

**Restudy of *Gaudryceas venustum* Matsumoto from the Hobetsu district, Hokkaido**  
(Studies of the Cretaceous ammonites from Hokkaido-LXXV)

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**Abstract**

*Gaudryceras venustum* Matsumoto, 1984 is restudied on the recently collected specimens as well as the original types from the Fukaushi Formation (early Maastrichtian) of the Hobetsu district, Hokkaido. A revised description is given and it is suggested that the phylogenetic origin of this species may be in *G. tenuiliratum* Yabe of Coniacian to early Campanian age. The phylogenetic affinities of *G. venustum* with Campanian *G. crassicos-tatum* (Jimbo) and also with late Maastrichtian *G. hamanakense* Matsumoto & Yoshida are discussed at length.

**Key words** — *Gaudryceras*, *G. venustum*, Maastrichtian, Fukaushi Formation, Hobetsu

**Introduction**

Ammonites of the family Gaudryceratidae occur fairly abundantly in the Upper Cretaceous deposits of Hokkaido. In the Maastrichtian part of the deposits several gaudryceratid species do occur, but they are, for some reasons, represented by rather a small number of specimens. *Gaudryceras venustum* Matsumoto, 1984 was established on only two specimens which were rarely obtained in 1961 from the Fukaushi Formation of the Hobetsu district. Moreover, the surface of the specimens were somewhat abraded.

The locality of the holotype is H311, a cutting of a road locally called "Sekiyu-zawa route" (Fig. 1). The cutting was repaired in 1991. Numerous fossiliferous nodules, yielded from the silty sandstone during the repair works, were mostly collected officially by the township of Hobetsu and have been stored in the Hobetsu Museum, but some of them were hunted personally.

By courtesy of Dr. Tsutomu Chitoku, curator of the Museum, and Mr. Toshiharu Abe, we were

afforded to have an opportunity to study the specimens of the above collections, comparing them with the original specimens in Kyushu University. This paper is the result of our study.

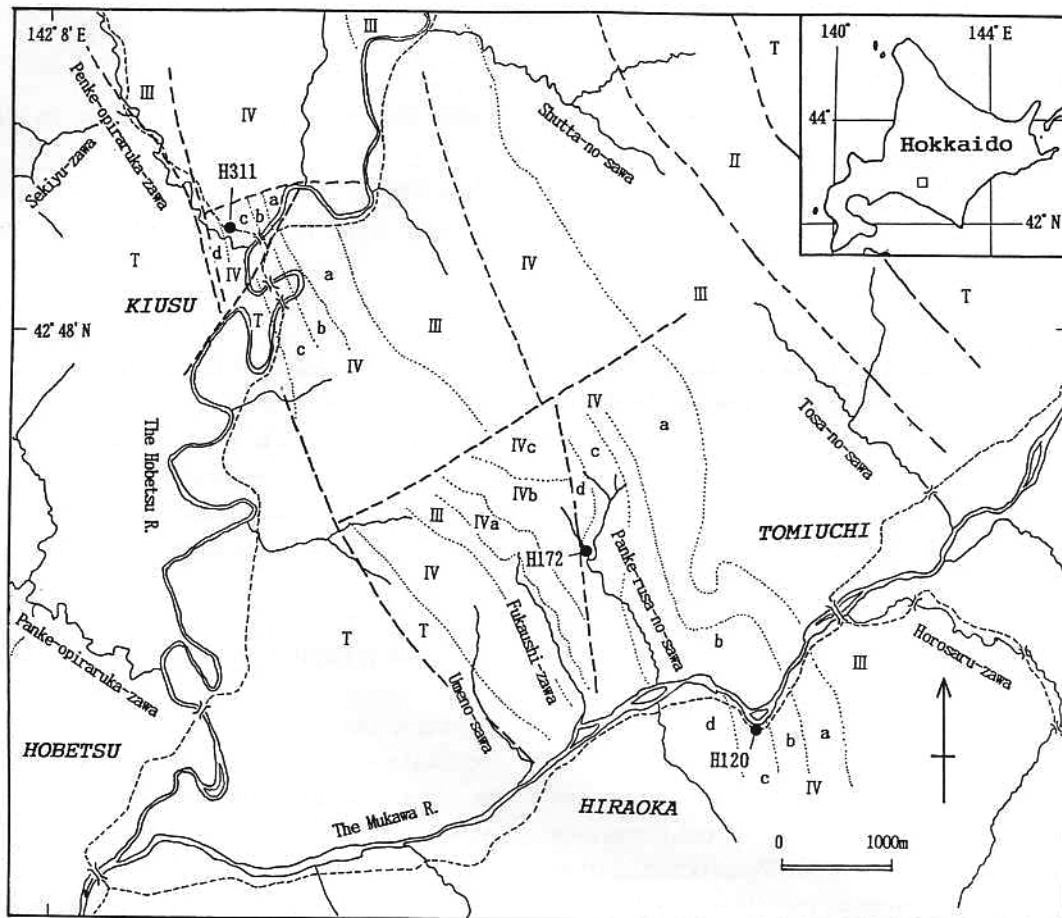
**Repositories.** — The official repositories, with abbreviation at each heading, are as follows:

HMG: Hobetsu Museum, Hobetsu, Hokkaido 054-02

GK: Type Room, Department of Earth and Planetary Sciences, Kyushu University 33, Hakozaki, Fukuoka 812

GSJ: Geological Museum, Geological Survey of Japan, Tsukuba, 305

**Acknowledgements.** — Before entering in the description, we should like to thank the above two gentlemen as well as the Director of the Museum. Thanks are extend to Dr. Masayuki Noda and Mr. Yukinobu Yoshikawa for their kind help in taking photographs. We owe much to Dr. Ikuwo Obata for his kindness in critical reading of the manuscript with valuable suggestions.



