The Genus *Gabbioceras* (Ammonoidea, Gaudryceratidae) from the Upper Cretaceous of Hokkaido, Japan

By

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Abstract Two species of *Gabbioceras* HYATT, 1900 (Ammonoidea, Gaudryceratidae), *Gabbioceras yezoense* sp. nov. and *G. mikasaense* sp. nov. are described from the Upper Cretaceous of Hokkaido, northern Japan. *G. yezoense* sp. nov. occurs in the lower part of the lower Cenomanian. *G. mikasaense* sp. nov. occurs in the lower to the middle part of the lower Cenomanian and represents a younger member of the *Gabbioceras* lineage. Although *Gabbioceras* experienced a distinct decline from the late Albian and became extinct in the Mediterranean Tethyan realm, the occurrences reported here suggest that a few species of *Gabbioceras* survived and evolved in the Northwest Pacific region during the early Cenomanian.

Introduction

The genus *Gabbioceras* HYATT, 1900 of the family Gaudryceratidae is characterized by having a round venter and depressed whorls with a strong angulation on the flank at some growth stage. This genus has been considered to be an offshoot of *Eogaudryceras* SPATH, 1927 (*Wiedmann, 1962*); *Gabbioceras lamberti* (BREISTRÖFFER), 1936 is the oldest species within the genus (*Kennedy & Klinge*, 1977). During Aptian and Albian time *Gabbioceras* evolved and radiated in the Tethyan realm. However, this genus declined in diversity in the Cenomanian, and only one species is known from the lower Cenomanian of Madagascar (*Collignon, 1964*; *Murphy, 1967a, 1967b*; *Kennedy & Klinge*, 1977).

Gaudryceratid ammonites occur fairly abundantly in the Upper Cretaceous of Japan and have been described in many papers (e.g., JIMBO, 1894; YABE, 1903; MATSUMOTO, 1938; MATSUMOTO, 1995). Nevertheless, no species of *Gabbioceras* has hitherto been reported. Recently, I have collected some well preserved specimens referable to *Gabbioceras* from the lower Cenomanian of Hokkaido assisted by friends of mine. In this paper, I describe two new species of the genus and discuss the phylogenetic and paleobiogeographic implications.
Systematic Description

*Location of specimens*: The specimens utilized herein are reposited in the National Science Museum, Tokyo (NSM), the University Museum, University of Tokyo (UMUT) and the Mikasa City Museum, Mikasa (MCM).

*Conventions*: Dimensions are given in millimeters: D = shell diameter, U = breadth of umbilicus, H = whorl height, B = whorl breadth.

Order Ammonoidea ZITTEL, 1884
Suborder Lytoceratina HYATT, 1889
Superfamily Tetragonitaceae HYATT, 1900
Family Gaudryceratidae SPATH, 1927
Genus *Gabbioceras* HYATT, 1900

*Type species*: *Gabbioceras angulatum* ANDERSON, 1902.

*Diagnosis*: Very involute gaudryceratids with a small umbilicus, a round venter and a depressed whorl with an angulation on the flank at some growth stage. Shell surface ornamented with growth lines and constrictions which are prorsiradiate on the flanks and form either an adorally convex arch or are almost straight on the venter. Suture is similar to that of early gaudryceratid-type, in having a bifid first lateral saddle.

*Discussion*: MATSUMOTO (1943) established the genus *Parajaubertella* but WIEDMANN (1962) considered the genus as a synonym of *Gabbiloceras*. However, MURPHY (1967a), JONES (1967) and MATSUMOTO (1995) pointed out that both genera can be clearly distinguished by the differences in the shape of the umbilicus, suture line and other characters, and I also agree with their view.


*Gabbiloceras yezoense* sp. nov.

Figs. 1–1, 2–1, 2, 7

*Diagnosis*: Small *Gabbiloceras* having a very depressed whorl, broadly arched venter, funnel-shaped deep umbilicus, angulation on flank, gently convex umbilical wall, subangular umbilical shoulder, and shell surface of fine growth lines and constrictions, which are almost straight on venter.

