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ON THE ONTOGENY OF *BARROISICERAS MINIMUM* YABE FROM THE UPPER AMMONITE BED IN HOKKAIDÔ

(Palaeontological Study of Cretaceous Ammonites from Hokkaidô—(I).)

By

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(With 2 Plates and 2 Figures)

Contribution from the Department of Geology and Mineralogy, Faculty of Science, Hokkaido University. No. 395

It is already fifty years ago that Prof. H. YABE named a small species of Barroisiceras characteristic of the Scaphites bed of Ikushunbetsu valley *Barroisiceras minimum* on account of its small size. Regretfully, however, it has been left undescribed since.

Recently the writers have had a chance of precisely investigating a great number of the specimens of Barroisiceras deposited in the Geological and Mineralogical Institute, Hokkaidô University; they belong to the collections mainly of Mr. R. SATTO and the junior writer.

In this study the writers have paid a particular attention to the ontogenetical changes of morphogenetical characters.

In this paper, *Barroisiceras minimum* YABE is described with a particular attention to the ontogenetical changes of characters as well as to the stratigraphical significance for the biostratigraphical consideration of the Cretaceous formation of Hokkaidô.

Note on the Genus Barroisiceras GROSSOUVRE.

Genotype: *Barroisiceras haberfellneri* GROSSOUVRE 1894.

Generic Character: Barroisiceras belonging to Prionotropidae MEEK, shell discoidal, compressed laterally, the whorls increasing rapidly in height, high-whorled with narrow umbilicus except in the senile stages of some forms. The flanks flat, almost parallel, ornamented with faint, straight or rather, sigmoidal ribs, sometimes bearing umbilical nodes and a row of median-lateral nodes, both less in number than the marginal nodes. Ribs show tendency to be markedly weakened in adult shells.

Periphery with either a sharp continuous keel or a nodose keel (median ventral nodes) accompanied on both sides by a row of ventro-lateral nodes. Umbilical shoulders abrupt throughout all stages, with the inner wall nearly at right angle to the flank. Living chamber occupies three-fourths of the last whorl. Suture with three saddles of about equal height and sometimes with the initial part of the fourth in addition. Lobes plump, toothed over the entire outline or running out into short, toothed branches. The first lateral more strongly dissected on the external side than on the internal side. Saddles rounded, more or less clearly bifid.

It has been much discussed as to which of the families Acanthoceratidae or Prionotropidae the genus Barroisiceras does belong. Certain authors as SOLGER (1904) and DOUVILLE (1901) insisted on its close affinity to Mortoniceratinae, while certain others like HYATT (1901) and SMITH (1913) placed it in the Acanthoceratinae.

Judging from the ontogenetical features of this genus, however, it seems quite certain that Barroisiceras should belong to the Prionotropidae. According to REESIDE[1], the following groups have to be regarded as inappropriate associates of *Barroisiceras haberfellneri*, namely, (1) the species which has a continuous keel throughout life as *B. desmoulinsi*, (2) the species with sigmoidal ribs, as *B. siskiyouense*, *B. knighteni*, *B. sequens*, and *B. boisselleri*, and (3) the species with median ventral nodes several times as numerous as the marginal nodes, as *B. tunetanum* and *B. inerme*. Although these groups were excluded by REESIDE from the genus Barroisiceras (s.s.), yet the present writer consides it proper, at least for the time being, to place the Japanese Barroisiceras characterized by sigmoidal ribs in the genus Barroisiceras (s.l.).

Barroisiceras minimum YABE (MS.)

H. YABE, 1909: Barroisiceras Gross. sp. nov., Zur Stratigraphie und Paläontologie der oberen Kreide von Hokkaido und Sachalin, Zeitsch. deut. geol. Gesell., 61 Band, p. 440.

S. SHIMIZU, 1932: *Barroisiceras minimum* YABE, On a New Type of Senonian Ammonite, *Pseudobarroisiceras nagaoi* SHIMIZU gen. et sp. nov. from Teshio Province, Hokkaidô, Jap. Jour. Geol. Geogr., Vol. X, Nos. 1-2, Pl. I. Fig. 3.

