

# Some gaudryceratid ammonites from the Campanian and Maastrichtian of Hokkaido

## Part I

(Studies of the Cretaceous ammonites from Hokkaido—XLIX)

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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1

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北海道をはじめ白亜紀日本区の各地のヘトナイ統（カンパニアン・マストリヒチアン両階）には、ゴードリセラス科に属するいくつかの種が産する。本編には *Gaudryceras* に属する2新種と1既知種を記載する。新種1 (*G. tombetsense*) は、北米太平洋岸産の *G. denmanense* (WHITEAVES) に類似し、未成年期では殻表面にだけ認められ内型には印象されない糸状肋 (*lirae*) が次第に発達して成年殻では肋となり、内型でも認められる。さらにこの肋のほか、未成年期における周期的のくびれに伴う高まり (*flares*) が成年期にも存続し、住房上では特徴的な主肋 (*major ribs*) として頻繁に現われること、また肋が外面でかなり著しい前方屈曲を示すこと、螺環の巻き数が多く、未成年期に巻きが緩いことなどで区別される。一見 *Mesopuzosia* に外観が似る、北海道北部の頓別川流域や宗谷地域のほか、中央部の穂別や四国（高知県）にも産し、マストリヒチアン階を特色づける。

新種2 (*G. venustum*) は今の所は穂別地域の深牛砂岩層上部産の2個の標本で代表されているが、*Neodesmoceras gracile* (MATSUMOTO) とともに産し、やはり同階の特徴種と言えるようになること期待される。*G. crassicoatum* (JIMBO) に似るが、周期的のくびれに伴う高まりから発達した成年期の住房上の頻繁な主肋が、その種における程強大でなく狭長で波曲も弱い。主肋間に弱い細肋 (*subcostae*) があるのは両種共通する。かなり大型で多巻きである。*G. striatum* (JIMBO) とも似るが、未成年期に巻きが緩く、へそが広く、細肋や主肋の波曲の程度が弱い。

既知の *G. crassicoatum* (JIMBO) については、宗谷産原標本にその後の追加標本（宗谷・浦河・サハリン産）をも加えて、再記載した。本種はカンパニアン（下部亜階上部と上部亜階下部）に産する。

### Introduction

More than ten species of the Gaudryceratidae occur in the Hetonaian (Campanian and Maastrichtian) of Hokkaido and other areas of Japan. *Gaudryceras hamanakense* MATSUMOTO et YOSHIDA, 1979, *G. izumiense* MATSUMOTO et MOROZUMI, 1980 and *G. mamiyai* MATSUMOTO et MIYAUCHI, 1984 have been recently established. In addition to them I am going to describe some more species from Hokkaido. This is to improve our knowledge about the Campanian and Maastrichtian.

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chtian biostratigraphy as well as to enrich the ammonite palaeontology.

Notes on the stratigraphy for the described ammonites are omitted for brevity. Readers may refer to the descriptions and maps in the works by IGI (1953), MATSUMOTO *et al.* (1980), MATSUMOTO *et al.* (1981) and YASUDA (1984) for the area of the River Tombetsu [Tonbetsu] and MATSUMOTO and MIYAUCHI (1984) for the Soya area, both northern Hokkaido, and those by MATSUMOTO (1942) and MATSUMOTO *et al.* (1979) and KANIE (1982) for the Hobetsu-Hetonai [Tomiuchi in the modern place name] and Urakawa areas in southern central Hokkaido.

### Palaeontological descriptions

#### Family Gaudryceratidae SPATH, 1927

The taxonomy of this family was comprehensively remarked by COLLIGNON (1956) and KENNEDY and KLINGER (1979). In this paper I follow the last work provisionally, although I am not completely satisfied with it.

#### Genus *Gaudryceras* DE GROSSOUVRE, 1894

*Type-species*: *Amomnites mitis* HAUER, 1866 (designated by BOULE, LEMOINE and THÉVENIN, 1906).

