A Monograph of the Collignoniceratidae from Hokkaido Part III : Studies of the Cretaceous Ammonites from Hokkaido and Saghalien-XX

Matsumoto, Tatsuro
Faculty of Science, Kyushu University

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A Monograph of the Collignoniceratidae from Hokkaido Part III

(Studies of the Cretaceous Ammonites from Hokkaido and Saghalien—XX)

By

Tatsuro MATSUMOTO

Abstract

Part III contains the systematic descriptions of the subfamily Barroisiceratinae. The hitherto used framework of classification of the Barroisiceratinae is to some extent modified. *Basseoceras* COLLIGNON, 1965, is regarded as a subgenus of *Barroisiceras*, whereas *Texasia* is separated as a distinct genus. A new subgenus of *Forresteria* is established which is characterized by a smoothed outer whorl. This is morphologically transitional to more evolute *Yabeiceras*, which is settled as a specialized offshoot in the Barroisiceratinae.

The described species from Hokkaido are altogether seven:—a new species of *Barroisiceras* (*Basseoceras*), two species of *Forresteria* (*Forresteria*), including world-wide *F.* (*F.*) *alluaudi* in a revised sense and a new one, two new species of a new subgenus of *Forresteria*, a species of *Yabeiceras* and a species of *Harleites*. In connection with the descriptions of the barroisiceratine ammonites from Hokkaido, comments are generally given on many genera and subgenera, and also on some species occurring outside Hokkaido.

Contents

Manuscript received July 5, 1969.

Systematic Descriptions
(Continued)

Subfamily Barroisiceratinae

The subfamily Barroisiceratinae BASSE, 1947, were comprehensively studied by REESIDE (1932) and BASSE (1947). The framework of the classification used in the *Treatise* by WRIGHT (1957) is in principle acceptable, as was previously supported by REYMENT (1955). There are subsequent works which should be taken into consideration, such as those of YOUNG (1963), PARNES (1964), MATSUMOTO et al. (1964), COLLIGNON (1965) and the late Dr. VAN HOEPEN (1968).

Although the Cretaceous deposits of Hokkaido are not so prolific in the Barroisiceratinae as those of Madagascar, our recent collections, aided much by Mr. T. MURAMOTO, contain some interesting examples. As a result of the study of them and also the survey of previous works, I modify to some extent WRIGHT's scheme of classification.

In view of the high variability of the barroisiceratine ammonites, as demonstrated by BASSE's (1947) fine work, too much splitting in classification should be avoided. Several superficially distinctive groups of species are treated as subgenera, whereas a few apparently resembling ones are separated as distinct genera, inasmuch as there are sufficient reasons.

The Barroisiceratinae are typically represented by *Barroisiceras* and range in shell characters from comparatively more compressed, feebly ornate or smoothish genera, such as *Solgerites* and *Harleites*, to more inflated, strongly ornate ones, such as *Forresteria* (s.s.) and *Subbarroisiceras*. Two major stocks, one without and the other with mediolateral tubercles, can be distinguished in the subfamily, but the mediolateral tubercles themselves may become apparently variable in the case when the smoothing of flanks takes place (as in *Solgerites* and *Harleites*). In other words, the affinity of *Barroisiceras* with a smoothed outer whorl (e.g. *Basseoceras*) and that of *Forresteria* with smoothed flanks (e.g. *Solgerites*) may be confused unless the ontogenetic change of characters in the inner whorls is carefully inspected. Many species of the Barroisiceratinae have fairly or very involute shells, but *Forresteria* includes less involute species. *Yabeiceras* is regarded as a specialized offshoot of the *Forresteria* stock characterized by evolute shells, more or less depressed and strongly tuberculate septate whorls and a smooth body-whorl. A new subgenus (*Muramotoa*) of *Forresteria* to be established below seems to represent an intermediate form between *Forresteria* (s.s.) and *Yabeiceras*. Sutures are also considerably variable in the Barroisiceratinae. Those of *Barroisiceras* may show the average pattern, although they vary to some extent in themselves. Comparatively reduced patterns are seen in *Harleites*, whereas more deeply indented ones characterize *Subbarroisiceras* and *Yabeiceras*.

The origin of *Barroisiceras* is certainly in *Subprionocyclus* of the Upper Turonian, as has already been mentioned by WRIGHT (1957, p. L432). *Reesidites*

WRIGHT and MATSUMOTO, 1954, another derivative of *Subprionocyclus* occurring near the Turonian-Coniacian boundary, indeed resembles *Barroisiceras* in some respects but is more closely related to *Subprionocylus*, as has been described in detail in *Part I* of this monograph (MATSUMOTO, 1965, p. 62). It could be possibly a passage form between *Subprionocyclus* and *Barroisiceras*, but I am rather inclined to regard it as a dead end offshoot of *Subprionocyclus*, because its much compressed shell-form, flexuous ribs, bullate umbilical tubercles, and modified pattern of sutures imply deviation from the normal characters which connect *Barroisiceras* with *Subprionocyclus*.

Almost all the genera and subgenera of the Barroisiceratinae are stratigraphically confined to the Coniacian, except that *Texasia* is informed by YOUNG (1963) to range up to the Lower Campanian.

The zonal succession of various species of the subfamily in the Coniacian has not yet been well established, inspite of their frequent occurrence in certain areas. According to COLLIGNON's (1965) atlas of characteristic fossils in Madagascar many of the illustrated species belonging to *Barroisiceras* (s.s.), *Subbarroisiceras*, *Harleites*, *Forresteria* (s.s.), *Yabeiceras* and *Solgerites* (two species) occur in the Middle Coniacian zone of *Kossmaticeras theobaldianum-Barroisiceras onilahyense*, several of *Solgerites* [=*Piveteauoceras*] and *Basseoceras* in the Upper Coniacian zone of *Prionocycloceras guyabanum-Gauthiericeras margae*, whereas three species of *Yabeiceras* occur already in the Lower Coniacian zone of *Peroniceras dravidicum*. Whether this succession is everywhere maintained in Madagascar and other regions or otherwise should be examined by further study. The available evidence in Hokkaido is not sufficient on this account. All the species from Japan occur in the zone of *Inoceramus uwajimensis*. In our present knowledge it may be broadly stated that most of the barroisiceratine genera and subgenera seem to have been rather suddenly differentiated directly or indirectly from the common ancestor, *Subprionocyclus*.