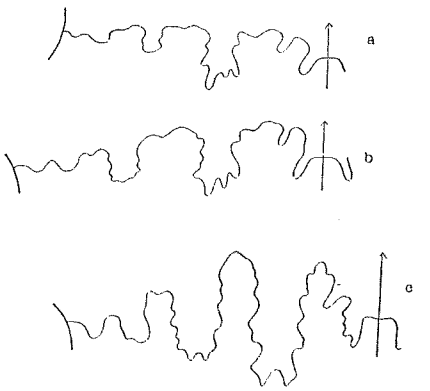
S. SHIMIZU, 1935: *Barroisiceras minimum* (YABE MS.) The Upper Cretaceous Cephalopods of Japan, Part. I, Jour. Shanghai Sci. Inst. Section II, Vol. I, p. 196.

Dimensions:

1) REESIDE, J. B., The Upper Cretaceous Ammonite Genus Barroisiceras in the United States, U.S.G.S., Prof. Paper. 170, 1931, P. 13.

Maximum diameter	104 mm (100%)
Height of last body whorl	52 mm (50%)
Breadth of last body whorl	21 mm (20%)
Umbilical width	16 mm (15.4%)
The number of ribs of last whorl	38

Description of Holotype: This beautiful specimen which is unusually large, exceeding 100 mm in diameter is covered by a thin black chitinous film. The shell is involute, discoidal, compressed, whorl-section subquadrate with greatest breadth near the middle of the flanks in young volution, and gradually approaching the umbilical margin with advancing age; venter high and narrow with a nodose, uneven, wavy keel along the siphonal margin; the venter is bordered on either side by a row of nodes which are equal in number to the serrations on the top of the nodose keel. The whorls rapidly increase in height, umbilicus



Text-fig. 1.

Suture-line of the specimens of the neanic stage.

a) Diameter ≒ 20 mm–25 mm
b) Diameter ≒ 20 mm–25 mm
c) Diameter = 11 mm

All figures representing different specimens.

very narrow. The flanks are flat, almost parallel, ornamented with rather indistinct, more or less sigmoidal ribs which start from each of the ventro-lateral nodes. Some of these ribs disappear, however, on the middle of the flank or beyond it and others reach the umbilicus ending in blunt umbilical nodes. These flexuous ribs are arranged radially or more or less convex forward on the flanks, and bend sharply forward near the ventral margin where they are swollen to somewhat radially

elongated nodes. Surface ornamentation tends to become smooth toward the aperture. Sometimes very fine flexuous striae can be seen between the ribs. Suture line is consisting of three saddles and corresponding lobes. External saddle is unsymmetrically bidid, and the first lateral saddle is nearly as broad as the preceding one. The first lateral lobe is distinctly hanging down compaired with another lobes and trifid at the end. The end of the second lateral lobe is digitated.

Occurrence: In the dark greenish-blue calcareous, fine-grained sandstone at the cliff along the rail bed, 100 m below the junction of the Ikushunbetsu River and the tributary Bannosawa.

Ontogenetical development:

Besides the above-mentioned holotype specimen, there are a great number of specimens. They are all considered by the writers as the varieties of the same species changing with age. The specimens all occurred at the same horizon of one and the same locality. For the sake of convenience, the writers describe this species dividing ontogenetically into the following five different stages of development, although in fact there is no sharp boundary between any two of them.

1) *Embryonic stage* (less than 2 mm)

Whorl depressed; venter distinctly smooth, without any trace of a keel; involution very slight, umbilicus wide, shallow and with oblique wall. Surface smooth without any ornamentation. Suture-line unknown.

2) *Nepionic stage* (2 mm–17 mm)

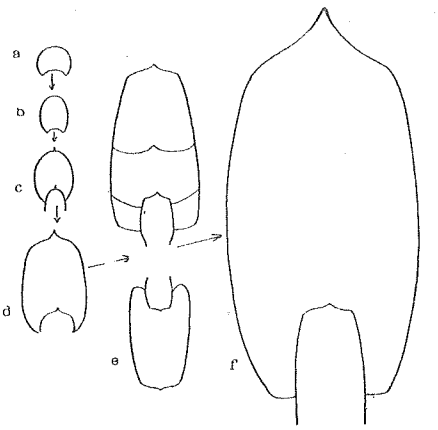
Shell discoidal, rather compressed laterally, subquadrate in cross-section, involution slight; umbilicus wide, shallow and with an oblique wall. Surface almost smooth without keel.