*Dimensions*: See Table 1. Initial chamber size, ammonitella size and its spiral length in specimen UMUT MM18958 in median section are 0.522 mm, 0.903 mm, and 298° respectively.
Description: The largest specimen (NSM PM8299), 15.3 mm in diameter at the preserved last septum, consists of the phragmocone and a part of the body chamber. The entire shell would be less than 30 mm in diameter. The shell is very involute, with a fairly narrow and funnel-shaped deep umbilicus separated from the venter by an angulation in the shell wall. The whorl cross section (Fig. 2–7) is depressed reniform with a broadly arched venter, a gently convex umbilical wall, and subangular umbilical shoulder. The angulation is at a position about one third the height from the umbilical seam to the venter. The shell surface is ornamented with constrictions and growth lines, which are almost straight on the venter. The ornamentation near the umbilical shoulder is sometimes conspicuous. The suture is similar to that of the gaudryceratid-type in having a bifid first lateral saddle (Fig. 1–1).

Comparison: Gabbioceras yezoense sp. nov. closely resembles Gabbioderas michelianum (d'Orbigny, 1850, p. 124) from the middle Albian of France but is distinguished from the latter in having a narrow umbilicus, a gently convex umbilical wall, and subangular umbilical shoulder. Gabbioceras yezoense sp. nov. also resembles Gabbioderas aff. michelianum (Murphy, 1967a, pl. 4, figs. 6, 7)

Fig. 1. External suture lines of: 1, Gabbioderas yezoense sp. nov., NSM PM8300, locality 4, at whorl height of 5.0 mm; 2, Gabbioderas mikasaense sp. nov., MCM. A299, locality 2, at whorl height of 5.6 mm. Broken line: position of the umbilical shoulder.
from the lower Albian of California in having a narrow umbilicus but is distinguished from the latter in having constrictions and a subangular umbilical shoulder.

**Etymology:** This species is named for the Yezo Supergroup.

**Material:** Holotype, NSM PM8300; paratypes, NSM PM8299, UMM18958.

**Type locality:** Locality 4.

**Occurrence:** Lower part of the lower Cenomanian; localities 4, 5, 6.

*Gabbioceras mikasaense* sp. nov.

Figs. 1–2, 2–3, 4, 5, 6, 8

**Diagnosis:** Small *Gabbioceras* having a depressed whorl, rounded venter, funnel-shaped deep umbilicus, gently convex umbilical wall, subangular umbilical shoulder, and shell surface of fine growth lines, which are almost straight on the venter.

**Dimensions:** See Table 2. Initial chamber size, ammonitella size and its spiral length in specimen MCM. A401 in median section are 0.696 mm, 1.286 mm, and 340° respectively.

**Description:** The shell is rather small, less than 35 mm in diameter, and very involute, with a fairly narrow and a funnel-shaped deep umbilicus. The cross section of the early whorls (Fig. 2–8) is depressed reniform with a weakly developed angulation at the mid-flank of the whorl, and that of the later whorl is relatively more depressed reniform with a rounded venter, gently convex umbilical wall, and a subangular umbilical shoulder, which is at a position about one fourth to one fifth the height from the umbilical seam to the venter. The shell surface is ornamented with growth lines, which are almost straight on the venter. The ornamentation near the umbilical shoulder is sometimes conspicuous. The configuration of the ornamentation is essentially the same at all growth stage and parallels the margin of the aperture. The suture is similar to that of the gaudryceratid-type in having a bifid first lateral saddle (Fig. 1–2).

**Comparison:** *Gabbioceras mikasaense* sp. nov. resembles *Gabbioceras beraketense* (Collignon, 1964, pl. 318, figs. 1354, 1355) from the lower Cenomanian (*Mantelliceras martimpreyi* Zone) of Madagascar but is distinguished
from the latter in having a fairly narrow umbilicus and a nearly vertical umbilical wall.