The geographical distribution of the Barroisiceratinae was summarized by BASSE (1947, p. 161–170, especially text-figs. 6–7), who concluded that they are distributed in a considerably wide belt on both sides of the postumed Late Cretaceous equator. Japan was not included in her distribution map. The occurrence of various species belonging to various genera and subgenera of the subfamily has become distinct in the present study. Hokkaido as well as the Pacific side of Northeast Japan must have been under the influence of the ocean current from the south in addition to that from the north or northeast.

The reason why the Barroisiceratinae have hitherto been overlooked from the study of the prolific Upper Cretaceous of Hokkaido is, in my view, in facies problem. In Hokkaido as well as in Northeast Japan, the barroisiceratine ammonites occur almost exclusively in comparatively shallower, more or less sandy (and glauconitic) open-sea sediments but are extremely rare in probably off-shore muddy sediments. While the strata of the latter facies are widely distributed in Hokkaido, those of the former facies are limited there.

Genus *Barroisiceras* DE GROSSOUVRE, 1894

Type-species.—*Ammonites haberfellneri* HAUER, 1866 (subsequent designation by SOLGER, 1904).

Generic diagnosis.—Whorls are moderately involute, more or less higher than broad, and usually broadest in the lower part (i.e. near the umbilicus), having compressed to considerably inflated flanks and a rather low, roof-shaped venter. The ventral keel is typically strong and the clavate ventral tubercles give rise to distinct serration on the keel.

From rather sparse umbilical tubercles arise radial ribs which are alternated with one or two shorter ones. All the ribs form clavate tubercles at the ventrolateral shoulder and then projected to the ventral clavi. The umbilical tubercles are typically rounded at least on the inner whorls but may sometimes be bullate. Normally the radial ribs are rather flat.

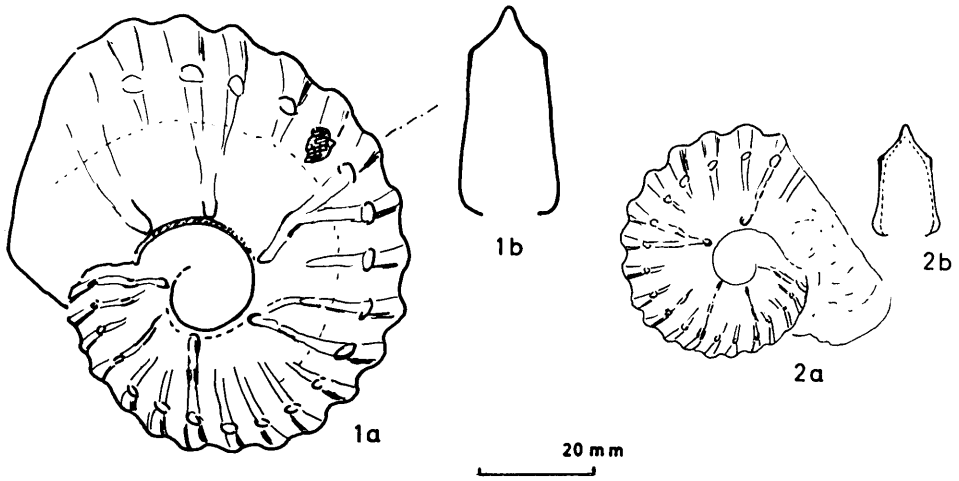
Although the suture is considerably variable, the first lateral lobe (L) is moderately deep and asymmetrically bipartite and the lateral saddles on both sides of L are massive to subrectangular in rough outline. The number of auxiliary elements is apparently variable. The saddles and lobes are moderately indented. The main lobules in the two lateral saddles and the folioles in the lower part of L may be considerably long and narrow. Other minor incisions are generally small, showing a rather reduced aspect of the suture.

The size of the shell is small to moderate.

Remarks.—In the *Treatise* (WRIGHT, 1957, p. L432) two subgenera, *Barroisiceras* (s.s.) and *Texasia* REESIDE, 1932, are included in the genus *Barroisiceras*. For the reasons described below I think it better to separate *Texasia* as a distinct genus and treat *Basseoceras* COLLIGNON, 1965, as a subgenus of *Barroisiceras*. The above described generic diagnosis is typically applied to the subgenus *Barroisiceras* (s.s.).

I had an opportunity to examine two syntypes of *Ammonites dentatocarinatus* RÖMER (1852), the type-species of *Texasia* REESIDE, 1932, in the University of Bonn (G.I.B. No. 48a and 48b) (Text-figs. 1–2). The larger and illustrated one (RÖMER, 1852, pl. 1, fig. 2a–c) is designated here as the lectotype. The smaller one is of identical species. In these specimens the major ribs which arise from the umbilical tubercles are somewhat elevated at the middle of the flank, if not forming distinct tubercles. The ribs are somewhat weakened between this row of elevations and that of ventrolateral tubercles. Some of the ribs show a slight bending at the elevating point. These characters, though indistinct and overlooked by subsequent authors (e.g. LASSWITZ, 1904; REESIDE, 1932; YOUNG, 1963), and the compressed whorls with flattened flanks and also very deeply incised sutures with an apparently trifid first lateral lobe, may indicate a possible affinity of *Texasia dentatocarinata* with such species as *Pseudoschloenbachia mexicana* (RENZ, 1936) (see YOUNG, 1963), although the ventral keel is more distinctly serrate in *Texasia*.

T. dentatocarinata occurs, according to YOUNG (1963, p. 120), in the uppermost Santonian and the lowest Campanian. *Texasia dartoni* (REESIDE) (1932,



Figs. 1-2. *Texasia dentatocarinata* (RÖMER)

Two syntypes, No. 48a (Fig. 1) and No. 48b (Fig. 2), in the Palaeontological Museum, University of Bonn. Lateral view (a) and whorl-section (b) in diagrammatic sketch. (T. M. *delin.*)

p. 16, pl. 6, figs. 7–9; pl. 7, figs. 8, 9), which is reported as older than *T. dentatocarinata,* seems to show slight thickening of the ribs at the mid-flank and weakening above that point. These species are more evolute than typical species of *Barroisiceras.*

REESIDE (1932, pl. 3, figs. 9–10; pl. 4, fig. 3) described under *T. dentatocarinata* a large shell which has prominent and distant ventrolateral nodes on otherwise smoothish body-whorl. This is a remarkable feature which is not seen in *Barroisiceras* (s.s.).