The progress from the foregoing embryonic stage to this nepionic stage takes place gradually without any rapid change, through the gradual change of the whorl-section from the depressed to the compressed.

3) *Neanic stage* (17 mm–40 mm)

This stage begins with the appearance of the ornamentation on the shell-surface, with the simultaneous appearance of a ventral keel on the venter.

Ammonites which represent this stage were the commonest among the examined specimens. Shell increases more rapidly in height than in breadth. Umbilicus moderate or rather narrow and shallow with



Text-fig. 2.

Variation of Whorl-section during the development of growth.

a) Diameter = 2 mm
b) Diameter = 8 mm
c) Diameter = 17 mm
d) Diameter = 22.5 mm
e) Diameter = 25 mm
f) Diameter = 104 mm

steep umbilical wall. Sculpture is ornamented with numerous sigmoidal ribs, most of which start from tubercles on the umbilical margin. These ribs are tubercle-like developed and elongated near the ventral margin.

There are numerous fine striae between these ribs. There are two types of varieties in this stage; the one which is the most common type, is elegant, the other which is of rare occurrence, is rather robust and is characterized by strong, rigid ribs. (Fig. 3a, 3b)

4) *Ephebic stage* (40 mm–70 mm)

Shell distinctly compressed, involution very large, umbilicus narrow and shallow; lateral flanks subparallel slightly converging toward the periphery, having steep perpendicular umbilical wall, Ventro-lateral nodes on either side of the narrow venter are rather exaggerated and elongated, appearing rows of marginal tubercles. Sculpture characterized by about 27 rounded, sigmoidal, primary ribs, seven or eight of which end in conical umbilical nodes, while the others disappearing on the way, before reaching the umbilical margin. There is no sharp boundary between the neanic and the ephebic stages, but the appearance of the elongated, swollen marginal nodes on the ventral shoulders seem to characterize the beginning of the latter.

5) *Gerontic stage* (70 mm or more)

In the ventral margin, the ribs are distinctly swollen, forming a row of elongated tubercles. These ribs are sigmoidal; besides the ribs there are many striae of growth which are parallel to ribs; towards the aperture, ornamentation is inclined to become indistinct and smooth. The holotype represents the gerontic stage.

Remarks: Owing to the lack of literature, an exact comparison with foreign specimens of Barroisiceras has been beyond our power. Among the North American species of Barroisiceras described by REESIDE, *Barroisiceras* (*Harleites*) *castellense* REESIDE is the most closely allied to the neanic stage of the present form, but it differs in a more sigmoidal form of ribs, a comparatively sharp keel on the venter, distinctly swollen ventro-lateral shoulder, and the existance of fine striae between ribs. YABE once compared this species with *Barroisiceras haberfellneri* var. *Harlei* GROSSOUVRE but the European form has a narrow umbilicus, and coarser, rounded ribs together with an unevenly serrated nodose keel on the venter. Consequently, the present writers consider our form a new species of the genus Barroisiceras.

Stratigraphical Significance:

These Barroisiceras specimens occurred in the dark greenish-gray fine-grained calcareous sandstone which is about 10 m thick exposed at the cliff along the rail bed near Katsurazawa. According to the biostratigraphical subdivision of the Upper Ammonite bed in Ikushunbetsu Valley by Prof. H. YABE, this rock corresponds to the upper part of the Scaphites bed superposed above the Mammites bed. Above this fossiliferous bed, the Parapachydiscus bed, with a rich fauna containing such common species as Parapachydiscus, Damesites, Tetragonites, Phylloceras, Gaudryceras and Hamites, etc., is superposed.

It is very important to note that this Barroisiceras zone is always accompanied by such other fossils as the following:

Gaudryceras limatum YABE
Bostrychoceras sp.
Baculites sp.
Hamites sp.
Lucina sp.
Tessarolax sp. etc.

