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Some gaudryceratid ammonites from the Campanian and Maastrichtian of Hokkaido Part II

(Studies of the Cretaceous ammonities from Hokkaido—LVI)

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北海道のカンパニアン・マストリヒチアン両階産の若干のゴードリセラス科アンモナイト—その 2

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前編(その1)に続き，本編では A. 宗谷地区産の *Gaudryceras crassicostatum* (JIMBO) について，完模式標本をはじめ最近の漁港再建工事で産出したかなりの数の標本を加えて，図示・記載し，住房の主肋の頻度にかなりの変異のあることなどを明らかにした。宗谷ではカンパニアン上部の下部に (*Schlueterella kawadai* 亜帯に多く，その上位にも) 産する(松本・宮内)。

B. *Anagaudryceras* 属の KENNEDY & KLINGER (1979) の定義にコメントを加えた上で，*Anagaudryceras politissimum* (KOSSMAT), *A. nanum* sp. nov., *A. matsumotoi* MOROZUMI の3種を記載した。第1のは北海道・南サハリンのマストリヒチアン下部産で，インド，マダガスカル，西豪産の *A. politissimum* に同定できるが，小型である。第2のは浦河のカンパニアン産の1個の完模式標本だけで代表される稀なものであるが，極端な小型でワールの幅が比較的狭く，側面がほぼ平坦・平行で，住房に *A. subsacya* (MARSHALL) 型の弱いが幅の比較的狭い肋がある。第3は淡路島のマストリヒチアン下部産のものを完模式標本として MOROZUMI (1985) が設立した種で，北海道・南サハリンのマストリヒチアン(下部と上部)産のものを図示し，特徴や他種との比較についても補足した(松本)。

C. 浦河の東町H1部層(マストリヒチアン)産の1個の完模式標本に基づき，*Anagaudryceras tetragonum* sp. nov. を設立した。へそがやや広く，成長後期のワールが断面で準四角形(但し外面はまるみがある)で，弱いくびれとそれに伴う肋が側面を斜め前方に走る。住房後半部が欠けている弱点は将来補足したい(松本・蟹江)。

D. その1とその2に記載されたものに加え，すでに記載されたものも加えると，日本の白亜系最終部 (ヘトナイ統主部) にはゴードリセラス科アンモナイトが12種余り知られている。それらを産出時代を併記して示した。これらはチューロニアン～下部カンパニアン産のよく知られた種に比べると，個体数は少ないが種数は多く，かなり多様に分岐した様相を示している。下位の諸種が泥質相に産することが多く，かつ未成年殻が多産するのに対し，ヘトナイ統のものは，概観的には海退期内の小海進時の砂質相に産することが多く，成熟期の殻の化石が普通である。このことの説明には，この類の生活史が関係するにちがいないが，それは必ずしもよくわかっていない。ゴードリセラス科の諸種は生存期間が長いと通例みなされていたが，必ずしも全部がそうでなく，とくにヘトナイ世においては示準化石として使

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える幾つかの種があるし，稀だが特異な形態の種が生じたりしている。日本区で観察された同科の自然史後期の様相が，世界の他地域にも認められるか否かは今後の課題である(松本)。

Introduction

The purpose of this study has been stated in Part I (MATSUMOTO, 1984, p. 1–2). Part II contains the following four sections by the indicated authorships:

A. *Gaudryceras crassicostatum* (JIMBO) from Soya by Tatsuro MATSUMOTO and Toshiya MIYAUCHI

B. Three species of *Anagaudryceras* from the Campanian and Maastrichtian of Hokkaido by Tatsuro MATSUMOTO

C. A new species of *Anagaudryceras* from Urakawa by Tatsuro MATSUMOTO and Yasumitsu KANIE

D. Concluding remarks by Tatsuro MATSUMOTO

A. *Gaudryceras crassicostatum* (JIMBO) from Soya

(Tatsuro MATSUMOTO and Toshiya MIYAUCHI)

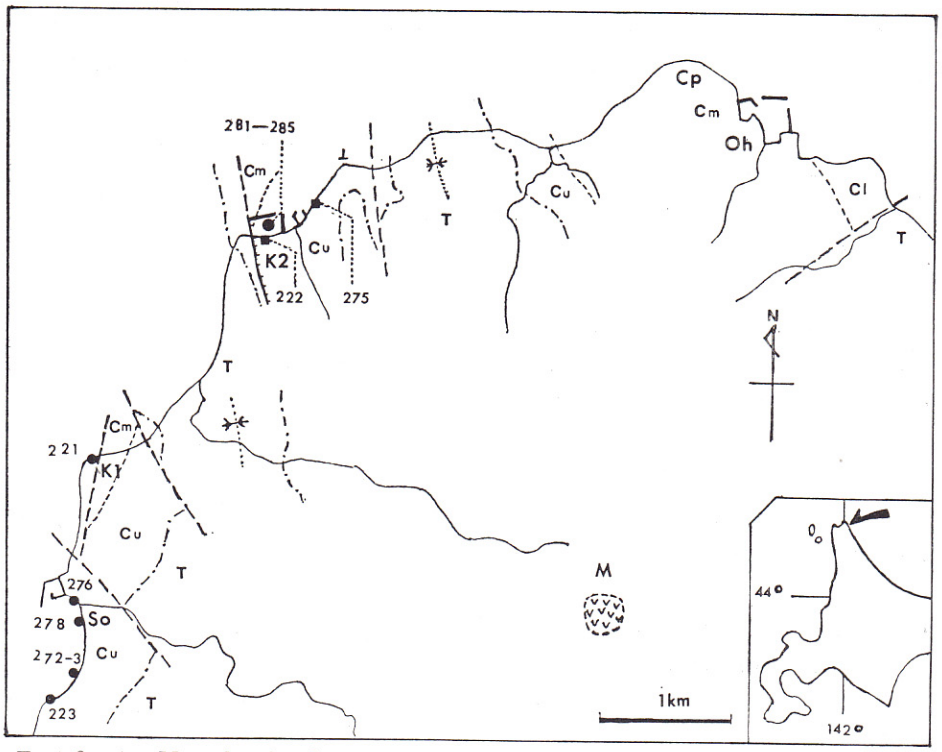
Gaudryceras crassicostatum (JIMBO, 1894)

Pl. 1, figs. 1–3; pl. 2, figs. 1–4; pl. 3, figs. 7–10

This species has already been described in Part I (MATSUMOTO, 1984, p. 6–8, pl. 4, figs. 1–3; pl. 5, figs. 1–2), but the details of the specimens from the Soya area (northern Hokkaido) have been left for Part II.

The holotype, UMUT. MM7492 (=I-117), was collected near the town of Soya (JIMBO, 1894) and its photographs are shown in this paper. Its plaster cast is kept in the Geological Collections, Kyushu University (GK. H9626). The younger specimen reported by YABE (1903, p. 36, pl. 6, fig. 1a, 1b) occurred also in the Soya area.

Owing to large scale excavations to reconstruct the fishery harbours of Soya and Kiyohama II, more than dozen specimens of this species have been obtained from the Soya area and are kept at MNH (T. MIYAUCHI's Natural History Collection of Northern Hokkaido) in Wakkanai. Examples are MNH 221 (pl. 2, figs. 3–4), 222, 223, 272, 273, 275 (pl. 3, figs. 9–10), 276, 278 (pl. 2, figs. 1–2), 279 (cf.), 280 (pl. 3, figs. 7–8), 281 (cf.), 282, 283, 285, etc (Text-fig. 1). Some of them were contained in calcareous nodules and others directly in fine-grained sandstone. Most of them came from the Subzone of *Schlueterella kawadai*, lower part of the Upper Campanian. For some reasons, they occur rather solitarily and many of them are adult, having body-chambers, although they are often distorted and more or less incompletely preserved, as in the case of the holotype. MNH 223 was obtained from a bed of sandstone at a point 700 m south of Soya harbour, where *Anapachydiscus* cf. *A. fascicostatus* (YABE) was obtained (MATSUMOTO and MIYAUCHI, 1984, p. 45, pl. 22, fig. 3). This bed is assigned to the upper part of the Zone of *Metaplacenticeras subtilistriatum*.



