATSUMOTO, 1970). Depite the *Vertebrites*-like surface ornamentation, the assignment of the present species to *Vertebrites* was incorrect. As is well shown by *V. murdochi* MARSHALL, 1926, the type-species of *Vertebrites*, the internal suture of this genus is dissimilar to that of *Gaudryceras* in having an independent pair of lobes (U1) between I and obliquely descending lobules of a suspensive lobe (U3=S). In addition to the original illustration of MARSHALL (1926, pl. 20, fig. 9a), another figure is shown here (Text-fig. 3) in comparison with the suture of the present species (Text-fig. 2).

Ammonites kayei FORBES, 1846 was established on a number of syntypes (see KOSSMAT, 1895, p. 124). The specimen illustrated by FORBES (1846, p. 101, pl. 8, fig. 3) [BM. C. 51050] is a small, probably immature specimen. Dr. M. V. HOWARTH (letter of 1978-10-18) wrote, in response to the inquiry from one of us (T. M.), that this specimen shows the *Vertebrites*



Text-fig. 3. *Vertebrites murdochi* MARSHALL
Internal suture at whorl-height=3.6 mm, breadth=7.0mm of the specimen C.W.W.N.Z. 27. (T. M. *delin.*)

type internal suture. It was erroneously indicated as holotype by MATSUMOTO (1959, p. 146), but is designated here as the **lectotype** of *Vertebrites kayei* (FORBES). Another, larger syntype [BM. C 51049] illustrated by KOSSMAT (1895, pl. 17, fig. 2a, b) is, according to PHILLIPS (1977) and HOWARTH, a more grown example of the same species. The specimens of *G. hamanakense* as large as this KOSSMAT's figured one are distinguished in having more rounded whorls, with less angular umbilical shoulders and the maximum breadth somewhat above (but not at) the umbilical shoulder. On the umbilical wall and shoulder the lirae are much finer in KOSSMAT's specimen than in *G. hamanakense* of the corresponding size.

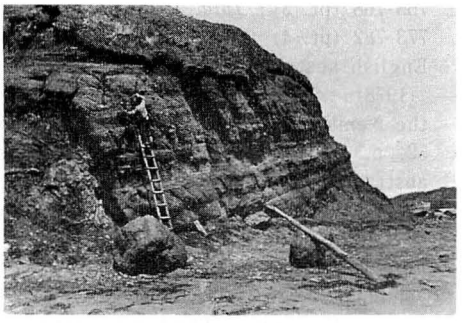
Unless the internal suture is examined it seems us to be difficult to identify *Vertebrites kayei* on small, probably immature specimens. Despite the unclear definition, many ammonites have been reported under this specific name from various regions. They need restudy, although some of them (e. g. examples from the Lower Maastrichtian of Madagascar, such as COLLIGNON, 1956, pl. 6, fig. 5) may be correct.

Lytoceras (*Gaudryceras*) *coalingense* ANDERSON (1958, p. 184, pl. 68, fig. 1) and *L.* (*G.*) *birkhauseri* ANDERSON (1958, p. 185, pl. 68, fig. 4), from the Maastrichtian equivalent of California, were once included by MATSUMOTO (1959, p. 146) in *G.* (*V.*) *kayei* currently understood at that date. They somewhat resembles *G. hamanakense*, but if we examine the lirae on the outer shell layer which is partly preserved on the holotypes of these ANDERSON's species, we notice a distinction. The lirae of our species are coarser at and near the umbilical shoulder but distinctly finer on the outer part of the whorl, with more intercalation and bifurcation than those of the California species. In other words, the California form is closer to *V. kayei*, although its internal suture has not been examined. The possibility that it may represent a geographical subspecies of *V. kayei* still remains.

A fragmentary ammonite from the Shimantogawa Group (Furumugi Formation) at Mugi (Shikoku), which OBATA (*in* SUYARI et al., 1967) called *G.* (*Vertebrites*) sp. cf. *G.* (*V.*) *kayei* (FORBES), likewise, shows the *kayei* type lirae, which are less coarser near the umbilical shoulder and less finer on the outer part than those of *G. hamanakense*. Incidentally this specimen seems to have a *Vertebrites* type internal suture, although much eroded.

Gaudryceras crassicostatum (JIMBO) (1894, p. 36, pl. 6, fig. 7) (YABE, 1903, p. 29, pl. 4, fig. 4), from the Campanian of Soya (northern Hokkaido), has the living chamber which is similar to that of the present species, but its major ribs become thicker than in the latter. Its inner whorls are as polygyral and as evolute as in the present species, but less broader and have less rounded umbilical shoulder than in the latter. Again the lirae of *G. crassicostatum* are less coarser near the umbilical shoulder and less finer on the ventral part than those of the present species.

Occurrence:—Two localities, indicated as A and B on the map of Text-fig. 1, which are cliffs at Ponporoto, Hamanaka-machi [previously Hamanaka-mura], Akkeshi-gun, eastern Hokkaido. A is the type-locality situated at 49°8′47″ N, 145° 9′59″ E, where the described ammonites occurred commonly in a sandstone bed, either in the contained calcareous nodules or in the calcareous part of the sandstone, exposed in the upper part of the outcropping beds (Text-fig. 4). This locality was numbered 7688 by W. HASHIMOTO. KIDO



Text-fig. 4. Sandstone outcrop on a cliff of loc. A at Ponporoto. A man is handling the ammonite bearing bed at point KU 1056. A fault cuts the bed near the western (left) end of this picture and a slump structure is partly shown on its west side. (S. Y. photo)

and MATSUMOTO distinguished samples KU. 1055 - KU. 1060 within this bed, of which the holotype was from KU. 1056, near the western end of the outcropping sandstone bed (i. e. the point where a man is handling in Text-fig. 4). At loc. B, situated about 250 m west of loc. A, the specimens are not so well preserved as at A.

The ammonite bearing bed belongs to the lower part of At 2 defined by NAGAO et al. (1966). At 2 is the main part of the Akkeshi Formation of these authors. According to KIMINAMI (1978), who defines At 2 only as the Akkeshi Formation, the fossiliferous bed is assigned to the lower member of his Akkeshi Formation (see Table 1 and also *Note on Stratigraphy*). From the same bed occurred *Opis hokkaidoensis* UEDA, *Limopsis shimonadaensis* (ICHIKAWA and MAEDA), *Acila* (*Truncacila*) n. sp., *Izumicardia parva* ICHIKAWA and MAEDA, *Tenea japonica* ICHIKAWA and MAEDA, *Periplomya elliptica* NAGAO and OTATUME and some brachiopods (UEDA, 1963; additional identification by M. TASHIRO, letter of 1978-12-13).

Concluding Remarks

The ammonite specimens from Ponporoto of the Hamanaka area, eastern Hokkaido, represent a new species of *Gaudryceras* in the upper part of K6b (approximate time-equivalent of Maastrichtian) in Japan. This species, named *G. hamanakense* MATSUMOTO and YOSHIDA, sp. nov., is allied to *G. varicostatum* VAN HOEPEN, from the Santonian of South Africa and Madagascar, in the septate shell but has persistent *Vertebrites*-like lirae in addition to the frequent, narrow major ribs on the adult living chamber. It has, however, the typical pattern of *Gaudryceras* suture.

Species of *Gaudryceras* generally have a long stratigraphical range, extending over two or more stages, and also a wide geographical distribution. Therefore, the true vertical and horizontal range of this species should be worked out in the future. It is noted that this species has not yet been found from K6b of central Hokkaido, where different species of gaudryceratids are found, though not yet described. According to TASHIRO (letter of 1978-12-13), the bivalve species from the bed with *G. hamanakense* are also of the fauna of upper K6b (TASHIRO, 1977).

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Explanation of Plate 10

Figs. 1-3. *Gaudryceras hamanakense* sp. nov. ..... Page 68

1. Holotype, GK. H5873a, from KU1056 of loc. A (Text-fig. 1), Ponporoto, Hamanaka-machi, eastern Hokkaido (Coll. H. KIDO and T. MATSUMOTO). Lateral view of the entire shell (a), ×about 0.7; the same without the outer quarter whorl to show more completely the next inner whorl (b), ×1.
2. Paratype, YU. C7615, from the type-locality (Coll. S. YOSHIDA), two lateral (a, b) and ventral (c) views, ×1.
3. Paratype, TKD. 30481, from the type-locality (Coll. W. HASHIMOTO etc.). Lateral (a) and frontal (b) views of an inner whorl, whose suture is illustrated in Text-fig. 2.

Kyushu University photos (K. TANABE), without whitening.

2a

2b

3b

2c

1a

1b

3a

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Akkeshi (厚岸), Chipomanai (知方学), Choboshi (長節), Esashito (恵茶人), Furumugi (古牟岐), Hamanaka (浜中), Karikan (カリカン), Kiritappu (霧多布), Monshizu (門静), Mugi (牟岐), Nemuro (根室), Ochiishi (落石), Oborogawa (尾幌川), Otamura (大田村), Ponporoto (奔幌戸), Poroto (幌戸), Senposhi (仙鳳趾), Soya (宗谷), Tokotan (床潭), Urakawa (浦河)

北海道東部産のゴードリセラス科の新しいアンモナイト：道東〔北海道東部〕の根室層群からは，若干種のアンモナイトの産出が報ぜられているが，詳しい記載がない。ここにはその中の1種を記載する。それは厚岸郡浜中町奔幌戸の海崖に露出する厚岸層 At 2 (第1表及び第1図参照)から産したかなりの数の標本に基づくもので，未成年期の殻は *Gaudryceras varicostatum* VAN HOEPEN に酷似するが，成年期になっても殻表面の特徴的な *Vertebrites* 型の条線が存続することで明確に区別される。しかし縫合線は *Vertebrites* 型ではなく，典型的な *Gaudryceras* 型である。外見上から，かって本種を仮に *V.* aff. *kayei* と呼んでいたことがあるが，それは正しくない。*Ammonites kayei* FORBES は *Vertebrites* に属し，また殻形や条線の性状も，詳しく見れば本種と異なる。本種は日本におけるマストリヒチアン階上部相当層に産しているが，その真の生存期間は今後究明しなければならない。

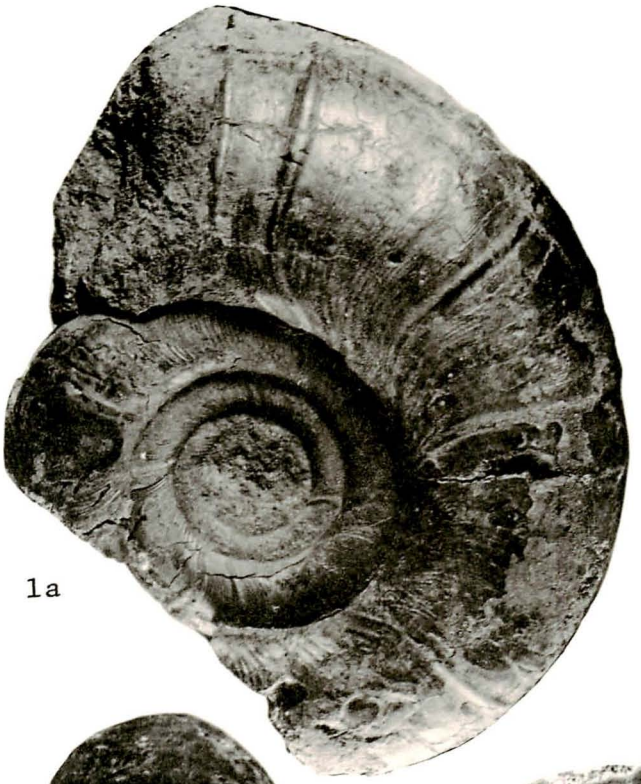
松本達郎・吉田三郎

Explanation of Plate 11

Figs. 1-2. *Gaudryceras hamanakense* sp. nov. ..... Page 68

1. Paratype, TKD. 30480, from the type-locality (Coll. W. HASHIMOTO etc.). Lateral (a) and back (b) views of an adult example, ×1.
2. Paratype, YU. C7615, from the type-locality (Coll. S. YOSHIDA). Lateral (a) and back (b) views, enlarged (× about 1.5) to show the characteristic lirae.

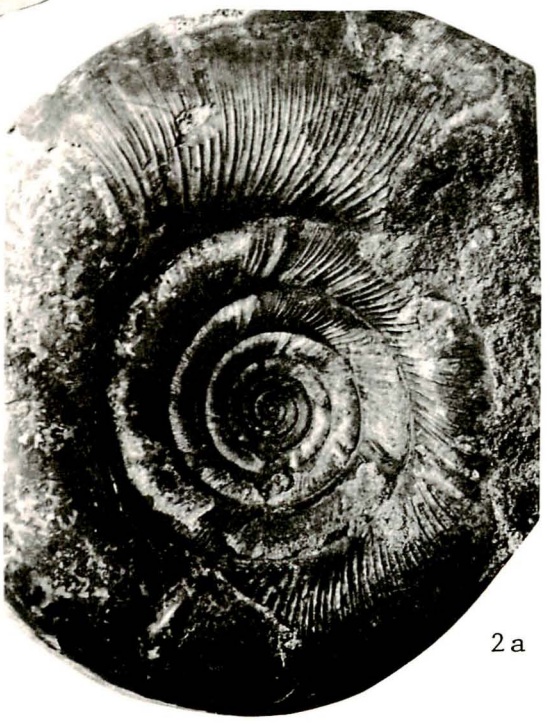
Photos by K. TANABE (1) and S. YOSHIDA (2), without whitening.



1a

1b

2b



2a

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 114, pp. 77-86, pls. 12, 13, July 15, 1979

703. TRIASSIC BRYOZOANS FROM THE HIDAKA GROUP IN HOKKAIDO, JAPAN*

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Abstract. Five bryozoan species from the Hidaka Group: *Leioclema sugiyamai* SAKAGAMI, n. sp., *Leioclema* sp. indet., *Pseudobatostomella kobayashii* SAKAGAMI, *Dyscritella hidakaensis* SAKAGAMI, n. sp. and *Dyscritella* sp. indet. are described. *Leioclema sugiyamai*, n. sp. and *Pseudobatostomella kobayashii* which was described originally from the Upper Triassic Kochigatani Series of the Sakawa basin are identical with *Batostomella* (1) and *Batostomella?* (2), respectively, both of which were recorded from the Hidaka Group by SUGIYAMA (1941). Thus the present bryozoan fauna is concluded to be Late Triassic (most probably early Carnian) in age. It is also supported by the conodont fauna associated with the bryozoans.

Introduction

In 1941, SUGIYAMA reported three forms of *Batostomella* from some localities of the Hidaka Group in Hidaka and Ishikari Provinces in Hokkaido, and he considered that these forms indicate a Permian age. Subsequently FUKADA (1949), however, on the evidence of brachiopods from one of the SUGIYAMA's bryozoan localities, concluded that the Hidaka Group belongs to the Triassic rather than the Permian.