To sum up *Texasia* considerably deviates from *Barroisiceras.*

In the Cretaceous of Hokkaido no examples of *Barroisiceras* (*Barroisiceras*) have been found, but there is a species which is referable to *B.* (*Basseoceras*).

Subgenus *Basseoceras* COLLIGNON, 1965

Type-species.—Basseoceras colcanapi COLLIGNON, 1965 (original designation).

Subgeneric diagnosis.—This subgenus resembles *Barroisiceras* (*Barroisiceras*) in the earlier growth-stages, but is distinguished by the disappearance of the ribs and tubercles in more or less late growth-stages. The ventral keel is also weakened and may disappear in the final stage. In other words the outer whorl is smoothish. Even on the inner whorls the ribs are weakened on the flank.

Comparison and remarks.—Basseoceras was set up by COLLIGNON (1965, p. 73) as a new genus of the Barroisiceratinae. I treat it as a subgenus of *Barroisiceras,* because it is closely related to *Barroisiceras* (s.s.) and because *Barroisiceras* (s.s.) is greatly variable and some examples show transitional

features to *Basseoceras*. In fact, if the immature specimens alone are handled, it may be sometimes difficult to tell whether they are referred to *B.* (*Barroisiceras*) or to *B.* (*Basseoceras*).

In addition to the type-species I should include in *Basseoceras* more species which have essentially the same characters as *Barroisiceras* (s.s.) in earlier growth-stages and lose the ornament in later growth-stages.

In *B. colcanapi* all kinds of ornament disappear rather suddenly in the adult stage, as is clearly described by COLLIGNON (1965, p. 74, pl. 447, fig. 1826).* But in certain other species, e.g. a new species described below, the ornament is weakened in an earlier growth-stage and it disappears rather gradually. COLLIGNON reckoned the upward shift of the umbilical tubercles with growth as a subgeneric character. This is, in my opinion, not so significant, since a similar feature is discernible in some examples of *Barroisiceras* (s.s.). Other species which I am going to refer to *Basseoceras* do not necessarily show this character.

In the reduced ornamentation *Basseoceras* is similar to *Solgerites* REESIDE, 1932. In this connexion some remarks should be given on the latter genus.

Solgerites was established by REESIDE (1932, p. 14) as a subgenus of *Barroisiceras* for the group of *B. brancoi* SOLGER, 1904. As the specimens of *B. brancoi* are not accessible to me, I have to depend on REYMENT's revision (1958, p. 65) as well as SOLGER's original description (1904, p. 174, pl. 5, figs. 4, 5) to understand what *B. brancoi* really is. Unfortunately the best preserved syntype (No. I specimen of SOLGER, 1904, pl. 5, fig. 4; reproduced in the *Treatise*, fig. 551-1) is missing. According to REYMENT, as well as SOLGER, No. III specimen is identical with No. I and No. II. Then it follows that *B. brancoi* evidently has weak mediolateral tubercles on the immature whorls. Until I could look at SOLGER's specimens and/or a good collection of a population from the type-locality, I should follow REYMENT's observation.

Solgerites in this sense is probably a derivative of a compressed subgroup of *Forresteria*, with attenuation of the ornament. *Solgerites* should, thus, be separated from *Barroisiceras* as a distinct genus. In other words, *Basseoceras* and *Solgerites* are probably superficially resembling, parallel developments in the Barroisiceratinae.

As WRIGHT (1957, p. L432) has pointed out, *Piveteauoceras* BASSE, 1947, falls in the synonym of *Solgerites* of the above interpretation, because its type-species, *Piveteauoceras eboroense* BASSE, likewise has small mediolateral tubercles on the inner whorls, as BASSE (1947, p. 143) herself clearly described and as REYMENT (1954, p. 265) discussed. Minor differences in the shell-form, umbilical margin, pattern of sutures, etc. would not deserve good criteria to distinguish the two nominal genera.

In *Solgerites brancoi* the umbilical tubercles are weak even in the immature stage and almost absent in the main stages, whereas the outer half of the ribs and also the ventrolateral tubercles persist to a later stage. In *Barroisiceras* (*Basseoceras*) *colcanapi*, on the contrary, the umbilical tubercles are fairly

* The plaster cast of the holotype of *B. colcanapi* was kindly sent to me through Dr. J. SORNAY.

strong in the immature stages and evidently persist to a later stage than in *S. brancoi*. This can be taken as one of the generic criteria. In this respect, *Barroisiceras romieuxi* PERVINQUÈRE (1907, p. 383, pl. 12, fig. 12; text-fig. 104), from Tunisia, is probably referable to *Solgerites*, although its inner whorls have not been satisfactorily examined.

When the above interpretation of *Solgerites* is accepted, some of the species which were previously referred to *Solgrites* should better be replaced to *Barroisiceras* (*Basseoceras*). For instance, *Solgerites congoensis* BASSE (1947, p. 125) [=*Barroisiceras haberfellneri*, LOMBARD, 1931, p. 298, pl. 31], from the Coniacian of Congo, is either an example of *Basseoceras* or at least an intermediate form from *Barroisiceras* (*Barroisiceras*) to *B.* (*Basseoceras*).

The species from the Celendín Formation (*Buchiceras bilobatum* zone) of Peru, described under *Barroisiceras* (*Solgerites*) *brancoi* by BENAVIDES-CÁCERES (1956, p. 477, pl. 58, figs. 1–4) is another example of *Basseoceras*. A new specific name, ***Barroisiceras* (*Basseoceras*) *peruvianum*** sp. nov., is proposed here for it. The species is established on two specimens, A. M. N. H. No. 27887/1 (holtoype) and 2 (paratype). It is distinguished from *Solgerites brancoi* by the coarser and stronger ribs, more distinct umbilical tubercles and the absence of mediolateral tubercles on its inner whorls. It has a more compressed and more involute shell, with a higher roof-shaped venter, and more numerous and more slender umbilical tubercles than *Barroisiceras* (*Basseoceras*) *colcanapi* (COLLIGNON). Even in the smoothish outer whorl *B.* (*Basseoceras*) *peruvianum* is distinct in its very high and compressed section and persistency of the fastigate venter. Therefore, it is somewhat similar to *Harleites* in shell-form, but it has no mediolateral tubercles and its ventrolateral clavi are not so persistent and its suture is not so reduced as in *Harleites*.