*Remarks*: I have not yet reached a satisfactory conclusion as to the taxonomic grouping of various species under this genus. KENNEDY and KLINGER (1979) set the subgroup of *G. tenuiliratum*, but it should be better called the subgroup of *G. denmanense*, because *G. tenuiliratum* (YABE), with *Lytoceras sacya* FORBES of YOKOYAMA (1890, pl. 18, fig. 12) as its lectotype, belongs to the same subgroup as *G. denseplicatum* (JIMBO, 1894). *G. tenuiliratum* seems to have been misunderstood by oversea palaeontologists, although I am responsible for this species.

#### *Gaudryceras tombetsense* sp. nov.

Pl. 1, figs. 1-2; pl. 2, figs. 1-4

1981. *Gaudryceras* sp. nov., MATSUMOTO, in *Geol. & Paleont. of the Shimanto Belt*, p. 289, pl. 46, figs. 3-5; pl. 47, figs. 3-6.

*Material*: Holotype, GK. H5991, from the lower course of the Kikusui-gawa, a tributary to the River Tombetsu, Esashi-gun, Hokkaido; collected by Chozo KURÔ and transferred to Dr. S. IMANISHI, who donated the specimen to Kyushu University. Paratype, GK. H5992, from loc. K70p, middle course of the Heitaro-zawa, a tributary of the River Tombetsu. There are also several other comparable specimens from the Tombetsu area and GK. H5993, from loc. H120, Tomiuchi [=Hetonai], Hobetsu area.

*Diagnosis*: Shell evolute, enlarging slowly, and widely umbilicate in earlier

stages of growth; moderately involute and expanding fairly rapidly later. Whorl section subrounded earlier and oval later. Periodic constrictions and associated major ribs fairly frequent throughout growth. Fine lirae at first, becoming to subcostae, with multiple branching or intercalation on outer part; later in the late part of the phragmocone and on the adult body-chamber the subcostae gradually strengthened to narrow ribs consisting of long and short ones in alternation with wider interspaces and finally becoming to ribs of moderate intensity. The subcostae and ribs gently flexuous, showing ventral projection. Extremely fine lines may be discernible on the surface in parallel with the ribs.

*Measurements* (in mm):

Specimen	Diameter	Umbilicus	Height	Breadth	B/H
GK. H5991	max > 140				
" (-90°)	112.0	46.4 (.41)	43.0 (.38)	35.0 (.31)	.81
GK. H5992*	151.0	52.8 (.35)	63.0 (.42)	53.2 (.35)	.84
" (-165°)	109.0	44.0 (.40)	41.5 (.38)	36.5 (.33)	.88

\* Specimen somewhat distorted but measured as it is.

*Description:* The holotype is well preserved on the right side, although its body-chamber is partly destroyed. Its left half is secondarily compressed and for the most part hardly separated from the rock matrix. The paratype shows both sides, but somewhat distorted and a part of its body-chamber and the very initial part are damaged.

The body-chamber occupies at least a half whorl in the two specimens. From the late septate stage onward the whorl is higher than broad. As the shell becomes less evolute and the whorl-height increases with a higher rate in the late growth-stage, the relative size of the umbilicus changes from wide (more than 40% of D) to moderate (about 35% of D). The shell is polygyral, consisting of at least nine whorls.

The ornamentation is the most characteristic of this species (see diagnosis and comparison).

As the shell layers are preserved, the suture is not well exposed, except for a portion of it.

*Comparison.*—This species is allied to *Gaudryceras denmanense* (WHITEAVES, 1901) (see USHER, 1952, p. 59, pl. 4. figs. 1, 2), from the Campanian of British Columbia, in the characters of the inner whorls and in that the subcostate on the late septate whorl are gradually coarsen to the ribs on the adult body-chamber, as well as in the general shell-form. The two species, however, are clearly distinguished as follows: First the periodic major ribs which are accompanied with constrictions persist well up to the body-chamber in *G. tombetsense* but disappear in *G. denmanense*. Secondly, the ribs on the body-chamber are as

flexuous as the subcostae on the preceding whorl in *G. tombetsense*, showing a considerable ventral projection, but they show little or almost no ventral projection in *G. denmanense*. Thirdly, *G. tombetsense* is somewhat more polygyral than *G. denmanense* and has somewhat (but not much) wider umbilicus at the corresponding stage. This point may not be so significant, as there could be a variation in these features.