**Fig. 1** Geological outline of the Hobetsu district, showing sites of the fossil-localities (small solid circles) where *Gaudryceras venustum* was collected (modified from Matsumoto, 1942; Matsumoto *et al.*, 1991; Takahashi & Wada, 1987; Toshimitsu, 1994). T: Tertiary, IV: Hakobuchi Group (IVc: Fukaushi Formation), III: Upper Yezo Subgroup, II: Middle Yezo Subgroup.

### Systematic description

Order Ammonoidea Zittel, 1884  
 Family Gaudryceratidae Spath, 1927  
 Genus *Gaudryceras* de Grossouvre, 1894

*Gaudryceras venustum* Matsumoto, 1984  
 Plates I-VIII

1984. *Gaudryceras venustum* Matsumoto, p. 5, pl. 3, figs. 1-2.

**Types.** — The holotype is GK. H5994 (Pls. I, II), an adult specimen of complete evolution, from the Fukaushi Formation at loc. H311a of the Hobetsu district. The paratype is GK. H5999, another adult but secondarily deformed specimen, from the same formation at loc. H172, western branch of the Panke-rusa-no-sawa, Hobetsu district. Both were collected by T. M. during the field work of 1961.

**Subsequent material.** — The following five

specimens have been investigated by us: (1) HMG 932 (Pl. III B, C, Pl. IV A), incomplete adult specimen, consisting of phragmocone and about one third of body chamber; (2) HMG 933 (Pl. IV B), internal mould of somewhat distorted phragmocone; (3) HMG 934 (Pl. III A), poorly preserved immature specimen; (4) T. Abe's collection no. 1 (Plaster casts: GSJ F14784, GK. H8469, HMG 1060; Pls. V, VI), adult specimen of complete evolution, except for some parts of restoration; (5) T. Abe's coll. no. 2 (Plaster casts: GSJ F14785, GK. H8470, HMG 1061; Pls. VII, VIII), well-preserved phragmocone plus a fraction of body chamber, with outer shell layer preserved in part. All came from loc. H311.

**Diagnosis.** — Shell fairly large, polygyral and widely to moderately umbilicate. Periodic constrictions and accompanied flared ribs [= collars] disposed regularly, showing increasing frequency with growth.

Cross-section of late septate whorl suboval, that of body chamber outer half suboval, inner half subtrapezoidal, and broadest immediately outside of the umbilical shoulders.

Ribs and lirae typically sigmoidal, tending to decrease their ventral projection on the body chamber. On the surface of septate whorls, the lirae of normal coarseness multipartited into extremely fine and dense lirae on the venter. On the adult body chamber the lirae coarsened, with some branching or intercalation, but not extremely multipartited.

**Description.** — The adult shell is fairly large, measuring 220 mm in diameter in the holotype and Abe's coll. no. 1 at their oral end. The body chamber begins at about 135 to 140 mm in diameter (D) and occupies nearly two thirds of the outer whorl. In Abe's coll. no. 2, the last septum is located at D=130 mm, where the whorl height (H) is 48 mm. GK. H5999 looks somewhat larger than the holotype, showing its last suture at H=60 mm, but it is badly cracked and distorted. In HMG 932 the last suture is located somewhere in the missing part

between 125 mm and 150 mm in D or between 50 mm and 60 mm in H. Thus, there is some, but not great, extent of variation in the measured size.

The coiling is polygyral; the whorls are counted full ten in the adult shell, and fairly evolute in youth, becoming moderately involute later. The adult body chamber overlaps about 1/2 in H of the preceding whorl and the rate of increase in whorl height is moderate to high, as indicated by H/h (1.5 to 1.7) in the measurements. The umbilicus is fairly wide and shallow in the main part of the phragmocone, becoming later moderate in width and depth.

The whorl is broadly rounded in youth and in the late part of the phragmocone suboval in section with B/H=4/5. The section of the adult body chamber is suboval in outer half and subtrapezoidal in inner half, showing rather flattened inner flanks, and is broadest immediately outside of the abruptly bent umbilical shoulders. The venter of the outer whorl is fairly narrowly arched.

The constrictions and the accompanied flared ribs are disposed regularly on the phragmocone, numbering 2, 3, 4 and 5 per half a whorl, increasing the frequency with growth. On the area from the umbilical wall to the inner flank, the lirae on the shell surface are sharp-headed and variably of moderate coarseness to rather fine, showing sometimes bifurcation and intercalation. They become finer and denser outward by more branching and intercalation, resulting in extremely fine and dense lirae (maybe called lines and striae by some authors) on the venter. Somewhat sharper lirae among them are the extensions of the coarser and more elevated ones among the lirae on the inner flank. The features described above are observable on the well-preserved specimens as shown in Pls. VII and VIII.

The flared ribs and lirae are flexuous as in those of the typical species of *Gaudryceras*, such as *G. mite* (Hauer) and *G. tenuiliratum* Yabe.

On the adult body chamber narrow major ribs are disposed in similar frequency to that of the periodic ribs on the late part of the phragmocone

Table 1. Measurements of *Gaudryceas venustum*.