Incidentally the illustrated specimen of LÜTHY (1918, p. 48, pl. 4, fig. 1) under *Schloenbachia* (*Barroisiceras*) *brancoi* var. *mitis* SOLGER, which has weak mediolateral tubercles on the fine ribs, cannot be identified with *B.* (*Basseoceras*) *peruvianum* here defined, but is probably an example of true *Solgerites* from Peru.

Solgerites tuberculatus REYMENT (1954, p. 267, pl. 2; text-fig. 11; 1955, pl. 17, fig. 5), from the Coniacian of Nigeria, is again another example of *B.* (*Basseoceras*), because it has no mediolateral tubercles and is very similar to species of *Barroisiceras* in the stages preceding to the smooth last stage.

Barroisiceras (*Basseoceras*) *inornatum* sp. nov.

Pl. 39 [27], Fig. 1; Text-figs. 3–4

Holotype.—GK. H5460, from the zone of *Inoceramus uwajimensis*, Pombets Gono-sawa (Coll. T. MURAMOTO, P5-6234).

Measurements.—

	Diameter	Umbilicus	Height	Breadth	B./H.
GK. H5460	80.0(1)	12.8(.16)	40.5(.51)	24.6(.31)	.60
〃 (−160°)	54.5(1)	8.5(.15)	31.5(.58)	21.4(.39)	.68

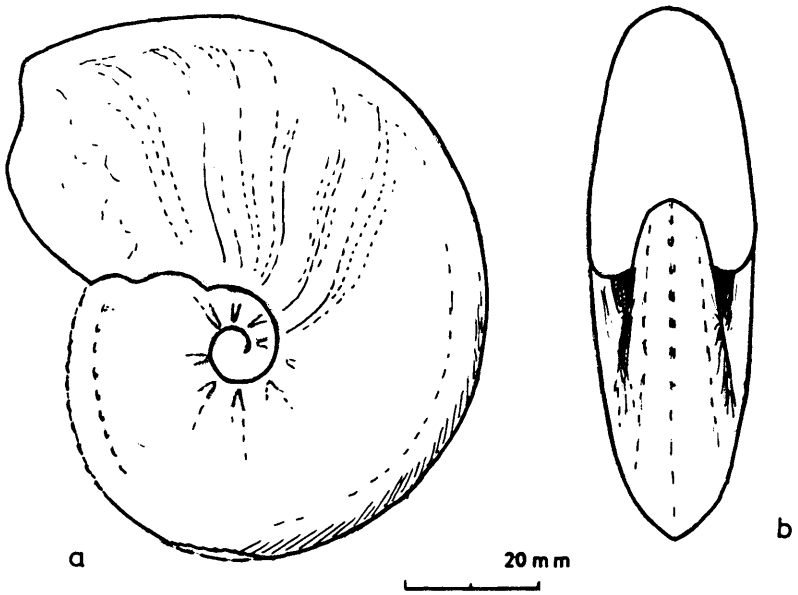


Fig. 3. *Barroisiceras* (*Basseoceras*) *inornatum* sp. nov.

GK. H5460, holotype. Diagrammatic sketches of lateral (a) and frontal (b) views. (T. M. *delin.*)

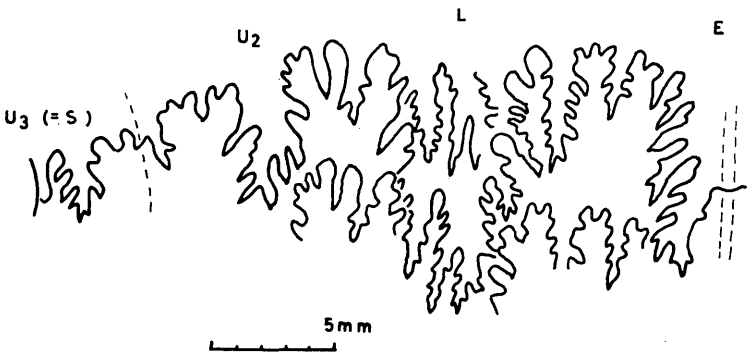


Fig. 4. *Barroisiceras* (*Basseoceras*) *inornatum* sp. nov.

GK. H5460, holotype. External sutures at whorl-height=25 mm. (T. M. *delin.*)

Diagnosis.—The shell is rather small, less than 100 mm. in the diameter of the adult stage, involute and narrowly umbilicate. The whorl is considerably higher than broad, showing about 10: 6–7 in the proportion of height to breadth, and broadest in the lower part (i.e. near the umbilical shoulder). The umbilical wall is overhanging and the umbilical shoulder is subangular. The flanks are slightly convex and convergent. There are obtusely subangular ventrolateral shoulders; the venter is narrow and roof-shaped with a low median keel. The keel and the ventrolateral shoulders are weekened but remain in the main part of the body-whorl. In the final part of the body-whorl the keel is almost lost and the venter is gently arched.

The surface of the body-whorl is nearly smooth, except for the prorsiradiate lirae on the flank, faint serration on the week keel on its posterior half and a few, occasional, blunt, remnants of ribs and umbilical bullae. In the preceding stage, i.e. on the main part of the septate whorls there are sparse umbilical bullae, faint ventrolateral clavi and fairly distinct medioventral clavi which correspond in number to the ventrolateral ones. No mediolateral tubercles are discernible. The ornaments of earlier whorls are concealed in the holotype.

The suture in the adult stage is deeply and fairly finely incised. Especially the first lateral lobe (L) is so deep that it is overlapped by a part of the saddle of the immediately preceding suture (see Fig. 4). The sutural pattern is somewhat peculiar. The first lateral saddle (between E and L) is subrectangular in rough outline, apparently tripartite, having a very deep, vertical lobule on the inner side (i.e. closer to L). The first lateral lobe (L) is the deepest, subrectangular in rough outline, divided into several deep branches in the lower part by narrow, upright, folioles of dissimilar heights. The second lateral saddle (between L and U_2) is again irregularly tripartite, having a deeper lobule on the outer side (i.e. closer to L). The auxiliaries are generally descending, but the lobule at the umbilical shoulder is unusually small. Finely subdivided folioles show somewhat phylloid terminals in some parts.

