

Notes on Some Cretaceous Ammonites from South Sakhalin Held at Tohoku University, Sendai

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ABSTRACT

Cretaceous ammonites from South Sakhalin held at the Institute of Geology and Paleontology, Tohoku University, Sendai are described. Among the 15 species, 12 are of Maastrichtian and/or Campanian age. Very few of the specimens from the late Dr. Saburo Shimizu's Collection are outstanding and the majority of the material for his 1935a work in Shanghai is regrettably missing.

Key words : Ammonites, Cretaceous, Campanian, Maastrichtian, South Sakhalin, Saburo Shimizu

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INTRODUCTION

Cretaceous ammonites from South Sakhalin are held in the Institute of Geology and Paleontology, Tohoku University, Sendai.

The late Dr. Saburo Shimizu (1934, 1935a) in the Institute published the results of his study of Cephalopoda from the Upper Cretaceous of the Japanese Islands, of which South Sakhalin was then a part. Unfortunately, it has proved difficult to trace the Shimizu collection, because most of the specimens must have been taken with him to the Shanghai Science Institute in China, and

are now missing (Prof. T. Kotaka pers. comm.), and Dr. Shimizu died without completing their description.

This paper contains notes on the ammonites from South Sakhalin which I selected for study from the collections of the Institute of Geology and Paleontology, Tohoku University, Sendai (abbr. IGPS). Readers will note that not a few of them are identified with species established or revised by authors (including myself) of papers published subsequent to Dr. Shimizu's works.

ACKNOWLEDGEMENTS

This paper is dedicated to Emeritus Professor Tamio Kotaka and the late Professor Kotora Hatai of Tohoku University. I thank Professor Yokichi

Takayanagi and Dr. Kenshiro Ogasawara of the same university for their kind help in various aspects and Dr. Masayuki Noda for his friendly help in taking

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photographs.

PALAEONTOLOGICAL NOTES

In the following descriptions the technical terms are those in current use and no additional explanation would be needed. Measurements are in mm. I use the following abbreviations for the dimensions:

D=diameter of shell, U=width of umbilicus,

H=whorl-height, W=whorl-breadth ;
~ = approximate,

(c)=costal, (ic)=intercostal ; E = preserved end.

A mark of arrow in a photograph indicates the position of the last septum, viz. the end of the phragmocone or the beginning of the body-chamber.

The locality records of the described specimens are not always sufficient to tell

the accurate stratigraphic positions. The place names are those used before, 1945, viz. written in Japanese letters or in Kanji. As to some specimens from the Naibuchi area, I can tell the approximate stratigraphic positions with reference to my previous work (Matsumoto, 1942).

In comparison with the IGPS specimens I may refer to particular specimens of other institutions, for which the following abbreviations are used:

BM.: British Museum (Natural History), London

GK.: Geological Collections, Kyushu University, Fukuoka

G.T. or UMUT: University Museum, University of Tokyo

SYSTEMATIC DESCRIPTION

Suborder Lytoceratina Hyatt, 1889

Family Tetragonitidae Hyatt, 1900

Genus *Tetragonites* Kossmat, 1895

Tetragonites popetensis

Yabe, 1903

Pl. 50, figs. 3, 4

Tetragonites popetensis Yabe, 1903, p. 48, pl. 7, figs. 4, 6.

Tetragonites popetensis Yabe; Matsumoto, 1959b, p. 152 (with full synonym list), text-fig. 74.

Tetragonites popetensis Yabe; Matsumoto and Miyauchi, 1984, p. 52, pl. 23, fig. 3.

Material: IGPS. 58039 and IGPS. 87136.

Dimensions:

Specimen	D	U	H	B	B/H
Holotype	34.0	10.5(.31)	14.5(.43)	15.0(.44)	1.03
58039	57.0	19.2(.34)	21.8(.38)	22.4(.39)	1.03
87136	48.5	15.8(.33)	18.8(.39)	19.8(.41)	1.05

Descriptive remarks: Matsumoto (1959b, p. 153) and then Matsumoto and Miyauchi (1984, p. 53) have given clearly

the revised specific diagnosis, with which the above two IGPS specimens match essentially. Although the early part of the outer whorl is somewhat deformed secondarily in the two specimens, the dimension tabulated above, without restoration, are similar to those of the Hokkaido and California examples (Matsumoto and Miyauchi, 1984; Matsumoto, 1959b).

IGPS. 87136 was labelled as "*Neoepigonicerias schmidti*". This name was proposed by Shimizu (1935a, p. 165) for *Ammonites timotheanus* of Schmidt (1873, p. 14, pl. 2, figs. 7-11) (non Mayor) from "Rukusnai" and Dui in Sakhalin. The genus *Neoepigonicerias* and the species *N. schmidti* are invalid as Wright and Matsumoto (1954, p. 110) have pointed out. Anyhow, IGPS. 87136 is not identical with the better preserved specimen of Schmidt (1873, pl. 2, figs. 7, 8, 10, 11), in that the former has nearly parallel sided whorl in stead of the

subrounded one with convex flanks which are convergent to the flat venter as Schmidt showed in his pl. 2, fig. 8. Incidentally, Schmidt illustrated evolute shell with a wide umbilicus ($U/D=0.40$) in lateral view (fig. 7) and moderate umbilicus ($U/D=0.34$) and considerable involution in cross section (fig. 8). Therefore it is difficult to give an adequate specific name to his form without seeing the actual specimens.

Shimizu (1935a) listed *Neopigoniceras schmidti* (nom. nud.) not only in the faunas from several places (Alexandrovskie, Naibuchi, Kawakami, Namikawa and Towada) in Sakhalin but also in those from various places in Hokkaido. IGPS. 87136 may be one of them, as judged from Shimizu's mode of hand-writing. This is, however, nothing but an example of *Tetragonites popetensis*.

Occurrence: IGPS. 38039 is labelled as loc. D, the Gogo-no-sawa (stream of no. 5), below the railway station Nakayama, South Sakhalin; IGPS. 87136 simply as Miho-gawa (the River Miho, a tributary of the River Naibuchi), S. Sakhalin.

The two specimens are similar to each other in lithologic characters, i.e. green, calcareous silty fine-grained sandstone with dark green coating on the surface of fossil shells. One of them (58039) is associated with a fraction of inoceramid shell with ornament like that of *Sphenoceras schmidti* (Michael), suggesting a Campanian age.

This species occurs in the Campanian in Hokkaido and ranges up to the Maastrichtian in California.

Genus *Saghalinites* Wright and
Matsumoto, 1954
Saghalinites teshioensis
Matsumoto, 1984

Pl. 51, fig. 1

Lytoceras (*Tetragonites*) *cala* (Forbes); Basse, 1931,
p. 17, pl. 1, figs. 27-28.

Saghalinites teshioensis Matsumoto, 1984, p. 27, pl. 9,
figs. 1-3.

Material: A single specimen, IGPS. 86181.