These fossil-enclosures, rich in marine fauna, are sporadically contained in the characteristic fine-grained sandstone and further it is

worthy of special mention that carbonized plant stems occur in assosiation in this fossiliferous enclosure. This Barroisiceras zone seems to be widely extended as a distinct key horizon as far as to Sentarozawa, Mikawa-mura, and Ponnebetsu, Manji Coal Mine.

In conclusion, we wish to express our grateful acknowledgements to Mr. R. SAITO for the privilege of studying these interesting materials. We are also indebted to Assistant Prof. M. MINATO for his kind suggestion and constant encouragement in the course of this work and to Mr. KUMANO for his laborious task of photographing the specimens.

Plate I

Explanation of plate I

Fig. 1. *Barroisiceras minimum* YABE; lateral view (Holotype) ($\times^3/_4$)

Fig. 2. Ventral view

Fig. 3. Lateral view of the opposite side

Fig. 4. Apertural view

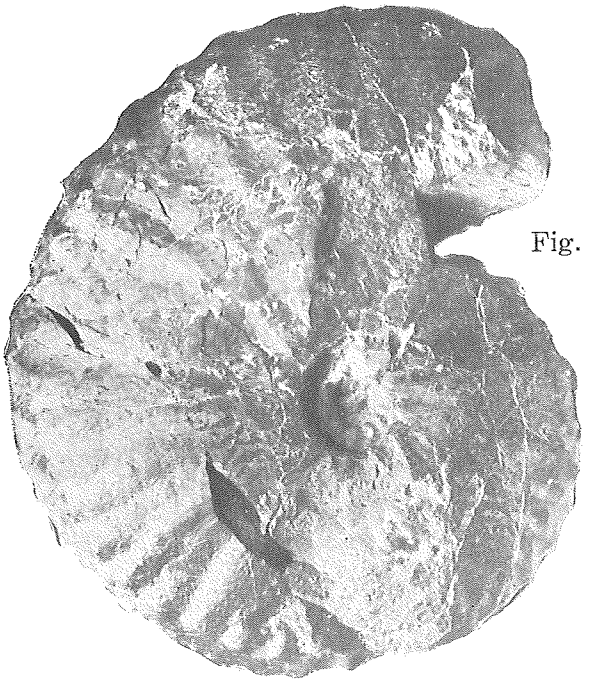


Fig. 1

Fig. 2

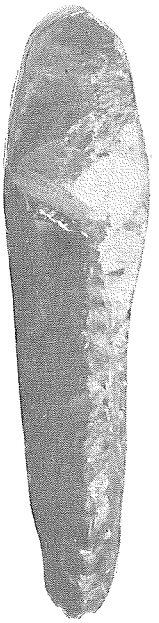


Fig. 4

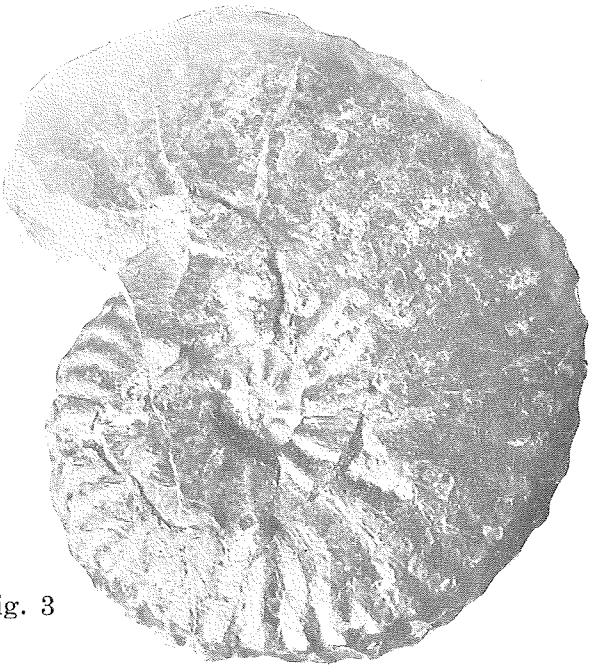


Fig. 3

KUMANO Photo

Barroisiceras minimum YABE

Plate II

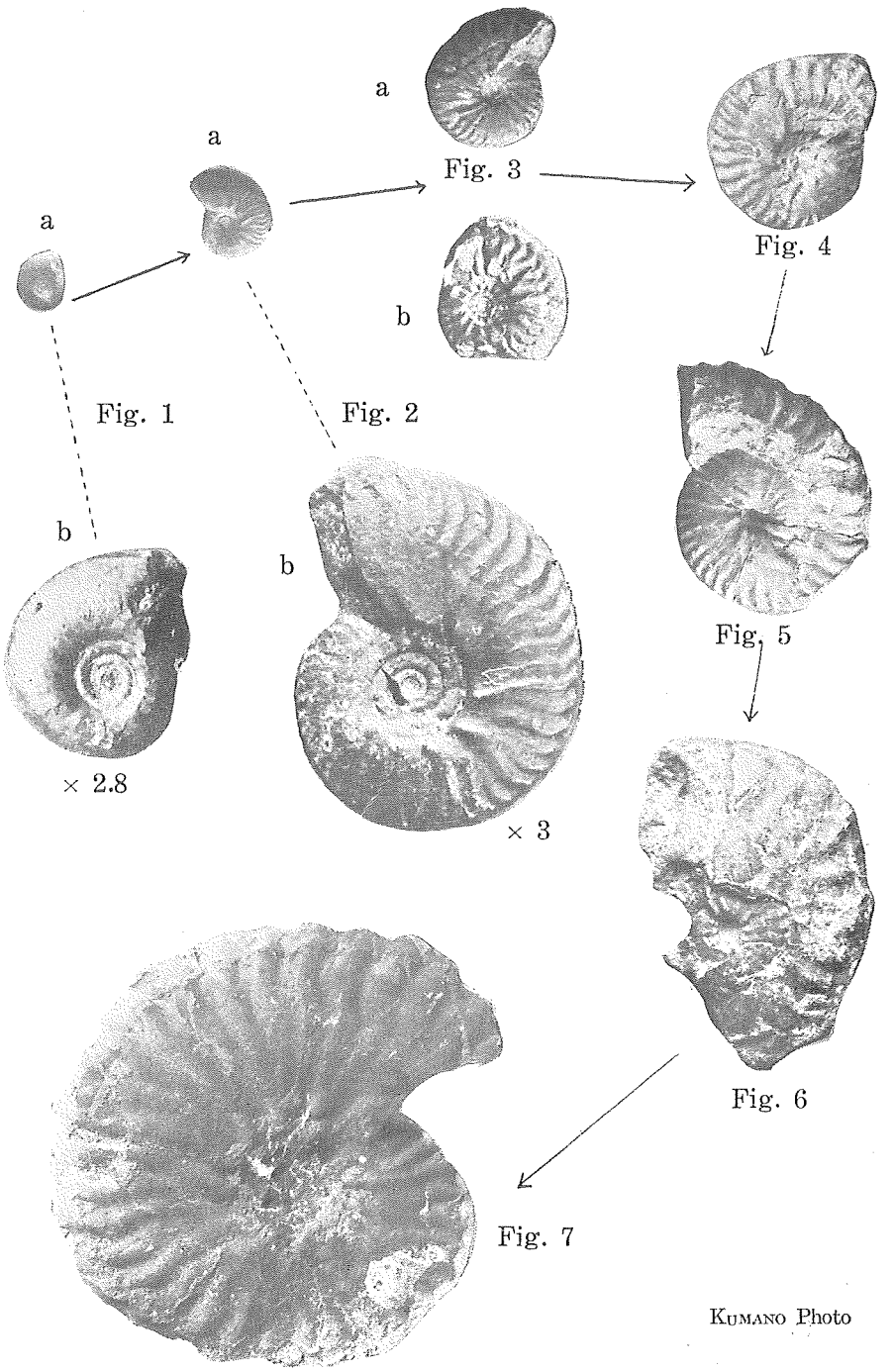
Explanation of plate II

(All figures in $^3/_4$ size, except Fig. 1b, 2b, which are magnified)

Fig. 1. a, b. *Barroisiceras minimum* YABE, nepionic stage

Fig. 2. a, b.
Fig. 3. a, b.
Fig. 4.
Fig. 5.
} Neanic stage

Fig. 6 & 7. Ephebic stage



Barroisiceras minimum Yabe