The specimens described under *G. tenuiliratum* YABE by JONES (1963), from the Zone of *Pachydiscus kamishakensis* in Alaska, are not identical with the named species. One of the illustrated specimens (JONES, 1963, pl. 9, figs. 1-3) resembles *G. mamiyai* MATSUMOTO et MIYAUCHI (1984), whereas the other (JONES, 1963, pl. 10, figs. 1-3) is rather similar to *G. tombetsense*, although I cannot give a final decision without seeing the specimens.

I described several incompletely preserved specimens from the Sukumo-Nakamura area of the Shimanto Belt in Shikoku under *Gaudryceras* sp. nov. (MATSUMOTO, 1981, p. 289, pl. 46, figs. 3-5; pl. 47, figs. 3-6), which was remarked as identical with the undescribed species from the Tombetsu area of northern Hokkaido. Now we can name them *G. tombetsense* or *G. cf. G. tombetsense*.

It is interesting to see that a homoeomorphic similarity is seen between *G. tombetsensis* and such species as *Mesopuzosia pacifica* MATSUMOTO, 1954 of the Puzosiinae.

*Occurrence.*—The holotype is from the lower course of the Kikusui-gawa, a branch of the River Tombetsu, near Matsuneshiri. It is from the greenish grey, silty fine-grained sandstone, referred probably to Member H3 (or possibly to Member H4) of the geological map of Pinneshiri (IGI 1959), which corresponds to Unit D (or E) of MATSUMOTO *et al.* (1980). The paratype is from loc. K-70 p of the Heitaro-zawa, a tributary of the River Tombetsu, about 3.5 km northwest of the street of Nakatonbetsu. This specimen and two other comparable specimens from the nearby localities K-62 and K-83 are referred to the greenish sandy siltstone or silty fine-grained sandstone of Unit E1 of MATSUMOTO *et al.* (1980). All of them are Maastrichtian, because these units are above Unit C which comprises the Zone of *Inoceramus shikotanensis*.

There is another, fairly large example of this species now in display at *Wakkanai Seishonen Kagakukan* (an educational center for the younger generation), which came from a sandstone quarry at Mitsuizawa of Magaribuchi, about 20 km SSE of Wakkanai. Also a specimen (GK. H5993) which can be called *Gaudryceras cf. G. tombetsense* is from loc. H120, in a siltstone layer within the Fukaushi Sandstones at Omagari on the left bank of the River Mukawa, Hobetsu area.

*Gaudryceras venustum* sp. nov.

Pl. 3, figs. 1-2

*Material*: Holotype, GK. H5994, from loc. H311a, Kiusu, Nakahobetsu, in Bed IVc5, upper part of the Fukaushi Formation, Hakobuchi Group. Paratype, GK. H5999 from the same formation. Both coll. T. MATSUMOTO in 1961.

*Diagnosis*: Adult shell large, polygyral, having high outer whorl which expands with a fairly high rate, embracing about a half of inner whorl. Younger shell more evolute and widely umbilicate, consisting of slowly enlarging rounded whorl. Phragmocone constricted with moderate frequency and finely lirate on surface. Body-chamber provided with frequent but narrow major ribs which are developed as flares along constriction; also with lirae and rather irregular weak subcostae on the intervals between the major ribs.

*Measurements* (in mm):

	Diameter	Umbilicus	Height	Breadth	B/H
(1)	216.0	66.6(.31)	92.0(.43)	55.5(.27)	0.60
(2)	Ca 125(?)	49.0(.39)	50.0(.40)	40.5(.32)	0.81

(1) Near the preserved end of body-chamber of holotype

(2) At the end of phragmocone of holotype

*Description*: The holotype was embedded in a calcareous nodule in greenish silty fine-grained sandstone and is only slightly compressed secondarily. The altered shell layer is preserved on the major part of the body-chamber and a part of the inner whorls.