One of the authors, SAKAGAMI (1972) described *Pseudobatostomella kobayashii* SAKAGAMI which KOBAYASHI collected from the *Oxytoma-Mytilus* beds of the Upper Triassic Kochigatani Series distributed in the Sakawa basin, Shikoku and he mentioned that *P. kobayashii* is very close to *Batostomella?* (2) which SUGIYAMA (1941) described from the Hidaka Group. At that time, SAKAGAMI suggested that the three forms of *Batostomella* recorded by SUGIYAMA may indicate to be Triassic and they should be reexamined.

On the other hand, the junior author (AS) engaged in the field survey of the areas of the upper courses of Motourakawa (river) and Kerimai (river) and collected some bryozoans and conodont remains from the limestone lenses embedded in the "Schalstein" member. In

* Received Feb. 21, 1979; read Jan. 22, 1979, at Fukuoka.

the summer of 1976, the senior author (SS) went there under the guidance of the junior author and could collect many bryozoan samples.

The present article is the result of study on the bryozoans collected at one locality in the Motourakawa and two in the Kerimai rivers.

Outline of geology and fossil localities

(by A. SAKAI)

The formation containing the bryozoan bearing limestone lenses distributed in this area has been hitherto known as the "Schalstein Formation" by TAKEUCHI and SANBONSUGI (1938), the Kerimaigawa Formation and/or Shunbetsugawa Formation by HASEGAWA and SAKŌ (1958), and the Iwashimizu Formation by MATSUSHITA and SUZUKI (1962). SAKAI (1976), however, proposed that the Naizawa Formation is most suitable for the given name, because this formation develops typically in the Naizawa valley which is one of the tributaries of Motourakawa (river).

The Naizawa Formation belongs to the *Hidaka western diabase belt* by SUZUKI (1977) and it can be distinguished from the Sorachi Group which is typically distributed in the *Kamuikotan tectonic belt*, because the fossil evidences are distinctly different from each other. The Naizawa and surrounded formations are bordered by the Cretaceous Yezo Group with thrust faults on the west, and by the Kamui Group with intrusions of the *Westernmost Hidaka serpentinite belt* on the east.

The Naizawa Formation consists mainly of basic lava, pillow lava and hyaloclastite, accompanied with chert, limestone, sandstone and mudstone, and in which many small network veins of calcite, albite, prehnite, etc. are developed.

The modes of occurrence of the bryozoan bearing limestones are as follows:

1. Motourakawa (Poronaizawa, tributary of Naizawa river)

A small limestone lens cropped out at the left side of this valley, about 4 m thick. This limestone is overlain by a thin mudstone bed (ca. 5 cm in thickness) and successively by green pillow lava, and is underlain by green hyaloclastite. The limestone consists of massive micrite, pale brownish gray to pale gray in color, includes small greenish angular hyaloclastitic fragments. The bryozoans occur in the massive part of the limestone without hyaloclastitic fragments. In this limestone, conodont remains identified with *Neogondolella polygnathiformis* (BUDUROV and STEFANOV) were found.

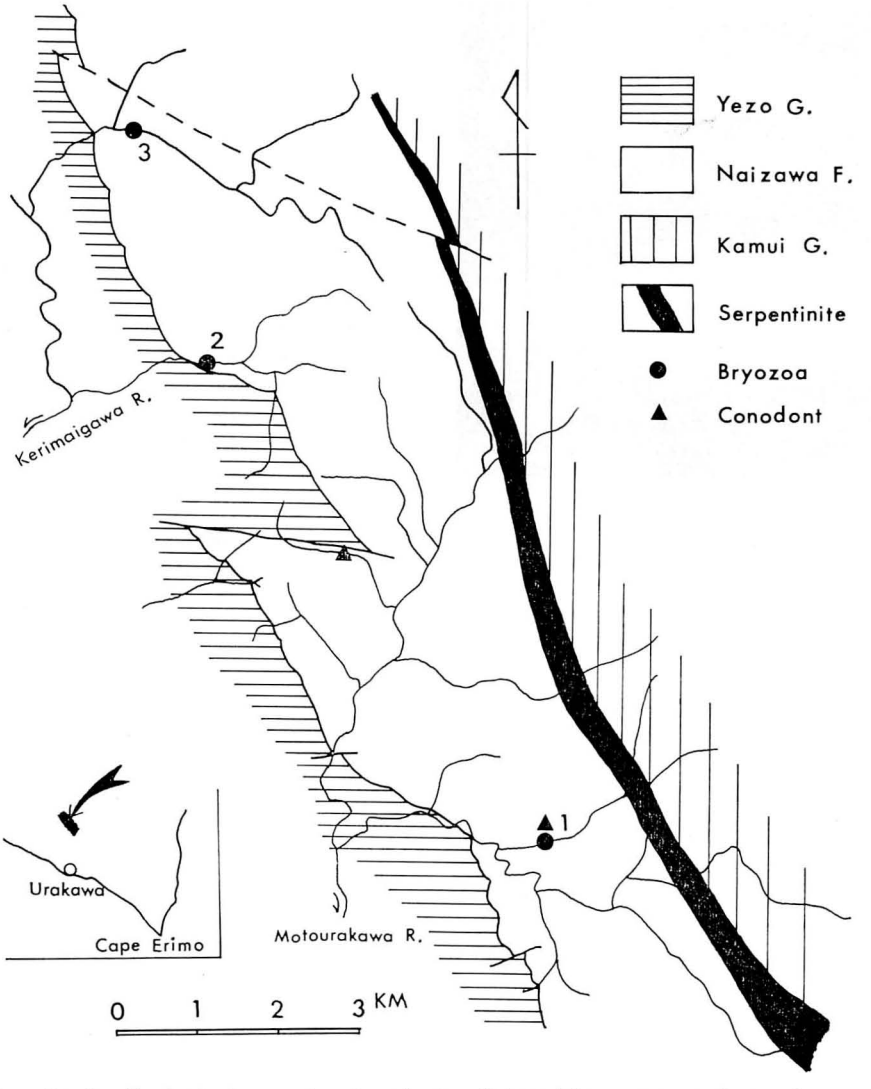
2. Kerimai (1) (Nukibetsuzawa, tributary of Kerimai river)

A small limestone lens, probably several meters thick, cropped out only at the left side of the valley, embedded in hyaloclastite bed, pale reddish brown to pale brownish gray in color, including dark reddish brown to green hyaloclastitic fragments in part. The bryozoans occur in the massive part of the limestone just like at Motourakawa.

3. Kerimai (2) (Oimatezawa, tributary of Kerimai river)

A small limestone lens, consisting of 3 to 4 m thick, cropped out at the right side of the valley, pale brownish gray to pale gray in color, contains green hyaloclastitic fragments in part. This limestone lens is embedded in hyaloclastite bed.

Further SAKAI (1976) found some conodont remains, smaller foraminifers, fish teeth, shark scales, etc. in the limestone lens located at about 4.5 km NNW of the bryozoan locality in Motourakawa (see Text-fig. 1). The conodont fauna includes *Neogondolella polygnathiformis*

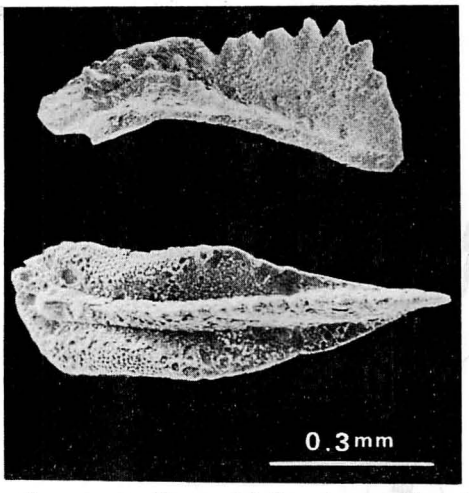


Text-fig. 1. Geological map showing the localities of bryozoans and conodonts.
1. Motourakawa, 2. Kerimai (1), 3. Kerimai (2).

(Text-fig. 2), *N. excelsa, N. navicula, Enantiognathus ziegleri,* etc. and may indicate the late Ladinian to early Carnian of Triassic age.

The tectonic and stratigraphic discussions and the conodont study in detail will be made by SAKAI in the near future.

IGO *et al.* (1974) recorded the Triassic conodonts from three localities in the Hidaka Mountains. At one of their localities situated at northern part of Nishicha (upper course of Horobetsu river), *Epigondolella abneptis* and *Enantiognathus ziegleri* were found in the grayish white chert. This chert member may be included in the Naizawa Formation of the present author but the conodont fauna indicates slightly younger



Text-fig. 2. *Neogondolella polygnathiformis* (BUDUNOV and STEFANOV) from the conodont locality in Motourakawa.

horizon than that in the limestone described here.

Bryozoans and their geologic age

(by S. SAKAGAMI)

The bryozoans reported by SUGIYAMA (1941) and their localities in the Hidaka Group are shown in Table 1.

Although the author could not reexamine the original specimens of SUGIYAMA (1941) because the depository is uncertain, from SUGIYAMA's descriptions and illustrations, it is clear that there are two common species between SUGIYAMA's and the present specimens. Namely, *Batostomella* (1) is identical with *Leioclema sugiyamai*, n. sp. and *Batostomella?* (2) is identical with the previously described species: *Pseudobatostomella kobayashii*, but *Batostomella* (3) could not be found in the present collections.

The bryozoans studied here and their localities are shown in Table 2. They are composed of one known species, 2 new and 2 indeterminable species. Among

Table 1. The bryozoans from the Hidaka Group by SUGIYAMA (1941).

Forms \ Localities	a	b	c	d
Batostomella (1)	0	0	0	0
Batostomella? (2)		0		
Batostomella (3)		0		

a: the upper course of Kerimai river, Mitsuishi-gun.
b: the upper course of Motourakawa river, Mitsuishi-gun.
c: Iwabenosawa (valley) of Shimukappu-mura, Yufutsu-gun.
d: Fujinosawa (valley) of Minamifurano-mura, Minami-sorachi-gun.

Table 2. Localities of the bryozoans in the Hidaka Group.

Species \ Localities	Motourakawa	Kerimai (1)	Kerimai (2)
Leioclema sugiyamai SAKAGAMI, n. sp. (=*Batostomella* (1) of SUGIYAMA (1941))	0		0
Leioclema sp. indet.		0	
Pseudobatostomella kobayashii SAKAGAMI (1972) (=*Batostomella?* (2) of SUGIYAMA (1941))	0	0	
Dyscritella hidakaensis SAKAGAMI, n. sp.		0	
Dyscritella? sp. indet.	0	0	

them, the known species: *Pseudobatostomella kobayashii* SAKAGAMI was originally described from the lower Carnian (Upper Triassic) of the Sakawa basin as already mentioned. *Leioclema sugiyamai*, n. sp. is nearest to *Leioclema abnorme* MOROZOVA which was described from the Carnian of the northwestern part of Caucasus and *Dyscritella hidakaensis*, n. sp. differs from the previously described species of the genus. In these circum-

stances, the present bryozoan fauna is considered to be most probably early Carnian of Late Triassic in age.

As already mentioned by SAKAGAMI (1972), the bryozoan remains are extremely rare in the Triassic System of the world, and he recognized only 32 species of the Triassic bryozoans by that time. After that, YANG and HSIA (1975) described and illustrated five species of the genus *Paralioclema* from the Everest regions. They are *Paralioclema multus* YANG et HSIA, *P. paucus* Y. et H., *P. pilula* Y. et H., *P. lioclemaformis* Y. et H. and *P. tulungense* Y. et H., which occurred from the upper part of the Tûlung Formation (Triassic) except for the last one from the middle part of the Tûlung. The genus *Paralioclema* was established by MOROZOVA (1960), but it may be a junior synonym of the genus *Leioclema* ULRICH.

Further BIZZARINI and BRAGA (1976, 1978) reported and described some Triassic cyclostomatous bryozoans from the S. Cassiano Formation (Upper Triassic) of the Dolomites (Eastern Alps), northern Italy. They consist of seven species in all: "*Ceriopora*" *gnemidium* (KLIPSTEIN), "C". *montisspeciei* BIZZARINI et BLAGA (n. sp.), "C". sp. 1, "C". sp, 2, *Seelandia annosciai* B. et B. (n. gen. and n. sp.), *S. lagaaiji* B. et B. (n. gen. and n. sp.) and *Cassianopora giulinii* B. et B. (n. gen. and n. sp.), but the newly established two genera were described as "*Incertae sedis*" in Cyclostomata.

Depositories: The specimens treated in the present article are registered and preserved in the Collections of Department of Earth Sciences, Faculty of Science, Chiba University (DESC).

The holotype and paratypes of *Pseudobatostomella kobayashii* SAKAGAMI which SAKAGAMI (1972) described and illustrated from the Sakawa basin are also registered and preserved in the Collections of DESC from the Ehime University Collections (EEG) as follows:

EEG-1001 (holotype) — DESC-79001
EEG-1002 (paratype) — DESC-79002
EEG-1003 (paratype) — DESC-79003
EEG-1004 (paratype) — DESC-79004
EEG-1005 (paratype) — DESC-79005
EEG-1006 (paratype) — DESC-79006

Systematic description of Ectoprocta (Bryozoa)

(by S. SAKAGAMI)

Genus *Leioclema* ULRICH, 1882

Leioclema sugiyamai SAKAGAMI, n. sp.

Pl. 12, Figs. 1-5.

1941. *Batostomella* (1) SUGIYAMA, pp. 190, 191, figs. 1-3.

Zoarium ramose, probably attached to foreign substance such as brachiopod shell, its diameter ranging from 2 mm to 5 mm.

In longitudinal section, zooecial tubes trend parallel to longitudinal direction of zoarium in immature region, curved gradually outward and making a right angle with surface. Zooecial wall thickened gradually from immature to mature regions and the boundary between these two regions indistinct. Diaphragms occur abundantly in zooecia and mesoecia, spaced at intervals of usually about 0.100 mm in average, ranging from 0.040 to 0.150 mm, very thin, complete and nearly straight or slightly concave.

In tangential section, zooecial tubes rather small, circular to subcircular, the shorter diameter ranging from 0.095 to 0.125 mm, longer diameter ranging from 0.125 to 0.156 mm, irregularly arranged but usually 7 zooecia in 2 mm length of longitudinal direction. Mesoecia circular

to subcircular, ranging from 0.045 to 0.095 mm in diameter. Acanthoecia also well developed, usually 4 to 5, occasionally 6 surrounding each zooecial tube, surrounded by concentric fibrous dark dense tissue, segregated from zooecial wall material, the outside diameter ranging from 0.040 to 0.070 mm and inside diameter ranging from 0.010 to 0.015 mm.

Remarks:—The present species coincides with *Batostomella* (1) which SUGIYAMA (1941) described and illustrated from four localities in the Hidaka Group of Hokkaido. SUGIYAMA stated that "Diaphragms irregular in density, but rare, ...". However, the careful observation of the present specimens made clear that many diaphragms are regularly arranged, but in some cases, some diaphragms had fallen off because they are very thin and fragile.

The present species seems to be nearest to *Paralioclema abnorme* which MOROZOVA (1969) described from the Carnian of the northwestern part of Caucasus, but the present species differs from that in the smaller zooecial diameter and the mode of curvature of zooecial tubes from immature to mature regions.