Remarks.—Only a single specimen is available at present, but its observed characters are so diagnostic that it is regarded as representing a new species.

Comparison.—The present species is distinguished from *Barroisiceras* (*Basseoceras*) *colcanapi* COLLIGNON (1965, p. 74, pl. 447, fig. 1826), from the Coniacian (zone of *Prionocycloceras guyabanum*) of Madagascar in its more compressed whorls (b/h=0.6–0.7 as compared with 0.8 (+) of *B. colcanapi*), smaller umbilicus (u/d=0.16 as compared with 0.26 of *B. colcanapi*), finer ventrolateral clavi and weaker and bullate umbilical tubercles which do not shift upward on the outer whorl.

BASSE (1947) finely demonstrated the great variability of *Barroisiceras onilahyense* BASSE, in which ornaments sometimes tend to become weak and delicate. It is noted that the described specimen from Hokkaido somewhat resembles one of the illustrated specimens of *B. onilahyense* BASSE (1947, pl. 4, fig. 2), although the former has more compressed whorls and still more weakened or nearly obsolete ornaments. The resemblance suggests that the present species could be derived from a certain species of *Barroisiceras* (*Barroisiceras*) by weakening of ornaments and by compression of whorls. The difference in the pattern of sutures between the two species is considerable, but the great variability in sutures of *Barroisiceras* as illustrated by BASSE seems to imply that such a particular pattern of suture as the present species could be led from a flexible suture of *Barroisiceras* (s.s.).

The present species is superficially similar to *Piveteauoceras eboroense* BASSE (1947, p. 142, pl. 33[9], figs. 4, 5), from the Coniacian ("Eboro bed") of Madagascar, in the shell-form, generally smoothish surface, and mode of the ventral ornaments. The Eboro species, which should be referred to *Solgerites* as discussed above, is provided with small mediolateral tubercles in a certain

growth-stages. *B.* (*Basseoceras*) *inornatum* has no mediolateral tubercles and more compressed whorls. Its suture is distinct from *Solgerites eboroensis* in the long, narrow and upright folioles and lobules of L and adjacent saddles.

B. (*Basseoceras*) *inornatum* resembles *Solgerites* (?) *laevis* BASSE (1947, p. 125, pl. 15[9], fig. 1; text-fig. 4), from the Coniacian ("Eboro bed") of Madagascar, in the smoothish and compressed shell. The two species are similar in the general pattern of suture, but differ in details as can be understood by comparing the text-figures. The umbilical margin is subangular and overhanging in the Hokkaido species, but it is rounded in the Madagascar species. The ventral keel and the ventrolateral angulations are weakened but persist to the posterior part of the body-whorl in the former, whereas they disappear earlier and the venter is more rounded in the latter. Incidentally, *Solgerites* (?) *laevis* BASSE may be referable to *Basseoceras*.

The described holotype of *Barroisiceras* (*Basseoceras*) *inornatum* shows an interesting feature that the body-whorl tends to become less involute, with widened umbilicus, and to be slightly decreased in height at the last stage. This scaphitoid character cannot be overlooked as accidental, since a similar feature is observable in some species of *Stoliczkaia* (see SPATH, 1931, p. 328), *Mantelliceras* (see MATSUMOTO et al., 1969, p. 253 and p. 258), and *Metoicoceras* (see HYATT, 1903, pl. 13, fig. 4; pl. 14, fig. 7; COBBAN, 1953, pl. 9), as well as in *Texasia* (see WRIGHT, 1957, p. L432).

Occurrence.—Gono-sawa (i.e. the fifth tributary) of the Pombets, a branch of the Ikushumbets, central Hokkaido. The described specimen was found by T. MURAMOTO in a calcareous nodule of greenish dark grey, sandy siltstone, along with numerous specimens of *Inoceramus uwajimensis*. The age is, accordingly, Lower Urakawan, approximately Coniacian.

Genus *Forresteria* REESIDE, 1932

Synonymy.—*Collignoniceras* VAN HOEPEN, 1955 (*non Collignoniceras* BREISTROFFER, 1947); *Collignonella* VAN HOEPEN, 1957.

Type-species.—*Barroiciseras* (*Forresteria*) *forresteri* REESIDE, 1932 (original designation) [=*Forresteria alluaudi* (BOULE, LEMOINE and THEVENIN, 1907), as described below].

Generic diagnosis.—The shell is typically moderate in size, about 80 to 100 mm. in diameter at the adult stage, but larger in some species and smaller in others.

The involution is moderate; the umbilicus is typically 25±5 percent of the shell diameter, but may be of variable width. The whorl is nearly as high as broad, or more or less broader than high, or *vice versa*, being fairly variable in section. The ventral keel is distinct.

The ornament is typically strong. It consists fundamental of rectiradiate ribs, with intercalation or bifurcation of the shorter ones at about the middle of the flank, umbilical, mediolateral, ventrolateral and medioventral tubercles. The tubercles are generally strong. Especially the mediolateral ones are

prominent in the middle growth-stages. The umbilical tubercles may be sometimes weaker or indistinct. The ornament may be modified in various ways, giving distinction between subgenera or species groups.

The suture has rather massive lateral saddles on both sides of rather narrow L and is moderately indented, but may be variable in minor details.

Remarks.—*Forresteria* was established by REESIDE as a subgenus of *Barroisiceras*, together with subgenera *Texasia*, *Alstadenites* and *Harleites*. I agree with REYMENT (1955) and WRIGHT (1957) in regarding *Forresteria* as distinct from *Barroisiceras* on account of the presence of prominent mediolateral tubercles in at least early to middle growth-stages. It is a fairly comprehensive and variable genus, comprising at least three subgenera, i.e. *Forresteria* (s.s.), *Reesideoceras* BASSE, 1947, and a new one (*Muramotoa*) to be established below. *Zumpangoceras* BASSE, 1947, could also be included in *Forresteria* as a subgenus, but I have no positive comments on this subgenus, which was established on crushed specimens from the Coniacian of Mexico (BURCKHARDT, 1919, pp. 99–108; pl. 22, fig. 16; pl. 23, figs. 1–2; pls. 24 and 25). I should furthermore include *Edenoceras* VAN HOEPEN, 1968 (with type-species *E. multicostatum* VAN HOEPEN, 1968) in *Forresteria* as a subgenus.