Text-fig. 1. Map showing localities of *Gaudryceras crassicostatum* (JIMBO) in the Soya area. ● in situ, ■ boulder. Number: Specimen register number at MNH. Place names — Cp: head of Cape Soya, K1: Kiyohama-I, K2: Kiyohama-II, M: Maru-yama, Oh: Ohmisaki, So: Soya. Geological outline (after MATSUMOTO & MIYAUCHI, 1984) —— Cl: Lower Campanian (in tripartite scheme), Cm: Middle Campanian (=upper Lower Campanian in bipartite scheme), Cu: Upper Campanian, T: Tertiary, v: basalt. ⊥: historical landing place of Rinzo MAMIYA.

The diagnosis and description given in Part I (MATSUMOTO, 1984, p. 7–8) are generally applicable for the above specimens, which show a certain extent of variation, as will be described below.

Measurements (in mm):

Specimen	Diameter	Umbilicus	Height	Breadth	B/H	Ribs*
Holotype	132.3 (1)	43.7 (.33)	56.7 (.43)	46.8 (.35)	0.82	6
MNH 221	142.0 (0)	~41 (.29)	61.0 (.43)	~45 (.32)	0.74	10
MNH 222	125.0 (1)	40.0 (.32)	56.0 (.45)	~50 (.40)	0.9	9
MNH 223	125.0 (1)	32.0 (.26)	~61 (.49)	—	—	6
MNH 272	105.0 (1)	36.0 (.34)	48.5 (.46)	~34 (.32)	0.7	5
MNH 275	118.0 (1)	~45 (.38)	53.0 (.45)	~48 (.40)	0.9	9
MNH 276	146.0 (1)	~49 (.34)	62.0 (.42)	49.0 (.34)	0.79	4-5
MNH 278	~135 (1)	~44 (.33)	~60 (.44)	~48 (.35)	0.8	6-7
〃	~108 (1)	~38 (.35)	~46 (.43)	~34 (.31)	0.74	

~ approximate or inferred

* Number of ribs in the last half whorl (main part of body-chamber)

The above measurements are on the deformed specimens without restoration. Therefore, the dimensions and ratios can give an approximate outline of the shell-form. After all, the holotype (pl. 1, figs. 1–3) can be regarded as a representative specimen. Although the very apertural margin is not preserved, the adult shell with body-chamber as long as 210° is about 135 (±10) mm in diameter. In other words the variation in size is little. Owing to the secondary deformation, the umbilical ratio U/D and whorl compression ratio B/H apparently vary to a considerable extent, but the holotype and the less deformed M. YAMASHITA's specimen from Tsukisap (Urakawa) figured in Part I (MATSUMOTO, 1984. pl. 4, figs. 1–3) both show U/D about one third and B/H about 0.8, representing probably the average ratios in the adult stage.

For some reasons the inner whorls are very poorly preserved in many of the specimens from the Soya area. In addition to the holotype, MNH 278 (pl. 2, figs. 1–2) may be a better preserved example in which characters of the inner whorls are shown. It shows B/H=0.96 at D=61 mm. This tells well the less compressed or more rounded whorl-section in a young stage. In this specimen periodic constrictions, 6 per whorl, are well marked on the phragmocone as in the Tsukisap specimen.

The major ribs are distributed at wide intervals on the adult body-chamber. They are at first narrow but soon become coarse on the main part of the body-chamber. Their frequency varies considerably and accordingly their number per half whorl varies from 5 to 10. The holotype represents the form with much distant major ribs, whereas the Tsukisap specimen represents the form with comparatively more frequent major ribs. Someone may presume that these two forms could be separated, but there are examples with 7 or 8 major ribs as illustrated in Part I (MATSUMOTO, 1984, pl. 5, figs. 1–2). Also the major ribs are not always equidistant. Therefore, we conclude a fairly wide extent of variation within a species as to the rib frequency. Several weak subcostae are preserved on the interspaces under favourable conditions. Otherwise the surface looks almost smooth.

B. Three species of *Anagaudryceras* from the Campanian and Maastrichtian of Hokkaido

(Tatsuro MATSUMOTO)

There are specimens of comparatively smaller sizes which I assembled intermittently from 1937 to 1959 from several Campanian and Maastrichtian outcrops in Hokkaido. They show some peculiar characters and have been left undescribed. They are now sorted into three species and are described under the genus *Anagaudryceras*. A few specimens from South Sakhalin are included in the material for the description, since they are of identical species with those from Hokkaido.

Genus *Anagaudryceras* SHIMIZU, 1934

Type species: *Ammonites sacya* FORBES, 1846.

Remarks: In this paper I generally follow KENNEDY and KLINGER (1979, p. 142) in the definition of this genus, but for a few points.

Many palaeontologists would agree in regarding *Ammonites buddha* FORBES, 1846 as a synonym of *A. sacya*, the former representing the adult body-chamber and the latter the immature phragmocone. More than 100 years ago, STOLICZKA (1865, p. 154) and WHITEAVES (1884, p. 203) stated the synonymy and subsequent authors followed them. At that date the rule of page priority was not definite and in such a case I should prefer author priority in the revision of this specific name (see also HENDERSON and MCNAMARA, 1985, p. 45).

Based on the remarks of HOWARTH (1965, p. 358), KENNEDY and KLINGER (1979, p. 146) attempted to sort many species of *Anagaudryceras* into two groups: (1) the group of *A. sacya* and (2) that of *A. involvulum* (STOLICZKA). The latter is indefinite, because the characters of the adult shell is not sufficiently known in many species of that group. If the weak ornament really persisted up to the adult stage, it would be better to refer that species to *Eogaudryceras* SPATH, 1927, even if it had somewhat more compressed whorl than that of the type species, *E. numidum* (COQUAND). On examining the type specimens at Calcutta, I presume that *A. madraspatanum* (STOLICZKA, 1865) could be such an example, since a larger specimen figured by STOLICZKA (1865, pl. 76, fig. 3 under *A. sacya*) probably represents the adult shell of *A. madraspatanum*. Incidentally, STOLICZKA (1965) wrote *Ammonites involvulus* in the text and *Ammonites involvus* in the explanation of plate.

There is also a high possibility that at least some species of the *involvulum* group could have the adult ornament similar to that of the *sacya* group (i.e. the *buddha*-like ornament). *A. yamashitai* (YABE, 1903), from the Santonian of Japan, is an example of such a case, although its revised description is not given in this paper. Also the ornament on the adult body-chamber of the *sacya* group is not constant but may vary between species, as I pointed out preliminarily (MATSUMOTO, 1941). I presume that a considerable diversity existed in the evolutionary trends within *Anagaudryceras*. The three species described below may be examples of less typical or atypical *Anagaudryceras*.

Anagaudryceras politissimum (KOSSMAT)

Pl. 3, figs. 1–6; pl. 5, figs. 5–8

1895. *Lytoceras* (*Gaudryceras*) *politissimum* KOSSMAT, *Beitr. Palaeont. Geol. Öst.-Ung.*, **9**, p. 128, pl. 15, fig. 7a–c.

1956. *Anagaudryceras politissimum* (KOSSMAT); COLLIGNON, *Ann. Géol. Serv. Mines* (Madagascar), **23**, p. 58, pl. 8, fig. 2, 2a, 2b.

1971. *Anagaudryceras politissimum* (KOSSMAT); COLLIGNON, *Atlas des Fossiles*

Caracteristiques de Madagascar (Ammonites), **17** (Maestrichtien), p. 4, pl. 641, fig. 2364.