The specific name, *sugiyamai* is dedicated to the late Dr. Toshio SUGIYAMA who introduced originally the occurrence of bryozoans including the present species from the Hidaka Group.

Occurrence: — Very abundant in the Kerimai (2) and rare in Motourakawa.

Specimen No.:—DESC-79018 (holotype), DESC-79019, DESC-79020 (Kerimai (2)); DESC-79009a (Motourakawa).

Leioclema sp. indet.

Pl. 12, Fig. 8.

Zoarium probably ramose, about 1.5 to 2 mm in diameter.

In longitudinal section, zooecial tubes trend parallel to longitudinal direction of zoarium in immature region, curved gradually outward and making nearly a right angle with surface. Zooecial wall thin in immature region and becoming gradually thick to mature region. Usually only one diaphragm disposed at nearly proximal part of mature zone of zooecial tube, thin, complete and nearly straight. Diaphragms in mesoecia seem to be more numerous, spaced at intervals of less than 0.010 mm.

In tangential section, zooecial tubes circular or subcircular, the shorter diameter 0.100 to 0.125 mm, longer 0.125 to 0.150 mm. Mesoecia numerous, trigonal or quadrate with rounded corners, usually 0.025 to 0.050 mm in diameter. Acanthoecia present but not so prominent, surrounded by dark colored concentric fibrous tissue, the outside diameter usually less than 0.050 mm and inner about 0.006 mm, usually disposed at each point of intersection of zooecial tubes.

Remarks:—The present form can be easily distinguished from *Leioclema sugiyamai*, n. sp. by the smaller zoarium, fewer number of diaphragms in zooecial tube, less developed acanthoecia and other essential characters. The present form is not unlike to *Paralioclema formosum* MOROZOVA (1969) which was described from the Norian of the northwestern part of Caucasus but is not identical. Because of only two oblique sections at hand, the detailed comparison with the previously described species of the genus and the specific decision are deferred until more specimens accumulate.

Occurrence:—Rare in Kerimai (1).

Specimen No.: — DESC-79012a and DESC-79010.

Genus *Pseudobatostomella* MOROZOVA, 1960

Pseudobatostomella kobayashii SAKAGAMI

Pl. 12, Figs. 6,7; Pl. 13, Figs. 1, 2.

1941. *Batostomella?* (2) SUGIYAMA, p. 191, figs. 4, 5.
1972. *Pseudobatostomella kobayashii* SAKAGAMI, pp. 275-277, pl. 33, figs. 1-6.

Zoarium ramose, usually about 4 to 5 mm in diameter.

In longitudinal section, zooecial tubes trend parallel to longitudinal direction of zoarium in immature region, curve gradually outward at posterior end of mature tube, then straighten in mature region and making large angle with surface. Zooecial wall very thin in immature region and gradually thickened to mature region. Usually 2 to 3 very thin diaphragms usually disposed at intervals of 0.6 to 1.0 mm, but in some cases, disposed more densely.

In tangential section, zooecial tubes subangularly oval, their shorter diameter usually ranging from 0.150 to 0.185 mm and longer diameter ranging from 0.185 to 0.250 mm. Mesoecia rare, usually circular, their diameter ranging from 0.050 to 0.100 mm. Acanthoecia well developed, usually 5 to 6 surrounding each zooecial tube, surrounded by concentric fibrous tissue, outside diameter usually 0.040 to 0.080 mm, and inner diameter very small, less than 0.005 mm.

Remarks:—The present form agrees with *Pseudobatostomella kobayashii*, which SAKAGAMI (1972) described from the *Oxytoma-Mytilus* beds (lower Carnian) of the Sakawa basin, Shikoku of Japan, in all of the essential characters. The preservation is better than the type specimens from the Sakawa. At that time, SAKAGAMI (1972) pointed out that *Pseudobatostomella kobayashii* resembles *Batostomella?* (2) which SUGIYAMA (1941) described in association with two other forms of *Batostomella* from the upper course of Motourakawa. One of the locality of the present form may be the same with the SUGIYAMA's *B.?* (2) locality, and the present form undoubtedly coincides with *Batostomella?* (2).

Although, in SUGIYAMA's description, it was stated that the diaphragm is probably absent, his photographic illustrations show that there are two diaphragms in a zooecial tube. Unfortunately I could not reexamine SUGIYAMA's bryozoan specimens, but I am of the opinion that *Batostomella?* (2) should be included in the *Pseudobatostomella kobayashii*.

Occurrence:—Very abundant in Motourakawa and rare in Kerimai (1).

Specimen No.: — DESC-79007, DESC-79008, DESC-79009b (Motourakawa); DESC-79014 (Kerimai (1)).

Genus *Dyscritella* GIRTY, 1911

Dyscritella hidakaensis SAKAGAMI, n. sp.

Pl. 13, Figs. 3-5.

Zoarium ramose, its diameter about 5.5 mm.

In longitudinal section, zooecial tubes trend parallel to longitudinal direction of zoarium, nearly straight but slightly curved outward and making a large angle with surface. Zooecial wall relatively thick in immature region and thickened gradually to mature region. Diaphragm lacking in almost of zooecial tubes but in one case, one complete diaphragm can be observed at the proximal part of mature region of zooecial tube.

In tangential section, zooecial tube irregularly formed, amoeba like shaped in extreme cases, the diameter measured about 0.180 to 0.250 mm. Mesoecia probably absent. Acanthoecia well developed, surrounded by concentric fibrous tissue, less than 0.015 mm in inner diameter,

irregularly arranged in wall, usually 5 to 6 disposed at wall margin where zooecial tube angularly shaped.

Remarks:—Only one species of the genus *Dyscritella* has been hitherto known from the Triassic in the world. It is *Dyscritella agischevi* which NEKHOROSHEV (1949) described from the Norian of the Kolyma river basin, Siberia, USSR. The present form can be distinguished from *D. agischevi* in many respects, especially by the peculiar form of zooecial tube in the tangential section, which is the most conspicuous character of the present new species.

Occurrence:—Rare in Kerimai (1).

Specimen No.:—DESC-79013 (holotype) and DESC-79012b.

Dyscritella sp. indet.

Pl. 13, Fig. 6.

Zoarium ramose, about 2 mm in diameter.

Zooecial tubes trend parallel to longitudinal direction of zoarium in immature region, curved gradually outward and making a large angle with surface. Zooecial wall gradually thickened from immature to mature regions. Diaphragm lacking. Zooecial tubes oval, 0.100 to 0.150 mm in shorter diameter. Mesoecia small and very rare, less than 0.050 mm in diameter. Acanthoecia well developed, irregularly arranged in wall, surrounded by concentric fibrous tissue, the outside diameter ranging from 0.030 to 0.045 mm, inner diameter very small and not measurable.

Remarks:—The present form apparently differs from the previously described species: *D. agischevi* and *D. hidakaensis*, n. sp. However, the specific denomination must be reserved, because only a few oblique sections at hand are too poor for specific identification.

Occurrence:—Rare in Motourakawa and Kerimai (1).

Specimen No.:—DESC-79010, DESC-79011, DESC-79015 and DESC-79017.

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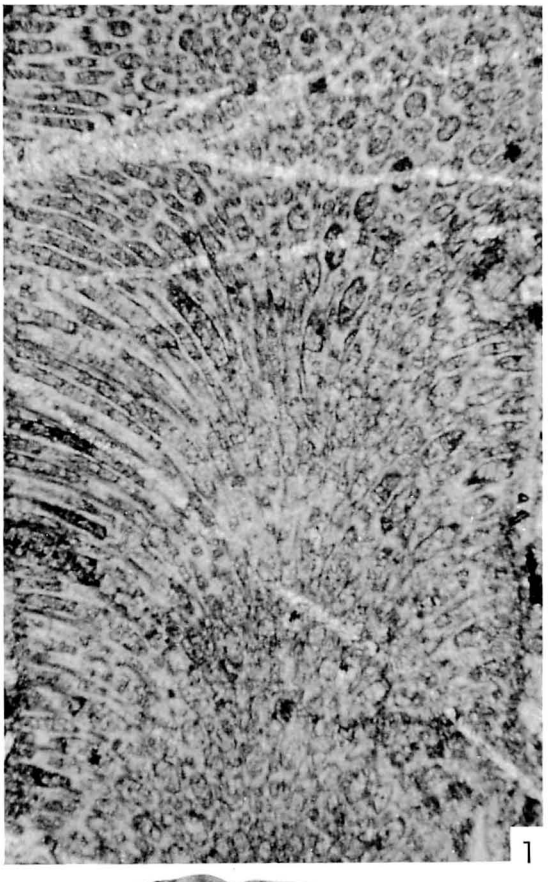
Explanation of Plate 12

Figs. 1-5. *Leioclema sugiyamai* SAKAGAMI, n. sp.
1. Obliquely but nearly longitudinal section, holotype (No. DESC-79018), ×20, Loc.: Kerimai (2), 2. Tangential section, paratype (No. DESC-79009a), ×20, Loc.: Motourakawa, 3, 4. Enlarged longitudinal and tangential parts of Fig. 1, respectively, ×60, 5. Enlarged part of another section, paratype (No. DESC-79020), showing the well developed acanthoecia, ×60, Loc.: Kerimai (2).

Figs. 6, 7. *Pseudobatostomella kobayashii* SAKAGAMI
6. Transverse section (No. DESC-79008), ×20, Loc.: Motourakawa, 7. Longitudinal section (No. DESC-79014), ×20, Loc.: Kerimai (1).

Fig. 8. *Leioclema* sp. indet.
Oblique section (No. DESC-79016), ×20, Loc.: Kerimai (1).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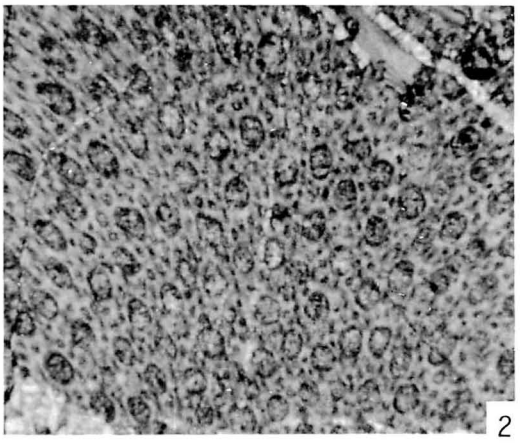
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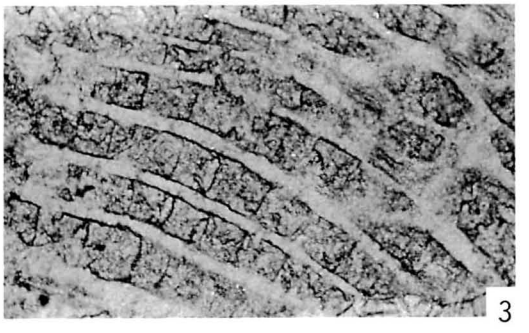
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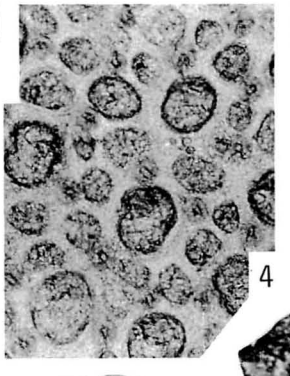
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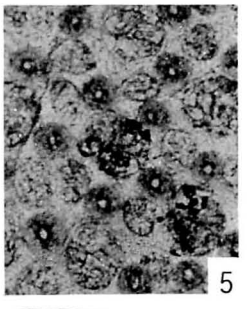
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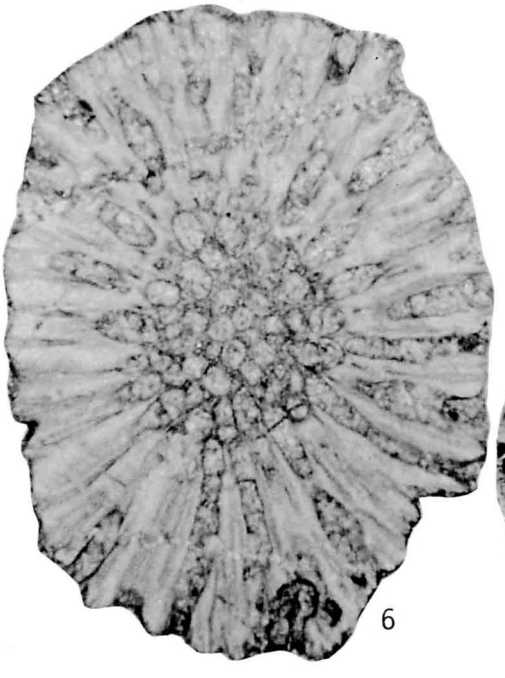
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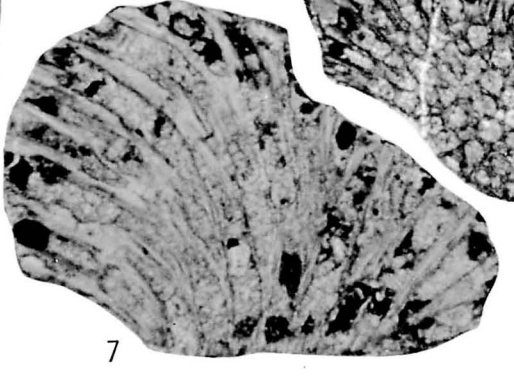
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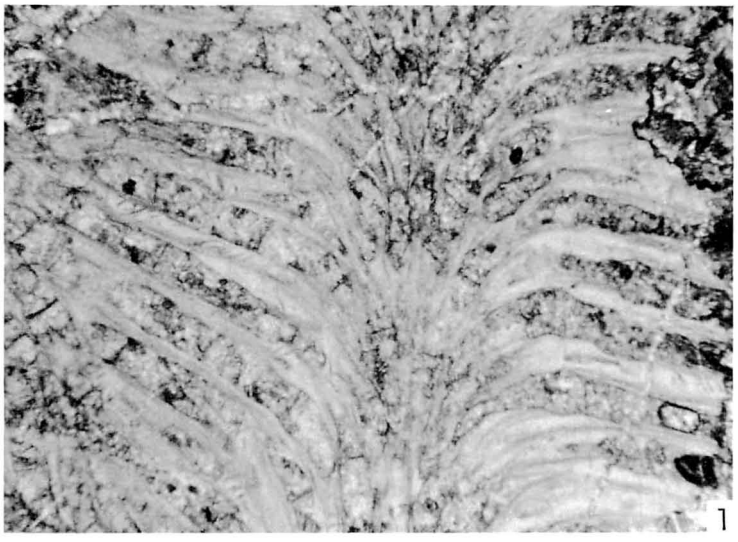
北海道日高層群産の三畳紀こけ虫化石：日高層群産のこけ虫化石5種, *Leioclema sugiyamai* SAKAGAMI, n. sp., *Leioclema* sp. indet., *Pseudobatostomella kobayashii* SAKAGAMI, *Dyscritella hidakaensis* SAKAGAMI, n. sp., *Dyscritella* sp. indet. を記載した。*Leioclema sugiyamai*, n. sp. と佐川盆地の上部三畳系河内ケ谷統から原記載された *Pseudobatostomella kobayashii* は杉山 (1941) が日高層群から報告した *Batostomella* sp. (1) と *Batostomella?* sp. (2) にそれぞれ同定される。このような観点から，こゝに報告するこけ虫動物群の地質時代は三畳紀後期（恐らくカーニアン世前期）であると結論される。このことは共産するコノドント動物群によっても支持される。 坂上澄夫・酒井 彰

Explanation of Plate 13

Figs. 1, 2. *Pseudobatostomella kobayashii* SAKAGAMI
1. Longitudinal section (No. DESC-79007), ×20, 2. Tangential section (No. 79009b), ×60, Loc.: Motourakawa.