The body-chamber occupies about 210°. The ocular sinus is situated on the steeply inclined umbilical wall immediately inside the umbilical shoulder and small, whereas the ventrolateral sinus is very shallow and broad. The whorl-section of the body-chamber is much higher than broad, broadest slightly above the umbilical shoulder, and elongated ovoid in outline, with gently convex, rather compressed flanks which converge to a narrowly arched venter.

The phragmocone has more rounded whorls as in other species of *Gaudryceras*, but its late part is somewhat higher than broad and subelliptical in section. It is polygyral, consisting probably of 9 whorls, although the very initial part is not well preserved. It is represented for the most part by the smooth internal mould, but it has fine lirae where the shell layer is preserved. Three constrictions are counted in a half whorl. The suture on the last part of the phragmocone is very finely and deeply incised.

There are eight major ribs on the body-chamber. In other words the major rib appear at each 30° or so on the average. Each major rib is accompanied by a narrow constriction in the earlier half but seems to be free from constriction in the later half. It is low and rather narrow and not covered with sub-

costae. The interval between the major ribs is covered with fine lirae and weak subcostae. The subcostae occur rather irregularly but become somewhat distinct on the last part.

The paratype is somewhat incomplete but shows essentially the same characters as above.

*Comparison:* This species resembles *Gaudryceras striatum* (JIMBO) (1984, p. 181, pl. 6, fig. 6) (YABE, 1903, p. 31, pl. 4, fig. 5), from the Campanian of Japan and Sakhalin, in the frequent periodic major ribs on the late stage and the fine lirae, but is more polygyral having more evolute and more numerous inner whorls than the latter. The ribs and lirae of *G. venustum* are less flexuous on the main part of the flank, showing weaker ventral projection than those of *G. striatum*.

In the polygyral shell and the presence of frequent major ribs and irregularly distributed subcostae on the adult body-chamber, *G. venustum* is somewhat similar to *G. crassicostatum* (JIMBO) (1894, p. 182, pl. 6, fig. 7), from the Campanian of Hokkaido, but the major ribs in that species is much stronger and broader.

This species is characterized by the slender outer whorl with weak ornamentation and looks elegant. For this reason the specific name *G. venustum* is given. For the same reason and for the weak ventral projection of the ribs, someone might regard it as a species of *Anagaudryceras*, but it does have subcostae on the shell surface and should be assigned to *Gaudryceras*.

*Occurrence:* The holotype was obtained at loc. H311a, Kiusu, Nakhobetsu, Yufutsu-gun, southern central Hokkaido. It was in bed IVc5, Fukaushi Formation of the Hakobuchi Group, together with *Neodesmoceras gracile* (MATSUMOTO) (holotype) (see MATSUMOTO *et al.*, 1979, fig. 7 for the locality map) and *Sphenoceras* (?) *hetonaianus* (MATSUMOTO), being assigned to K6b2 of the Japanese scale, that is approximately Upper Maastrichtian. The paratype from loc. H172, western branch of the Panketosano-sawa, Tomiuchi area, upper part of the Fukaushi Formation.

*Gaudryceras crassicostatum* (JIMBO, 1894)

Pl. 4, figs. 1-3; pl. 5, figs. 1-2

1894. *Lytoceras crassicostatum* JIMBO, *Palaeont. Abh.*, N. F., 2 (3), p. 36[182], pl. 6[22], fig. 7, 7a.

1903. *Gaudryceras crassicostatum* (JIMBO); YABE, *Jour. Coll. Sci., Imp. Univ. Tokyo*, 18, p. 29, pl. 4, fig. 4.

1963. *Gaudryceras crassicostatum* (JIMBO); MATSUMOTO in MATSUMOTO (ed.) *A Survey of Fossils from Japan Illustrated in Classical Monographs*, Pt. X, p. 44, pl. 65, fig. 7.

*Material:* Holotype, UMUT. MM7492 (=I-117) from Soya. YABE's (1903)

specimen, UMUT. MM7469 (=I-189) from Soya. More than ten specimens from the Soya area in T. MIYAUCHI's Collection (to be recorded in Part 2). H65 of M. YAMASHITA's Collection from Tsukisap [=Tsukisappu], Urakawa area, now donated to Kyushu University (GK. H5995). Also GT. I-3799 from loc. N107a, Naibuchi area, collected by T. MATSUMOTO and GT. I-1390 from loc. 823 of To-guchi, collected by K. ISHISAKI and K. SAKAKURA are examples from South Sakhalin.