Harleites REESIDE, 1932, with which *Alstadenites* REESIDE, 1932, is synonymous (WRIGHT, 1957, p. L434; BASSE, 1947, p. 137), is treated in this paper as an independent genus for the reasons described in another page (see genus *Harleites*).

The type-species of *Forresteria*, *F. forresteri* REESIDE, 1932, is identical with *Acanthoceras* (*Prionotropis*) *alluaudi* BOULE, LEMOINE and THEVENIN, 1907, as is discussed below. VAN HOEPEN (1955, p. 361) established *Collignoniceras* on the type-species *C. hammersleyi* VAN HOEPEN, 1955. This generic name was subsequently renamed by VAN HOEPEN (1957) as *Collignonella*, as he noticed that *Collignoniceras* VAN HOEPEN, 1955, is a homonym of and preoccupied by *Collignoniceras* BREISTROFFER, 1947. *Collignonella* VAN HOEPEN, 1957, is, however, a synonym of *Forresteria*, because *C. hammersleyi* and other species which VAN HOEPEN assigned to *Collignonella* are all good examples of *Forresteria*, as VAN HOEPEN (1968) himself has recently acknowledged.

Species of *Forresteria* occur in the Coniacian of various regions, some of which show world-wide distribution.

Subgenus *Forresteria* REESIDE, 1932

Remarks.—*F.* (*F.*) *alluaudi* (BOULE, LEMOINE and THEVENIN), the type-species, represents generalized or average characters of *Forresteria*, showing rather a gradual change of ornament with growth. More depressed and strongly tuberculate species as *F. razafiniparanyi* COLLIGNON, 1965, and *F. reymenti* VAN HOEPEN, 1968 (the two of which are closely allied to each other and could be identical), are included in *Forresteria* (s.s.).

In *F. hobsoni* (REESIDE, 1932) the mediolateral tubercle is shifted upward and united with the large, horn-like ventrolateral tubercle on the adult whorl.

I would regard this character as specific rather than generic, since such a feature does not necessarily occur in other species of *Forresteria*.

The subgenus *Forresteria* comprises also less depressed but distinctly tuberculate species, such as *F. itwebae* VAN HOEPEN, 1968, and a new one (*F. armata*) to be described below.

The illustrated syntype of *Gauthiericeras margae* var. *peruanum* BRÜGGEN (1910, p. 720, pl. 27, fig. 3) and the finely illustrated specimen of LÜTHY (1918, p. 41, pl. 1, fig. 2), from the Coniacian of Peru, probably represent another species of rather compressed *Forresteria*, as is *F.* (*F.*) *basseae* BENAVIDES-CÁCERES (1956, p. 477, pl. 58, fig. 5). They seem to be identical and should be called *Forresteria* (*Forresteria*) *peruanum* (BÜGGEN).

Some of the less depressed species such as *F. stantoni* (REESIDE, 1932) and *F. pitalensis* (STEINMANN, 1897), have a modified ornament on the outer whorl, on which mediolateral tubercles are absorbed by raised ribs. This subgroup can be, in my opinion, grouped with the subgenus *Edenoceras*, because on the outer whorl of *E. multicostatum* VAN HOEPEN (1986, p. 171, pl. 12, text-fig. 4b), the mediolateral and also the umbilical tubercles are likewise absorbed by thick ribs. Secondary, shorter ribs are more frequently intercalated in *E. multicostatum*, but this is probably a specific character.

The subgenus *Reesideoceras* BASSE, 1947, has less inflated flanks and its mediolateral tubercles fuses with the umbilical one on the outer whorl. Its type-species is *Ammonites petrocoriensis* COQUAND (1859, p. 995; DE GROSSOUVRE, 1894, pl. 2, fig. 5). *Reesideoceras gallicum* BASSE, 1947, is an unnecessary specific name, because it is synonymous with *Forresteria* (*Reesideoceras*) *petrocoriensis*. In this subgenus the keel disappears on the outer whorl, on which the venter is flat or concave, bordered by ventrolateral clavi.

The world-wide species *F.* (*F.*) *alluaudi* is found in Hokkaido. In addition to it there is another remarkable new species of *Forresteria* (s.s.) in the collections from Hokkaido.

No examples of *Forresteria* (*Reesideoceras*) and *F.* (*Edenoceras*) have been found in Hokkaido, but there are two species of a new subgenus, which are characterized by a smoothed outer whorl.

Forresteria (*Forresteria*) *alluaudi*
(BOULE, LEMOINE and THEVENIN, 1907)

Pl. 40 [28], Figs. 1–4; Text-figs. 5–7

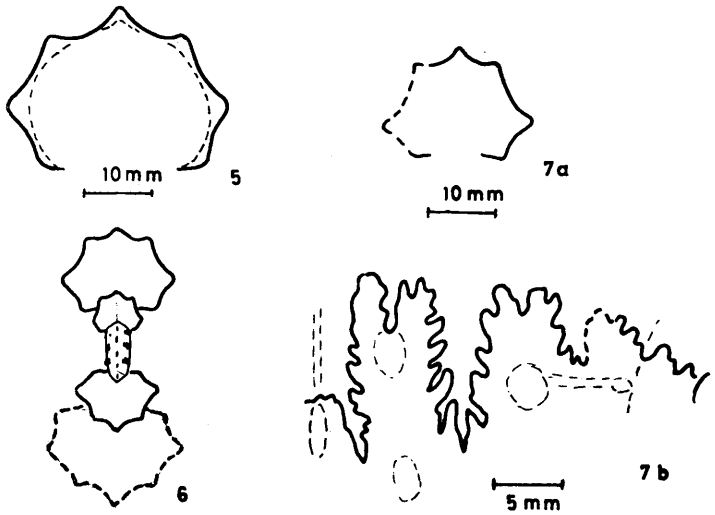
1907. *Acanthoceras* (*Prionotropis*) *alluaudi* BOULE, LEMOINE and THEVENIN, *Ann. Paléont.*, vol. 2, p. 12 [32], pl. 1 [8], figs. 6, 6a, 7, text-fig. 17.
1908. *Prionotropis alluaudi*, LISSON, *Sobre algunos ammonites del Peru*, p. 17, pl. 17.
1910. *Prionotropis alluaudi*, BRÜGGEN, *N. J. Min. Beil.* Bd. 30, p. 772.
1932. *Barroisiceras* (*Forresteria*) *allaudi* [*sic*], REESIDE, *U. S. Geol. Surv. Prof. Paper* 170-B, p. 14.
1932. *Barroisiceras* (*Forresteria*) *forresteri* REESIDE, *U. S. Geol. Surv. Prof. Pape* 170-B, p. 17, pl. 5, figs. 2–7.