Figs. 3-5. *Dyscritella hidakaensis* SAKAGAMI, n. sp.
3. Tangential section, paratype (No. DESC-79013), 4. Typical longitudinal section, holotype (No. DESC-79012b), ×20, Loc.: Kerimai (1), 5. Enlarged part of Fig. 3, showing the zooecial shapes, ×60.

Fig. 6. *Dyscritella* sp. indet.
Oblique section (No. DESC-79015), ×20, Loc.: Kerimai (1).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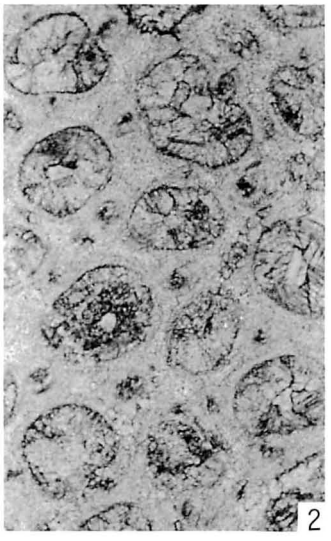
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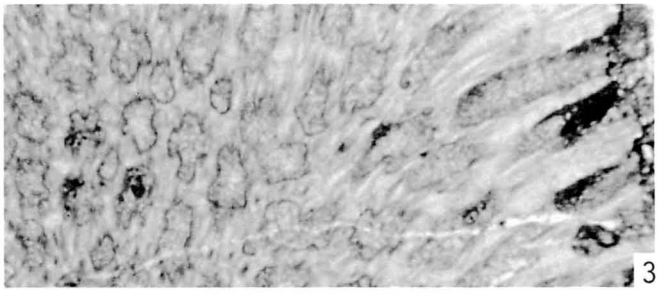
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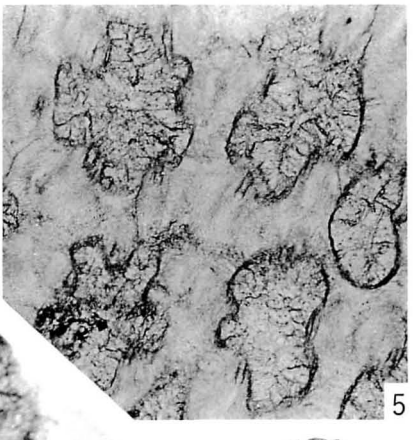
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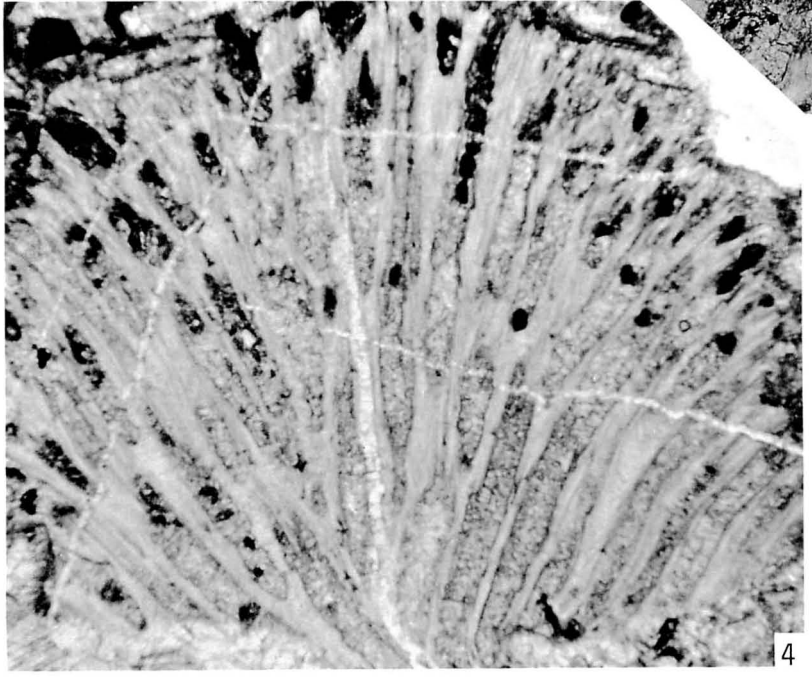
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Trans. Proc. Palaeont. Soc. Japan, N.S., No. 114, pp. 87-96, pls. 14, 15, July 15, 1979

704. EARLY CRETACEOUS PLANTS FROM THE TOKURAZAWA FORMATION, GUMMA PREFECTURE, IN THE INNER ZONE OF NORTHEAST JAPAN*

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and

TAKAO TOJO

Kamo Junior High School, Ichikawa 290

Abstract: A small early Cretaceous flora is reported from the Tokurazawa Formation. The locality is located in Northeast Japan, about 120 km east of the Itoigawa-Shizuoka Geotectonic Line. The flora includes several species characteristic of the Inner Zone 'Tetori'-type flora and no species characteristic of the Outer Zone 'Ryoseki'-type flora except *Onychiopsis elongata*. The evidence from the present flora agrees with that from the fauna of the Tokurazawa Formation.

We describe here the following fossil plants from the upper part of the Tokurazawa Formation: *Asplenium dicksonianum*, *Adiantopteris sewardii*, *Cladophlebis* sp. A, *C.* sp. B, *Sphenopteris* sp., *Onychiopsis elongata*, Cfr. *Czekanowskia nipponica*, *Leptostrobus* sp. and *Podozamites* cfr. *lanceolatus*.

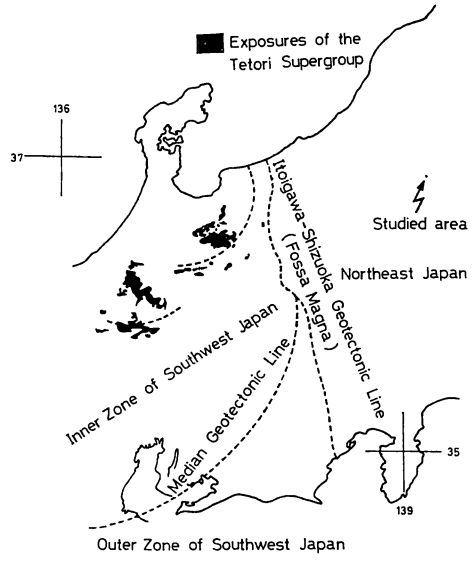
Introductory remarks

This paper deals with the description of a fossil flora newly found from the Tokurazawa Formation with reference to its significance for the Cretaceous paleogeography.

The Tokurazawa Formation (HAYAMA et al., 1969), surrounded by basic igneous rocks, is narrowly distributed in the northeastern part of Tokura, Katashinamura, Tone-gun, Gumma Prefecture, along the upper course of the Katashina River (Text-fig. 1). It has been studied or reviewed by KAWADA (1955), MURAYAMA and KAWADA (1956), HAYASHI et al. (1965), TOYA et al. (1965), SUDO (1976) and CHIHARA et al. (1977).

According to TOYA et al. (1965), the Tokurazawa Formation is lithologically divisible into three members as shown in Table 1. In this paper, we adopt the name of Tokurazawa Formation as defined by HAYAMA et al. (1969), instead of

* Received Nov. 20, 1978; read September 23, 1975 at Kanazawa.



Text-fig. 1. Location of the Tokurazawa Formation (pointed by arrow), the distribution of the Tetori Supergroup in the Inner Zone of Southwest Japan (with reference to MAEDA's figure), and the major geological provinces and geotectonic lines of Japan.

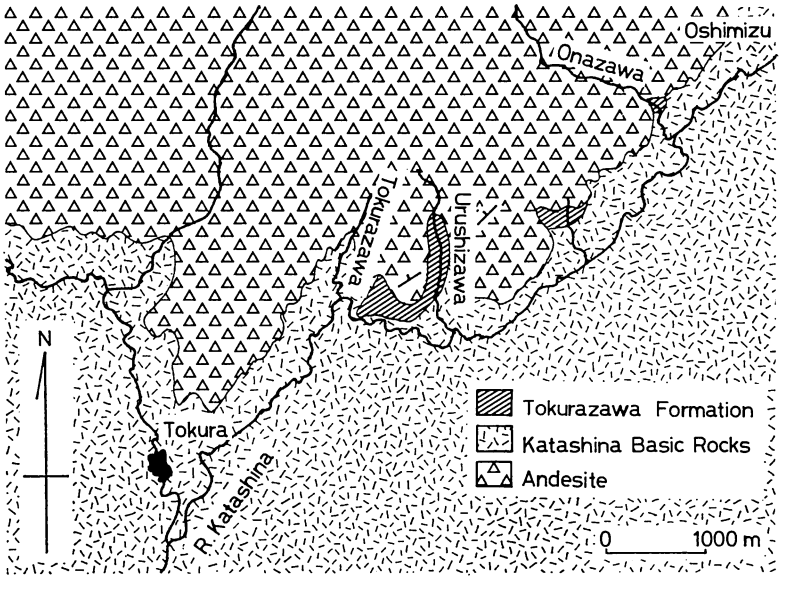
Table 1. Brief stratigraphy of the Tokurazawa Formation (after TOYA et al., 1965)

Upper member; consisting of alternation of cross-laminated sandstone and shale (300 m thick); yielding abundant *Corbicula tetoriensis* KOBAYASHI and SUZUKI
Middle member; consisting of arkose and leucocratic sandstone with subordinate conglomeratic layers (200 m thick)
Lower member; consisting of alternation of sandstone and shale, and massive black shale (30 m thick); yielding belemnites

(Fossil plants here described are found from the Upper member)

the Tokura Formation proposed by MURAYAMA and KAWADA (1956), because the name 'Tokura' was previously used for the Tertiary volcanic rocks near Tokura (KUNO et al., 1954).

The Tokurazawa Formation is intruded by the Tokura Basic Rocks and is cov-



Text-fig. 2. Distribution of the Tokurazawa Formation and associated geological units.

ered by the volcanic rocks, and its lowest and uppermost parts are concealed.

During the period from 1975 to 1977, SAITO and TOJO worked vigorously collecting fossil plants from the Tokurazawa Formation and obtained some 250 specimens from the upper member exposed along the Tokurazawa and the Urushizawa valleys. Text-fig. 2 gives the general geology of this area by SAITO and TOJO with the fossil plant localities, and Text-fig. 1 shows the fossil locality in relation to the major geological provinces of Japan.

Tokurazawa Flora and its geological significance

A large number of fossil plants occur in the upper member of the Tokuzawa Formation. In this horizon the flora is uniform in composition. The rocks were metamorphosed by the intrusion of igneous rocks, and the cuticles were destroyed. The plant fossils are preserved as impressions, showing macroscopic features only.

The following genera and species have been recognized in our collection and this assemblage is here called Tokurazawa Flora:

Ferns; *Asplenium dicksonianum* HEER, *Adiantopteris sewardii* (YABE) VASSILEVSKAJA, *Cladophlebis* sp. A, *C.* sp. B, *Sphenopteris* sp. and *Onychiopsis elongata* (GEYLER) YOKOYAMA.

Czekanowskiales; Cfr. *Czekanowskia nipponica* KIMURA and OHANA and *Leptostrobus* sp.

Conifer; *Podozamites* cfr. *lanceolatus* (LINDLEY and HUTTON) BRAUN.

Although the flora is small, it includes species or genera characteristic of the Inner Zone floras of 'Tetori'-type in Southwest Japan, while it lacks species characteristic of the Outer Zone floras of the same age. Such elements of the 'Tetori'-type floras as Dicksoniaceae and *Ginkgo* leaves have not been observed. The following species are regarded as the elements of Inner Zone floras.

1) *Asplenium dicksonianum* and its allied forms have been known in the early Neocomian Oguchi Flora (KIMURA and SEKIDO, MS), the late Neocomian Akaiwa Flora (KIMURA and SEKIDO, 1976, 1978) and the Aptian Tamodani Flora (KIMURA and HORIUCHI, 1979), all from the Inner Zone of Southwest Japan, as well as in the early Cretaceous floras in East Siberia. But they have not been found in the coeval floras from the Outer Zone of Japan.
2) *Adiantopteris sewardii* is also abundant in the Oguchi (OISHI, 1940) and the Akaiwa (KIMURA and SEKIDO, 1978) Floras. It occurs also in the early Cretaceous Nagdong Flora (YABE, 1905; OISHI, 1940) and the Jurasso-Cretaceous flora from Mongolia (JÄHNICHEN and KAHLERT, 1972). But it has not been found in the coeval floras from the Outer Zone of Japan.
3) Czekanowskians are common to the floras from the Tetori Supergroup and the coeval floras from East Siberia and NE-China, but they have not been found among the coeval floras from the Outer Zone of Japan.
4) *Podozamites* leaves are also common to the floras from the Tetori Supergroup and the coeval floras from East Siberia and NE-China, but they have not been found in the coeval floras from the Outer Zone of Japan, except for some doubtful records.

In a flora of Outer Zone type in this age, the following species might be expected; Matoniaceous ferns, *Zamites buchianus*, *Ptilophyllum* ex gr. *pecten*, *Nilssonia* ex gr. *schaumburgensis*, *Nageiopsis* spp. and *Cupressinocladus* sp. These species are not found in the present col-

lection from the Tokurazawa Formation.

Judging from the species composition, the Tokurazawa Flora may correspond in age to either of the Oguchi, the Akaiwa and the Tamodani Floras in the Itoshiro Group of the Tetori Supergroup. This agrees with the view mentioned by HAYASHI et al. (1965) that the Tokurazawa Formation corresponds in age to the Itoshiro Group, based on the abundant occurrence of *Corbicula tetoriensis*, a brackish or fresh-water bivalve in these strata.

During the late Jurassic-early Cretaceous, the floral composition differs considerably between the Inner and Outer Zones of Southwest Japan (KIMURA, 1975a, b, 1976; KIMURA and HIRATA, 1975; KIMURA and ASAMA, 1975). The Outer Zone floras in those days are of North European Wealden-type, and this zone is included in the VAKHRAMEEV's Indo-European Palaeofloristic Area. While the coeval floras from the Inner Zone of Southwest Japan, called the 'Tetori'-type floras, are similar in composition to those of the VAKHRAMEEV's Siberian Palaeofloristic Area, possibly representing its marginal facies.

Acknowledgements

We first express our sincere gratitudes to Professor Emeritus Thomas M. HARRIS, F. R. S. of the University of Reading for his very helpful suggestions in palaeobotany and his critical reading of the present manuscript.