*Gabbioiceras mikasaense* sp. nov. also closely resembles the juvenile form of *Parajaubertella kawakitana* MATSUMOTO (1943, p. 667, text-figure 2) from the
Table 2. Measurements (in mm) of Gabbioiceras mikasaense sp. nov. at the preserved last septum.

<table>
<thead>
<tr>
<th>Specimen</th>
<th>D</th>
<th>U</th>
<th>H</th>
<th>B</th>
<th>U/D</th>
<th>B/H</th>
</tr>
</thead>
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<tr>
<td>MCM A397</td>
<td>23.0</td>
<td>5.5</td>
<td>10.2</td>
<td>17.6</td>
<td>0.24</td>
<td>1.73</td>
</tr>
<tr>
<td>MCM A398</td>
<td>19.3</td>
<td>4.7</td>
<td>8.2</td>
<td>15.2</td>
<td>0.24</td>
<td>1.85</td>
</tr>
<tr>
<td>MCM A399</td>
<td>13.2</td>
<td>3.8</td>
<td>5.5</td>
<td>10.9</td>
<td>0.29</td>
<td>1.98</td>
</tr>
<tr>
<td>MCM A400</td>
<td>15.4</td>
<td>4.1</td>
<td>6.8</td>
<td>12.8</td>
<td>0.27</td>
<td>1.88</td>
</tr>
</tbody>
</table>

lower Cenomanian of Sakhalin and Hokkaido but is distinguished from the latter in having a narrow umbilicus and an almost straight aperture on the venter. The umbilical shoulder of the former is located at the site of the third saddle (Matsumoto, 1943, 1995), but that of the latter is located in the midst of the second umbilical lobe (Fig. 1–2).

*Etymology:* This species is named for Mikasa, the type locality of this species.

*Material:* Holotype, MCM. A397; paratypes, MCM. A398, MCM. A399, MCM. A400, MCM. A401.

*Type locality:* Locality 1.

*Occurrence:* Lower part of the lower Cenomanian; locality 2, middle part of the lower Cenomanian; localities 1, 3.

**Discussion**

The phylogenetic relationships within the Apto-Cenomanian Gabbioiceras species have been discussed by Wiedmann (1962) and Murphy (1967b). Murphy recognized two lineages within the Gabbioiceras based on characteristics of ornamentation, suture line, and shell form. The Gabbioiceras angulatum group consists of species characterized by an adorally convex sinuous aperture on the venter and has its ancestor in the Aptian species, Gabbioiceras lamberti (Breistroffer), 1936. This group includes Gabbioiceras angulatum Anderson, 1902 from the Aptian and Gabbioiceras jacobi Murphy, 1967 from the lower Albian. The Gabbioiceras michelianum group consists of species characterized by an almost straight aperture on the venter. Gabbioiceras lamberti (Breistroffer), 1936 of the former group seems to be a possible ancestor of this group, and this group includes Gabbioiceras drushchichi Wiedmann, 1962, Gabbioiceras muntaneri Wiedmann, 1962, and Gabbioiceras michelianum (d’Orbigny), 1850 from the Albian and Gabbioiceras beraketense (Collingon), 1964 from the lower Cenomanian.

*Gabbioiceras yezoense* sp. nov. possesses an almost straight aperture on the venter, and it belongs to the Gabbioiceras michelianum group. Furthermore, this species closely resembles Gabbioiceras michelianum (d’Orbigny) in having a very
Upper Cretaceous *Gabbioiceras* from Hokkaido

depressed whorl and funnel-shaped deep umbilicus. Therefore, *Gabbioiceras yezoense* sp. nov. is considered to have originated from a species of this group, and the probable ancestor is *Gabbioiceras michelianum* (d'ORBIGNY), 1850. *Gabbioiceras mikasaense* sp. nov., with the same apertural type, may also have been derived from a species of this group. Judging from the morphological similarity and stratigraphical distribution, the probable ancestor of *Gabbioiceras mikasaense* sp. nov. is either *Gabbioiceras yezoense* sp. nov. or *Gabbioiceras beraketense* (COLLIGNON), 1964.