Dimensions:

Specimen	D	U	H	B	B/H
Holotype	57.0(1)	27.0(.47)	16.4(.29)	18.8(.33)	1.15
86181 (E)	73.0(1)	34.4(.47)	22.8(.31)	~22 (.30)	0.97
" (E-90°)	60.0(1)	27.6(.46)	18.4(.31)	~18 (.30)	0.98
Basse's	69.0(1)	34.0(.49)	21.0(.30)	24.8(.36)	1.18

Descriptive remarks: *S. teshioensis* Matsumoto, 1984 was established on 5 mature and 1 immature specimens from the Zone of *Metaplacentoceras subtilistriatum* (lower Upper Campanian) of the Teshio Mountains, northern Hokkaido.

IGPS. 86181 matches the specific diagnosis (see Matsumoto, 1984, p. 27) in essential points. It is secondarily compressed, but its shell form would be quite similar to that of the types, if it is properly restored.

It is somewhat (but not much) larger than the adult specimens from the Teshio Mountains. The holotype preserves a hood at its apertural end. This was not described in the text but is shown in the figure (Matsumoto, 1984, pl. 9, fig. 1) and marks the end of a complete shell, which is 57 mm in diameter. Other four paratypes are similar to the holotype in size, being less than 60 mm. This size is evidently smaller than *S. nuperus* (van Hoepen, 1921) (see Kennedy and Klinger, 1977), from the Lower Campanian and Santonian of South Africa, whose maximum diameter was recorded as 98.5 mm. IGPS. 86181 may be intermediate in size between typical forms of *S. teshioensis* and *S. nuperus* but is as evolute and as widely umbilicate as the types of *S. teshioensis*.

There are 4 narrow but distinct constrictions in the last 180° of the body-chamber of IGPS. 86181, but the preceding part for about 120° looks to be free from constriction. This feature is

similar to (if not quite identical with) that seen in the typical form of *S. teshioensis*.

The specimen (internal mould) from "Horizon 10, base of the Senonian" of the Maintirano province, Madagascar, described by Basse (1931, p. 17, pl. 1, fig. 27, pl. 10, fig. 7) under *Lytoceras* (*Tetragonites*) *cala* (Forbes) resembles IGPS. 86181 in size, evolute and subrounded whorl, wide umbilicus and course and narrowness of constrictions, but the constrictions are disposed uniformly at every 60°.

It would be unwise to stress much importance in the frequency of constrictions, which may not be well shown when the test is preserved. Therefore, I am inclined to regard Basse's form as probably identical with ours, being referable to *S. teshioensis*.

Shimizu (1935a, p. 181) mentioned that the above form from Madagascar is indistinguishable from his *Saghalinites saghalinensis*, which itself was not well defined illustrated. Typical examples of his *S. saghalinensis* seem to occur somewhere in Sakhalin, but at present it is very difficult to trace his original specimens. IGPS. 86181 has no sign of Shimizu's hand-writing on the label.

Occurrence: The locality of IGPS. 86181 is labelled as simply "Kukei-zawa", which is, according to my survey, a branch in the upper reaches of the River Naibuchi. The upper part of the Ryugase Group is generally exposed along the main course of the Kukei-zawa. Without the indication of the very point, it is difficult to tell precisely the stratigraphic horizon, although somewhere from the Upper Campanian to Maastriachian is suggested.

Genus *Pseudophyllites*
Kossmat, 1895

Pseudophyllites cf. *teres*
(van Hoepen, 1920)

Pl. 50, figs. 1, 2

Compare:

Tetragonites teres van Hoepen, 1920, p. 144, pl. 25, figs. 1-2.

Pseudophyllites teres (van Hoepen); Kennedy and Klinger, 1977, p. 187, figs. 23-24 (with full synonym list).

Pseudophyllites cf. *P. teres* (van Hoepen); Matsumoto and Miyauchi, 1984, p. 54, pl. 21, fig. 4; pl. 23, figs. 4-5.

Material: IGPS. 58090 a and b.

Dimensions:

Specimen	D	U	H	B	B/H
58090a	~45 (1)	~10 (.22)	25.7(.57)	16.5(.37)	0.64
58090b	14.9(1)	4.5(.35)	6.5(.44)	6.8(.46)	1.05

Descriptive remarks: IGPS. 58090a is a fragmentary piece, for about 90°, of a squashed specimen whose restored diameter is 45 mm. 58090b is a small but undeformed nuclear part of another individual. They were contained in the same rock.

58090b shows general characters of *Tetragonites*, with moderate involution and subrounded whorl-section. It may represent an immature shell of *P. teres*, but the evidence is not sufficient, since the ontogenetic development of *P. teres* has not been precisely described.

The observable characters of 58090a are favourable to refer it tentatively to *P. teres*, as redescribed by Kennedy and Klinger (1977), but I hesitate to determine conclusively, because of the poor state of preservation.

Occurrence: The locality is recorded on the label as Taki-no-sawa, on the road between Toyohara and Maoka (Ho-Shin Sando), where a tunnel was under construction. The rock matrix is fine-grained sandstone, containing fragmentary shell of inoceramid.

In the Soya area of northern Hokkaido

two examples of *Pseudophyllites* cf. *P. teres* have been recently reported to occur in the Subzone of *Schlueterella kawadai* of the Zone of *Metaplacentceras subtilistriatum*, lower part of Upper Campanian (Matsumoto and Miyauchi, 1984).

Family Gaudryceratidae
Spath, 1927

Genus *Gaudryceras* de
Grossouvre, 1894

Gaudryceras cf. *stefaninii*
(Venzo, 1936)

Pl. 50, fig. 8

Compare :

Lytoceras (*Gaudryceras*) *stefaninii* Venzo, 1936, p. 79 (21), Pl. 6 (2), figs. 3-4.

Gaudryceras stefaninii Venzo; Kennedy and Klinger, 1979, p. 130, pl. 1, figs. 2, 5, 8; pl. 2, fig. 1 (with full synonymy list).

Material : IGPS. 58085.

Dimensions :

Specimen	D	U	H	B	B/H
58085*	15.0(1)	7.4(.49)	4.5(.30)	6.8(.45)	1.51
Syntype**	29 (1)	15 (.51)	9 (.31)	12 (.41)	1.33

* at the end of phragmocone; ** after Venzo, 1936, p. 79.

Descriptive remarks : This is a small specimen embedded in rock matrix on its right side. Its inner whorls are well preserved, but the body-chamber is deformed.

This form is similar to the immature examples of *G. stefaninni* (Venzo, 1936, p. 79, pl. 6, figs. 3, 4; Collignon, 1963, pl. 247, fig. 1057; 1964, pl. 318, fig. 1352; Kennedy and Klinger, 1979, p. 130, pl. 1, figs. 2, 5, 8) in the evolute coiling, slowly expanding whorls, depressed whorl-section, shallow constrictions without distinct flares and gently flexuous and prorsiradiate lirae on the surface of shell.

The lirae are distinct on the umbilical wall and flank, with outward branching and intercalation, becoming extremely fine and dense on the venter. This feature is what Kennedy and Klinger

called *Vertebrites*-like fashion. As I have already noticed (Matsumoto, 1941, p. 23), the same feature occurs in the whorl of early growth-stage of *G. tenuiliratum* Yabe.

Kennedy and Klinger (1979, p. 133, pl. 2, fig. 1) further described the characters of *G. stefaninii* in the middle and late growth-stages. Such examples have yet to be searched for in Sakhalin and Hokkaido.