We also thank Miss Tamiko OHANA, a graduate student of the Tokyo Gakugei University for her kind help in drawing the figures in this paper. We are much indebted to the Oze Ringyo Co. Ltd. for permitting us to collect the fossil plants herein described in the company-owned land. This study was supported in part by the Scientific Research Fund from the Ministry of Education, Japan (no. 354290-'78).

Systematic description

Filicales

Genus *Asplenium* LINNÉ

Asplenium dicksonianum HEER

Pl. 14, fig. 1; Pl. 15, fig. 1, Text-fig. 3(1)

Asplenium dicksonianum HEER: 1874, p. 31, pl. 1, figs. 1-5 (Lower Cretaceous of Greenland); KIMURA and HORIUCHI 1979, p. 10, pl. 1, fig. 6; text-figs. 5a, b (Chinaboradani Formation, Fukui Prefecture).

Asplenium cfr. *dicksonianum* HEER; KIMURA and SEKIDO: 1976, p. 353, text-fig. 11 (Osugidani, Akaiwa Formation); 1978, p. 260 (Ditto).

For further references, see KRYSHTOFOVICH and BAIKOVSKAJA, 1960, p. 11.

Description: Several specimens were obtained. Pl. 14, fig. 1 shows a delicate penultimate pinna fragment. Ultimate pinnae are set rather remotely, 1 cm distant, and at an angle of 45 degrees to the axis with a distinct median furrow. Pinnules are anadromic in order, and are as a whole elongate-rhomboidal in form, 1.8 cm long and 5 mm wide at the widest portion. Their apical halves are usually deeply dissected into 1-3 pairs of narrow lobes. Each lobe is directed forward and its apex is acutely pointed or sometimes shallowly serrated. Nerves are delicate and *Sphenopteris*-type, secondaries fork twice or thrice. Each lobe receives a set of secondary nerves. Pl. 15, fig. 1 and Text-fig. 3(1) show the venation. (Fructification has not been known).

Remarks: Although our specimens are all incomplete, they are referable in general form to *Asplenium dicksonianum*

widely known from the younger Mesozoic plant-beds in the Northern Hemisphere.

Our specimens closely resemble some of the figures of this species but other figures differ and the leaf is evidently rather variable. However it seems constant and characteristic that the order of branching of the pinnules is anadromic.

ENDO's specimens regarded by him (1925) as *Asplenium dicksonianum* (?) from the Upper Cretaceous of Hokkaido, Japan, though very small pinna fragments, are similar in form to ours. *Asplenium* cfr. *dicksonianum* described by KIMURA and SEKIDO (1976) from the Osugidani vally of the Akaiwa Formation, is now referable to *A. dicksonianum*.

Occurrence: Common.

Specimens: TK-063, 069, 075, 092, 103.

Genus *Adiantopteris* VASSILEVSKAJA, 1968: 49

Adiantopteris sewardii (YABE) VASSILEVSKAJA

Pl. 14, figs. 2-4; Pl. 15, fig. 2; Text-fig. 3(2-4)

For further references, see KIMURA and SEKIDO, 1978, p. 265-266.

Remarks: Many pinna fragments were obtained. They are all referable to *Adiantopteris sewardii* originally described by YABE as *Adiantites sewardi* (1905) from the Lower Cretaceous of Japan and Korea. This species is common to the Oguchi and Akaiwa Floras.

Occurrence: Very abundant.

Specimens: TK-015, 020, 043, 053, 059, 088, 203 and many others.

Form-genus *Cladophlebis* BRONGNIART, 1849: 105

Cladophlebis sp. A

Text-fig. 3(5)

Several pinna fragments were obtained, one of which is shown in Text-fig. 3(5). Pinnules are of *Pecopteris*-type, triangular or finger-shaped, small-sized, with entire margin, ending with the obtusely pointed apex, and attached to the axis at a wide angle. Nerves are invisible.

The present specimens resemble the sterile pinnae of *Gleichenites nipponensis* OISHI known from the Lower Cretaceous of the Inner Zone of Japan and of Lo-tzu-kou, NE-China.

Occurrence: Rather rare.

Specimens: TK-097, 101.

Cladophlebis sp. B

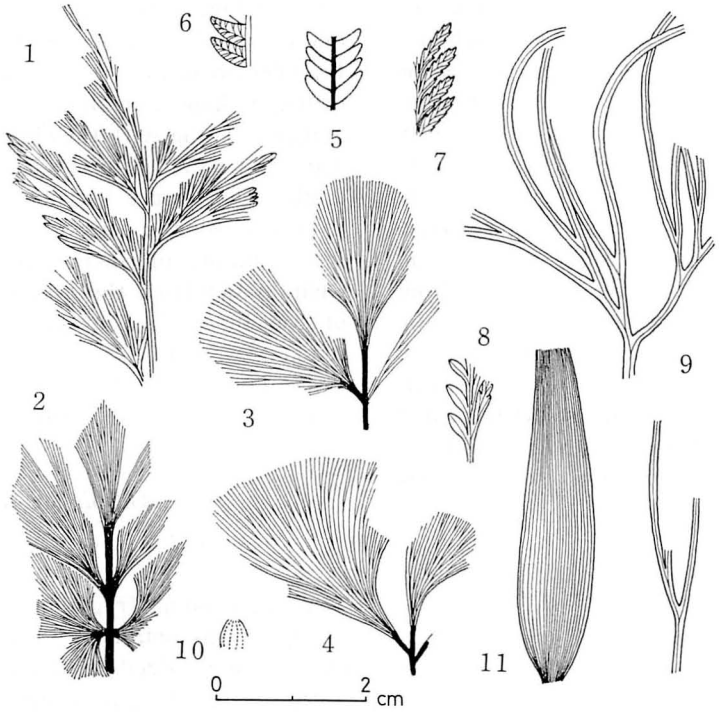
Pl. 14, fig. 5; Text-fig. 3(6)

A single pinna fragment shown in Pl. 14, fig. 5 was obtaind. Pinnules are set closely, small-sized, triangular in form, with entire margin, ending with the obtusely pointed apex, 0.5 cm long and 2.5 mm wide at the base, and attached by their whole base to the pinna axis at a wide angle. Midnerve is persisting to the tip and sending off 5 pairs of secondaries which fork once in the manner as shown in Text-fig. 3(6).

The present pinnules resemble those of *Cladophlebis* ex gr. *denticulata* or apical pinnules of *C.* ex gr. *williamsonii* both of which are common to the Oguchi and the Akaiwa Floras.

The name *Cladophlebis* ex gr. *denticulata* is comprehensively used by workers in Japan. Specimens reported as *Cladophlebis* ex gr. *denticulata* from the Lower Cretaceous plant beds in the Outer Zone of Southwest Japan are regarded as rather different in general form from those from the coeval plant beds in the Inner Zone of Japan, as mentioned by KIMURA and KANSHA (1978, p. 111).

Occurrence: Rare.



Text-fig. 3. 1. *Asplenium dicksonianum* HEER; a penultimate pinna fragment, drawn from the specimen shown in Pl. 14, fig. 1 (TK-103). 2-4. *Adiantopteris sewardii* (YABE) VASSILEVSKAJA; all pinna fragments, 2; TK-015, 3; drawn from Pl. 14, fig. 2 (TK-059), 4; TK-053. 5. *Cladophlebis* sp. A; TK-101. 6. *Cladophlebis* sp. B; drawn from Pl. 14, fig. 5 (TK-197). 7. *Sphenopteris* sp.; drawn from Pl. 15, fig. 3 (TK-168). 8. *Onychiopsis elongata* (GEYLER) YOKOYAMA; showing fertile pinnules (sori?) on the left side of pinna axis and sterile one on the right, drawn from Pl. 15, fig. 6 (TK-167). 9. Cfr. *Czekanowskia nipponica* KIMURA and OHANA; drawn partly from Pl. 15, fig. 8, showing two branching leaves with a single vein on each lamina (TK-152). 10. *Leptostrobus* sp.; an incompletely preserved valve, drawn from Pl. 14, fig. 8 (TK-175). 11. *Podozamites* cfr. *lanceolatus* (LINDLEY and HUTTON) BRAUN; drawn from Pl. 14, fig. 7 (TK-229).

Specimen: TK-197.

Form-genus *Sphenopteris* (BRONGNIART) STERNBERG, 1825: 15

Sphenopteris sp.

Pl. 14, fig. 6; Pl. 15, fig. 3; Text-fig. 3(7)

Several pinna fragments as shown in Pl. 14, fig. 6 and Pl. 15, fig. 3 were obtained. Pinnae are delicate. Pinnules are set closely, elongate-oblong in form, and directed forwards but often bending outward. Laminae are shallowly divided into four lobes directed forward. Midnerve is sinuous, of *Sphenopteris*-type, and sending off four pairs of simple secondaries. Each lobe receives one secondary nerve in the manner as shown in Text-fig. 3(7).

The present pinnules differ in form from those of *Onychiopsis elongata* known abundantly from the Upper Jurassic to the Lower Cretaceous plant beds in Japan, and also differ in venation from those of *Asplenium dicksonianum* described here.

Occurrence: Rare.

Specimens: TK-110, 168.

Genus *Onychiopsis* YOKOYAMA, 1889: 26

Onychiopsis elongata (GEYLER) YOKOYAMA

Pl. 15, figs. 4-7; Text-fig. 3(8)

Thyrsopteris elongata GEYLER; 1877, p. 224, pl. 30, fig. 5; pl. 31, figs. 4-5 (Kuwashima, Oguchi Formation).

For further references, see KIMURA, 1975a, p. 77.

Many specimens referable to this well-known species were obtained. Pl. 15, figs. 4-5 show sterile leaf-fragments and figs. 6-7 fertile pinna fragments, a part of which is shown in Text-fig. 3(8). Unfortunately the details of the fructification are not recognizable because of the poor state of preservation.

Occurrence: Very abundant.

Specimens: TK-018, 021, 049, 055, 078, 083, 107, 112, 114, 129, 137, 167 and many others.

Czekanowskiales

Genus *Czekanowskia* HEER, em. HARRIS and MILLER, 1974: 92

Cfr. *Czekanowskia nipponica* KIMURA and OHANA

Pl. 15, fig. 8; Text-fig. 3(9)

Comparable specimens:

Czekanowskia nipponica KIMURA and OHANA; 1978, p. 595, figs. 1-12 (Upper Cretaceous Omichidani Formation, Ishikawa Prefecture).

Description: Many leaf-fragments were obtained as shown in Pl. 15, fig. 8. Leaves are branching four times dichotomously but asymmetrically with a small angle, but the whole shape is unknown. Laminae are rather slender, 0.7-1.1 mm wide but 1.4 mm just below the branching and with a single vein throughout as shown in Text-fig. 3(9).

Remarks: The present leaves agree fully with *Czekanowskia nipponica* in macroscopic characters and, in our opinion, are somewhat different from several other species, but these differences are slight.

The fact that the vein is clearly visible is a point of agreement, since in many species the vein is very difficult to be seen. Since the cuticle is not preserved in the present specimens, however, we prefer to call them Cfr. *Czekanowskia nipponica*, reserving full taxonomic determination to specimens confirmed by the cuticle.

As mentioned recently by KIMURA and OHANA (1978), *Czekanowskia* is one of the characteristic members not only in the older Mesozoic floras in the Northern Hemisphere, but also in the late Jurassic to the early Cretaceous floras of the VAKHRAMEEV's Siberian Palaeofloristic Area and the coeval floras in the Inner Zone of Japan.

After examining the present good material of *Czekanowskia* as well as the specimens described by KIMURA and OHANA (1978), we revise the former determination of *Czekanowskia* sp. (KIMURA, 1958, p. 37, text-fig. 10). We now consider the specimen generically indeterminable.

Occurrence: Probably common.

Specimen: TK-152.

Genus *Leptostrobus* HEER, 1876 em. HARRIS, 1951 : 485

Leptostrobus sp.

Pl. 14 fig. 8; Text-fig. 3(10)

Several detached valves as shown in Pl. 14, fig. 8 (pointed by arrows) were obtained. They are all crushed, but some of them faintly reveal their surface ornamentation as shown in Text-fig. 3(10). Their outer margins are missing, and some are represented only by their sedimentary fillings.

From the preserved ridges on the upper surface of each valve, we are certain that the present material belongs to *Leptostrobus*. The valves differ from those described by KIMURA and SEKIDO (1976, p. 370, pl. 38, fig. 7) from the Akaiwa Formation in being somewhat smaller and in having fewer ridges. If, as we believe, these valves belong to Cfr. *Czekanowskia nipponica*, they are surely an element of the Inner Zone flora.

Occurrence: Rare.

Specimens: TK-151, 175.

Conifers

Genus *Podozamites* BRAUN, 1843

Podozamites cfr. *lanceolatus* (LINDLEY and HUTTON) BRAUN

Pl. 14, fig. 7; Text-fig. 3(11)

An incomplete lanceolate leaf shown in Pl. 14, fig. 7 was obtained. Its apical and basal parts are missing. Nerves are numerous, forking dichotomously near the base, then parallel to each other as shown in Text-fig. 3(11); the density is 22 per cm at the middle.

The present specimen resembles a detached leaf of *Podozamites lanceolatus*. But we reserve its full taxonomic identification with this comprehensive species because of its poor state of preservation

Occurrence: Rare.

Specimen: TK-229.

Repository: All the specimens here described are deposited in the Department of Astronomy and Earth Sciences, Tokyo Gakugei University.

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Explanation of Plate 14

(All enlarged twice, unless otherwise mentioned)

Fig. 1. *Asplenium dicksonianum* HEER; TK-103.