1979. *Anagaudryceras politissimum* (KOSSMAT); KENNEDY and KLINGER, *Bull. Brit. Mus. (Nat. Hist.)* [Geol.], **31**, (2), p. 154, pl. 5, fig. 3.

1985. *Anagaudryceras politissimum* (KOSSMAT); HENDERSON and MCNAMARA, *Palaeontology*, **28**, p. 46, pl. 1, figs. 9–10; text-fig. 4d.

Holotype: KOSSMAT's (1895) illustrated specimen from the Upper Trichinopoly Group of Varagur, southern India.

Material: GK. H3823 (Pl. 3, figs. 1–6), from loc. H12d6, and GK. H3824 from loc. H12d4, Tomiuchi, Hobetsu area, Hokkaido; also GK. H2302 (pl. 5, figs. 5–8), from loc. N12d6, Naibuchi area, South Sakhalin; all collected by T. MATSUMOTO.

Measurements (in mm):

Specimen	Diameter	Umbilicus	Height	Breadth	B./H.
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
GK. H3823	41.3(1)	13.3(.32)	17.5(.42)	15.0(.36)	0.86
〃	29.5(1)	11.0(.37)	12.0(.41)	11.0(.37)	0.92
GK. H3824	26.5(1)	9.8(.37)	10.8(.41)	12.2(.38)	0.97

* After KOSSMAT, 1895.

Description: The above three specimens are all small, but the last suture is situated a little behind the preserved end of the two specimens (GK. H2302 and GK. H3823).

Despite their small size, they show the diagnostic characters of *A. politissimum*, such as the moderate rate of whorl expansion, somewhat compressed suboval whorl-section, broadest at a point between mid-flank and umbilical shoulder, with gently convex and convergent flanks, narrowly arched venter, rounded umbilical shoulder and steeply inclined umbilical wall, and the gently prorsiradiate periodic, weak constrictions or thin flares. Otherwise, the surface of the shell is nearly smooth.

Remarks: The holotype and some other illustrated specimens from southern India, Madagascar and South Africa are about 80 to 90 mm in diameter and that from Western Australia 114 mm, but they are all septate and the mode of ribbing on the adult body-chamber is not known in this species. In this respect the specific diagnosis is insufficient, but the phragmocone itself shows the characters which enable us to distinguish this species from others.

So far as the phragmocone is concerned, this species is allied to *Anagaudryceras yamashitai* (YABE, 1903), but the latter has a narrower umbilicus, stronger involution and subradial instead of prorsiradiate constrictions. Although the redescription of *A. yamashitai* has been delayed, I have collected several specimens from the Santonian of Hokkaido. One of them, about 150 mm in diameter,

has the body-chamber which is ornamented with frequent narrow ribs with associated narrow furrows on the posterior half and flat bands separated by narrow furrows with or without associated narrow and low ribs on the anterior half. The last ornament is similar to but not quite identical with the *buddha* type ornament of *A. sacya*. The ribs and furrows are curved forward around the umbilicus but run nearly radially on the ventral half. I call this curvature subradial.

The holotype of *Anagaudryceras mikobokense* COLLIGNON, 1956 (pl. 8, fig. 1), from the Lower Maastrichtian of Madagascar, is also wholly septate, but I have illustrated an adult example from California (MATSUMOTO, 1959, p. 139, pl. 38, fig. 1), which has distant, narrow, major ribs on the body-chamber. The phragmocone of *A. mikobokense* has subradial, instead of prorsiradiate constrictions and less compressed whorls than those of *A. politissimum* and *A. yamashitai* at corresponding growth-stages.

Now the described specimens from Hokkaido and Sakhalin are peculiar in that they show diagnostic features of the typical, larger specimens of *A. politissimum* in their smaller shells. They may represent a dwarfed form.

Occurrence: Locs. H12d4 and H12d6 in a small gully on the southeastern side of the River Mukawa, about 1.5 km southwest of Tomiuchi [=Hetonai] (see map in MATSUMOTO, 1942, pl. 17), Unit IVb (Lower Sandy Siltstone) of the Hakobuchi Group, Zone of *Inoceramus shikotanensis-Neodesmoceras japonum*, Lower Maastrichtian. Also loc. N12d6, above the water-fall along the River Miho, upper part of unit Ray2, Ryugase Group of the Naibuchi area, South Sakhalin, together with *Canadoceras kossmati* MATSUMOTO and *C. multicostatum* MATSUMOTO, probably upper part of the Lower Campanian (see map in MATSUMOTO, 1942, pl. 8 for the location).

According to KOSSMAT (1895–1898), this species occurred in the Upper Trichinopoly Group of Varagur, southern India, which is most probably referred to the Coniacian as evidenced by *Kossmaticeras theobaldianum* (STOLICZKA) and *Peroniceras dravidicum* (KOSSMAT). It has been reported from the Lower Maastrichtian of Madagascar (Collignon, 1956, 1971) and Western Australia (HENDERSON and MCNAMARA, 1985) and the Santonian of Zululand (KENNEDY and KLINGER, 1979).

To sum up, *A. politissimum* occurs in southern India, Madagascar, South Africa, Western Australia, Japan and Sakhalin and its known stratigraphic range is from Coniacian to Lower Maastrichtian.

Anagaudryceras nanum MATSUMOTO, sp. nov.

Pl. 5, figs. 1–4

Holotype: GK. H3124 from loc. U45, Member Ur4β of the Urakawa area, coll. T. MATSUMOTO.

Diagnosis: Shell very small for the genus, with fairly wide umbilicus. Body-chamber somewhat higher than broad, with fairly narrowly arched venter, gently convex and nearly parallel flanks, subrounded umbilical shoulder and low but steep umbilical wall; marked with subradial furrows and intervening, low ribs. Some furrows and ribs more distinct and rounded on its later part.

Phragmocone, consisting of four and a half whorls, which are more rounded than body-chamber with gradual change of B/H as in other species and nearly as high as broad at the end, where venter is fairly narrowly arched; ornamented with very fine lirae on the outer shell layer but nearly smooth on the inner shell layer or on the internal mould, and periodically constricted with flares on the surface. Suture similar to that at immature stage of other *Anagaudryceras* species.

Measurements (in mm):

	Diameter	Umbilicus	Height	Breadth	B/H
Preserved end	24.0(1)	10.1(.42)	8.8(.37)	7.8(.33)	0.89
End of phragmocone	18.0(1)	7.6(.42)	6.0(.33)	6.0(.33)	1.00

Remarks: The holotype is well preserved. Its inner whorls show finely the shell surface, but its body-chamber and the late part of the phragmocone are covered only by the semi-transparent inner shell layer. The external mould of the right side is also kept.

Since I collected this single specimen in 1940, I have tried to find additional material, but not yet been successful.

Comparison and discussion: This species was listed provisionally as *Anagaudryceras* sp. indet aff. *A. ryugasense* MATSUMOTO MS (nom. nud.; now revised to *A. matsumotoi* MOROZUMI) (MATSUMOTO, 1942, p. 268). It differs from *A. matsumotoi* in its still smaller size, much wider umbilicus, more compressed phragmocone and a dissimilar type of ornamentation on the body-chamber.

The ribs and furrows on the body-chamber of this species is rather similar to those of *A. subsacya* (MARSHALL, 1926) (see HENDERSON, 1970, p. 18, pl. 2, figs. 5–6; KENNEDY and KLINGER, 1979, p. 152, pl. 11, fig. 3), from the Campanian of New Zealand and the Campanian or Santonian of South Africa, but *A. subsacya* is larger and has less compressed whorls than this species. Although *A. subsacya,* has not yet been recorded from the northern Pacific region, this species could be interpreted as an offshoot from that kind of species with ontogenetic acceleration.

In the compressed whorl this species is comparable to *A. politissimum,* but the former is smaller and has wider umbilicus and subparallel rather than convergent flanks. The ornamentation of *subsacya* type has not been shown by the hitherto reported examples of *A. politissimum.*

Occurrence: Rare in the Zone of *Sphenoceramus schmidti* of the Urakawa area, Lower Campanian (mid-Campanian in a tripartite scheme).