Specimen	D	U	U/D	H	H/D	B	B/D	B/H	H/h
HT (E)	215	64	.31	92	.43	56	.26	.61	1.56
// (LS)	~130	48	.37	50	.38	40	.31	.80	1.56
HMG 932 (E)	190	67	.35	76	.40	61	.32	.80	1.62
// (E-180°)	125	45	.36	50	.40	41	.33	.82	1.67
HMG 933 (LS)	130	48	.37	50	.38	36	.28	.72	1.50
HMG 934 (E)	45	23.5	.52	13	.29	15	.33	1.15	1.53
Abe-1 (E)	220	76	.35	89	.40	66	.30	.74	1.62
// (LS+55°)	158	58	.37	62	.39	49	.31	.79	1.63
Abe-2 (LS)	130	52	.40	48	.37	41	.32	.79	1.60

HT: Holotype, E: preserved end, LS: last septum, E-180°: half whorl back from E, D: diameter, U: width of umbilicus, H: whorl-height, B: whorl-breadth, h: whorl-height at half whorl earlier than H, ~: roughly. Measurements are in mm. Body chamber of HT is secondarily compressed and HMG 933 is distorted and secondarily compressed but they are measured as they are.

and are accompanied in front by shallow or indistinct grooves. The lirae coarsen and can be traced even if the outer shell layer is abraded; hence they can be called subcostae or riblets. On the ventral part of the body chamber the subcostae weaken, showing some branching or intercalation of lirae, but the extremely fine and dense ornament disappears. In more or less late part, the ribs and riblets tend to decrease the degree of their ventrolateral projection. In the last part, the major ribs are lowered and approximated, becoming less distinct from coarsened subcostae. Some of them may have acted as flanges on the apertural margin.

The suture is of typical *Gaudryceras* pattern. In the late part of the phragmocone its subdivisions and incisions are so deep and fine that it looks apparently intricate.

Incidentally, it is interesting to see traces of bryozoans and annelids on the inner surface of the body chamber in Abe's no. 1 specimen, except for the two portions where the shell form was restored artificially.

**Dimensions.** — See Table 1.

**Comparison and discussion.** — *G. venustum* is somewhat similar to *G. tenuiliratum* Yabe, 1903, emended by Matsumoto (1995 in press), but in the adult stage the former is much larger and has a peculiar suboval-subtrapezoidal section of the body chamber instead of the subelliptical and more rounded one of the latter and also less frequent major ribs. It should be noted that the characteristic ornament on the phragmocone of *G. venustum* is essentially similar to that of much smaller immature shell (D less than 30 mm) of *G. tenuiliratum*. This suggests that *G. tenuiliratum* of Coniacian to early Campanian age may be an indirect ancestor of *G. venustum* of early Maastrichtian age.

In the intervening main part of the Campanian, there are *G. striatum* (Jimbo, 1894) and *G. crassicosatum* (Jimbo, 1894). *G. striatum* resembles *G. tenuiliratum* in size, shell form and general configuration of ornament, but it is distinguished by its finer and more numerous lirae on both phragmocone and adult body chamber, as has been already mentioned by Yabe (1903, p. 31, pl. 4, fig. 5) and Matsumoto (1941, p. 23, text-fig. 2e). The extremely fine ventral ornament occurs only in young shell of *G. striatum* as in the case of *G.*

*tenuiliratum*.

*G. crassicostratum* was redescribed in detail by Matsumoto (1984, p. 6, pl. 4, figs. 1-3; pl. 5, figs. 1-2) and Matsumoto and Miyauchi (*in* Matsumoto *et al.*, 1985, p. 20, pl. 1, figs. 1-3; pl. 2, figs. 1-4; pl. 3, figs. 7-10). It is larger than *G. striatum* and *G. tenuiliratum*, measuring 130-150 mm in D at the almost full-grown stage of adult examples. This size is roughly the same as that of the end of the phragmocone of *G. venustum*, whereas the full-grown adult shell of *G. tenuiliratum* is nearly of the same size as the end of the phragmocone of adult *G. crassicostratum*, i. e. D = 80 to 95 mm.

Apart from the difference in size and number of coiling, *G. crassicostratum* is similar to *G. venustum* in shell form and general style of ornamentation. The available specimens of *G. crassicostratum* from the Soya area are not so well preserved that the details of the ventral surface of the septate whorl are hardly observed. The small inner whorl (D = about 30 mm) of the specimen illustrated by Yabe (1903, pl. 4, fig. 4) has lirae of normal coarseness on the umbilical wall and inner flank and much finer and denser ones on the venter, although the figure drawn on that paper does not show such details. On the other hand, the specimen GK. H5995 from Urakawa shows very fine and dense lirae and striae on the shell surface of the ventral part at the late septate stage. This character is essentially similar to that of *G. venustum*. The ornament of the adult body chamber is roughly similar between the two species, but the major ribs are somewhat stronger (i. e. broader and more elevated) and more flexuous in *G. crassicostratum* than those in *G. venustum*. Moreover, the body chamber of *G. crassicostratum* is subelliptical or suboval in cross-section and does not show such a peculiar outline as that of *G. venustum*.

*Gaudryceras hamanakense* Matsumoto & Yoshida (1979, p. 68, pl. 10, figs. 1-3; pl. 11, figs. 1-2; text-fig. 2), from the upper part of the Maastrichtian in eastern Hokkaido, is interesting in that the extremely fine ornament of multipartited lirae continues to the adult stage. As far as the style of lirae-

ornament is concerned, this character occurs in the younger part of phragmocone in *G. tenuiliratum* of Coniacian-early Campanian age, in nearly the whole part of the phragmocone in *G. crassicostratum* of Campanian age and in the whole part of the larger phragmocone of *G. venustum* of early Maastrichtian age and finally persists to the adult body chamber in *G. hamanakense*. In other words, this character looks to have developed progressively with geological time.