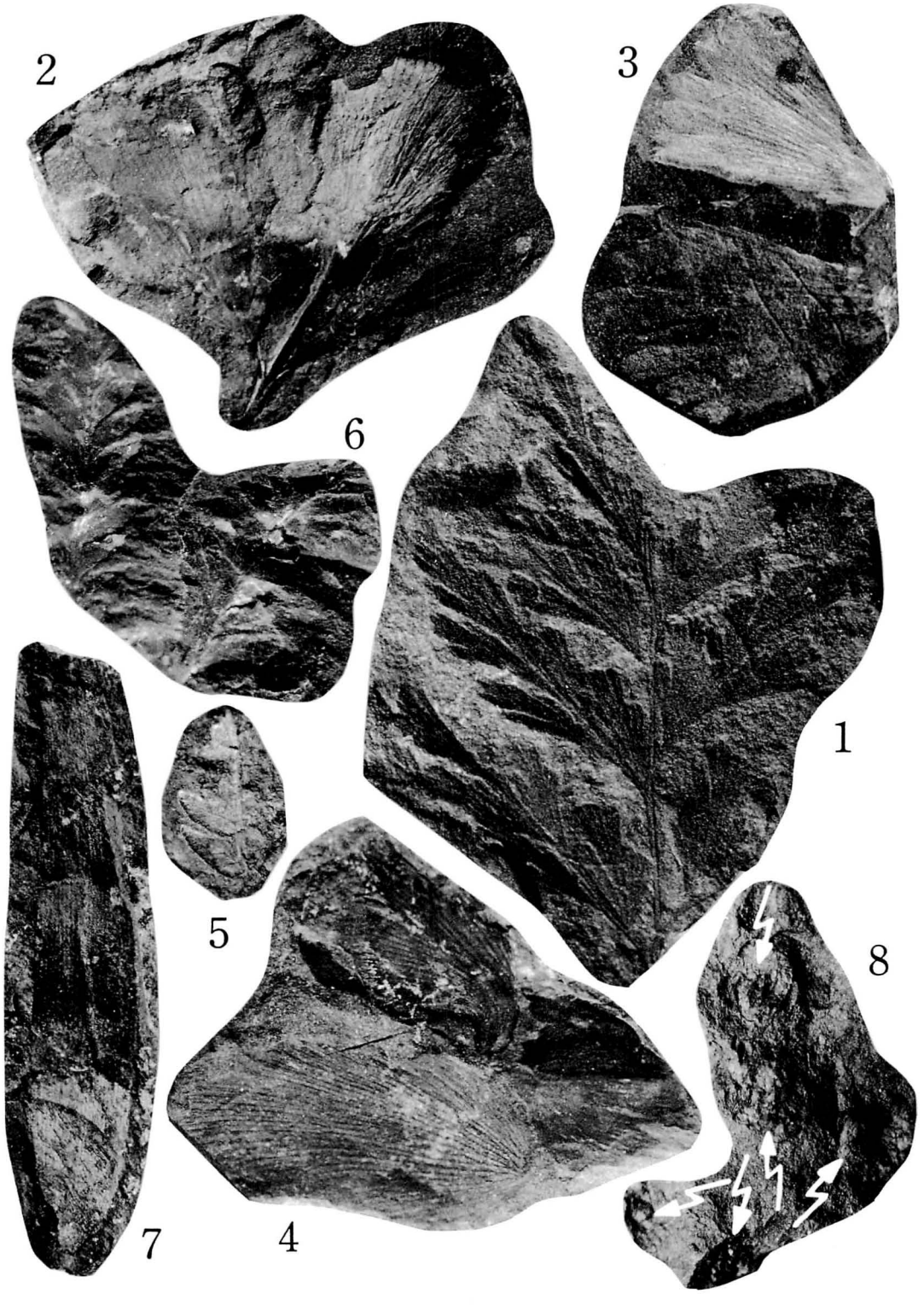
Figs. 2-4. *Adiantopteris sewardii* (YABE) VASSILEVSKAJA; Fig. 2; TK-059, Fig. 3; TK-171. Fig. 4; TK-203.

Fig. 5. *Cladophlebis* sp. B; TK-197.

Fig. 6. *Sphenopteris* sp.; TK-157, ×3.

Fig. 7. *Podozamites* cfr. *lanceolatus* (LINDLEY and HUTTON) BRAUN; TK-229.

Fig. 8. *Leptostrobus* sp.; TK-175.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Akaiwa 赤岩, Chinaboradani 知那洞谷, Itoigawa-Shizuoka 糸魚川—静岡, Itoshiro 石徹白, Iwamuro 岩室, Kami-Uchinami 上打波, Katashina 片品, Kuruma 来馬, Kuwashima (=Kuwajima) 桑島, Kuzuryu 九頭竜, Lo-tzu-kou 羅子溝, Nagdong (=Naktong) 洛東, Oguchi 尾口, Omichidani 大道谷, Osugidani 大杉谷, Tamodani 田茂谷 (多母谷), Tetori (=Tedori) 手取, Tokura 戸倉, Tokurazawa 戸倉沢, Tone-gun 利根郡, Urushizawa 漆沢

群馬県利根郡片品村戸倉，片品川上流域に小規模に露出する戸倉沢層から，つぎのような手取型の植物化石が得られたので記載・報告する；*Asplenium dicksonianum*, *Adiantopteris sewardii*, *Cladophlebis* sp. A, *C.* sp. B, *Sphenopteris* sp., *Onychiopsis elongata*, Cfr. *Czekanowskia nipponica*, *Leptostrobus* sp., および *Podozamites* cfr. *lanceolatus*.

以上はいずれも，手取累層群の石徹白層群の植物群に共通するもので，これらの化石から判断する限り，戸倉沢層は下部白亜系の石徹白層群に対比される。したがって，この事実は，さきの岩室累層から来馬型の植物化石が発見されたことと並んで，古植物学的にも，西南日本内帯が，少くとも東北日本の片品川流域部に延長されることは確実と考えられる。

戸倉沢層の植物化石は，その上部層のある層準に密集して産するが，組成は単純である。また以上の戸倉沢層の植物化石のうち，*Onychiopsis elongata* 以外のものは，外帯の後期ジュラ紀および前期白亜紀植物群にはまだ知られていない。　　木村達明・斉藤　茂・東城隆男

Explanation of Plate 15

(All enlarged twice, unless otherwise mentioned)

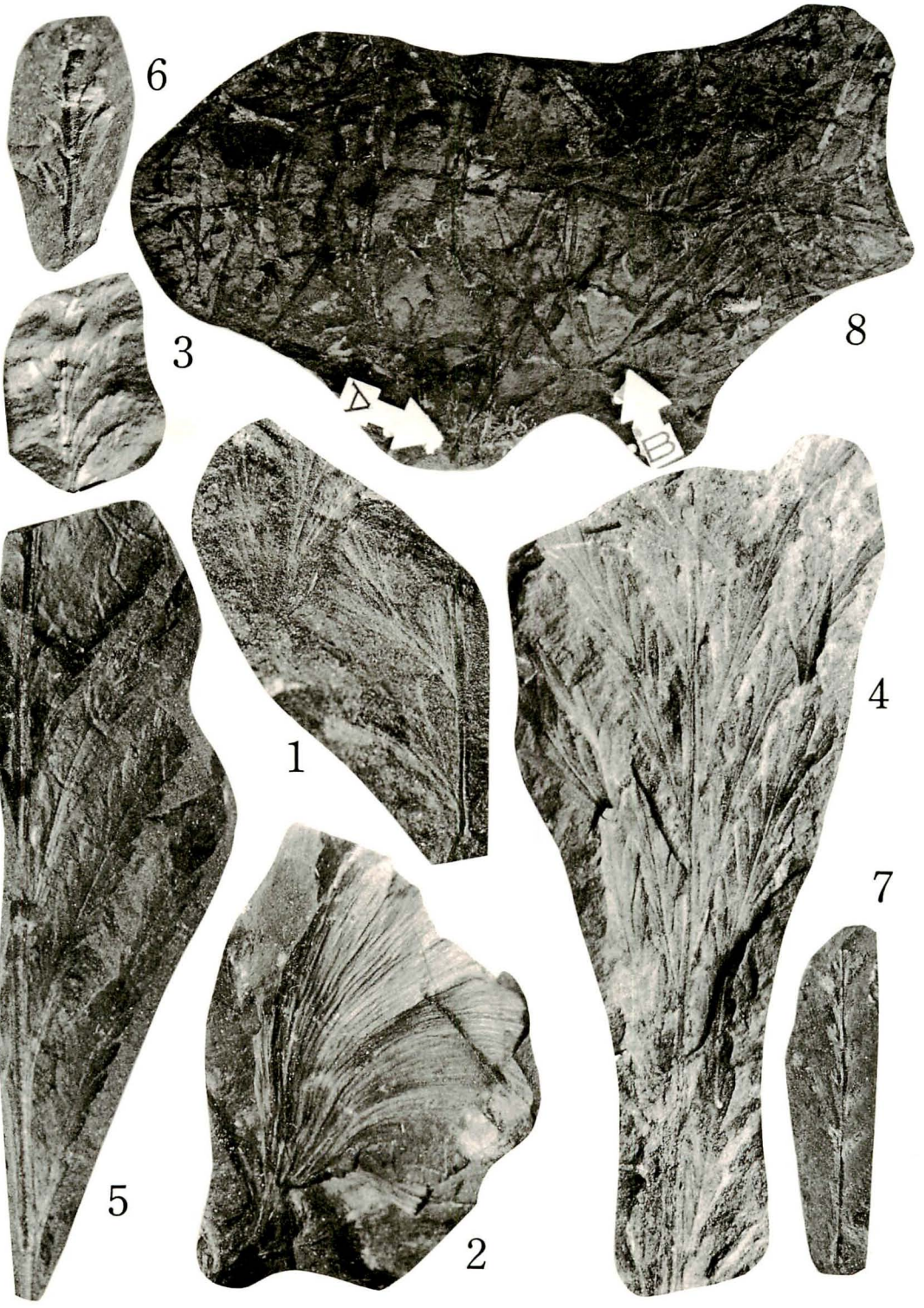
Fig. 1. *Asplenium dicksonianum* HEER; TK-075.

Fig. 2. *Adiantopteris sewardii* (YABE) VASSILEVSKAJA; TK-053B.

Fig. 3. *Sphenopteris* sp.; TK-168.

Figs. 4-7. *Onychiopsis elongata* (GEYLER) YOKOYAMA; Figs. 4-5; sterile leaves, Fig. 4; TK-112, Fig. 5; TK-221. Figs. 6-7; fertile parts of leaves, Fig. 6; TK-167, Fig. 7; TK-112.

Fig. 8. Cfr. *Czekanowskia nipponica* KIMURA and OHANA; branching parts are pointed by arrows, TK-152, natural size.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PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

学 会 記 事

日本古生物学会第123回例会は1979年6月9日～11日に石川県辰口町の総合福祉会館において開催された（参会者93名）。

個 人 講 演

"Gyroidina" nipponica Ishizaki に存在する補口孔について .....八田明夫・前田四郎
能登半島北東部中新統の浮遊性有孔虫層序 .....池田 正
Bolivina robusta Brady にみられる殻形態の地理的変異について .....北里 洋
Miocene benthonic Foraminifera from the Sendai area and its environs (Part 1) .....Hasegawa, S. and Takayanagi, Y.
北西太平洋の放散虫化石 (DSDP Leg 56).....酒井豊三郎
奄美大島産前期白亜紀放散虫化石 .....酒井豊三郎・相田吉昭
六射珊瑚の budding の形式について－そのI *Caulastrea tumida* .....山際延夫・浜本智子
六射珊瑚の budding の形式について－そのII *Favia speciosa* .....山際延夫・石川幸子
サンゴ礁前縁部におけるサンゴ藻の遷移と生長速度 .....松田伸也・小西健二
模式地における下部石炭系日頃市層の化石層序の再検討 .....森 啓・田沢純一
Discovery of Visean brachiopods from the upper part of the Karaumedate Formation, southern Kitakami mountains.....Tazawa, J. and Osawa, M.
Ontogenic studies of a few Upper Cambrian trilobites from the Deadwood Formation, South Dakota (代読).....Hu, C. H.
Life habit of a giant patelliform gastropod from the Upper Cretaceous of Saghalien and Japan .....Hayami, I. and Kanie, Y.
北海道留萌市周辺の峠下層（中新統）産 *Dosinia* 属（二枚貝）.....天野和孝・菅野三郎
能登半島平床および宇治貝層の放射年代 大村明雄
Record of *Texanites* from the Urakawa Cretaceous area.....Matsumoto, T. and Kanie, Y.
Notes on *Pachydiscus* from Hokkaido.....Matsumoto, T., Kanie, Y. and Yoshida, S.
Some ammonites from the Yatsushiro Formation of Kyushu and their implications .....Matsumoto, T. and Ohta, Y.
Restorative aspect on the jaw apparatus of tetragonitid ammonites.....Kanie, Y., Fukuda, Y. and Tanabe, K.
富山県からはじめて産出したナウマン象について .....藤井昭二・赤座久明・山本新一・赤羽久忠・桐井義博・津田禾粒
Biostratigraphic significance of silicoflagellates from Isozaki Formation, Ibaraki Prefecture (代読).....Ling, H. Y.
Calcareous nannoplankton from the Cretaceous along Kanajirizawa and Akanosawa, Obira area, Hokkaido.....Okamura, M.
いわゆる石灰質ナンノプランクトン *Coccolithus pelagicus—Braarudosphaera bigelawi* 共存帯について（予報）.....高山俊昭
現生超微プランクトン群集からみた二次化石の可能性 .....西田史朗
岐阜県郡上郡白鳥湖成層産 acritarchs について .....高橋 清・下野 洋
北海道天北地域新第三系産中心目珪藻の休眠胞子若干 .....小村精一
稀産珪藻の研究（その2）：*Astrionella* 型珪藻1新属2新種 .....小村精一
山口県大嶺産三畳紀の *Taeniopteris* について.....内藤源太郎
美弥層群産材化石について .....山崎純夫・岡田清史・網田幸司
イチョウ属（*Ginkgo*）について .....松尾秀邦
北日本の古第三紀カツラ属葉化石の再検討 .....棚井敏雅
岩手県小川町の古第三紀フローラ .....棚井敏雅
On the Tertiary *Paliurus* from Eastern Asia .....Huzioka, K. and Uemura, K.
Fagus hayatae Palib. について ....岩尾雄四郎
鹿児島県仕明層産つばき科について ....長谷義隆

長岩石灰岩中のミニ鱗木（年輪式断面を含む）封印木，盧木の化石 .....岡村長之助

コロキウム

「地質時計としての化石――その分解能」

序言 .....小西健二

生物硬組織の成長輪と日，月および年周期――軟体動物を例に―― .....岩崎泰頴

貝殻物質の放射炭素年令 .....浜田達二

放射炭素年令の新しい測定法の化石への適用――加速器による ^{14}C 年代測定―― ..中井信之

第四紀化石の非平衡放射年代測定法のいろいろ ..... 阪上正信

完新世貝殻の酸素同位体比と成長速度に関する問題点 .....鎮西清高・大場忠道・小池裕子・松島義章・北里 洋

酸素同位体比と石サンゴ時計からみたサンゴ礁域の環境変遷 ..小西健二・辻 喜弘・田中武男・大村明雄・小村和久・桜井次郎

地質時計としてのアンモナイトの評価――研究の現状と今後の課題 .....棚部一成

浮遊性微化石年代――対比，時代区分の基礎と分解能 .....斉藤常正

なお，6月8日夜に白亜紀総研，大桑・万願寺研究連絡会，第三紀植物研究会の夜間小集会，6月9日夜に加賀白山荘で懇親会，6月10日に白峰村桑島および手取ダムへの巡検（参加者19名）が行なわれた。

○1979年6月8日に行なわれた定例評議員会で次の諸君の入退会が承認された。

〔入会者〕鈴木茂之，下野 洋，松田伸也，中筋治雄，杉山 卓，森田利仁，田吹亮一

〔退会者〕黒田秀隆，新谷俊雄，山崎良雄

○同評議員会で日本古生物学会報告・紀事編集出版規約の一部改正が審議され，投稿論文は必ずしも本学会の年会・例会で講演することを要しないこと，また，9印刷頁以上24印刷頁以内の原著論文は図版3葉（従来は2葉）を限度とし，それ以上の超過分について実費を著者が負担することとするよう総会にはかることとした。