*Diagnosis:* Shell of moderate size polygyral, consisting of widely umbilicate phragmocone and moderately involute body-chamber. Inner whorls subrounded in section; body-chamber higher than broad and suboval in section.

Inner whorls moderately frequently constricted with associated flares, nearly smooth on the internal mould, having fine lirae on the shell surface. Adult body-chamber provided with flexiradiate major ribs, which are coarse on the main part and separated by wide interspaces; also several weak subcostae at each interval of the ribs.

Suture as for the genus.

*Measurements* (in mm):

Specimen	Diameter	Umbilicus	Height	Breadth	B/H
Holotype*	132.3(1)	43.7(.33)	56.7(.43)	46.8(.35)	0.82
GT. I-189	45 (1)	21 (.46)	15 (.33)	12 (.26)	0.8
GK. H5995	137.0(1)	44.4(.32)	60.0(.44)	48.0(.35)	0.80
" (-120°)	61.0(1)	28.4(.46)	22.6(.37)	23.8(.39)	1.05

\* JIMBO's measurements included misprints.

*Description:* This species is not uncommon, being represented by about 20 specimens. They are, however, mostly adult, having the characteristic body-chamber. When a phragmocone alone or an immature specimen is dealt with, it may be difficult to identify this species with certainty. As to the fine ornamentation other than the major rib, I should observe carefully the surface of the outer shell layer, which may be preserved partly on actual specimens.

The diameter of the adult shell is 120 to 135 mm in the available specimens, although the apertural margin is not preserved in any of them. The body-chamber occupies at least 210°. In the holotype the coarse major ribs are disposed at wide intervals, numbering 5 (or 6?) within a half whorl, and on each interval there are several subcostae faintly impressed on the inner shell layer. The ribs and subcostae are flexiradiate on the flank and projected on the venter. The major rib is narrow on the earlier part of the body-chamber but becomes broader on the later part. The specimens in T. MIYAUCHI's Collection are generally similar to the holotype and will be described in more detail in Part 2.

The specimen from Urakawa (No. 65 of YAMASHITA's Coll.) has more frequent major ribs, numbering 10 within a half whorl. The ribs are strong

and broad (about 6 to 9 mm in breadth on the venter) on the adoral half of the body-chamber but are somewhat narrower on the posterior part. The subcostae on the interspaces of the ribs are irregular and rather weak, but some of them are fairly distinct around the umbilicus, showing branching and / or intercalation outward. The flexuosity of the ribs and subcostae on the inner half of the flank is strong, whereas the ventral projection of the ribs on the adoral part is not so remarkable as that of the holotype.

The mode of ribbing on the body-chamber of GT. I-3799 is similar to that of the Urakawa specimen. GT. I-1390 has coarser ribs which are disposed at wider intervals on the middle part of the body-chamber.

The constrictions, with associated flares, are counted 6 per whorl in the immature stages. They seem to become less well marked and less frequent on the last half of the septate whorl. YABE's figure (1903, pl. 4, fig. 4) is misleading in that the actually existing constrictions and flares were omitted.

The shell layer is only partly preserved in the available specimens. On its surface the lirae are narrow but separated by the interspaces which are slightly wider than the lirae themselves around the umbilicus, but they are branched and become very fine and dense on the outer ventral part.

*Comparison:* *G. crassicosatum* is closely allied to *G. venustum* MATSUMOTO, 1984, from the Maastrichtian of Hokkaido, but the former is smaller and has stronger and broader major ribs on the adult body-chamber. The latter has more compressed whorl in the late growth-stage and even its late septate whorl is higher than broad. It is noted, however, that the major ribs of *G. crassicosatum* are fairly narrow on the early (i.e. posterior) part of the body-chamber. In *G. venustum* this narrow and fine ribbing persists up to the adoral part of the body-chamber. I presume that *G. venustum* may have evolved from *G. crassicosatum*.