Anagaudryceras matsumotoi MOROZUMI

Pl. 4, figs. 1–10

1985. *Anagaudryceras matsumotoi* MOROZUMI, *Bull. Osaka Mus. Nat. Hist.*, (39), p. 29, pl. 9, fig. 1a–d.

Remarks: This species has been recently established by MOROZUMI (1985) on the holotype, GK. H6882, from loc. Aw15 (Haraikawa) of Awaji Island, Southwest Japan. Although the paratypes from Hokkaido and South Sakhalin in GK and GT collections were listed by MOROZUMI, no illustration was given for them. In this paper some of them are illustrated and additional description is given.

Material: I repeat here a list of the paratypes in more detail.

GK H5980a (pl. 4, fig. 1), GK. H5980b and GK. H5980c, collected by Y. IGI from loc. P-240, Unit H4 of IGI (1959), Pinneshiri Quadrangle, Tombetsu area;

GK. H5981 and GK. H5982 (pl. 4, figs. 2–3), collected by S. NISHIJIMA from loc. Nj-68, on the Nitatsu-nai, Unit C of MATSUMOTO *et al.* (1980), Tombetsu area;

GK. H5983 (pl. 4, figs. 4–5) collected by T. MATSUMOTO from loc. Nm 175, Pokkiriiso, middle part of Unit N4 of the Nemuro Group;

GK. H5984 (pl. 4, figs. 6–8) collected by H. KIDO and T. MATSUMOTO from loc. Kd1404, near Senposhi, Poroto Formation of Unit N3, Nemuro Group;

GT. I-3785 (pl. 4, figs. 9–10) from loc. N109c, GT. I-3782 from loc. N411c4, and GT. I-3783 from loc. N457e4, all three collected by T. MATSUMOTO from the lower part of Member Rdy, Ryugase Group, Naibuchi area of South Sakhalin.

Diagnosis: Shell small for the genus. Phragmocone consisting of rounded whorls. Body-chamber compressed, expanding rapidly in height, and moderately involute. Umbilicus moderately wide in septate stages and abruptly narrowed at the adult. Phragmocone with very fine, subradial lirae on shell surface; periodic constrictions weak and accompanied with fine flares. Body-chamber marked with subradial (at first) to somewhat prorsiradiate furrows, which are frequent and distinct on its later main part, where the intervening parts form broad band-type or scale-like ribs; also very fine lirae on shell surface in parallel with furrows. Suture same as in typical species of *Anagaudryceras*.

Measurements: (in mm):

Specimen	Diameter	Umbilicus	Height	Breadth	B/H
Holotype*	45.1(1)	13.6(.30)	20.0(.44)	16.2(.36)	0.81
GK. H5980a	52.0(1)	15.0(.29)	24.5(.47)	18 (.35)	0.73
〃 (last septum)	—	10.0	10.0	10.5	1.05
GK. H5980c	—	—	12.4	13.4	1.08
GK. H5984	—	—	14.0	14.4	1.03
〃 (−90°)	29.0(1)	10.3(.35)	11.8(.41)	12.6(.43)	1.07
GT. I-3785	33.0(1)	12.1(.36)	12.8(.39)	13.4(.41)	1.05
GT. I-3783	24.8(1)	9.2(.37)	10.1(.41)	10.7(.43)	1.06

* After MOROZUMI, 1985. Boby-chamber of holotype and GK. H5980a may be somewhat secondarily deformed, but is measured as it is.

Description: GK. H5980a resembles the holotype quite well. GK. H5980b has a part of the squashed body-chamber in addition to the less deformed phragmocone. GK. H5980c is a phragmocone with a rounded whorl-section, showing a suture on the part where outer shell layer is taken. These specimens show well the surface of the shell, which has subradial, very fine lines (lirae which may correspond to growth-lines). The lirae are slightly more elevated at intervals, e.g. at a distance of 1–2 mm on the late part of the phragmocone. The periodic constrictions and associated flares are so faint that they may be carelessly overlooked.

On the posterior part (for about 90°) of the body-chamber, there are three subradial furrows, with weakly raised rib immediately behind each of them. These correspond probably to the periodic constrictions and associated flares. On the succeeding main part of the body-chamber, the furrows become more frequent, more distinct and are prorsiradiate. The intervening parts look like low and broad band-type ribs as in the adult body-chamber of *Zelandites* and that of certain species of *Anagaudryceras*. Each of the bands is slightly more elevated at its anterior margin immediately behind the furrow.

The external suture of *Gaudryceras-Anagaudryceras* type is well exposed on a part of GK. H5984 and can be seen through a semi-transparent inner shell layer on GK. H5983, GK. H5980c and GT. I-3785.

Comparison and discussion: I have hesitated for a long time to describe this species for the reason of uncertainty in generic assignment. I thank Dr. MOROZUMI for his fine work in describing this species on the holotype from the Maastrichtian of Awaji Island (Southwest Japan), with dedication to me.

For the reason of the small size and compressed and fairly involute body-chamber with frequent furrows, this species is similar to some species of *Zelandites*. In *Zelandites* the compressed whorl is developed gradually with growth and the suture is modified to a peculiar pattern. The phragmocone of

this species is quite similar to that of certain species of *Anagaudryceras*, e.g. *A. yokoyamai* (YABE, 1903), in every character and the adult body-chamber shows abruptly the *Zelandites*-like features. I am still considering a possibility of a new genus to settle the systematic position of this species, but have not yet arrived at a definite conclusion. For the time-being I follow MOROZUMI (1985) to affiliate this species to *Anagaudryceras*.

Occurrence: On the ground of available records, this species is characteristic of the Maastrichtian of Japan (Awaji in Southwest Japan, Tombetsu area of northern Hokkaido, Nemuro-Kushiro area of eastern Hokkaido) and Sakhalin. It occurs in both Lower and Upper Maastrichtian. For more details see *Material*.

C. A new species of *Anagaudryceras* from Urakawa

(Tatsuro MATSUMOTO and Yasumitsu KANIE)

Anagaudryceras tetragonum MATSUMOTO et KANIE, sp. nov.

Pl. 5, figs. 9–11

Holotype: YCM. Ur 076001, obtained by Nachio MINOURA from loc. U76A, Higashi-cho, Urakawa, Member Hl of KANIE (in press).

Diagnosis: Shell of medium size, consisting of slowly enlarging whorls of moderate involution. Phragmocone fairly widely umbilicate. Whorl in the late growth-stage subtetragonal in section, with rather flat, slightly convergent flanks, moderately rounded venter, abruptly rounded umbilical shoulder and vertical umbilical wall. Inner whorls subrounded and broader than high. Constrictions weak, infrequent and prorsiradiate. Ornament of adult body-chamber not precisely known, except for low major ribs at intervals on the earlier (i.e. posterior) part.

Measurements (in mm):

Position	Diameter	Umbilicus	Height	Breadth	B/H
*	78.5(1)	29.8(.38)	29.6(.38)	30.6(.39)	1.03
−270°	48.0(1)	19.5(.41)	16.7(.35)	19.8(.41)	1.18

* Immediately behind the preserved last constriction.

Description: The single available specimen is incomplete in that only the posterior part (about 90°) of the body-chamber is preserved. A trace of the umbilical seam of the rest main part of the body-chamber is impressed on the next inner whorl for about 130°. As the preserved posterior part of the body-chamber has a low rib along the weak constriction, there may have been some kind of major ribs on the later part of the body-chamber. The body-chamber is slightly broader than high in its posterior part. It may be as high as broad or even somewhat higher than broad in its adoral part, if it is assumed to fol-

low the general tendency. The maximum breadth is immediately above the abruptly rounded umbilical shoulder.

The outer whorl covers the next inner one for about a half of the latter.