日本学術会議第12期会員選挙について

日本学術会議中央選挙管理会

昭和55年11月には，3年に一度の日本学術会議会員選挙が行われます。

この選挙は，会員を選挙する方も，会員に選挙される方も有権者でなければなりませんので，次のことに御留意ください。

(1) 新たに有権者としての登録を希望する方は，登録用カードを早めに提出してください。

(2) 引き続き有権者の方は住所，勤務機関，勤務地等登録カード記載事項に変更があった場合は，すみやかに異動届を提出してください。

以上について不明の点がありましたら，下記にお問い合せください。

〒106 東京都港区六本木7-22-34
日本学術会議会員選挙管理事務室
03-403-6291

日本古生物学会会則　(1978, 1, 20 改訂)

第 1 条　本会は日本古生物学会という。

第 2 条　本会は古生物学およびこれに関係ある諸学科の進歩および普及を計るのを目的とする。

第 3 条　本会は第 2 条の目的を達するため次の事業を行なう。
1. 会誌そのほかの出版物の発行。2. 学術講演会の開催。3. 普及のための採集会・講演会そのほかの開催。4. 研究の援助・奨励および研究業績ならびに会務に対する功労の表彰その他第 2 条の目的達成に資すること。

第 4 条　本会の目的を達するため総会の議を経て本会に各種の研究委員会を置くことができる。

第 5 条　本会は古生物学およびこれに関係ある諸学科に興味を持つ会員で組織する。

第 6 条　会員を分けて普通会員・特別会員・賛助会員および名誉会員とする。

第 7 条　普通会員は所定の入会申込書を提出した者につき評議員会の議によって定める。

第 8 条　特別会員は本会に 10 年以上会員であり古生物学について業績のあるもので，特別会員 5 名の推薦のあったものにつき評議員会の議によって定める。

第 9 条　会員は第 2 条の目的を賛助する法人で評議員会の推薦による。

第10条　名誉会員は古生物学について顕著な功績のある者につき評議員会が推薦し，総会の決議によって定める。

第11条　会員は第12条に定められた会費を納めなければならない。会員は会誌の配布を受け第 3 条に規定した事業に参加することができる。

第12条　会費の金額は総会に計って定める。会費は普通会員年 4,500 円，特別会員年 6,000 円，賛助会員年 1 口 10,000円以上とする。名誉会員は会費納入の義務がない。在外の会員は年 6,000円(または等価の U.S. ドル) とする。

第13条　本会の経費は会費・寄付金・補助金などによる。

第14条　会費を 1 ケ年以上滞納した者および本会の名誉を汚す行為のあった者は，評議員会の議を経て除名することができる。

第15条　本会の役員は会長 1 名，評議員 15 名，および常務委員若干名とする。任期は総て 2 年とし再選を妨げない。
会長の委嘱により本会に幹事および書記若干名を置くことができる。
常務委員会は評議員会において互選された者で構成される。但し会務上必要とする場合は，特別会員の中から常務委員若干名を評議員会の議を経て加えることができる。

第16条　会長は特別会員の中から評議員会において選出され，本会を代表し会務を管理する。
会長に事故ある場合は会長が臨時代理を委嘱する。

第17条　本会には名誉会長を置くことができる。名誉会長は評議員会が推薦し総会の決議によって定める。名誉会長は評議員会に参加することができる。

第18条　本会は毎年 1 回定例総会を開く。その議長には会長が当たり本会運営の基本方針を決定する。
総会の議案は評議員が決定する。
会長は必要があると認める時は臨時総会を召集する。総会は会員の十分の一以上の出席をもって成立する。会長は会員の三分の一以上の者から会議の目的たる事項および召集の理由を記載した書面をもって総会召集の請求を受けた場合は臨時総会を召集する。

第19条　総会に出席しない会員は他の出席会員にその議決権の行使を委任することができる。但し，欠席会員の議決権の代行は 1 人 1 名に限る。

第20条　総会の議決は多数決により，可否同数の時は議長がこれを決める。

第21条　会長および評議員は評議員会を組織し，総会の決議による基本方針に従い運営要項を審議決定する。

第22条　常務委員は常務委員会を組織し評議員会の決議に基づいて会務を執行する。

第23条　会計監査 1 名をおく。監査は評議員会において評議員および幹事をのぞく特別会員の中から選出される。任期は 2 年とし再選を妨げない。

第24条　本会の会計年度は毎年 1 月 1 日に始まり 12 月 31 日に終る。

第25条　本会会則を変更するには総会に付議し，その出席会員の三分の二以上の同意を得なければならない。

付　則　1) 評議員会の議決は無記名投票による。

日本古生物学会報告・紀事 編集出版規約

(1973年1月16日)

Ⅰ 出版・編集

ⅠA 発 行

—1 日本古生物学会報告・紀事（以下報告・紀事と略称）は，年4回発行される。

ⅠB 掲 載

—1 報告・紀事には，本会の会則第2条の目的にかなう原著論文，短報および学会紀事，古生物学界ニュース等を掲載する。

—2 投稿された論文は，原則として受理順に掲載される。

ⅠC 配 布

—1 報告・紀事は，本会のすべての会員ならびに評議員会の認める若干の機関に配布され，会員外の者はこれを購読することができる。

ⅠD 編集委員会

—1 報告・紀事の編集は，会の編集出版規約にもとづき，編集委員会がこれを行なう。

—2 編集委員会は，評議員である編集長1名および常務委員会で認められる若干の委員から構成され，編集会議は編集長の召集により開かれる。

—3 編集長は，必要に応じて受付原稿のコピーを編集委員以外の適切な人に示し，その意見を徴することができる。

—4 原稿の採否は，編集会議において編集委員会の責任で決定し，編集長はその結果を常務委員会に報告する。

—5 不採用原稿は，その理由を付して著者に返却する。

—6 編集委員会の決定に不服の著者は，評議員会に対して異議申立を行なうことができる。編集委員会および著者は，評議員会の裁定にしたがう。

ⅠE 校 正

—1 校正は，原則として編集委員会がこれを行なう。ただし，著者は初校について1回限り著者校正をとることができる。このとき正規の原稿は著者に返送されない。

Ⅱ 投 稿

ⅡA 資 格

—1 本会の会員は，報告・紀事に投稿する権利を有する。ただし，常務委員会で認める特例については，非会員でも投稿できる。

—2 投稿論文は欧文（英・仏・独のいずれかが望ましい）で書かれたもので，本学会の年会・例会等で講演されたものとする。

ⅡB 執筆制限

—1 原稿はタイプスクリプトとする。原著論文では，挿図，表などを含めて24印刷頁，および図版2葉を限度とする。ただし，4印刷頁以内の論文については，とくに認められた場合を除いて図版を付さない。短報類は1印刷頁以内とし，かつ図版を用いないものとする。

—2 挿図は，1論文につき10図，あるいは印刷延面積で 600 cm^2 を限度とする。ただし，4印刷頁以内の論文では2図，あるいは合計面積 200 cm^2 までとする。挿図は印刷時に，1つの図の幅が本文の1段幅（6.4 cm）か2段幅（＝1頁幅，13.4 cm）のいずれかの大きさに縮小されるので，原図はそれに適した大きさと鮮明さを備えたもので，原稿本文とは別紙に画かれたものとする。

—3 上に示されたそれぞれの執筆制限をこえる場合には，超過分の印刷出版に要する実費を著者自身が負担する。

ⅡC 原稿の体裁

—1 属種名などの学名や特殊な語についての字体の指定は，原稿中に著者自身が行なう。

—2 挿図・表等の挿入希望箇所を，原稿の欄外に指定する。

—3 挿図・表の題および説明，ならびに図版説明等は，本文とは別紙にまとめる。

—4 引用文献は本文の最後の部分にまとめ，著者名の姓の アルファベット 順および発表年代順に配列し，原則として下記の要領にしたがう。

著者名，年，論文表題，雑誌名（斜体指定のため下線をほどこす），巻，号，頁数，図版数，その他。

—5 日本など漢字でかく地名を含む 論文については，ローマ字表現と漢字とを 対照した表を本文の末尾に付すことが望ましい。

—6 著者の現所属機関名とその所在地，あるいはそれらに代わる 住所を，タイトル頁の著者名の下に完記する。

—7 短報類以外の論文には，邦題，著者名を含めて 800 字以内にまとめた 邦文要旨を別紙として付ける。（日本語を常用しない著者の論文については，英文要旨を付しておけば，それにもとづいて編集委員会が邦文要旨を作成する。）

II D **著者の責務**

—1 著者は，編集上の諸事項に関して可能な限り編集委員会の指示にしたがわなければならない。

—2 原稿の受付後に，著者が大幅改訂を希望する場合は，原稿は返却されるが，改訂した原稿は新規の投稿とみなされる。

—3 投稿に際しては，正規の論文原稿の他に，図，表，図版等を含む完全なコピー 1 組を付して下記へ送付する。

113 東京都文京区弥生 2—4—16
日本学会事務センター気付
日本古生物学会 編集長

—4 投稿に際しては，別に定める投稿カードに 必要事項を記入し，原稿類とは別便で上記事務局宛に送付する。

II E **別 刷**

—1 別刷は，無表紙 120 部までを 無償で著者（複数の場合は 分配）に供与する。それ以上の部数または表紙等に要する費用は，著者自身の負担とし，直接印刷所に支払うものとする。

付 則

i) 本規約の発効・改訂・廃止に関しては，評議員会の議を経て，総会の承認を得なければならない。

ii) 本規約の発効により，従来の「日本古生物学会報告・紀事出版規定」は失効する。

◎日本古生物学会報告・紀事投稿案内（1973 年 1 月）の一部訂正。

p. 2 IIB-2 600 cm^2 で限度——→600 cm^2 を限度

p. 6 II7 章の見出しは左に寄せて——→章の見出しは中央部に，節，項などの見出しは左に寄せて

CONSTITUTION
of the
PALAEONTOLOGICAL SOCIETY OF JAPAN

(Jan. 20, 1978 amended)

Article 1. The Society shall be known as the Palaeontological Society of Japan.

Article 2. The object of the Society is to promote the study and popularization of palaeontology and related sciences.

Article 3. The Society, to execute Article 2, shall undertake the following business:

1. Issue the Society journal and other publications.
2. Hold or sponsor scientific lectures and meetings.
3. Popularize the science by field trips, scientific lectures and other projects.
4. Aid and encourage research work; award outstanding contributions to the Society; carry out the objectives stated in Article 2.

Article 4. To attain the object of the Society, the Society may, by decision of the General Meeting, establish within it research committees.

Article 5. The Society shall be composed of members who are active or interested in palaeontology or related sciences.

Article 6. The members shall be known as Regular Members, Fellows, Patron and Honorary Members.

Article 7. Persons desiring membership in the Society are requested to fill out the necessary application forms and receive the approval of the Council.

Article 8. Fellows are persons who have held Regular Membership in the Society for more than ten years, have contributed to the science of palaeontology, have been nominated by five Fellows and approved by the Council.

Article 9. Patrons are organizations supporting Article 2 and recommended by the Council.

Article 10. Honorary Members are persons of distinguished achievement in palaeontology. They shall be recommended by the Council and approved by the General Meeting.

Article 11. The members of the Society shall be obliged to pay the annual dues stated in Article 12. Members shall enjoy the privilege of receiving the Society journal and participating in the activities stated under Article 3.

Article 12. The rates for annual dues shall be decided by the General Meeting. Rates for annual dues are: Regular Members, Yen 4,500; Fellows, Yen 6,000; and Foreign Members, Yen 6,000 or its equivalent in U.S. dollars; Patrons are organizations donating more than a share (Yen 10,000) annually; Honorary Members are free from obligations.

Article 13. The budget of the Society shall be from membership dues, donations and bestowals.

Article 14. The Society, by decision of the Council, may expel from membership persons who have failed to pay the annual dues or those who have disgraced the Society.

Article 15. The officers of the Society shall be composed of one President, fifteen Councillors and several Executive members. The term of office is two years and they may be eligible for re-election without limitation. The President may appoint several persons who shall be Secretaries and Assistant Secretaries. An Executive Council shall be nominated and approved by the Council. If necessary, several Executive members, who must be Fellows, may be added with the Council's approval. Councillors shall be elected from Fellows by vote of returned mail unsigned ballot.

Article 16. The President shall be a Fellow nominated and approved by the Council. The President shall represent the Society and supervise the business affairs. The

President may appoint a Vice-President when he is unable to perform his duties.

Article 17. The Society may have the Honorary President. The Honorary President shall be recommended by the Council and approved by the General Meeting. The Honorary President may participate in the Council.

Article 18. The Society shall hold regularly one General Meeting a year. The President shall be Chairman and preside over the administrative affairs. The program for the General Meeting shall be decided by the Council. The President may call a Special Meeting when he deems it necessary. The General Meeting requires the attendance of more than one-tenth of the members. The President shall call a Special Meeting at the written request of more than one-third of the members. The request shall be granted only if the written statement fully explains the reasons for assembly and items for discussion.

Article 19. Members unable to attend the General Meeting may give as attending member a written statement signed by himself trusting the bearer with the decision of business matters. Only one attending member may represent one absentee.

Article 20. The decision of the General Meeting shall be by majority vote. When the number of votes is equal, the President shall cast the deciding vote.

Article 21. The President and Councillors shall compose the Council. The dicision of the General Meeting concerning administration shall be considered and implemented by the Council.

Article 22. The Executive Council shall carry out the decisions of the Council.

Article 23. An auditor shall be elected by the Council from Fellows excluding Councillors and Secretaries. The term of office is two years and he may be eligible for re-election.

Article 24. The fiscal year of the Society shall begin on the first of January each year and end on the thirty-first of December of the same year.

Article 25. The amendments to the Constitution of the Society shall be decided at the General Meeting and must be approved by more than two-thirds of those members who are in attendance.

Addendum 1) Voting in the Council shall be by unsigned ballot.

POLICY PROVISIONS OF THE TRANSACTIONS AND PROCEEDINGS OF THE PALAEONTOGICAL SOCIETY OF JAPAN

(January 16, 1973)

I Publishment and Editing

IA Issue

—1 The "Transactions and Proceedings of the Palaeontological Society of Japan" (TPPSJ) will be published quarterly.

IB Contents

—1 TPPSJ will include original papers and notes that comply with Article 2 of the Constitution of the Society as well as the proceedings of the Society meetings and news concerning any aspect of palaeontology.

—2 Contributions will be published in the order of the acceptance by the Editorial Board.

IC Circulation

—1 All members of the Society and some organizations specified by the Council will generally receive TPPSJ free of charge. Non-members and institutions are invited to become subscribers.

ID Editorial Board

—1 The Editorial Board will be responsible for editing TPPSJ according to the policy provisions of the Society.

—2 The Editorial Board will be composed of the Editor in Chief, who must be a member of the Council, and several members designated by the Executive Committee. All editorial meetings will be called by the Editor in Chief.

—3 The Editor in Chief will have the authority to submit a copy of the manuscript under consideration to an appropriate person for reviewing.

—4 The final decision on the acceptance or rejection of submitted manuscript will be made by the Editorial Board at an editorial meeting. The Editor in Chief will report the results of the meeting to the Executive Committee.

—5 Rejected manuscript will be returned to the author with an explanation of the reason for its rejection.

—6 An author who disagrees with the decision of the Editorial Board may take his complaint to the Council. Both the Editorial Board and the author must abide by the final judgement of the Council.