According to MURPHY (1967), *Gabbioiceras* evolved and radiated in the Tethyan realm during the Aptian and Albian, and, thereafter, declined in diversity in the Cenomanian. Only one endemic species of Cenomanian *Gabbioiceras* is known from the lower Cenomanian of Madagascar. However, there were two Cenomanian species of the genus, at least in Japan, as described above. This evidence shows that *Gabbioiceras* evolved in the Northwest Pacific region and Madagascar during the early Cenomanian.

Gaudryceratid ammonites in the lower Cenomanian of Hokkaido are more diverse and abundant than below and more than ten species have been described (MATSUMOTO et al., 1972; MATSUMOTO, 1984, 1995; this paper). Most of them are endemic species restricted to the region of Hokkaido and Sakhalin. Especially, *Takahashia* MATSUMOTO, 1984 and *Miogaudyiceras* MATSUMOTO, 1995 are endemic genera in the lower Cenomanian of Hokkaido. This evidence shows that a phylogenetic divergence and endemism of gaudryceratid ammonites occurred at about the age of the Albian-Cenomanian transition.

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**References**


COLLIGNON, M., 1964. *Atlas des Fossiles caracteristiques de Madagascar (Ammonites), XI (Cenom-


Appendix

Locality Information

The following localities are entered in the National Science Museum, Paleontological Collection Locality (NSM PCL).

Locality 1 [NSM PCL 4–14–14; 141°58'32"E, 43°14'02"N; = locality IK1236 in Uchida (1995)]; a roadside cliff about 3 km south of at Ikushunbetsu, Mikasa
City, Hokkaido; the lower part of Member 2b of the Mikasa Formation in MATSUMOTO (1965); silty sandstone; the middle part of the lower Cenomanian (Mantelliceras japonicum Zone) by MATSUMOTO (1991).

Locality 2  [NSM PCL 4–14–13; 141°58'30"E, 43°14'04"N; = locality IK1235 in UCHIDA (1995)]; a roadside cliff near locality 1 about 3km south of at Ikushumbetsu, Mikasa City, Hokkaido; Member 2a of the Mikasa Formation in MATSUMOTO (1965); sandy siltstone; the lower part of the lower Cenomanian (Desmoceras kossmati-Graysonites adkinsi Zone) by MATSUMOTO (1991).

Locality 3  [NSM PCL 4–15–1; 142°0'02"E, 43°14'34"N; = locality IK1100 in MATSUMOTO (1965)]; a cliff above a shelter covering the prefectural road from Ikushumbetsu to the Katsurazawa dam, Mikasa City, Hokkaido; the lower part of Member 2b of the Mikasa Formation in MATSUMOTO (1965); silty sandstone; the middle part of the lower Cenomanian (Mantelliceras japonicum Zone) by MATSUMOTO (1991).

Locality 4  [NSM PCL 3–35–4; 142°5'46"E, 44°16'49"N]; calcareous concretion in the stream bed of Shumarinai-gawa River, Horokanai-cho, Hokkaido; Middle Yezo Group; the lower part of the lower Cenomanian (Desmoceras kossmati-Graysonites adkinsi Zone) by MATSUMOTO (1991).

Locality 5  [NSM PCL 3–35–3; 142°4'52"E, 44°13'00"N]; calcareous concretion in the stream bed of Suribachi-zawa Creek, a tributary of the Sounnai River, Horokanai-cho, Hokkaido; Middle Yezo Group; the lower part of the lower Cenomanian (Desmoceras kossmati-Graysonites adkinsi Zone) by MATSUMOTO (1991).

Locality 6  [NSM PCL 3–4·5–4; 142°1'48"E, 45°25'56"N]; calcareous concretion was obtained from the coast near the fishery harbor of Higashiura, Wakkanaï City, Hokkaido; Middle Yezo Group; the lower part of the lower Cenomanian (Desmoceras kossmati-Graysonites adkinsi Zone) by MATSUMOTO (1991).