Occurrence : Loc. c on south bank of the River Naibuchi, "west 25" (record on the label same as IGPS. 58038 = *Anagaudryceras sacya*), presumably somewhere in the Kawakita Group (Matsumoto, 1942), lower part of the Cenomanian or upper part of the Albian.

G. stefaninii has been reported to occur in the Lower and Middle Cenomanian of South Africa and Albian and Lower Cenomanian of Madagascar.

Genus *Anagaudryceras*
Shimizu, 1934

Anagaudryceras cf. *sacya*
(Forbes, 1846)

Pl. 50, fig. 5

Compare :

Ammonites sacya Forbes, 1846, p. 113, pl. 14, fig. 10.

Ammonites buddha Forbes, 1846, p. 112, pl. 14, fig. 9.

Ammonites sacya Forbes; Stoliczka, 1865, p. 154, pl. 75, figs. 5-7.

Anagaudryceras buddha (Forbes); Kennedy and Klinger, 1979, p. 146, pl. 8, figs. 1-3; pl. 9, figs. 1-3, 1-6; pl. 11, figs. 1-2) (with full list of synonymy).

Material : IGPS. 58038.

Descriptive remarks : This specimen consists of a fragmentary body-chamber and a displaced portion of inner whorl. The former has band-like ribs separated by narrow grooves, which are prorsiradiate near the umbilicus and gradually curved to be almost radial on the main part of the flank, crossing the venter nearly vertically. The latter crops out partly showing periodic flares.

This specimen is probably referred to *Anagaudryceras sacya* (Forbes), although it is incomplete. The specific name should be *A. sacya* (author priority).

Occurrence: In sandy calcareous sandstone at "loc. c, on the south bank of the River Naibuchi, west 25", presumably somewhere in the Kawakita Group, lower part of the Cenomanian or upper part of the Albian.

Anagaudryceras yokoyamai
(Yabe, 1903)

Pl. 50, fig. 6

Gaudryceras yokoyamai Yabe, 1903, p. 36, pl. 6, figs. 1, 2; pl. 7, fig. 6.

Anagaudryceras yokoyamai (Yabe); Matsumoto, 1941, p. 20, fig. 1c.

Material: IGPS. 58087a and b

Dimensions:

Specimen	D	U	H	B	B/H
58087a	35.0(1)	11.6(.33)	15.0(.43)	14.0(.40)	0.93
Holotype	86.0(1)	22.0(.26)	42.0(.49)	40.0(.46)	0.95
Paratype	45.0(1)	13.5(.30)	20.0(.44)	18.0(.40)	0.90

Descriptive remarks: For some reasons this species is commonly represented by fossils of phragmocones. The holotype from Hokkaido (Yabe, 1903, pl. 6, fig. 1) is of moderate size (D = 86 mm), representing the middle growth-stage.

IGPS. 58087a is small and septate; 58087b still smaller. These small, immature specimens show diagnostic features, such as subcircular whorl-section, moderate size of umbilicus (U/D) which decreases with growth, moderate degree of involution, weak constrictions on inner whorls and nearly smooth surface, only with dense and very fine lirae or striae which are discernible with the aid of magnifier. In the preserved outer whorl of 58087a, faint and narrow radial furrows are also discernible even on the inner shell layer at irregular intervals—say about 10 in a quarter whorl. The radial furrows of

this kind continue to develop up to the body-chamber of a larger specimen, as Yabe (1903, p. 37) has already noticed. In addition to them narrow but raised ridges develop on the adult body-chamber. These features are shown by myself in a diagrammatic sketch (Matsumoto, 1941, fig. 1c) which was based on a few adult specimens.

Occurrence: South of the pass between Highashi-Shiraura and Manui, S. Sakhalin. *Hauericeras* (?) sp. (IGPS. 58087c, d) and *Inoceramus* sp. (58087e) are associated.

Anagaudryceras politissimum
(Kossmat, 1895)

Pl. 50, fig. 7

Lytoceras (*Gaudryceras*) *politissimum* Kossmat, 1895, p. 128, pl. 15, fig. 7a-c.

Anagaudryceras politissimum (Kossmat); Matsumoto in Matsumoto *et al.*, 1985, p. 23, pl. 3, figs. 1-6; pl. 5, figs. 5-8 (with full list of synonyms).

Material: IGPS. 86184b and c.

Dimensions:

Specimen	D	U	H	B	B/H
86184b	42.0(1)	18.5(.44)	15.4(.37)	13.9(.33)	0.90
86184c	32.5(1)	12.4(.38)	13.8(.41)	11.5(.35)	0.86
Holotype	89 (1)	34 (.38)	33 (.38)	28 (.31)	0.85
GK. H2302	27.6(1)	10.2(.37)	11.2(.40)	10.4(.38)	0.93

Descriptive remarks: The above two specimens resemble the small form of *A. politissimum* recently described by myself (Matsumoto in Matsumoto *et al.*, 1985, p. 23, pl. 3, figs. 1-5; pl. 5, figs. 5-8). IGPS. 86184b deviates to a certain extent from the normal or average form in its wider umbilicus and more distinctly prorsiradiate constrictions, as shown by the figures, but it is secondarily compressed. It occurs with 86184c, which is normal. Extremely fine and dense striae are impressed on the external mould of 86184b.

Occurrence: Labelled as "drift in the main stream of the River Naibuchi, S. Sakhalin". The host nodule is dark

green-grey, calcareous, fine-sandy siltstone, which resembles those contained in the beds occurring at several horizons of the Ryugase Group, e. g. Rby, Rcy2 and Rdy1. IGPS. 86184a, among others of the associated fossils, may be a fragmentary piece of *Neodesmoceras gracile* (Matsumoto), suggesting a Maastrichtian age. A particular type of brachiopod (86184d) is also associated.

Anagaudryceras cf. seymouriense
Macellari, 1986

Pl. 51, fig. 2; pl. 53, fig. 1

Compare:

Anagaudryceras seymouriense Macellari, 1986, p. 10,
figs. 9.1-9.6; 10.1-10.4.

Material: IGPS. 86176.

Dimensions:

Specimen	D	U	H	B	B/H
86196	~170.0(1)	50.0(.29)	82.0(.48)	~60(.35)	0.73
Holotype*	203.6(1)	55.2(.27)	103.0(.51)	87.9(.43)	0.85

* after table 1 of Macellari, 1986; ~ approximately restored

Descriptive remarks: This single specimen is fairly large, but deficient as the photograph shows. It is septate for the major part, showing a part of the finely and deeply incised suture.

The outer whorl expands with a high ratio, considerably involute and subelliptical to subovoid in section, with the maximum breadth slightly dorsad from the middle of the flank. The inner whorl may be subrounded, but actually it seems to be secondarily compressed and covered by rock matrix for the main part.

Where the outer shell layer is preserved, the surface has very fine and dense striae as in many other species of *Anagaudryceras*. In the outer whorl, on which the outer shell layer is not preserved except for a portion, the surface looks nearly smooth but for periodic shallow constrictions and associated low flares at every 60° or so.

The constrictions or flares are gently sigmoidal, with a forward convex curve at about the subrounded umbilical shoulder, passing gradually to nearly radial orientation on the main part of the flank and then gently curved forward at about the ventrolateral part. In parallel with the flares indistinct undulations separated by faint furrows may be seen on the outer whorl.