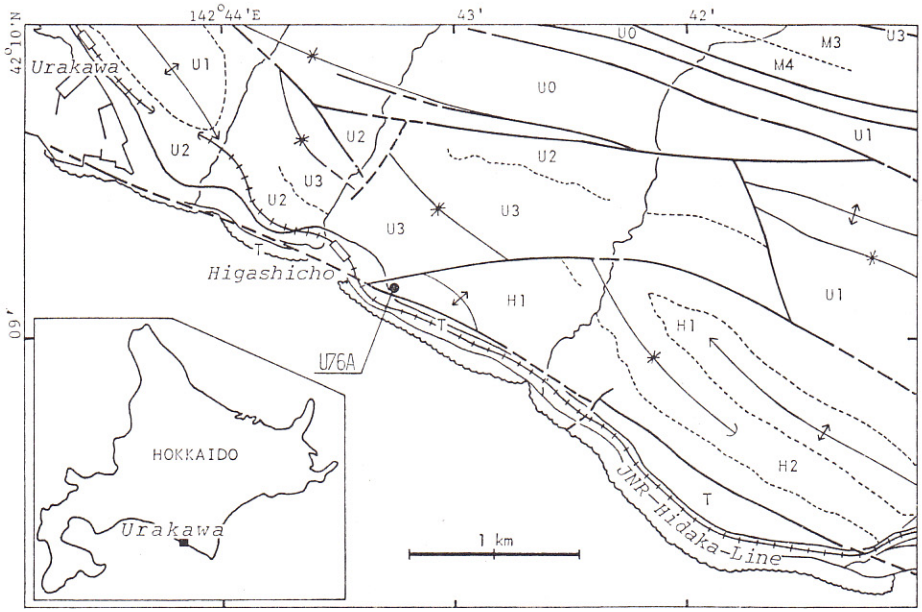
The surface of the specimen is nearly smooth, except for the infrequent constrictions. Very fine lines of growth are discernible on the surface of the partly preserved outer shell layer.

The suture has bipartite, finely incised lateral saddles as that of other species of *Anagaudryceras* (e.g. KOSSMAT, 1895, pl. 15, fig. 7c for *A. politissimum*).

Comparison: This species is allied to *A. politissimum* (KOSSMAT) in the moderately wide umbilicus, rather flat and slightly convergent flanks of the outer whorl and prorsiradiate constrictions, but distinguished by its broader whorl and less narrowly arched venter.

It is somewhat similar to *A. mikobokense* COLLIGNON, 1956, from the Lower Maastrichtian of Madagascar and California (see MATSUMOTO, 1959), but that species has more convex flanks and subradial constrictions.

Anagaudryceras lueneburgense (SCHLÜTER, 1872) (see also BIRKELUND, 1982, p. 14, pl. 1, fig. 1), from the Upper Campanian and Maastrichtian of northwestern Europe, has subrounded to ovoid whorl-sections and the body-



Text-fig. 2. Map showing the locality (U76A) of *Anagaudryceras tetragonum* MATSUMOTO et KANIE with a solid circle (●). Geological outline cited from KANIE (in press) —— M3 and M4: Members of the Middle Yezo Group, Uo–U3: members of the Upper Yezo Group, H1 and H2: members of the Hakobuchi Group, T: Neogene beds.

chamber characterized by fairly frequent and flexiradiate furrows. By these characters it is distinct from *A. tetragonum*. Incidentally the lectotype of *A. lueneburgense* should be the original of SCHLÜTER, 1872, pl. 18, fig. 8. The smaller specimen (Schlüter, 1872, pl. 18, fig. 9) would be paralectotype.

At first sight, the Urakawa specimen looked like *Saghalinites nuperus* (VAN HOEPEN, 1921) (see KENNEDY and KLINGER, 1977) in the moderately wide umbilicus, subtetragonal whorl-section and prorsiradiate constrictions. Its suture has bipartite, instead of tripartite, lateral saddles and its constrictions are not so well marked and do not show a backward sinus on the venter. The similarity is certainly a homoeomorphy.

Occurrence: Rarely found at loc. U76A in the sandstone of Member H1 of KANIE (in press), Higashi-cho, Urakawa, southern central Hokkaido. No specimen other than this specimen has been obtained at this locality, but the geological mapping (text-fig. 2) by one of us (Y. K.) shows that this locality should be within Member H1, that is a part of the Maastrichtian. For more details of the stratigraphy see KANIE (in press).

D. Concluding Remarks

(Tatsuro MATSUMOTO)

Ammonites species of the family Gaudryceratidae from the Upper Cretaceous of Japan have not yet been sufficiently monographed. On the ground of fieldworks, certain species occur abundantly or fairly commonly in the Turonian to Lower Campanian sequences in Hokkaido and other areas of Japan. Examples are *Gaudryceras denseplicatum* (JIMBO, 1894) (Turonian to Lower Campanian), *G. tenuiliratum* YABE, 1903 (Coniacian to Lower Campanian), *G. striatum* (JIMBO, 1894) (Campanian), *Anagaudryceras limatum* (YABE, 1903) (Turonian and Coniacian), *A. yokoyamai* (YABE, 1903) (Santonian and Lower Campanian), *A. yamashitai* (YABE, 1903) (Santonian) and *Zelandites kawanoi* (JIMBO, 1894) (Santonian and Lower Campanian), although some of them need revised descriptions. The specimens referable to the first two species, which were interpreted hypothetically to be united into one species by HIRANO (1978), are of immense number. Those of other species, except for the last two, are also fairly numerous.

In high contrast to the above fact, the gaudryceratid species from the Campanian (Upper Camp. except for 9 in the list below) and Maastrichtian of Japan are represented by comparatively less numerous specimens. The hitherto described species, including those in this paper, are as follows, with summarized records of their occurrences.

(1) *Gaudryceras crassicostatum* (JIMBO, 1894): Silty fine-grained sandstone of the Subzone of *Schlueterella kawadai* and higher beds in Soya and similar rock probably above the Zone of *Sphenoceramus schmidti* in Urakawa,

Hokkaido, Upper Campanian; also comparable examples from Sukumo in Shikoku and from Togushi and Naibuch in South Sakhalin.

(2) *Gaudryceras venustum* MATSUMOTO, 1984: Silty fine-grained sandstone of Fukaushi Formation, central Hokkaido, Maastrichtian.

(3) *Gaudryceras mamiyai* MATSUMOTO et MIYAUCHI, 1984: Silty fine-grained sandstone of the Subzone of *Schlueterella kawadai* in Soya, northern Hokkaido, Upper Campanian.

(4) *Gaudryceras izumiense* MATSUMOTO et MOROZUMI, 1980: Siltstone in the Izumi Group of the Izumi Mountains in Southwest Japan, Maastrichtian; also comparable examples from Sukumo (Shikoku) and Tombetsu (Hokkaido).

(5) *Gaudryceras hamanakense* MATSUMOTO et YOSHIDA, 1979: Sandstone in Member At2 of the Nemuro Group in eastern Hokkaido, probably Upper Maastrichtian. (At2 is overlain conformably by At3 from which Palaeocene foraminiferas have been obtained by KAIHO *et al.*, 1984.); also examples of the same species from Tombetsu (northern Hokkaido) and Sukumo (Shikoku).

(6) *Gaudryceras tombetsense* MATSUMOTO, 1984: Silty fine-grained sandstone in Members D and El (?) of Tombetsu (northern Hokkaido), Maastrichtian; also in a part of the Shimanto Group of Sukumo (Shikoku).

(7) *Vertebrites kayei* (FORBES, 1846): Sandy siltstone of the Zone of *Pachydiscus* aff. *P. subcompressus* in the Izumi Group of Awaji Island, Maastrichtian; also a part of the Shimanto Group near Mugi, Shikoku.