If other characters are taken into consideration, however, the relationships between the species are not so simple. For instance, *G. hamanakense* is distinctly smaller than *G. venustum* and rather similar in size to *G. crassicostratum*. *G. venustum* is the largest among the five species under discussion. As to the major ribs of the body chamber, *G. venustum* is more similar to *G. hamanakense* than to *G. crassicostratum*. With respect to the outline of whorl-section in later growth stages, *G. hamanakense* is similar to *G. tenuiliratum* rather than to *G. venustum*.

Incidentally, GK. H5993, from the Fukaushi Formation at loc. H120 of Hobetsu district, was labelled as *G. cf. tombetsense* (see Matsumoto, 1984, p. 2). It is a somewhat eroded phragmocone, but its whorl-section in the preserved last part shows an outline which is similar to that of HMG 932. Hence, it is here revised to be labelled as *G. cf. venustum*.

Probably because of the insufficient preservation of the holotype, *G. venustum* seems to have been misunderstood by some authors. For instance, the specimens illustrated by Zonova and Jamoida (eds., 1993, pl. 87, fig. 1; pl. 102, fig. 1; pl. 103, fig. 3) as *G. venustum*, from the Maastrichtian of Sakhalin may not be the named species. It could be *G. izumiense* Matsumoto & Morozumi (1980, p. 12, pls. 11-13), but without examining the actual specimens we cannot give a definite conclusion on their specific name.

**Occurrence.**— All the examined specimens occur from the middle part of the Fukaushi Forma-



tion [written as "Hukausi Sandstones" by Matsumoto [Matumoto] (1942, p. 249)] in the upper subgroup of the Hakobuchi Group. Among the associated species we identify *Neophylloceras surya* (Forbes), *Pachydiscus* (*Pachydiscus*) *kobayashii* (Shimizu), *Pachydiscus* (*Neodesmoceras*) *gracilis* Matsumoto and *Sphenoceras* *hetonaianus* (Matsumoto). This assemblage in the Fukaushi Formation represents the Zone of *Sphenoceras* *hetonaianus*-*P. (Neodesmoceras) gracilis* and can be referred to the upper part of the Lower Maastrichtian in the Japanese scale, although the precise correlation with the Lower Maastrichtian of the standard area in Northwest Europe has yet to be worked out.

On the cliff of the type locality H311, sandstones of about 30 m are exposed and the holotype was obtained from the lower portion (H311a) of the fossiliferous part (H311a, b, c, d at each 5 m) on the west side of the road. The excavation during the repair works of road was carried mainly on the east side of the cutting, where strata of a-d are extended. To avoid to disturb the works, we were unable to put marks on the yielded nodules in accordance with the subdivisions mentioned above. They are altogether in one zone, for *Sphenoceras* *hetonaianus* and *Pachydiscus* (*Neodesmoceras*) *gracilis* occur in the subdivisions H311a to d on the west side. No fossils have been obtained from the higher part of the cutting (i. e. H311e) on both sides. *S. hetonaianus* occurs also at locs. H120, H172, and elsewhere.

#### References

- Jimbo, K. (1894) Beiträge zur Kenntniss der Fauna der Kreide Formation von Hokkaido. *Palaeont. Abhandl. [N. F.]*, 2 (3), 140-194, pls. 17-25.
- Matsumoto [Matumoto], T. (1941) A study of the relationship between different species, with special reference to the problem on the range of a fossil species. *Jour. Geol. Soc. Japan*, 48, 17-37 (in Japanese).
- Matsumoto [Matumoto], T. (1942) Fundamentals in the Cretaceous stratigraphy of Japan. Part I. *Mem. Fac. Sci. Kyushu Univ. [D] Geol.*, 1 (3), 129-280, pls. 5-20.
- Matsumoto, T. (1984) Some gaudryceratid ammonites from the Campanian and Maastrichtian of Hokkaido. Part I. *Sci. Rept. Yokosuka City Mus.*, (32), 1-10, pls. 1-5.
- Matsumoto, T. (1995) Notes on gaudryceratid ammonites from Hokkaido and South Sakhalin. *Palaeont. Soc. Japan, Spec. Pap.*, 35 (in press).
- Matsumoto, T., Miyauchi, T. & Kanie, Y. (1985) Some gaudryceratid ammonites from the Campanian and Maastrichtian of Hokkaido. Part II. *Sci. Rept. Yokosuka City Mus.* (33), 19-36, pls. 1-5.
- Matsumoto, T. & Morozumi, Y. (1980) Late Cretaceous ammonites from the Izumi Mountains, Southwest Japan. *Bull. Osaka Mus. Nat. Hist.*, 33, 1-31, pls. 1-16.
- Matsumoto, T., Toshimitsu, S. & Noda, M. (1991) Appendix- Geological setting of the Cenomanian ammonite locality, north of Tomiuchi, Hobetsu district. (in Japanese). In Matsumoto, T. & Toshimitsu, S. A find of a Cenomanian ammonite from Tomiuchi, Hobetsu district, Hokkaido. *Bull. Hobetsu Mus.*, (7), 1-8.
- Matsumoto, T. & Yoshida, S. (1979) A new gaudryceratid ammonite from eastern Hokkaido. *Trans. Proc. Palaeont. Soc. Japan [N. S.]*, (114), 65-76, pls. 1-11.
- Takahashi, K. & Wada, N. (1987) "Hobetsu". *Explanatory of the geological map of Japan, scale 1/50000*. 40p. Geol. Surv. Hokkaido (in Japanese with English abstract).
- Toshimitsu, S. (1994) Geological significance of the occurrence of *Inoceramus (Platyceras) japonicus* from the Fukaushi-zawa River in the Tomiuchi region of Hobetsu town, Hokkaido, Japan. *Bull. Hobetsu Mus.*, (10), 35-38 (in Japanese with English abstract).
- Yabe, H. (1903) Cretaceous Cephalopoda from the Hokkaido. Part 1. *Jour. Coll. Sci. Imp. Univ. Tokyo*, 18 (2), 1-55, pls. 1-7.
- Zonova, T. D. & Jamoida, A. I., eds. (1993) Atlas of the leading group of the Cretaceous fauna in Sak-

halin. *Commission of Geology and Execution of Ground Resources, Russia. All-Russian Scientific Research Institute of Geology, Nedra, 327pp., Sankt-Peterburg (in Russian).*