Judging from the above characters, IGPS. 87176 is best comparable with the holotype of *Anagaudryceras seymouriense* Macellari (1986, fig. 9-1, 2) from the Upper Maastrichtian of Seymour Island (Antarctic Peninsula).

A. seymouriense resembles *A. mikobokense* Collignon, 1956 in many respects as Macellari himself has stated. There may be a problem about the distinction or relation between the two species, since the shape of whorl-section and the curvature of constrictions or flares change with growth. For the moment I follow Macellari in approving the criteria to discriminate the two species. Thus, the Sakhalin specimen is probably referred to *A. seymouriense* and the Californian specimens described by Matsumoto (1959b, p. 139, pl. 38, fig. 1) are assigned to *A. mikobokense*.

Occurrence: "Yuki-no-sawa, S. Sakhalin.", that is probably the Yukimizawa, a tributary in the upper reaches of the River Naibuchi running in parallel with the Kukei-zawa. From this location and the lithology of the rock matrix, Member Rdy1, upper part of the Maastrichtian is suggested.

Anagaudryceras matsumotoi
Morozumi, 1985

Pl. 51, fig. 3

Anagaudryceras matsumotoi Morozumi, 1985, p. 29,
pl. 9, fig. 1.

Anagaudryceras matsumotoi Morozumi; Matsumoto
in Matsumoto et al., 1985, p. 27, pl. 4, figs. 1-10.

Material: IGPS. 86180.

Dimensions :

Specimen	D	U	H	B	B/H
IGPS. 86180	19.4(1)	7.6(.39)	7.4(.38)	8.4(.43)	1.13
GK. H5984	29.0(1)	10.3(.35)	11.8(.41)	12.6(.43)	1.07
" (-240°)	17.0(1)	5.8(.34)	7.0(.41)	8.2(.47)	1.17
GT. I-3783	24.8(1)	9.2(.37)	10.1(.41)	10.7(.43)	1.06

Descriptive remarks : This is small and wholly septate. It resembles a young, nuclear part of *A. yokoyamai* or that of *A. matsumotoi*. Although the two species are similar in a young stage, they are clearly distinguished in the adult shell (see Morozumi, 1985 and also Matsumoto, 1985). In this case the assignment to *A. matsumotoi* is reasonable for the occurrence.

Occurrence : Kukei-zawa, a branch of the River Naibuchi. *Pachydiscus subcompressus* Matsumoto and *Zelandites varuna* (Forbes) are associated; hence the host rock is probably Member Rdy 1, upper part of the Maastrichtian.

Genus *Zelandites* Marshall, 1926*Zelandites varuna*
(Forbes, 1846)

Pl. 51, fig. 4

Ammonites varuna Forbes, 1846, p. 107, pl. 8, fig. 5.
Zelandites varuna (Forbes) var. *japonica* Matsumoto, 1938, p. 140, pl. 14, figs. 5-7; text-fig. 1.
Zelandites varuna (Forbes); Macellari, 1986, p. 14, figs. 11 • 11-11-12, 12.

Material : Two small specimens, IGPS. 86179a, b.

Dimensions :

Specimen	D	U	H	B	B/H
IGPS. 86179a	21.6 (1)	3.4 (.16)	11.1 (.51)	6.9 (.32)	0.62
BM. C 51059*	23 (1)	4.5 (.20)	12 (.52)	7.5 (.33)	0.63
OSU. 38254**	32.6 (1)	5.0 (.15)	18.0 (.55)	11.3 (.35)	0.63
GT. I-2501a***	23 (1)	4.5 (.20)	11.5 (.50)	7.5 (.33)	0.65

* after Kossmat (1895); ** after Macellari (1986); *** after Matsumoto (1938) = UMUT. MM 9122a.

Descriptive remarks : IGPS. 86179a is a fine specimen, showing the diagnostic characters of the phragmocone (see Pl. 51, fig. 4) although about a half of the shell was cut off. 86179b has a body-chamber which was

badly distorted.

About 50 years ago I described several specimens from Member Rdy 1 of the Ryugase Group (Naibuchi valley) under *Z. varuna* var. *japonica* Matsumoto. One of them (Matsumoto, 1938, pl. 14, fig. 5 = GT. I-2502, now UMUT. MM 9123) has the body-chamber which has several grooves at regular intervals. Others are phragmocones and IGPS. 86179a is quite similar to them.

In 1979 I examined Forbes' original specimens, at least 7, of which the figured specimen, BM. C 51059 is designated herein as the **lectotype** of *Ammonites varuna* Forbes. They are all septate. As the measurements and illustration show, there is no significant distinction between the forms from South India and South Sakhalin. Unless the adult specimen from S. India would be found to have different type of ornament or shell-form, I should agree with Macellari (1986, p. 14) to regard the specimens from S. India, S. Sakhalin, Chile (Steinmann, 1895) and Seymour Island as belonging to an identical species *Z. varuna* (Forbes).

I should add to note that IGPS. 86179a has on the shell surface, very fine and dense striae which are prorsiradiate around the umbilicus and gradually curved to radial orientation on the main part of flank and the venter. The striae show rhythmically minor change in density and intensity which may foretell the incipient grooves on the whorl of the late growth-stage.

Occurrence : Kukei-zawa a branch of the River Naibuchi, probably Member Rdy 1, Maastrichtian.

As to the taxonomy of heteromorpha see Matsumoto (1984, p. 28).

Family Diplomoceratidae
Spath, 1926
Genus *Glyptoxoceras* Spath, 1925

Glyptoxoceras cf. *circulare*
Shimizu, 1935

Pl. 53, fig. 3

Compare :

Anisoceras subcompressum Forbes ; Stoliczka,
1865, p. 179, pl. 85, fig. 4.

Glyptoxoceras circulare Shimizu, 1935b, p. 272,
figs. 10-11.

Material : IGPS. 87128a and b.

Dimensions :

Specimen	Length	H	B	R	remarks
87128a	>59	~12	~15	7-8	secondarily depressed
87128b	>33	10.0	10.2	5	undeformed

R = number of ribs in the distance = $(H + B) \times 1/2$

Descriptive remarks : IGPS. 87128a (Pl. 53, fig. 3) is a secondarily depressed piece of a straight arm, consisting mainly of the body-chamber with the last portion of the phragmocone at its preserved posterior end. 87128b is a shorter straight arm of the phragmocone.

Shimizu (1935b) established this species on the specimen from South India illustrated by Stoliczka (1865, pl. 85, fig. 4) under *Anisoceras subcompressum*. According to Shimizu (1935b), it is nearly circular in section as *G. indicum* is but has coarser ribs than those of *G. indicum*. Should this distinction be maintained, the specimens before me would be referred to *G. circulare*. In fact Shimizu wrote "*Glyptoxoceras* cf. *circulare*" on the label with his hand-writing, although this species was not recorded to occur in the Upper Cretaceous of Japan in his two papers (Shimizu, 1935a, b).

The ribs are moderately coarse, fairly crowded (see R in dimensions), and separated by the interspaces which are as narrow as the ribs on the shell surface and slightly broader than the ribs on the internal mould. At about 30 mm from

the beginning of the body-chamber in IGPS. 87128a a rib is slightly more elevated than others and has a somewhat broader interspace behind. The ribs are not sharp-headed even on the shell. 87128b shows a suture-line, in which the saddle between L and U is the largest and I is distinctly smaller (i.e. narrower and shorter) than U and is tripartite (not bipartite as Shimizu observed).