(8) *Anagaudryceras politissimum* (KOSSMAT, 1895): Sandy siltstone in the Zone of *Neodesmoceras japonicum-Inoceramus shikotanensis* of Tomiuchi [=Hetonai], central Hokkaido, Lower Maastrichtian; also member Ray2 of Naibuchi, South Sakhalin, upper part of Lower Campanian.

(9) *Anagaudryceras nanum* MATSUMOTO, sp. nov: Zone of *Sphenoceramus schmidti* in Urakawa, Hokkaido, upper part of Lower Campanian.

(10) *Anagaudryceras matsumotoi* MOROZUMI, 1984: Sandy siltstone in the Zone of *Pachydiscus* aff. *P. subcompressus* of Awaji Island; siltstone in Members C-E of Tombetsu (northern Hokkaido) and Units N3-N4 of Kushiro-Nemuro (eastern Hokkaido); also sandy siltstone in the Zone of *Pachydiscus subcompressus* of Naibuchi (South Sakhalin); Lower and Upper Maastrichtian.

(11) *Anagaudryceras tetragonum* MATSUMOTO et KANIE, sp. nov.: Sandstone of Member H1 in Urakawa, Hokkaido, Maastrichtian.

(12) *Zelandites* cf. *Z. varuna* (FORBES, 1846): Sandy siltstone in the Zone of *Pachydiscus* aff. *subcompressus* of Awaji Island, Lower Maastrichtian.

Also incompletely preserved example from Senposhi, Maastrichtian of eastern Hokkaido.

There are also a few more species which have not yet been described because of poor material.

The less abundance of the above species may owe partly to the true rareness but partly to the less frequent outcrops of ammonite bearing beds of the Campanian and Maastrichtian ages (collectively called the Hetonaian in Japan) when marine regressions predominated generally over minor transgressions in the Japanese province. *Gaudryceras crassicostatum* may provide an example for the latter case, as its number of collected specimens has increased recently on account of large scale excavations of the fossiliferous beds to reconstrict some fishery harbours of the Soya area. On the other hand, *Anagaudryceras nanum* is probably an example of true rareness, in view of fairly frequent outcrops of the Zone of *Sphenoceramus schmidti* (Lower Campanian) in various areas.

It is also noteworthy that fossils of the mature shells, with body-chambers preserved, predominate remarkably over those of immature ones in many of the above listed species, e.g. (1), (2), (3), (4), (5), (6), (9) and (10). They were all embedded in sandy siltstone or sandstone. On the other hand, experience leads me to state that fossils of immature shells predominate over those of mature ones in most species from the Turonian to Lower Campanian of Hokkaido. They are mostly contained in calcareous nodules in muddy facies. Exceptionally in the Turonian and Coniacian sandy siltstones of the Mikasa area, which represent near shore facies, mature shells of *Anagaudryceras limatum* occur fairly commonly. (Incidentally, I disagree with the authors who regarded *A. limatum* as a synonym of *A. sacya*. The body-chamber of the former has stronger ribs separated by wider and deeper interspaces than that of the latter.)

The above facts must be concerned with the life history and habitats of gaudryceratid species, although I know little about this subject.

Many species of the Gaudryceratidae have been regarded as long ranging through two or more stages. In fact such species as *Anagaudryceras sacya* and *Gaudryceras denseplicatum* [= ? *G. glaneggense* (REDTENBACHER, 1873) *] are widespread but have long stratigraphic ranges. However, many of the twelve species listed above have so far comparatively shorter stratigraphic ranges. Some of them can be evaluated as useful guide species for the biostratigraphic correlation within the Japanese province. In other words, the tempo of the evolutionary change in the Gaudryceratidae was not always slow. In the late Campanian and Maastrichtian times the gudryceratids were branched into quite

* The synonymy may be correct as KENNEDY and SUMMERSBERGER (1979) discussed, but I use JIMBO's specific name for the species from the Japanese and other provinces in the Indo-Pacific realm, until REDTENBACHER's species is firmly defined on a sufficient number of specimens.

a number of species and some of them, e.g. (1), (2), (3), (4), (5), (6), (9 ?), (10) and (12), have shorter stratigraphic ranges than the species of earlier ages. How far this observation can be applied to the extra-Japanese provinces is a problem to be worked out.

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Repositories: The specimens described in Parts I and II of this paper are kept in the following collections, with abbreviation indicated in parentheses:

Geological Collections of Kyushu University, Hakosaki, Fukuoka (GK)

Toshiya MIYAUCHI's Natural History Collections of Northern Hokkaido, Wakkanai (MNH)

Palaeontological Collections in the University Museum, University of Tokyo, Hongo, Tokyo (UMUT or GT)

Yokosuka City Museum, Yokosuka (YCM)

References cited

(Those listed in Part I are omitted below for brevity.)

BIRKELUND, T. 1982. Maastrichtian ammonites from Hemmoor, Niederelbe (NW-Germany). *Geol. Jb.*, **A61**: 13–33 (incl. 3 pls.).

COLLIGNON, M. 1971. *Atlas des Fossiles Caracteristiques de Madagascar* (Ammonites), **17** (Maestrichtien): 1–44, pls. 640–658, Serv. Géol., Tananarive.

FORBES, E. 1846. Report on the Cretaceous fossil invertebrates from southern India, collected by Mr. KAYE and Mr. CUNLIFFE. *Trans. Geol. Soc. London*, [2], **7**: 97–174, pls. 7–19.

HENDERSON, R. A. 1970. Ammonoidea from the Mata Series (Santonian-Maastrichtian) of New Zealand. *Spec. Pap. Palaeont.*, **6**: 1–81, pls. 1–15.

——— and MCNAMARA, K. J. 1985. Maastrichtian non-heteromorph ammonites from the Miria Formation, Western Australia. *Palaeontology*, **28**(1): 35–88.

HIRANO, H. 1978. Phenotypic substitution of *Gaudryceras* (a Cretaceous ammonite). *Trans. Proc. Palaeont. Soc. Japan*, N. S., (109): 235–258, pls. 33–35.

HOEPEN, E. C. N. van 1921. Cretaceous Cephalopoda from Pondoland. *Ann. Transv. Mus.*, 8: 1–48, pls. 1–11.

HOWARTH, M. K. 1965. Cretaceous ammonoids and nautiloids from Angola. *Bull. Brit. Mus. (Nat. Hist.)*, Geol., **10**(10): 337–412, pls. 1–14.

KAIHO, K., YAMADA, M. and ISOBE, T. 1984. Foraminifera biostratigraphy of the Nemuro Group on the coast of Nemuro-Kushiro area. *In* SAITO, T., OKADA, H. and KAIHO, K. (eds.) *Biostratigraphy and International Correlation of the Paleogene System in Japan*: 19–23 (in Japanese), Yamagata Univ.

KANIE, Y. 1985 (in press). Cretaceous biostratigraphy and sedimentary facies in the Urakawa district, southcentral Hokkaido. *Bull. Geol. Surv. Japan.* (In Japanese with English abstract)

KENNEDY, W. J. and KLINGER, H. C. 1977. Cretaceous faunas from Zululand and Natal, South Africa. The ammonite family Tetragonitidae HYATT, 1900. *Ann. S. Afr. Mus.*, **73**(7): 149–197.

——— and SUMMERSBERGER, H. 1979. A revision of *Ammonites mitis* HAUER and *Ammonites glaneggensis* REDTENBACHER from the Gosau Beds (Upper Cretaceous) of Austria. *Beitr. Paläont. Osterreich*, (6): 71–79, pls. 1–4.

KOSSMAT, F. 1895–1898. Untersuchungen über die südindische Kreide formation. *Beitr. Paläont. Geol. Öst.-Ung.*, **9** (1895): 97–203, pls. 15–25; **11** (1897): 1–46, pls. 1–8; **12** (1898): 89–152, pls. 14–19.

MARSHALL, P. 1926. The Upper Cretaceous ammonites of New Zealand. *Trans. New Zeal. Inst.*, **56**: 129–210.