*G. striatum* (JIMBO, 1894) is less polygyral and less evolute and has finer and denser lirae on the whole surface of the shell and no subcostae of the second order on the interspace of narrower and more frequent major ribs of the body-chamber.

Outside Japan and adjacent parts of the northwestern Pacific region, I have seen no species which is clearly allied to *G. crassicosatum*.

*Occurrence:* Occasionally found in the Campanian of Hokkaido and Sakhalin. Holotype is from the sandstone near the town of Soya, which may be the lower part of the Upper Campanian on the evidence of the subsequent collections. An example from the upper reaches of the River Tsukisap, Urakawa is in the fine-sandy siltstone of Member U4 $\beta$  (KANIE, 1982) not far from the bed with *Sphenocerasmus schmidtii*. Loc. N107a, Member Rcy (?) (Upper Campanian ?) of the Naibuchi area; loc. 823, Togushi Sandstones in South Sakhalin.



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Esashi-gun (枝幸郡)	Fukaushi (深牛)	Hakobuchi (函淵)
Heitaro-zawa (平太郎沢)	Hetonai (辺富内)	Hobetsu (穂別)
Kikusui-gawa (掬水川)	Kiusu (キウス)	Magaribuchi (曲淵)
Matsuneshiri (松音知)	Mitsui-zawa (三井沢)	Mukawa (鶴川)
Naibuchi (内淵)	Nakahobetsu (中穂別)	Nakamura (中村)
Nakatonbetsu (中頓別)	Omagari (大曲)	Pinneshiri (敏音知)
Shimanto (四万十)	Soya (宗谷)	Sukumo (宿毛)
Togushi (十串)	Tomiuchi (富内)	Tombetsu [=Tonbetsu: Tombetsu by Jimbo, 1894] River (頓別川)
Tsukisap [=Tsukisappu] (月寒)	Wakkanai (稚内)	Yufutsu-gun (勇払郡)
Urakawa (浦河)		

### Explanation of plate 1

Figs. 1-2. *Gaudryceras tombetsense* sp. nov.

Holotype, GK. H5991, from Kikusui-gawa, Kurô-Imanishi Coll. Lateral (1) and ventral (2) views,  $\times 1$ .

### Explanation of plate 2

Figs. 1-4. *Gaudryceras tombetsense* sp. nov.

Paratype, GK. H5992, from loc. K-70 p, Heitaro-zawa, T. MATSUMOTO Coll. Lateral (1) and ventral (2) views of the phragmocone; lateral (3) and frontal (4) views of the whole specimen, including the partly destroyed body-chamber,  $\times 0.9$ .

### Explanation of plate 3

Figs. 1-2. *Gaudryceras venustum* sp. nov.

Holotype, GK. H5994, from loc. H311a, Kiusu of Nakahobetsu, T. MATSUMOTO Coll. Ventral (1) and lateral (2) views,  $\times 0.65$ .

### Explanation of plate 4

Figs. 1-3. *Gaudryceras crassicoatum* (JIMBO)

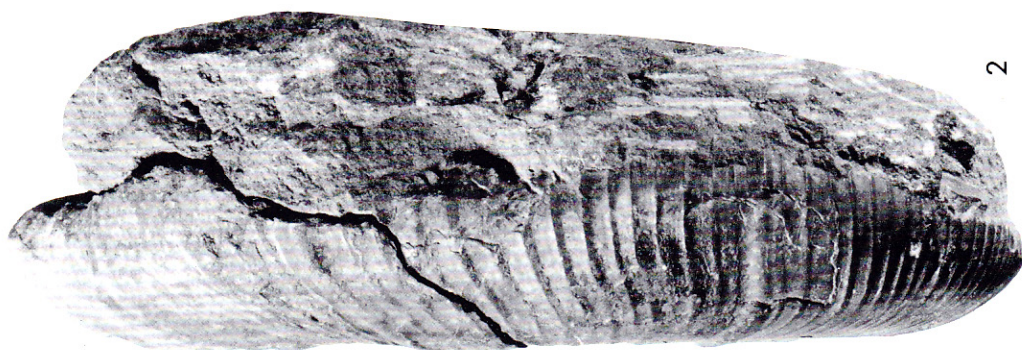
Hypotype, GK. H5995, from Tsukisap, Urakawa, M. YAMASHITA, Coll. Lateral (1), ventral (2) and frontal (3) views,  $\times 0.95$ .