Occurrence : Written as "M", main stream of the River Naibuchi. As there is no explanation of "M", the stratigraphic position is uncertain, but a Campanian or Maastrichtian age is suggested by this species.

Family Baculitidae Meek, 1876

Genus *Baculites* Lamarck, 1799

Baculites sp.

Material : IGPS. 87130, which consists of 9 pieces of fragmentary and secondarily deformed specimens of more than 2 individuals, collected by S. Shimizu.

Descriptive remarks : This is labelled as *Baculites sachalinensis* sp. nov. (Shimizu, 1935a), which is a *nomen nudum* because of the lack of diagnosis or distinction from the well defined species.

The above specimens are too poorly preserved to show clearly the specific characters. Presumably they may have been extra-specimens which Shimizu did not intend to designate as the holotype or paratypes.

Although incomplete, the specimens seem to suggest a fairly rapid tapering in the young stage, rather slender oval outline in cross-section and moderate size of shell. Partly exposed sutures are of advanced type like that of *Baculites rex* Anderson (see Matsumoto, 1959a, p. 136, pl. 31, fig. 5 ; text-figs. 45-50).

Occurrence : Only recorded as the Miho-gawa, a tributary to the River Naibuchi. Dark green-gray sandy

siltstone suggests Member Rby (Upper Campanian) or Rcy2 or Rdy1 (lower or upper part of Maastrichtian).

Suborder Ammonitina Hyatt, 1889

Family Pachydiscidae Spath, 1922

Genus *Pachydiscus* Zittel, 1884

Pachydiscus subcompressus

Matsumoto, 1954

Pl. 53, fig. 2

Pachydiscus subcompressus Matsumoto, 1954, p. 287, pl. 26[10], fig. 4 (only) (non pl. 27[11], fig. 1; pl. 28[12], fig. 1).

Pachydiscus subcompressus Matsumoto; Verechagin *et al.*, 1965, p. 56, pl. 70, fig. 1.

Material : IGPS. 86178a, b, c. Three incomplete specimens of dissimilar sizes in one and the same nodule.

Descriptive remarks : The largest of the above three, 86178a, is illustrated. It is about 155 mm in diameter, septate for major part, with the beginning of the body-chamber at its preserved last part. Its umbilicus cannot be developed, because the inner part of the shell is dissolved in the rock matrix. Should H/D be assumed as 0.45, as suggested by the holotype (UMUT. MM 6821=GT. I-2815), H would be about 70 mm. B is measured at about 35 mm, hence B/H would be 0.5. Anyhow, the whorl is highly compressed. It looks to be nearly parallel sided and its venter is moderately rounded as this and other two specimens show.

Numerous ribs of moderate strength run on the outer part of the flank nearly radially or with slightly forward inclination and cross the venter in perpendicular to the siphonal line. They are disposed rather regularly, being separated by slightly wider interspaces. Some ribs are longer and may be on the extension of the umbilical bullae which are not preserved in these specimens but are seen in the holotype and several other specimens (now kept at UMUT) of *P. subcompressus* Matsumoto, 1954.

This species is closely allied to *P. gollevillensis* (d'Orbigny, 1850) (see Kennedy, 1986) from the Upper Maastrichtian of Europe, Madagascar and other regions, but the criteria to distinguish the two species which I pointed out (Matsumoto, 1954, p. 288) are still warrantable. The former is generally larger and more narrowly umbilicate than the latter. In the former some of the long ribs continue to the outer ribs, showing a gently flexuous curve, whereas in the latter the umbilical and outer ornaments are clearly differentiated.

On this occasion I should like to mention a probable mistake (omission of sentences) in the printing of the valuable paper of Macellari (1986, p. 48, right half, between lines 10 and 11). Readers may notice there an obvious confusion between *Pachydiscus flexuosus* Matsumoto, 1979 and *P. subcompressus* Matsumoto, 1954. *P. flexuosus* Matsumoto (*in* Matsumoto *et al.*, 1979, p. 53, pl. 9, figs. 1-3; pl. 10, fig. 4; pl. 12, fig. 1; text-fig. 4) is well defined on the basis of fine specimens from Hokkaido. *Pachydiscus ultimus* Macellari (1986, p. 46, figs. 36 • 1-36 • 4, 37 • 1-37 • 2) from Seymour Island is allied to *P. flexuosus* in having high whorls with convergent flanks and more or less flexuous but weak ribs which tend to differentiate into umbilical and outer ornaments. The former is distinguished from the latter in its greater involution, narrower umbilicus, higher whorl and more numerous ribs with less distinct flexuosity. I wrote to Dr. Macellari that most specimens of *P. subcompressus* from the Maastrichtian of South Sakhalin are secondarily compressed and cannot be measured with precision. The same is applied to IGPS. 86178a, b, c.

Occurrence : The Kukei-zawa, a branch of the River Naibuchi, probably Member Rdy1 of the Ryugase Group, Upper Maastrichtian. IGPS. 86178a, b, c are associated with 86179a, b

(*Zelandites varuna*) and 86180
(*Anagaudryceras matsumotoi*).

Genus *Urakawites* Matsumoto, 1955

Urakawites rotalinoides

(Yabe, 1915)

Pl. 52, fig. 1

Pachydiscus rotalinoides Yabe, 1915, p. 21, pl. 21, pl. 1, fig. 9; pl. 2, figs. 5, 6.

Urakawites rotalinoides (Yabe); Matsumoto, 1955, p. 169, pl. 34, figs. 1-3; pl. 35, fig. 2; pl. 37, fig. 1; text-figs. 6, 7.

Material: IGPS. 87122a, b and IGPS. 58084.

Dimensions:

Specimen	D	U	H	B	B/H
IGPS. 87122a	75.6(1)	23.2(.31)	32.2(.43)	36.6(.46)	1.14
Lectotype	55.3(1)	14.5(.26)	23.0(.42)	29.5(.53)	1.28
UMUT. MM 5633	96.0	29.5(.31)	38.0(.40)	36.0(.38)	0.95

Descriptive remarks: IGPS. 87122a (Pl. 52, fig. 1) is the best preserved of the three specimens. The two others are somewhat distorted and unfavourable for precise measurements.

The above three specimens show the diagnostic characters of *U. rotalinoides* (Yabe) redefined by Matsumoto (1955). In this species the ribs are coarser and more widely separated, with more infrequent intercalation of shorter ribs, and the ventrolateral tubercles appear earlier and persist longer in growth-stage than those in *U. binodatum* (Whiteaves), but there is some extent of variation in these characters. For instance, in IGPS. 87122a the ventrolateral tubercles disappear at D=70 mm in the middle of the body-chamber and the last part is ornamented with at least three distinct flares, which are accompanied with narrow constrictions and considerably projected on the venter, whereas in IGPS. 87122b the ventrolateral tubercles persist longer on the major part of the body-chamber, where some of the major ribs are bifurcated at the umbilical tubercles and

minor ribs are intercalated here and there.