MATSUMOTO, T. 1941. A study of interspecific relations. *Jour. Geol. Soc. Japan*, 48: 17–37. (In Japanese)

——— 1959. Upper Cretaceous ammonites of California. Part 2. *Mem. Fac. Sci. Kyushu Univ.*, ser. [D], Spec. Vol. **1**: 1–172, pls. 1–41.

——— 1984. Some gaudryceratid ammonites from the Campanian and Maastrichtian of Hokkaido. Part I. *Sci. Rept. Yokosuka City Mus.*, (32): 1–10, pls. 1–5.

MOROZUMI, Y. 1985. Late Cretaceous (Campanian and Maastrichtian) ammonites from Awaji Island, Southwest Japan. *Bull. Osaka Mus. Nat. Hist.*, (39): 1–58, pls. 1–18.

REDTENBACHER, A. 1873. Die Cephalopoden Fauna der Gosauschichten in der nordöstlichen Alpen. *Abh. K.-K. Geol. Reichsanst.*, **5**: 91–140, pls. 22–30.

SCHLÜTER, C. 1871–1876. Die Cephalopoden der oberen deutschen Kreide. *Palaeontographica*, **21**: 1–24, pls. 1–8 (1871); **21**: 25–120, pls. 9–35 (1872); **24**: 121–264 (1–144), pls. 36–55 (1876).

SHIMIZU, S. 1934. Ammonites. In SHIMIZU, S. and OBATA, T., *Cephalopoda* (Iwanami's Lecture Series of Geology and Palaeontology, Tokyo): 1–137 (in Japanese).

SPATH, L. F. 1927. Revision of the Jurassic cephalopod fauna of Kachh (Cutch). *Mem. Geol. Surv. India, Palaeont. Indica*, N. S. **11**: 1–71, pls. 1–7.

STOLICZKA, F. 1863–66. The fossil Cephalopoda of the Cretaceous rocks of southern India. *Mem. Geol. Surv. India, Palaeont. Indica*, [3], **1**: 41–56, pls. 26–31 (1863); **2–5**: 57–106, pls. 32–54 (1864); **6–9**: 107–154, pls. 55–80 (1865); **10–13**: 155–216, pls. 81–94 (1866).

WHITEAVES, J. F. 1884. On the fossils of the coal-bearing deposits of the Queen Charlotte Islands collected by Dr. G. M. DAWSON in 1878. *Geol. Surv. Canada Mesozoic Fossils* **1** (3): 191–262, pls. 21–32.

Awaji (淡路)
Furuyashiki (古家敷)
Higashi-cho (東町)
Izumi (和泉)
Kiyohama-I (第一清浜)
Kiyohama-II (第二清浜)
Kushiro (釧路)
Maru-yama (丸山)
Miho (美保)
Mugi (牟岐)
Nemuro (根室)
Nitatsu-nai (仁達内)
Ohmisaki (大岬)
Pokkiriiso (ポッキリ磯)
Poroto (幌戸)
Ryugase (龍ケ瀬)
Senposhi (仙鳳趾)

Place names indicated in Part I (p. 10) are not repeated herein.

Explanation of plate 1

Figs. 1–3. *Gaudryceras crassicostatum* (JIMBO)
Holotype, UMUT. MM 7492, from near the town of Soya. Two lateral (1, 3) and ventral views, with whitening. Scale bar=30 mm.

Explanation of plate 2

Figs. 1–2. *Gaudryceras crassicostatum* (JIMBO)
MNH. 278, from loc. W 7A, excavated from the bed with *Schlueterella kawadai* on the floor of Soya harbour. Lateral (1) and ventral (2) views, ×2/3. Body-chamber distorted; phragmocone well-preserved.
Figs. 3–4. *Gaudryceras crassicostatum* (JIMBO)
MNH. 221, from Kiyohama-I, showing more frequent major ribs than the holotype. Ventral (3) and lateral (4) views, ×5/7. The entire shell somewhat distorted.

Explanation of plate 3

Figs. 1–6. *Anagaudryceras politissimum* (KOSSMAT)
GK. H 3823, from loc. H12d6, Lower Sandy Siltstone (IVb) of the Hakobuchi Group in Tomiuchi (=Hetonai). Two lateral (1, 2), ventral (3) and frontal (4) views of inner whorl, ×1.5; lateral (5) and oblique section (6) of the same individual, with a fragmental piece of outer whorl, whose preserved end is the beginning of body-chamber, ×1.5.
Figs. 7–8. *Gaudryceras crassicostatum* (JIMBO)
MNH. 280, from Kiyohama-II (W7E), excavated from the bed with *Schlueterella kawadai*. Lateral view (7) and cross-section (8) of phragmocone, contained in a nodule, ×1. The outer shell layer with fine lirae was mostly taken away.
Figs. 9–10. *Gaudryceras crassicostatum* (JIMBO)
MNH. 275, from a boulder on the coast, northeast of Kiyohama-II. Lateral (9) and ventral (10) views, ×3/4.