## (地名表)

Fukaushi 深牛, Fukuoka 福岡, Hiraoka 平丘, Hobetsu 穂別, Hokkaido 北海道, Horosaru-zawa 幌去沢, Kiusu キウス, Mukawa 鶉川, Panke-opiraruka-zawa パンケオピラルカ沢, Penke-opiraruka-zawa ペンケオピラルカ沢, Panke-rusa-no-sawa パンケルサの沢, Sekiyu-zawa 石油沢, Shutta-no-sawa シュッタの沢, Soya 宗谷, Tosa-no-sawa トサの沢, Tsukuba つくば, Ume-no-sawa 梅の沢, Urakawa 浦河

## (和文要旨)

Matsumoto, T. and Toshimitsu, S., 1995, Restudy of *Gaudryceras venustum* Matsumoto from the Hobetsu district, Hokkaido. *Bull. Hobetsu Mus.*, (11), 1-16, pls. I-VIII. (松本 達郎・利光 誠一, 1995, 北海道穂別地域産 *Gaudryceras venustum* Matsumoto の再研究. 穂別博研報, (11), 1-16, pls. I-VIII.)

*Gaudryceras venustum* Matsumoto, 1984 は北海道穂別の深牛砂岩層 (マストリヒ階下部) の 2 地点産標本に基づき設立された。数が少なく表面が幾分摩滅している点に不備があった。1990 年度道路工事の際に模式地点 loc. H311 の崖から保存良好のを含む複数標本が追加されたので、再研究した。その成果をここに報告する。

本種の形態上の特徴を列挙する。(1) 成年殻はかなり大きく、D は約 22 cm あり、住房は 2/3 巻を占める。(2) 殻は多巻で、成長初期には緩いが後期には中庸で内のワールを外のものが 1/2 覆い、H の増大率もかなり著しくなる (H/h=1.6)。(3) ワールは初め準円形で H<W、気房部後期で B/H=4/5 の準卵形、住房で B/H=3/4 の半卵-半台形である。(4) 装飾の概要は G. 属様式で、気房部と住房上で異なる。(5) 気房部 (D≤13 cm) には周期的のくびれとこれに伴う肋状カラーが独特の J 字状屈曲を呈して規則正しく配列するが、半巻で 2, 3, 4, 5 本と漸次頻繁になる。lirae (殻外層表面の線状細肋) はへその周辺から側面内半にかけては通常の粗さであるが、外側部で多分岐・挿入が著しく、外面 (腹面) で極めて細密になる。但しその中の所々にやや明確な線状細肋が認められる。(6) 成年殻の住房では周期的の狭長な主肋が (5) のカラーと大差なく分布するが、末期には頻度は増すが肋は弱化する。また住房上では肋の外側部における前方屈曲が弱くなっていく傾向がある。線状細肋はやや粗く副肋 (riblets or subcostae) となり、外面での多分岐はない。(7) 縫合線は G. 属の一般型で、気房部後期での刻みは深く細かい。

上記の諸形質は本種より古い (コニアシアン-カンパニアン初期の) *G. tenuiliratum* Yabe のそれに類似するが、本種は格段と大型である。(5) で記した性状は *G. tenuiliratum* の未成年殻 (D≤3 cm) だけに見る特性と同じだが、それが気房部後期にまで及んだと言える。中間のカンパニアン期には *G. striatum* (Jimbo) と *G. crassicostatum* (Jimbo) があり、それとの比較も記した。また上記特質が住房にまで及んだのがマストリヒ期後期の *G. hamana-kense* Matsumoto & Yoshida であろう。これとの関係についても予察的に論述したが、なお今後の究明を要する。

## Explation of Plates

## Plate I

*Gaudryceras venustum* Matsumoto. Holotype, left side, x0.8.

Arrow : beginning of the body chamber. Scale bar : 20 mm.

(cited from Matsumoto, 1984, pl. 5, fig. 1 by permission of Yokosuka City Museum.)

## Plate II

*Gaudryceras venustum* Matsumoto. Holotype, right side and back view (venter of body chamber), x0.7. Scale bar : 20 mm. (ditto)

## Plate III

*Gaudryceras venustum* Matsumoto. A : HMG 934, x1.

B : Sketch of whorl-section at Q of Fig. C.

C : HMG 932, x0.8. Scale bar : 20 mm.

## Plate IV

*Gaudryceras venustum* Matsumoto. A : HMG 932, x0.8.

B : HMG 933, x1. Scale bar : 10 mm.

## Plate V

*Gaudryceras venustum* Matsumoto. Abe's coll. no. 1, x0.6.

Scale bar : 20 mm.

## Plate VI

*Gaudryceras venustum* Matsumoto. Abe's coll. no. 1, x0.7.

Above is the later half of body chamber. Scale bar : 10 mm.

## Plate VII

*Gaudryceras venustum* Matsumoto. Abe's coll. no. 2, x1. Scale bar : 10 mm.

## Plate VIII

*Gaudryceras venustum* Matsumoto. Abe's coll. no. 2, A : Inner

whorls, enlarged. B : Part of venter, enlarged, x1.4. Scale bar : 10 mm.