There is also some extent of variation in the size of shell. The known largest example is UMUT. MM 5633 (=GT. I-2774) from loc. N428c of the Naibuchi area, nearly 100 mm in diameter, as illustrated by Matsumoto (1955, pl. 37, fig. 1). The lectotype from Urakawa, and IGPS. 58084 here dealt with, are smaller examples in which the last septum is at D=40 mm or so.

These aspects of variation suggest us a problem about the relationship between *U. rotalinoides* and *U. binodatus*.

Occurrence: IGPS. 87122a and b are recorded as "loc. D of the Gogo-no-sawa, below the railway station of Nakayama, Kawakami Colliery; IGPS. 58084 is "the Jugogo-no-sawa (branch stream no. 15) of the River Suzuya, S. Sakhalin.

Urakawites binodatus

(Whiteaves, 1903)

Pl. 52, fig. 2

Pachydiscus binodatus Whiteaves, 1903, p. 347, pl. 49, fig. 1; text-fig. 23; Usher, 1952, p. 86, pl. 21, figs. 1-2; pl. 31, fig. 9.

Urakawites aff. *binodatus* (Whiteaves); Matsumoto, 1955, p. 172, pl. 35, fig. 1.

Material: IGPS. 87121.

Dimensions:

Specimen	D	U	H	B	B/H
IGPS. 87121 (c)	82.0(1)	21.0(.26)	35.4(.42)	41.0(.50)	1.16
" (-30°) (ic)	74.0(1)	18.6(.25)	32.5(.44)	35.0(.47)	1.08
GK. H 5200	55.0(1)	14.0(.25)	24.0(.44)	26.5(.48)	1.10
Holotype (ic)*	98.4(1)	26.4(.27)	41.4(.42)	47.8(.48)	1.13
" (-90°) (e)	82.2(1)	22.8(.28)	36.2(.44)	41.8(.51)	1.15

* measured on the plaster cast kindly sent from the Geological Survey of Canada; the last one at the last septum.

Descriptive remarks: In this specimen the phragmocone ends at D=60 mm and the body-chamber is well preserved for about 180°, but the last portion is destroyed and displaced. For some reasons the test is preserved on the phragmocone, whereas the body-chamber is represented by the internal mould, with shelly material remaining

on a portion of its venter. The umbilicus is covered with rock matrix.

This specimen is similar to the early middle-aged shell of *Eupachydiscus haradai* (Jimbo) in having subrounded whorl with convex flanks and rounded umbilical shoulder, fairly narrow umbilicus, alternating long and short, coarse ribs at fairly wide intervals and strong tubercles on the long ribs at the umbilical shoulder. The ventrolateral tubercles begin to appear in the last part of the phragmocone and continue to develop on the long ribs of the body-chamber for nearly 180°. The last three major ribs are free from the ventrolateral tubercles. In this specimen the

ventrolateral tubercles are shifted outward and disposed on either side of the siphonal zone. This is probably individual variation.

This specimen is somewhat larger than the previously described one (GK. H 5200) from Hokkaido, but it is still smaller than the holotype from the Nanaimo Group. There is, however, no significant difference between the forms on both sides of the North Pacific Ocean. Therefore, I regard them as an identical species.

Occurrence: Locality is labelled as the Kawakami Colliery without record about the stratigraphic level.

SUMMARY OF RESULTS

The species on which I have given remarks in this paper are as follows, with the register number at IGPS of the examined specimens:

- (1) *Tetragonites popetensis* Yabe 58039; 87136
- (2) *Saghalinites teshioensis* Matsumoto 86181
- (3) *Pseudophyllites* cf. *teres* (van Hoepen) 58090a, b
- (4) *Gaudryceras* cf. *stefaninii* (Venzo) 58085
- (5) *Anagaudryceras* cf. *sacya* (Forbes) 58038
- (6) *A. yokoyamai* (Yabe) 58087a, b
- (7) *A. politissimum* (Kossmat) 86184b, c
- (8) *A.* cf. *seymouriense* Macellari 86176
- (9) *A. matsumotoi* Morozumi 86180
- (10) *Zelandites varuna* (Forbes) 86179a, b
- (11) *Glyptoxoceras* cf. *circulare* Shimizu 87128a, b
- (12) *Baculites* sp. 87130
- (13) *Pachydiscus subcompressus* Matsumoto 86178a, b, c
- (14) *Urakawites rotalinoides* (Yabe)

87122a, b; 58084

- (15) *U. binodatus* (Whiteaves) 87121

It should be noted that twelve species of the above fifteen are Maastrichtian and/or Campanian age, only two (4 and 5) are Albian and/or Cenomanian, and that only one (6) is probably Santonian. There are three others, without descriptive remarks, which may be Coniacian and/or Santonian as follows:

- (16) uncertain species cf. *Protexanites* (*Anatexanites*) *nomii* (Yabe and Shimizu) 58046 (Tanzan-machi, Kawakami Coal Mine, coll. Toyama and Inai)
 - (17) *Neopuzosia ishikawai* (Jimbo) 58033a
 - (18) *Gaudryceras tenuiliratum* Yabe (middle growth-stage) 58033b (a and b both from a block south of j, main stream of the River Naibuchi)
- The above unbalance in age distribution is caused by my selection of the ammonites to be studied. In fact, some of the above species are those which have been established or redefined in recently issued papers (e.g., Kennedy and Klinger, 1977, 1979; Macellari, 1986; Matsumoto, 1984; Matsumoto and

Miyauchi, 1984; Matsumoto *et al.*, 1979, 1985; Morozumi, 1985).