### Explanation of plate 5

Figs. 1-2. *Gaudryceras crassicoatum* (JIMBO)

Hypotypes, UMUT. GT. I-1390 (Fig. 1) from loc. 823 of Togushi, K. ISHIZAKI & K. SAKAKURA Coll.; UMUT. GT. I-3799 (Fig. 2) from loc. N107a, Naibuchi, T. MATSUMOTO Coll., both lateral views,  $\times 1$ .

Photos (pls. 1-4) by courtesy of Dr. M. NODA and (pl. 5) Mr. C. UEKI.



2

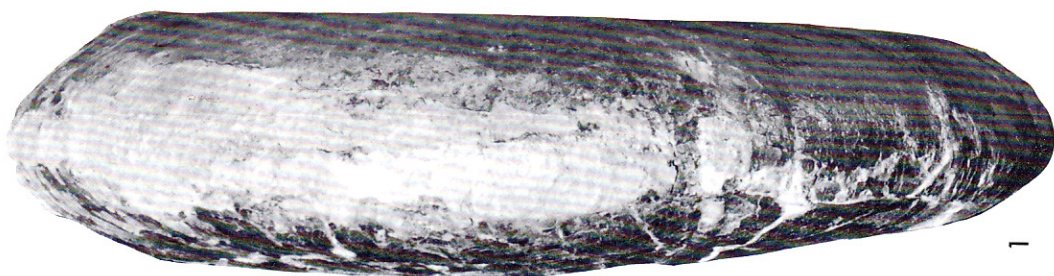


1





2

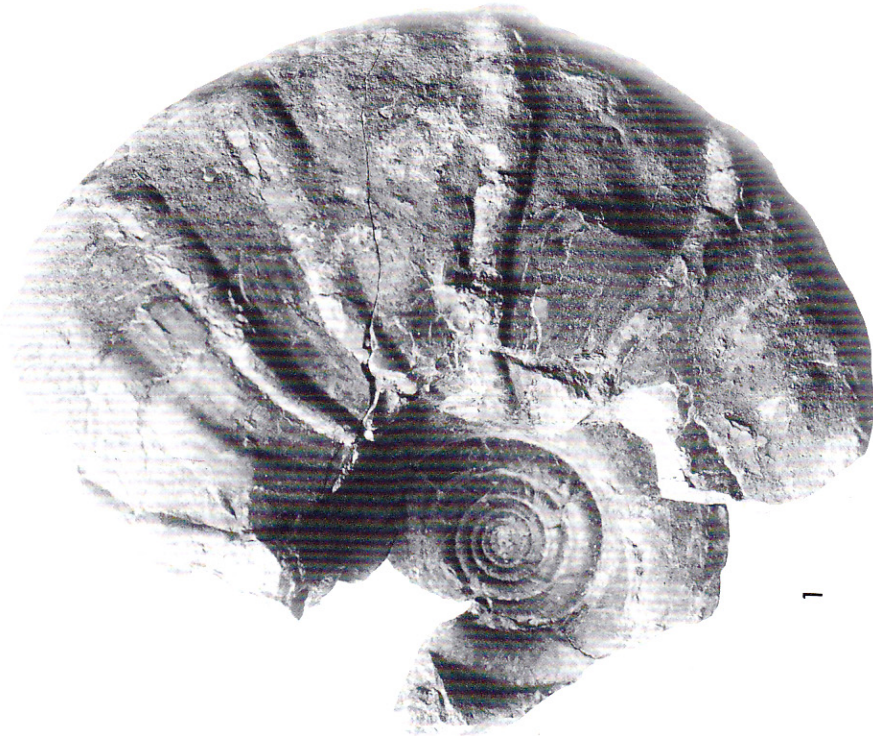


1





2



1