1947. *Barroisiceras* (*Forresteria*) *alluaudi*, BASSE, *Ann. Paléont.*, vol. 33, p. 128 [32], pl. 8, fig. 3, 3a; pl. 9, fig. 2, 2a (?).

? 1955. *Collignoniceras peregrinator* VAN HOEPEN, *South Afr. Jour. Sci.*, Vol. 51, p. 364, text-figs. 10–11.

1956. *Barroisiceras* (*Forresteria*) *alluaudi*, BENAVIDES-CÁCRERES, *Bull. Amer. Mus. Nat. Hist.*, vol. 108, p. 478, pl. 61, fig. 1.

1965. *Forresteria alluaudi*, COLLIGNON, 1965, *Atlas Fossiles Caracter. Madagascar*, fasc. 13, p. 76, pl. 448, fig. 1828.



Figs. 5–7. *Forresteria* (*Forresteria*) *alluaudi* (BOULE, LEMOINE and THEVENIN).

Whorl-sections in various growth-stages and an external suture of an immature shell. 5: GK. H5442, 6: GK. H5440, 7: GK. H5441b. (T. M. *delin.*)

Types.—BOULE et al. (1907) did not designate the holotype. Of the two illustrated syntypes, the larger one (BOULE et al., 1907, pl. 1, fig. 6, 6a) is somewhat malformed in that the ventral row of tubercles deviates from the siphonal line. The smaller one (BOULE et al., 1907, pl. 1, fig. 7; text-fig. 17) may be better preserved, but the authors did not illustrate its side view. Therefore, I hesitate to designate the lectotype without seeing the specimens, although they are certainly of identical species.

Material.—The following six specimens from the Ikushumbets area are referred to this species: (1) GK. H5442 (T. MURAMOTO Coll. 2156), from Gono-sawa, Pombets, (2) GK. H5440 (T. MURAMOTO Coll. 914), from a pebble of the Ikushumbets at Yayoi, (3) GK. H5441 (T. MURAMOTO Coll.), from another pebble of the Ikushumbets at Yayoi, (4) GK. H5464 (T. MURAMOTO Coll. P5-2451), from Gono-sawa, Pombets, (5) GK. H5622 (H. KOKUBU Coll.), from Ik 2119 p, Gono-sawa Pombets, and (6) GK. H5623 (T. TAKAHASHI Coll. 36613), from Ik 2147 p, Gono-sawa, Pombets.

Specific diagnosis.—A species of *Forresteria* (s.s.) which has a moderately stout shell, moderately distant and coarse, radial ribs, and distinct tubercles, of which the mediolateral ones are the most prominent. Sutures are moderately

incised, having lateral saddles of roughly subrectangular outline and fairly narrow lateral lobes.

Measurements.—

Specimen	Diameter	Umbilicus	Height	Breadth	B./H.	Number of major ribs per whorl
GK. H5622(c)	40.5(1)	9.2(.23)	20.4(.50)	25.0(.61)	1.22	11
—(+10°)(ic)	40.5(1)	9.2(.23)	20.0(.49)	22.0(.54)	1.10	
—(−180°)(c)	—	—	13.5	17.3	1.28	
—(−190°)(ic)	—	—	12.7	13.0	1.02	
GK. H5623(c)	23.7(1)	5.6(.23)	11.7(.49)	13.8(.58)	1.17	12
—(−10°)(ic)	22.4(1)	5.2(.23)	11.2(.50)	11.2(.50)	1.00	
—(−180°)(c)	—	—	7.2	7.2	1.00	
—(−190°)(ic)	—	—	6.6	6.3	0.95	
GK. H5440(c)	29.0(1)	8.2(.28)	12.8(.44)	17.06(.58)	1.32	5 or 6×2
—(+10°)(ic)	—	—	11.8	14.0	1.18	
GK. H5442(c)	~57	~16(.28)	~27(.48)	~33(.58)	~1.2	14(15?)
COLLIGNON, 1965, p. 76	81	25(.31)	37(.46)	50(.62)	1.35	
For comparison						
F. forresteri	~50(c)	("1/4-1/3")	25(.5)	33(.6)	1.2	10(?)
(REESIDE, 1932, p. 17)	~50(ic)		25(.5)	25(.5)	1.0	
	28(c)		13(.46)	16(.57)	1.2	10
	14		6(.43)	4.5(.32)	0.75	
the same (pl. 5, f. 2–4)	26.5(c)	5.9(.22)	13(.49)	16	1.2	10
	(ic)		13	13.5	1.04	
C. peregrinator (HOEPEN, 1955, p. 364)	75(1)	20(.27)	36(.48)	45(.60)	1.25	11(?)

Descriptive remarks.—The specimens from Hokkaido show characters of various growth-stages. GK. H5442 is nearly as large as the large syntype of BOULE et al., while GK. H5622 is slightly larger than their smaller syntype and slightly smaller than BASSE's (1947, pl. 14 [8], fig. 3) specimen. GK. H5623 is a small shell, representing the stage immediately preceding to that of GK. H5622. Other three specimens are as large as one of the above three and show a part of still inner whorls, although they are more or less defective. The specimen illustrated by COLLIGNON (1965, pl. 448, fig. 1828) is the largest but still wholly septate. One of BRÜGGEN's (1910, p. 722) specimens, from Peru, seems to be as large as COLLIGNON's from Madagascar, although I have not seen it. No example as large as COLLIGNON's has been obtained from Hokkaido, although GK. H5442, which preserves a portion of the body-whorl, may have been similarly large when it was complete.