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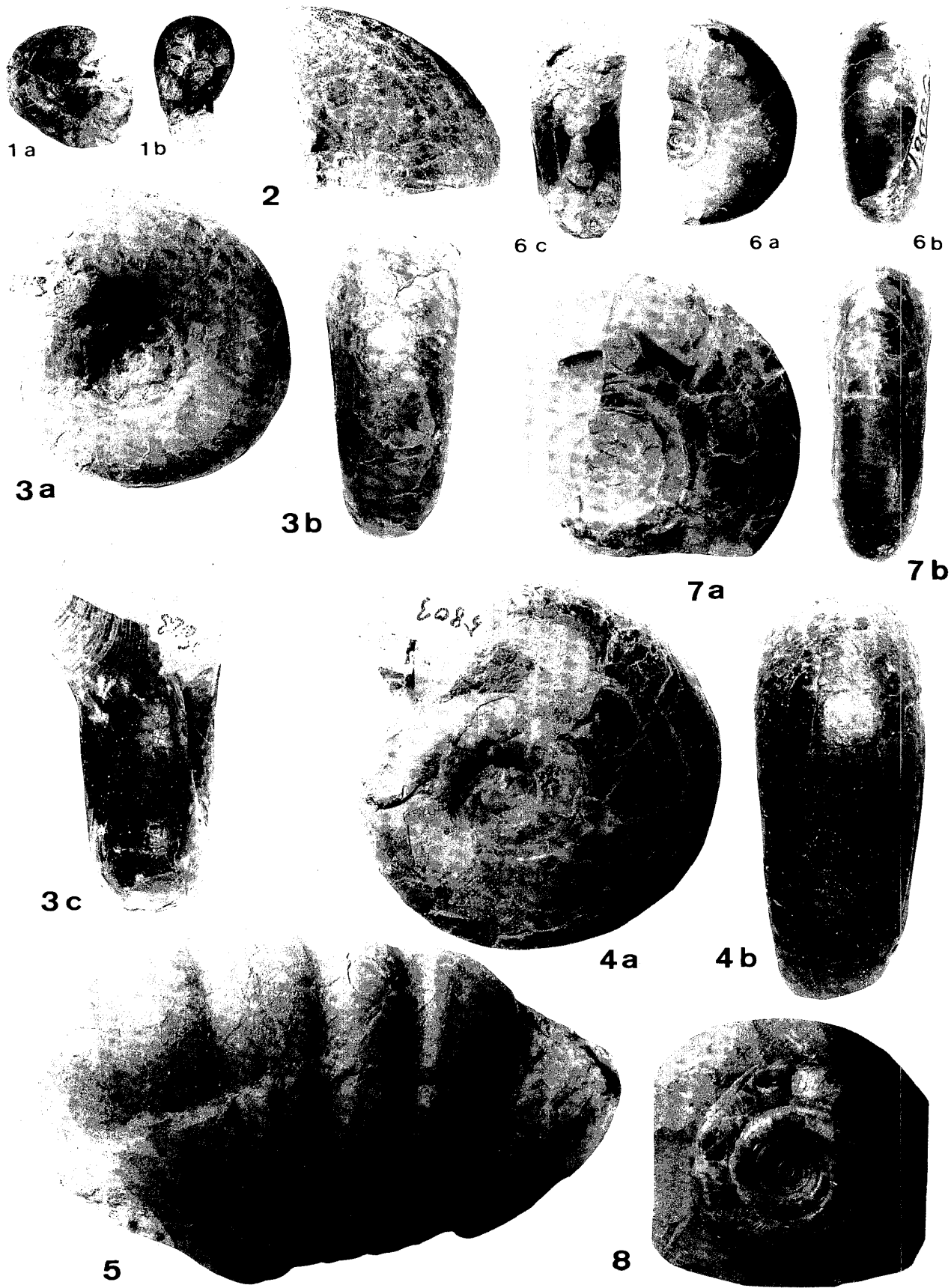
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Plates 50-53

Plate 50

- Figs. 1, 2. *Pseudophyllites* cf. *teres* (van Hoepen)p. 180
1: IGPS. 58090b, lateral (a) and sectional (b) views of nuclear part, $\times 1.5$. 2: IGPS. 58090a, lateral view of a fragmentary whorl, $\times 1$. Both from the Taki-no-sawa, between Toyohara and Maoka.
- Figs. 3, 4. *Tetragonites popetensis* Yabep. 178
3: IGPS. 87136 from the Miho-gawa, tributary to the River Naibuchi, lateral (a) and back (b) views, $\times 1$; also frontal view (c), $\times 1.3$. 4: IGPS. 58039 from the Gogo-no-sawa, below Nakayama railway station, lateral (a) and back (b) views, $\times 1$.
- Fig. 5. *Anagaudryceras* cf. *sacya* (Forbes)p. 181
IGPS. 58038 from "loc. C on the south bank of the River Naibuchi, west 25", lateral view, $\times 1$.
- Fig. 6. *Anagaudryceras yokoyamai* (Yabe)p. 182
IGPS. 58087a, from south of the pass between Higashi-Shiraura and Manui, lateral (a), back (b) and sectional views, $\times 1$.
- Fig. 7. *Anagaudryceras politissimum* (Kossmat).....p. 182
IGPS. 86184b from a drift in the River Naibuchi, lateral (a) and back (b) views, $\times 1.5$.
- Fig. 8. *Gaudryceras* cf. *stefaninii* (Venzo)p. 181
IGPS. 58085 from "loc. C, south bank of the River Naibuchi, west 25", lateral view, $\times 1.5$.



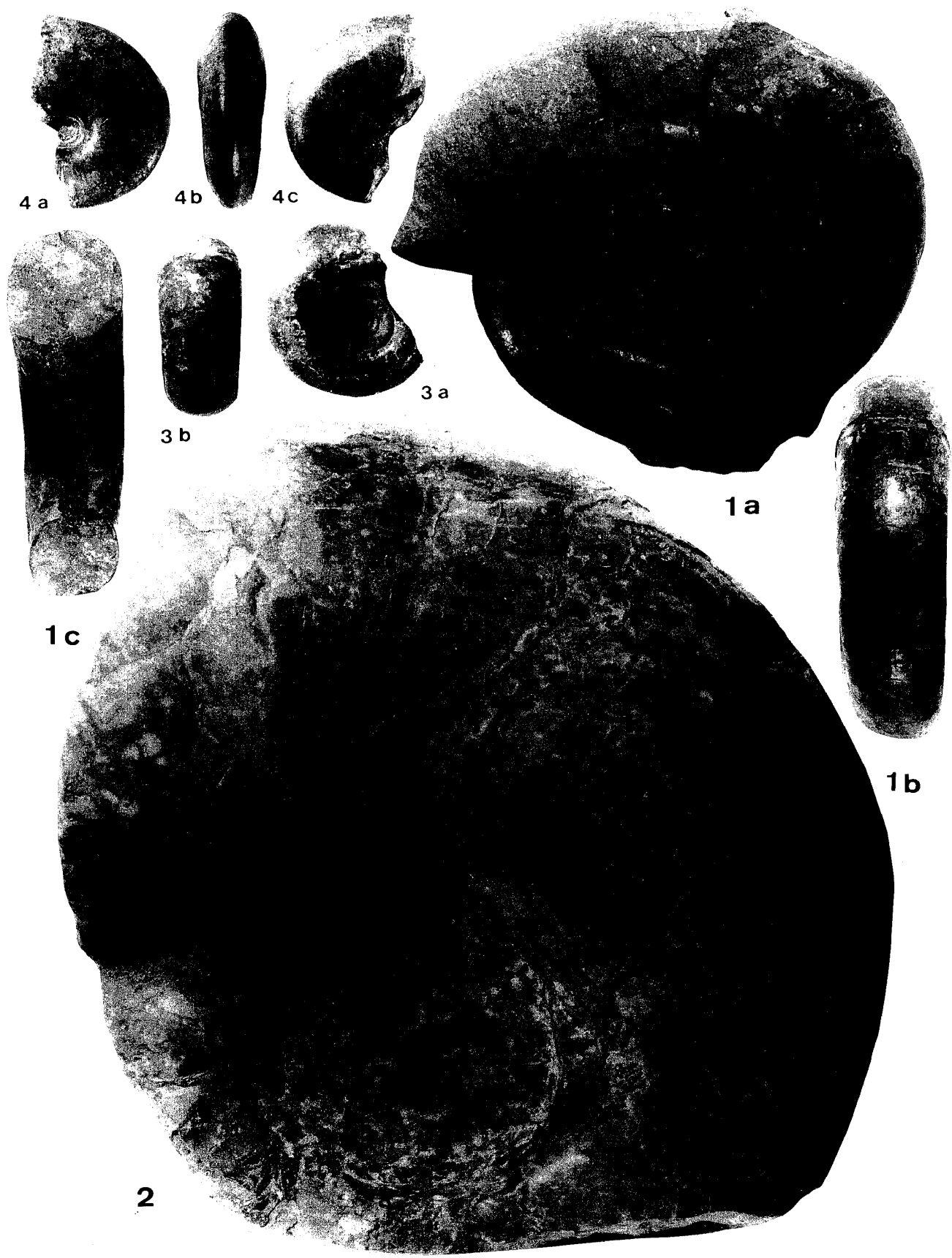
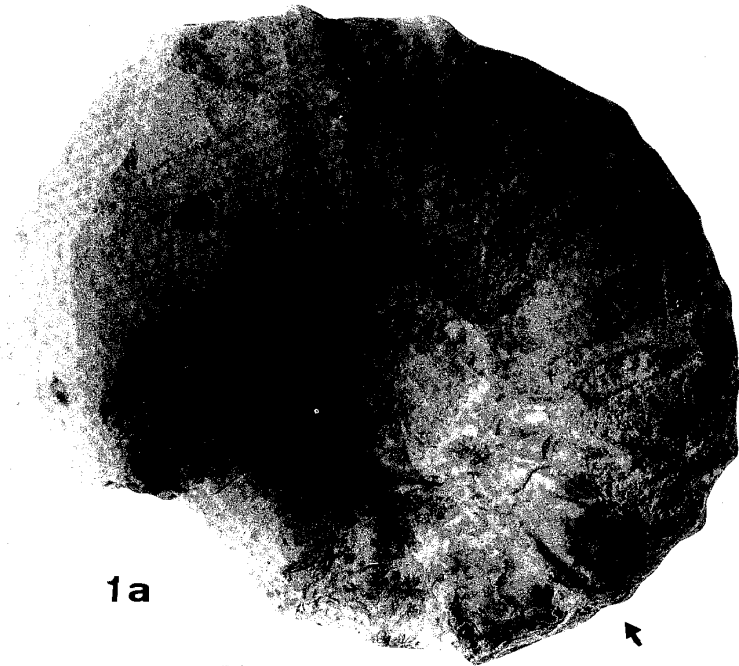