Plate I



Plate II

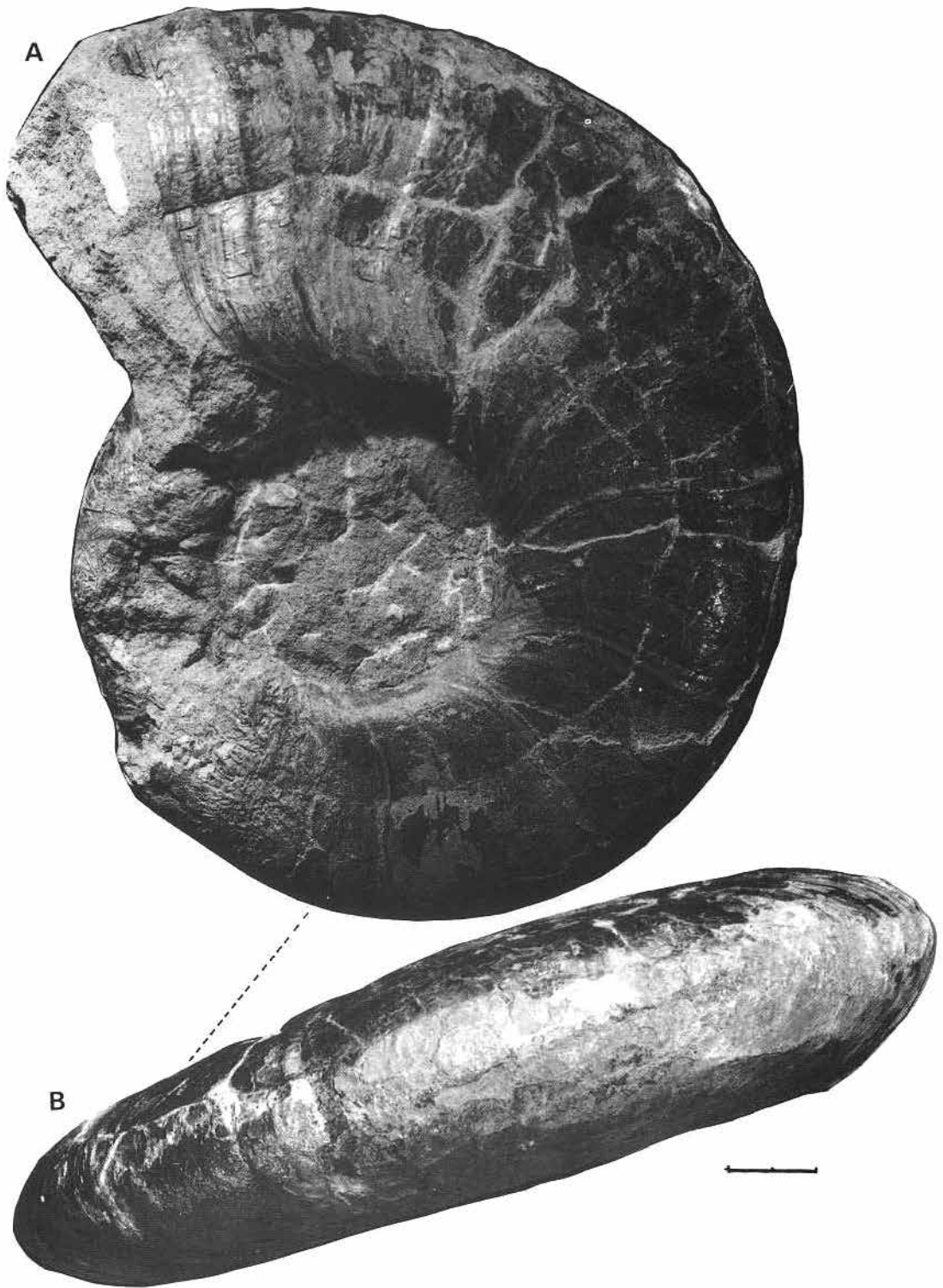


Plate III

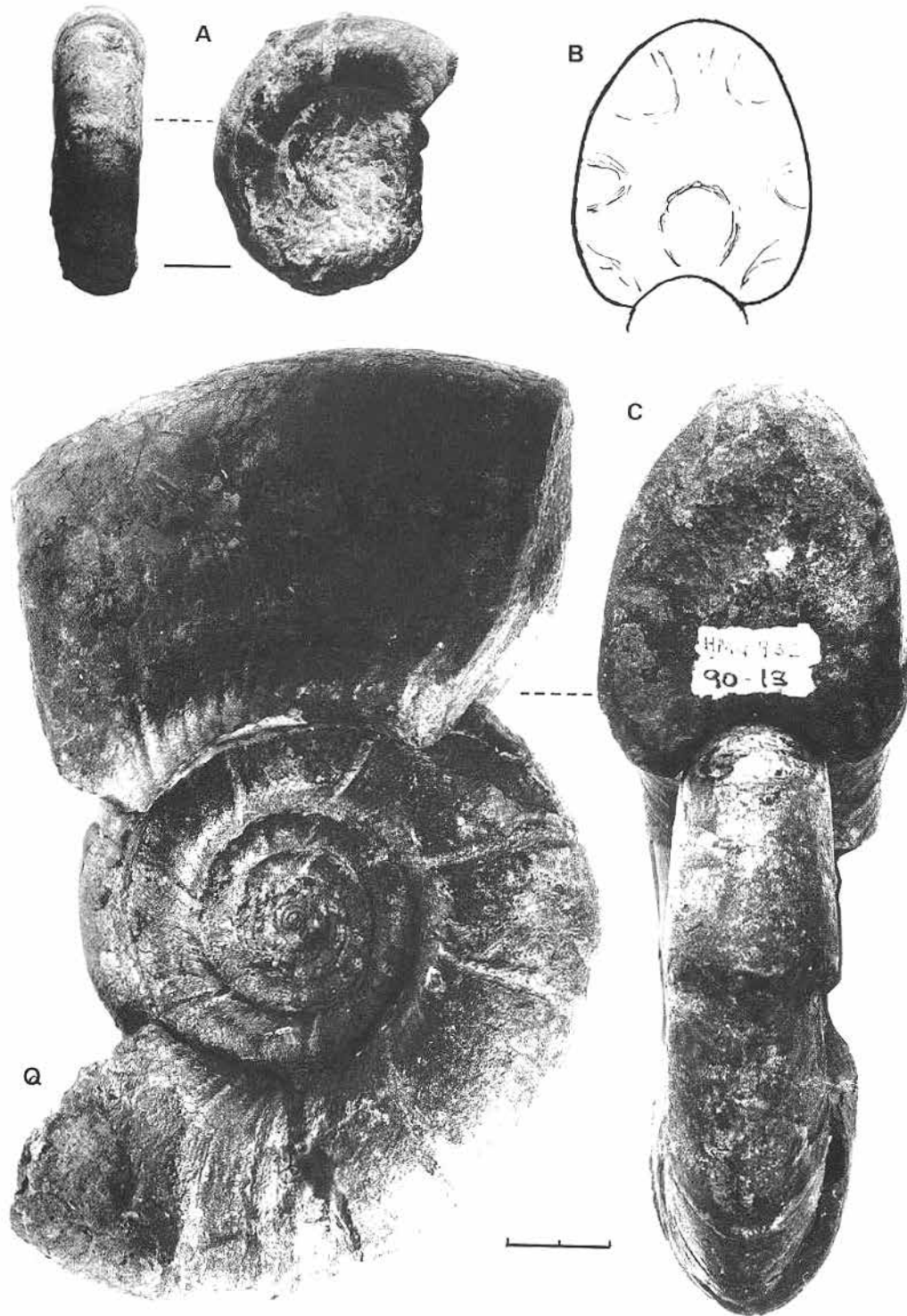