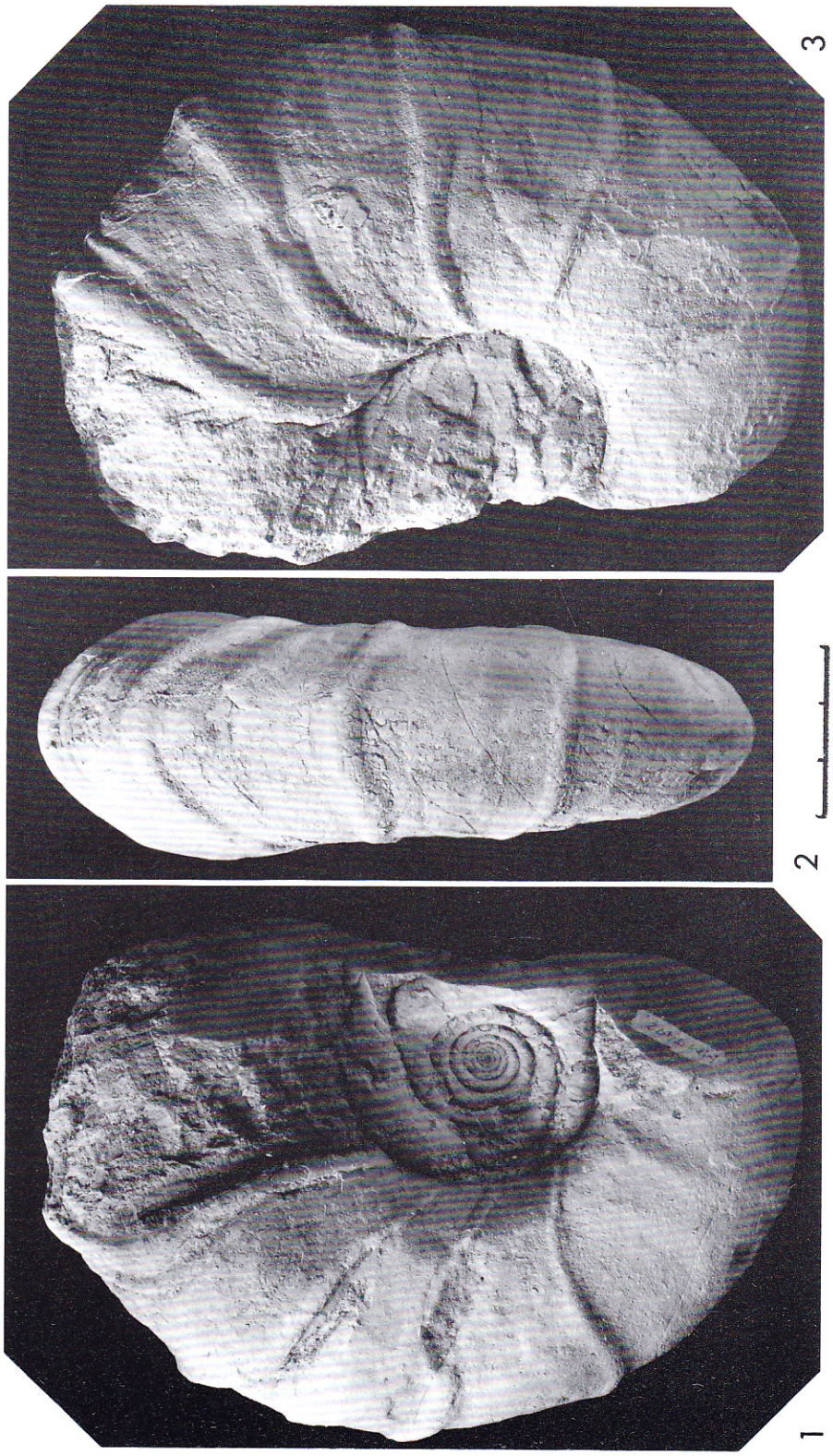
Explanation of plate 4

Fig. 1. *Anagaudryceras matsumotoi* MOROZUMI
GK. H 5980a, paratype from loc. P 240, Unit H3 of the Pinneshiri Quadrangle of Y. IGI (1953), Tombetsu area. Lateral view, ×4/3.
Figs. 2–3. *Anagaudryceras matsumotoi* MOROZUMI
GK. H 5982, collected by S. NISHIJIMA from loc. Nj-68 of the Tombetsu area (see MATSUMOTO *et al.*, 1980, text-fig. 1). Lateral (2) and ventral (3) views, ×1.5. Outer whorl deformed.
Figs. 4–5. *Anagaudryceras matsumotoi* MOROZUMI
GK. H 5983, paratype, from loc. Nm 175, Pokkiriiso, Unit N4 of the Nemuro Group. Lateral (4) and ventral views of phragmocone, ×1.5.
Figs. 6–8. *Anagaudryceras matsumotoi* MOROZUMI
GK. H 5984, paratype, from loc. Kd 1404, between Senposhi and Furuyashiki, Poroto Formation (N3) of the Nemuro Group. Two lateral (6, 7) and frontal (8) views of phragmocone, ×1.5. Highly squashed body-chamber excluded from the illustration.
Figs. 9–10. *Anagaudryceras matsumotoi* MOROZUMI
GT. I-3785, paratype, from loc. N109c, lower part of Member Rdy, Ryugase Group of Naibuchi area (South Sakhalin). Lateral (9) and ventral (10) views of phragmocone, ×1.5.

Explanation of plate 5

Figs. 1–4. *Anagaudryceras nanum* MATSUMOTO, sp. nov.
Holotype, GK. H 3124, from loc. U45, Member Ur4ß of MATSUMOTO (1942). Two lateral (1, 3), ventral (2) and frontal (4) views, ×1.5.
Figs. 5–8. *Anagaudryceras politissimum* (KOSSMAT)
GK. H 2302, from loc. N12d6, Member Ray2 of the Ryugase Group, Naibuchi area, South Sakhalin. Ventral (5), two lateral (6, 7) and frontal (8) views, ×1.5.
Figs. 9–11. *Anagaudryceras tetragonum* MATSUMOTO et KANIE, sp. nov.
YCM. Ur076001, from loc. U76A, Member H1 of Urakawa area. Frontal (9) and two lateral (10, 11) views, with whitening, ×1.

Photos by H. MAEDA (pl. 1), Y. KANIE (pl. 5, figs. 9–11) and M. NODA (others, without whitening).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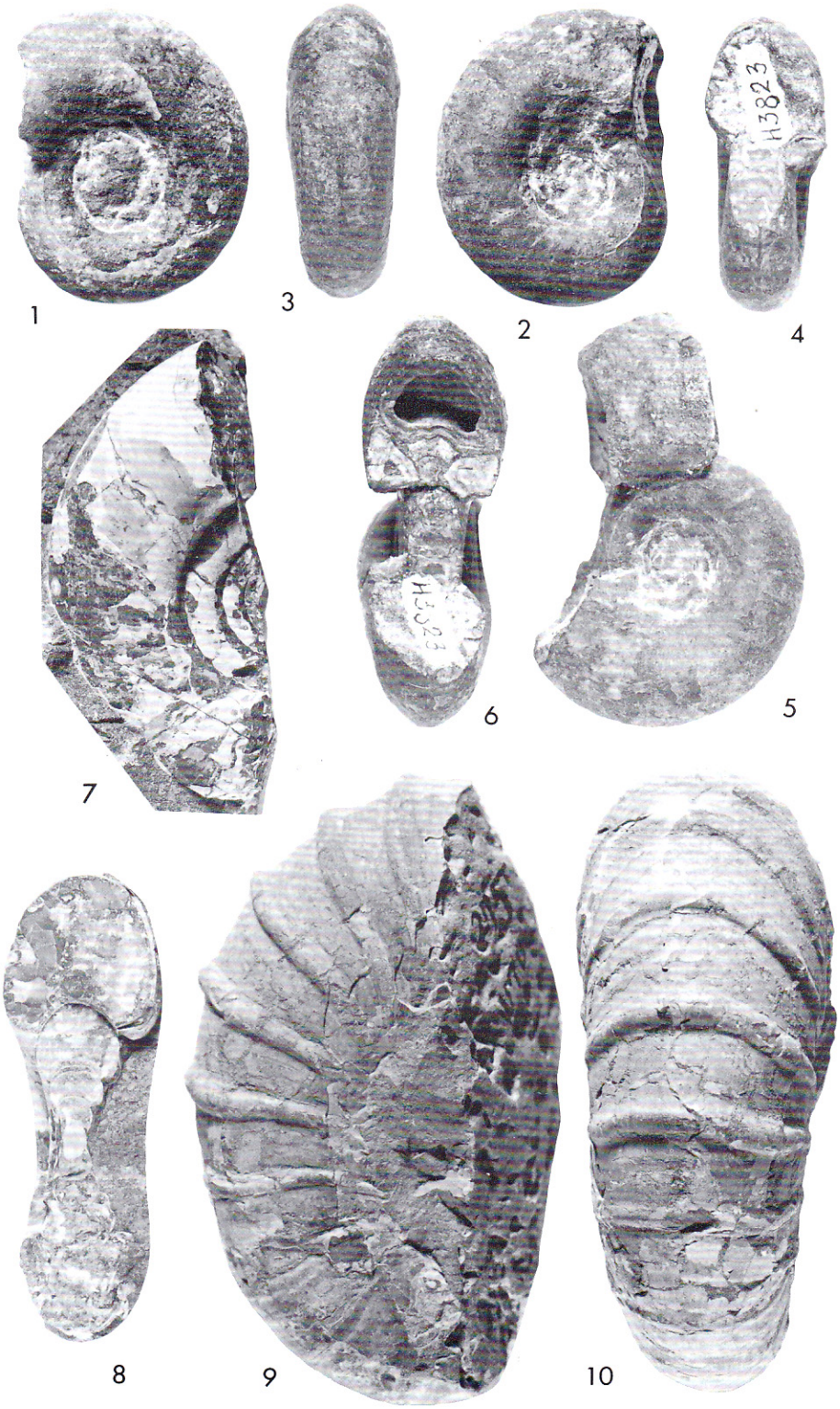
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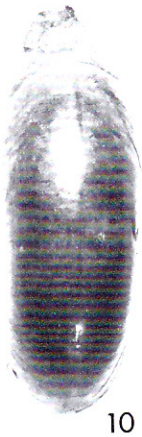

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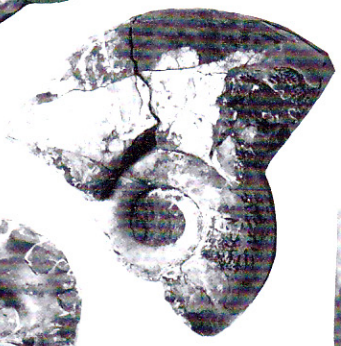

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