IE Proof Reading

—1 Proofs will be read, as a rule, by the Editorial Board. A set of page proofs without the original manuscript will be sent to the author.

II Contribution

IIA Eligibility

—1 All members of the Society may submit contributions to TPPSJ. Contributions from non-members will be accepted for publication if they are approved by the Executive Committee.

—2 Manuscript should be written, as far as possible, in English, French or German, and should have been read at an annual meeting or ordinary meeting of the Society.

IIB Limitation of Manuscript

—1 Manuscript should be typewritten, and should be limited to 24 printed pages including tables and text-figures. Two plates may also be added to it. Plates may not be attached to the articles of up to 4 printed pages only without the approval of the Editorial Board. Notes may not exceed one printed page, and no plate may be used for it.

—2 Ten figures or 600 cm^2 of the total printed area will be permitted for a single article. Two figures or 200 cm^2 of the total for article of less than 4 printed pages. The original illustrations should be neat and legible to permit reduction to either the width of one printed page (13.4 cm) or one column (6.4 cm). Figures should be kept separate from the text of the manuscript.

—3 Excess printing charges for articles exceeding the stated limit must be borne by the author.

IIC Style of Manuscript

—1 Generic and specific names and special words should be indicated in the manuscript.

—2 Suggested positions of tables and text-figures should be indicated in the margin of the text.

—3 Captions and explanations of text-figures, tables and plates should be submitted on separate sheets of paper numbered independently from the text.

—4 References cited should be listed in a bibliography at the end of the text in alphabetical order under the author's name, and in chronological order, as follows:

Author's name, year, title of article, name of journal (underlined), vol., no., pages, plates, etc.

—5 It is recommended that an alphabetical list of romanized geographical names be included with Kanji (Chinese ideograph), if any. The annotated list will be placed at the end of the text.

—6 Name(s) and professional or private present address of the author(s) should appear below the title of the manuscript.

—7 All manuscripts with the exception of notes should be accompanied by an abstract in Japanese of 800-words or less on separate sheet(s) of paper. The abstract should include the title in Japanese and the author's name. Abstracts of papers by non-Japanese speaking authors will be prepared by the Editorial Board if an English abstract be submitted with the manuscript.

IID Obligation of Author

—1 Authors are expected to follow the directions of the Editorial Board regarding editorial matters.

—2 Manuscripts will be returned to an author if he wishes to make large-scale revisions. The revised manuscript must be submitted as a new contribution.

—3 Manuscript should be accompanied by a complete copy including text-figures, tables and plates. Manuscript should be sent to

Editor in Chief
Palaeontological Society of Japan
c/o Business Center for Academic Societies
4-16, Yayoi 2 chome, Bunkyo-ku, 113 Tokyo, JAPAN

—4 The author should fill out the register card for contributions and send it to the Society office under separate cover.

IIE Reprints

—1 120 reprints without covers will be furnished free of charge. Excess charges for printed covers, additional reprint copies, etc. will be borne by the author who must pay the amount directly to the publisher.

Proviso

i) Effecting, amending or rescinding of policy provisions will be considered by the Council, and must be approved by the general meeting of the Society.

ii) The approved policy provisions will nullify and replace existing "Regulations for Publication in Transactions and Proceedings of the Palaeontological Society of Japan".

日本古生物学会特別号の原稿募集

PALAEONTOLOGICAL SOCIETY OF JAPAN, SPECIAL PAPERS, NUMBER 24 を 1980 年度に刊行したく，その原稿を公募します。適当な原稿をお持ちの方は，次の事項に合わせて申込書を作成し，原稿の写しを添えて，〒812　福岡市東区箱崎　九州大学理学部地質学教室気付，日本古生物学会特別号編集委員会（代表者首藤次男）宛に申し込んで下さい。

(1) 古生物学に関する論文で，欧文の特別出版にふさわしい 内容のもの。同一の大題目の下に数編の論文を集めたもの（例えばシンポジュウムの欧文論文集）でもよい。分量は従来発行の特別号に経費上ほぼ匹敵すること。学会以外からも経費が支出される見込のある場合には，その金額に応じて上記よりも分量が多くてよい。

(2) 内容・文章ともに十分検討済の完成した原稿で，印刷所に依頼して正確な見積りを算出できる状態にあること。申込書とともに必ず原稿の写しを提出して下さい。(用済の上は返却致します)。

(3) 申込用紙は自由ですが，次の事項を明記し，〔　〕内の注意を守って下さい。

(a) 申込者氏名；所属機関または連絡住所・電話番号。〔本会会員であること〕。

(b) 著者名；論文題目。〔和訳を付記すること〕。

(c) 研究内容の要旨。〔800～1,200字程度，和文で可〕。

(d) 内容ならびに欧文が十分検討済であることの証明。〔校閲者の手紙の写しでもよい〕。

(e) 本文の頁数（刷上り見込頁数または原稿で欧文タイプ25行詰の場合の枚数――ただし，パイカーかエリート字体かを添記すること）；また本文中小活字（8ポ組み）に指定すべき部分があるときは，そのおよその内訳（総頁に対するパーセント）；挿図・表の各々の数と刷上り所要頁数；写真図版の枚数。

(f) 他からの印刷経費支出の見込の有無，その予算額，支出源。〔その見込の証明となる書類またはその写しを添えて下さい〕。

(g) その他参考事項。

(4) 申込及び原稿提出締切 1979 年 10月25日（必着）。採否は 1980 年1月の評議員会で審議決定の上，申込者に回答の予定です。ただしその前または後に，申込者との細部の交渉を，編集委員から求めることがあるかもしれません。

(5) 上記（f）の他からの印刷経費支出の見込みがない場合は，1980年度の文部省刊行助成金（「研究成果刊行費補助金」）を申請いたしますので，上記（2）の条件がみたされている場合にのみ考慮されます。

(6) 論文が完全な場合には，評議会での決定後できるだけ早く印刷にとりかかる予定です。文部省の刊行助成金の申請は，本会から行ない（例年は11月末に申請締切），その採否・金額など決定後印刷にとりかかります。その場合は文部省との約束により，その年の秋（前例では 10 月 20 日）までに初校が全部出なければ，補助金の交付が中止されることになっています。

(7) 特別号の投稿規定はとくにありません。会誌に準じ，前例を参考とし，不明の点は編集委員会に問い合わせて下さい。経費がかかるので，特別な場合を除き，別冊は作成せず，本刷 25 部を著者に無料進呈します。それ以上は購入（但し著者には割引）ということになります。いくつかの論文を集めて1冊にするときには，世話人の方から指示して，体裁上の不統一のないようにして下さい。印刷上の指示事項が記入できるよう，原稿の左右両側・上下に十分空白をとって，タイプで浄書して下さい。なお文部省出版助成金が得られなかった場合には，出版を繰延べることもあるかもしれません。

Palaeontological Society of Japan Special Papers No. 22

Bibliography of Palaeontology in Japan, 1961-1975

Edited by Kametoshi KANMERA and Hiroshi UJIIE

Issued March 30, 1978, x+263 pp.

Price (postage and handling incl.) ¥6,900 or equivalent US dollars

This is the third issue of the Bibliography of Palaeontology in Japan, containing about 3100 literatures of palaeontology and related disciplines published during fifteen years from 1961 to 1975. This includes articles written by Japanese authors using materials not only from Japan but also from foreign countries, articles by foreign authors using materials from Japan and its adjacent seas, and also articles by foreign authors that appeared in Japanese journals.

The contents of this volume consist of two parts; one is the author catalogue arranged alphabetically by senior author name with full title, medium of publication and prefixed with item number; the other consists of indices of three groups—junior author, geologic age and taxa.

This volume is indispensable not only for all palaeontologists but also for researchers of the related sciences in our own and other count ries.

The following back numbers of the Special Papers are on sale at the Society. Orders must be accompanied by remittance made payable to Dr. Tsugio SHUTO, Editor of the Special Papers, Palaeontological Society of Japan, c/o Department of Geology, Faculty of Science, Kyushu University, 33, Fukuoka (Hakata) 812, Japan.

Number 12 (Issued Sept. 20, 1966): Postcranial Skeletons of Japanese Desmostylia. By Tokio SHIKAMA. .....¥5,000 or equivalent US dollars.
Number 13 (Issued March 16, 1968): The Echinoid Fauna from Japan and Adjacent Regions. Part II. By Shōzō NISIYAMA. .....¥7,400 or ditto.
Number 15 (Issued Feb. 25, 1971): Early Devonian Brachiopods from the Lesser Khingan District of Northeast China. By Takashi HAMADA.....¥4,400 or ditto.
Number 16 (Issued Dec. 25, 1971): Tertiary Molluscan Fauna from the Yakataga District and Adjacent Areas of Southern Alaska. By Saburo KANNO. .....¥5,600 or ditto.
Number 18 (Issued Nov. 30, 1974): Silurian Trilobites of Japan in Comparison with Asian, Pacific and Other Faunas. By Teiichi KOBAYASHI and Takashi HAMADA. .....¥5,100 or ditto.
Number 19 (Issued Feb. 10, 1976): Bivalve Faunas of the Cretaceous Himenoura Group in Kyushu. By Masayuki TASHIRO. .....¥4,700 or ditto.
Number 20 (Issued May 10, 1977): Devonian Trilobites of Japan in Comparison with Asian, Pacific and other Faunas. By Teiichi KOBAYASHI and Takashi HAMADA. .....¥6,900 or ditto.
Number 21 (Issued May 10, 1977): Mid-Cretaceous Events—Hokkaido Symposium, 1976. By Tatsuro MATSUMOTO (org.) .....¥5,800 or ditto.

第26回万国地質学会議第2回サーキュラー

Sessions of the International Geological Congress have been held every four years since 1878. The 26th session will celebrate the Centenary of this organization convened under the auspices of the International Union of Geological Sciences.

Organization Committee : Chairman : Jean AUBOUIN
Secretary General : Paul SANGNIER

Timetable : - 26 june to 5 july - Pre-congress scientific excursions
- 7 to 17 july - The Congress will meet at the Palais des Congrès at Porte Maillot
- 18 to 27 july - Post-Congress scientific excursions.

Scientific Program

1) Opening Scientific Meeting : Leading specialists will survey five main themes concerning the current state of scientific progress.

2) Sections : The proposed program covers almost the entire field of the Earth Sciences and is divided into 20 sections. The Organization Committee has also planned to have the work of the various international scientific organizations affiliated with the International Union of Geological Sciences integrated into the program of the Congress. Authors are free to choose their own subjects for communications and these should be sent to the Secretary General before 1 october 1979 for the publication of abstracts.

3) Colloquia : The program for the colloquia was chosen so as to illustrate the main themes of current scientific and economic interest. There will be seven in all and they will be chaired by leading scientific figures. Communications to the Colloquia are made by invitation only.

Excursions

The Organization Committee in association with the National Committees for Geology of 18 european countries has organized an attractive program of geological excursions. The chosen themes make it possible to offer Congress participants a survey of all aspects of the geology of Western Europe. 85 different excursions each lasting for 9 days are planned from 26 JUNE to 6 JULY 1980 or from 19 JULY to 26 JULY 1980. Since only a limited number of persons can participate in the excursions the places will be reserved by the Organizing Committee in october 1979 in the order in which the reservation forms were received.

Exhibition

An exhibition to be called "GEOEXPO 80" will be held in the same premises as the Congress from 7 to 11 july 1980. It will be open to all international institutions and will make it possible for exchanges of ideas and contacts to take place with scientists from all over the world.

Social Program

Since the Congress is taking place in Paris the organizers will be able to plan a very attractive program for the participants and a special program for persons accompanying them.

State of Advancement of Congress Preparation

80,000 copies of the first circular were sent out in october 1977. By 1 december 1978 the Organization Committee had received 5,800 answers from 114 different countries and 4,000 persons had asked to take part in the excursions. The second circular is now available and contains the final registration form.

Those interested in participating in the Congress and wishing to receive the second circular should request it from the :

Secrétariat Général du 26ème Congrès Géologique International
Maison de la Géologie
77-79, rue Claude Bernard
75005 PARIS - FRANCE

行事予定

	開催地	開催日	講演申込締切
第124回 例会	名古屋大学	1979年10月20日	1979年8月20日
1980年総会・年会	筑波大学	1980年1月25・26日	1979年11月25日

講演申込先：〒113 東京都文京区弥生2-4-16 日本学会事務センター 日本古生物学会行事係

10月20日の第124回例会にひきつづき夜間小集会「古生物研究所計画懇談会」（世話人：高柳洋吉・速水格）の開催が予定されている。

お知らせ

今春から常務委員などの役割分担が一部変更になりました。会務の円滑を期するため，1979—80年度の本会関係の連絡先を用務別に記しておきますのでよろしく御協力下さい。

○会費の払込 お送りしている銀行振込用紙で日本学会事務センター
○会費に関する問合せ 会計係：浅間一男（科学博物館分館地学部）
○本会の常務委員会への連絡一般 庶務係：鎮西清高・山口寿之（東京大学・理学部・地質学教室）
○住所変更・入退会申込・報告紀事バックナンバー購入申込 日本学会事務センター内日本古生物学会
○講演申込 日本学会事務センター，または行事係：浜田隆士（東京大学・教養学部・宇宙地球科学教室）
○報告紀事への投稿 なるべく書留便で日本学会事務センター内日本古生物学会，または編集係：速水格（東京大学・総合研究資料館）（原稿コピーと投稿カードを同封または別送して下さい）
○報告紀事編集に関する問合せ 編集委員会：速水格（同上），斎藤常正（山形大学・理学部・地学教室），小沢智生（東京大学・理学部・地質学教室）
○特別号に関する問合せ・購入申込 特別号編集委員会：首藤次男・柳田寿一（九州大学・理学部・地質学教室）（郵送によらない直接販売は東大・総合研究資料館，科学博物館でも取扱います）
○“化石”に関する問合せ・投稿・購入申込 化石編集部：高柳洋吉・石崎国熙（東北大学・理学部・地質学古生物学教室）
○各種の賞に関する問合せ，推薦依頼 賞の委員会：猪郷久義（筑波大学・地球科学系）（79年度のみ）

特別号編集係より

○特別号21号の出版に際して，特別会員松本達郎君より出版費の一部として100万円が本会に寄付されました。
○特別号24号の原稿を別記（本号106頁）の要領で募集します。
○特別号バックナンバーの在庫状況は別記（本号107頁）の通りです。ただし，この広告文に記されている価格は外国からの購入価格です。国内の販売価格は本誌111号の巻末のお知らせを御参照下さい。

◎ 文部省科学研究費補助金（研究成果刊行費）による。

1979年7月10日 印刷
1979年7月15日 発行
ISSN 0031-0204
日本古生物学会報告・紀事
新篇 114号
2,000円

発行者 日本古生物学会
文京区弥生2-4-16
日本学会事務センター内
（振替口座東京84780番）
編集者 速水 格・斎藤常正
印刷者 東京都練馬区豊玉北2ノ13
学術図書印刷株式会社 富田 潔

Transactions and Proceedings of the Palaeontological Society of Japan

New Series No. 114 July 15, 1979

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