Plate 51

- Fig. 1. *Saghalinites teshioensis* Matsumotop. 179
IGPS. 86181 from the Kukei-zawa, a branch in the upper reaches of the Naibuchi, lateral (a), back (b) and sectional (c) views, $\times 1$.
- Fig. 2. *Anagaudryceras* cf. *seymouriense* Macellarip. 183
IGPS. 86176 from the Yuki-no-sawa, i.e. probably the Yukimi-zawa, branch of the River Naibuchi, lateral view, $\times 0.95$. (See Pl. 53, fig. 1.)
- Fig. 3. *Anagaudryceras matsumotoi* Morozumip. 183
IGPS. 86180 from the Kukei-zawa, tributary to the River Naibuchi, lateral (a) and back (b) views of inner nuclear part, $\times 1.5$.
- Fig. 4. *Zelandites varuna* (Forbes)p. 184
IGPS. 86179a from the Kukei-zawa, tributary to the River Naibuchi, two lateral (a, b) and back (c) views, $\times 1.5$.

Plate 52

- Fig. 1. *Urakawites rotalinoides* (Yabe) p. 187
IGPS. 87122a from loc. D, Gogo-no-sawa, below the Nakayama railway station, near Kawakami
Colliery, lateral (a) and 2 ventral (b, c) views, $\times 1$.
- Fig. 2. *Urakawites binodatus* (Whiteaves) p. 187
IGPS. 87121 from the neighbourhood of Kawakami Coal Mine, lateral (a), front (b) and back (c)
views, $\times 1$.
- Arrow indicates the position of the last septum.



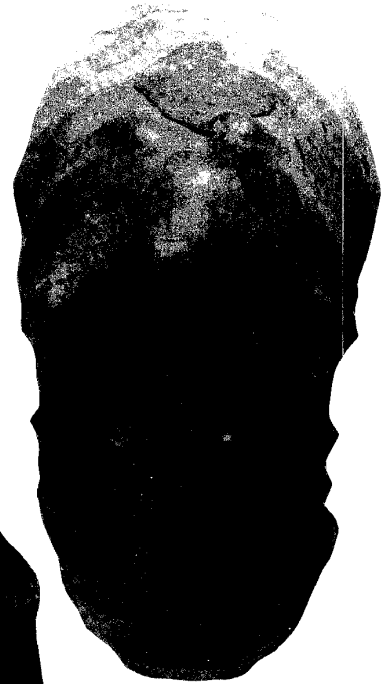
1a



1c



1b



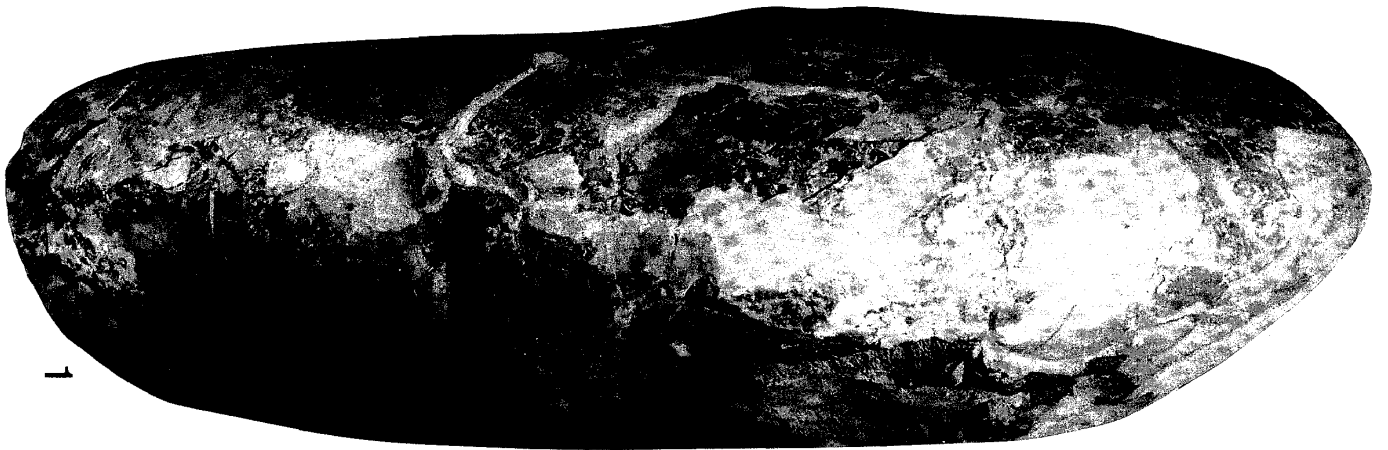
2c



2b



2a



2b



Plate 53

- Fig. 1. *Anagaudryceras* cf. *seymouriense* Macellari p. 183
IGPS. 86176, back view, $\times 0.95$.
(See Pl. 51, fig. 2 for lateral view.)
- Fig. 2. *Pachydiscus subcompressus* Matsumoto p. 186
IGPS. 86178a from the Kukei-zawa, tributary to the River Naibuchi, lateral (a) and back (b)
views, $\times 0.95$.
Scale bar (for Figs. 1, 2) = 10 mm.
- Fig. 3. *Glyptozoceras* cf. *circularis* Shimizu p. 185
IGPS. 87128a from loc. M, main stream of the River Naibuchi, lateral view, $\times 1$.

Photos (Pls. 50-53) all by courtesy of Dr. M. Noda.