Plate IV

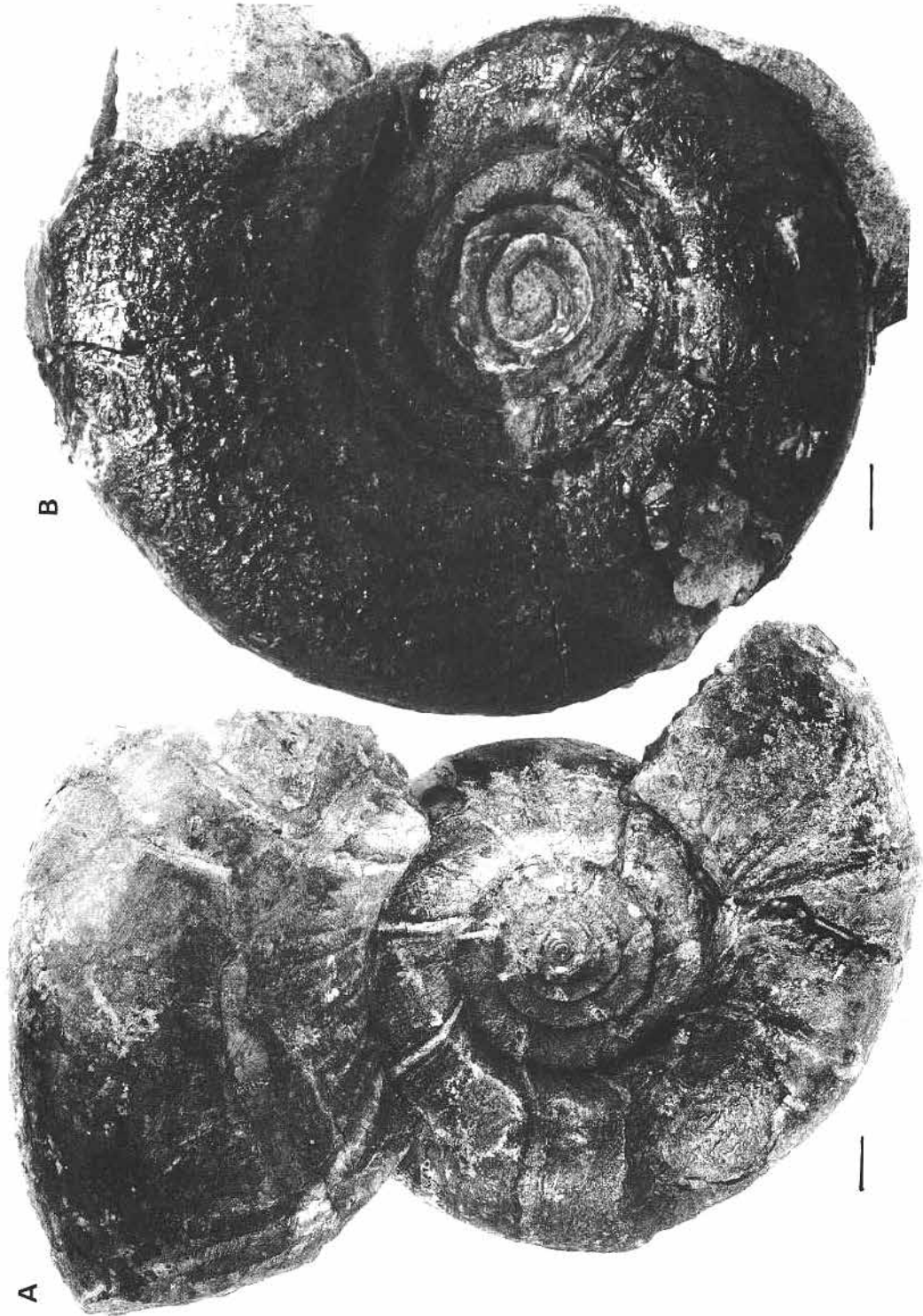


Plate V

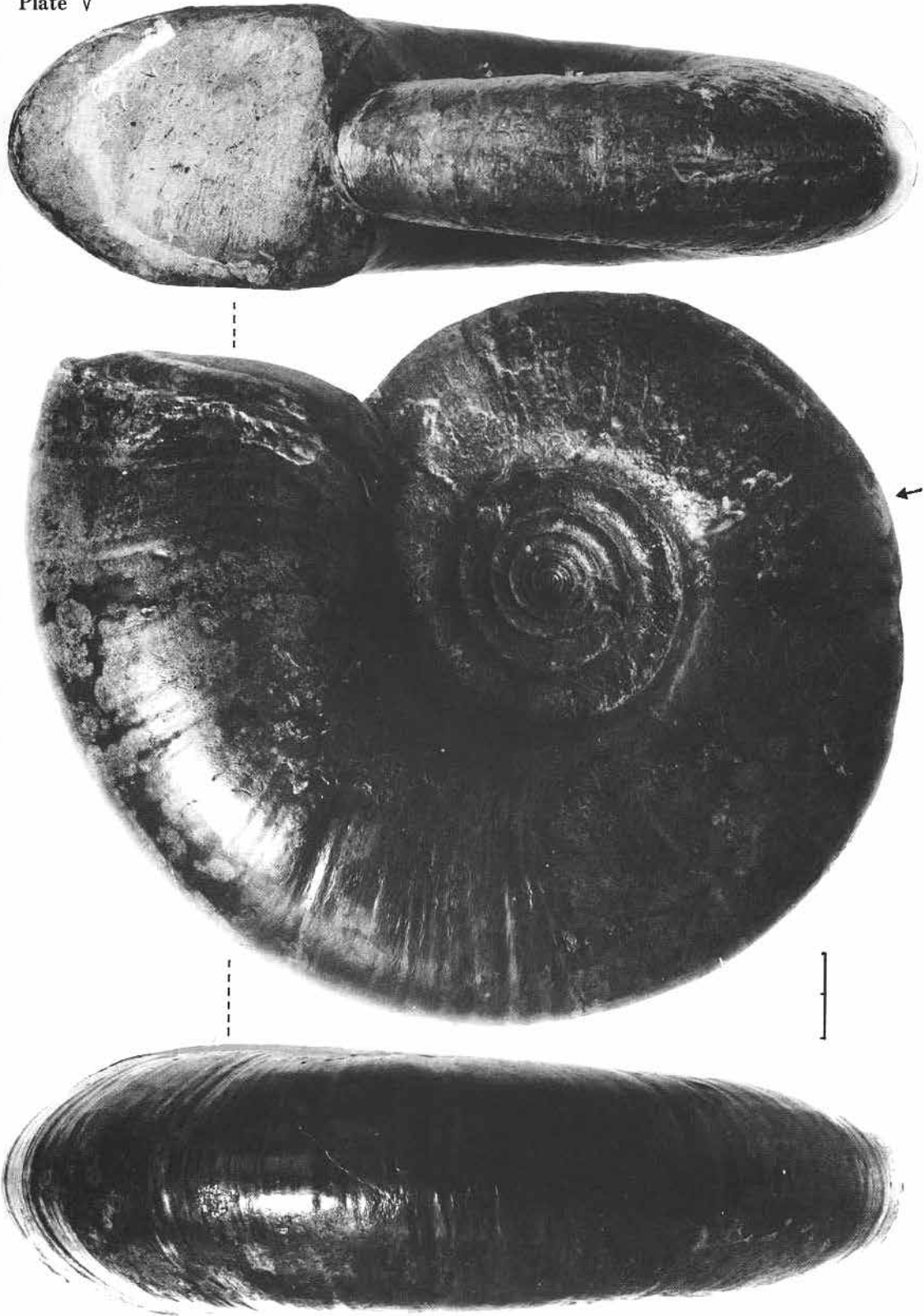


Plate VI

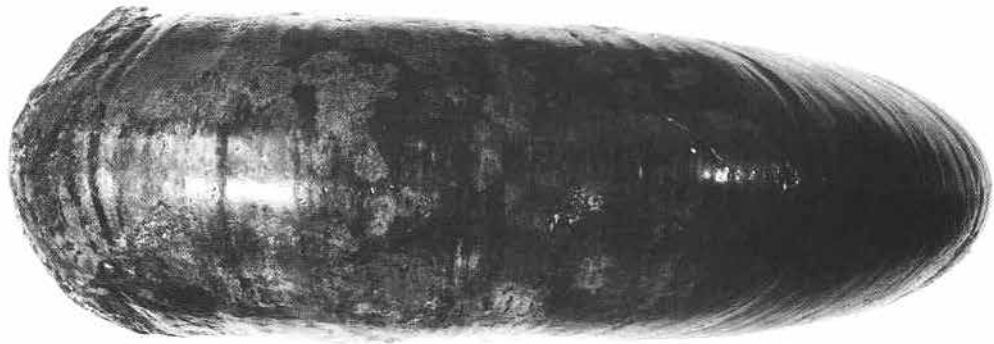




Plate VII



Plate VIII