Summarizing the observation of these specimens as well as other previously described ones, it may be stated that the present species shows a rather gradual change of characters with growth. The specific diagnosis described above concerns primarily with the shells of later growth-stages. There are, furthermore, minor differences between individuals of the same growth-stage.

The whorl grows with a moderate rate, embracing a little over a half of the inner one, with the umbilical seam just on the row of mediolateral tubercles. The umbilicus is, accordingly, fairly narrow, ranging from one third to one fifth of the diameter of the entire shell. It is considerably deep.

At first the whorl is slightly higher than broad, having distinct ventrolateral shoulders and a keeled venter. At the shell diameter of 20 mm. or so the whorl becomes broader, being as high as broad in the intercostal section and somewhat broader than high in the costal section (between tubercles). In the later growth-stages it is slightly broader than high even in the intercostal section (with b./h. = about 1.1) and considerably broad in the costal section (with b./h.=1.3±0.1). The intercostal whorl-section is subrounded, with a steep umbilical wall, a rounded umbilical shoulder, moderately inflated flanks, and an arched but weakly keeled venter. Owing to the strong tuberculation the costal whorl-section looks polygonal.

Ribs and tubercles begin to appear at about the shell diameter of 10 mm. In the early stage they are not so strong as in the later stages, especially the umbilical tubercles are undeveloped or indistinct, the mediolateral ones are of moderate intensity, where ribs are normally bifurcated, and the ventral ornaments of the barroisiceratine type, consisting of three rows of clavate tubercles and ribs in chevrons, are characteristic.

In the later growth-stages the ribs are coarsened and the tubercles are strengthened. The mediolateral tubercles are especially prominent, having a large base and a spinose apex. The umbilical tubercles are much smaller and of variable intensity. The ventrolateral tubercles are moderately strong, having a broader base than in the earlier growth-stage. The medioventral clavi persist to the adult stage, although the keel is lowered.

A low major rib runs radially from the umbilical margin to the mediolateral tubercle. The mode of bifurcation of the ribs at the mediolateral tubercles may vary with individuals or from place to place even in one specimen. Typically one secondary rib is projected forward and the other runs almost radially on the extension of the major one. Sometimes Y shaped branching is shown. Occasionally the intercalation of the secondary rib is seen at one place, while the simple extension of the major rib is seen at another.

As far as the measurable specimens are concerned, there are 10 to 12 major ribs in a whorl. GK. H5442 may be exceptional in that its septate whorl has somewhat more crowded and more numerous (14) ribs, but on its body-whorl the ribs are as distant as in normal specimens. On the other hand the holotype of *Barroisiceras* (*Forresteria*) *forresteri* REESIDE (1932, p. 17, pl. 5, fig. 2–7), NSNM. 73757, has 10 major ribs per whorl and the ribs on the outer whorl seem to be somewhat more distant than those on the syntypes of *F. alluaudi*. The difference is by no means great and can well be included within the variation of *F.* (*F.*) *alluaudi*. As the available specimens from North America are few, it is not decided at this moment whether a subspecific separation is possible or not between the North American and Madagascar groups of individuals.

It is interesting to note that some of the specimens from Hokkaido (e.g.

GK. H5442, H5622 and H5623) are closer to the syntypes of *F.* (*F.*) *alluaudi* from Madagascar and some others (e.g. GK. H5440 and H5441) are rather similar to the holotype of *F. forresteri* from North America. The latter subgroup has slightly more distant ribs and better marked umbilical tubercles in somewhat earlier growth stage than the former, but the difference is slight and there is gradation between the two subgroups. In other words it is natural and reasonable to refer the Hokkaido specimens to one and the same species which in itself shows a moderate (but not great) extent of variation.

BENAVIDES-CÁCERES (1956, p. 479) stated that *F. alluaudi* and *F. forresteri* were separable only by the spinose character of the ornamentation in the latter species. This is, in my observation, merely a problem of preservation. GK. H5622, for instance, does show the spinose mediolateral tubercle on a well preserved part but the spine is septate and only the basal rounded nodes are shown on other parts of the same specimen.

Taking all the above observations into consideration, I am led to the conclusion that *Forresteria forresteri* (REESIDE, 1932) falls in the synonym of *Forresteria alluaudi* (BOULE, LEMOINE and THEVENIN, 1907). Even if the subspecific separation could be considered, the specific name *alluaudi* should precede *forresteri*.

Collignoniceras peregrinator VAN HOEPEN, 1955, (p. 364, text-figs. 10–11), from South Africa, is possibly identical with *F. alluaudi*, because of the similarity in every respect. VAN HOEPEN (1968, p. 167) has recently regarded *F. pereginator* as identical with *F. hammersleyi* VAN HOEPEN, 1955. Should this be accepted, then it would follow that the large holotype of *F. hammersleyi* (VAN HOEPEN, 1955, p. 361, text-figs. 7–9), from South Africa, with a diameter over 220 mm., would represent the full-grown stage of *F. alluaudi*. I refrain from giving the final conclusion, until I can examine relevant specimens from South Africa and Madagascar.

A minor but interesting malformed feature is occasionally observable in the available specimens. On the last one third of the whorl of GK. H5623, the medioventral row of tubercles deviates from the siphonal line, resulting in unequal distance from the row of ventrolateral tubercles on either side. The same feature is seen on one of the syntypes of BOULE et al. (1907, pl. 1 [8], fig. 6a).

Comparison.—*Forresteria* (*Forresteria*) *alluaudi* most typically represents the subgenus *Forresteria* in that it shows the subgeneric characters in a general way and in a moderate degree. It is not so compressed as *F. sevierense* (REESIDE) (1932, p. 16, pl. 4, figs. 4–8) nor is it so depressed as *F. razafinì-paranyi* COLLIGNON (1965, p. 78, pl. 449, figs. 1829–1831). Its ribs and tubercles are regularly disposed and rather gradually strengthened with growth. In this species there is no hypernodosity nor shift of tubercles as in *F. hobsoni* (REESIDE) (1932, p. 18, pl. 9, figs. 1–2, pl. 10, figs. 1–2), nor fusing of lateral tubercles into sharp ribs as in *F. stantoni* (REESIDE) (1932, p. 17, pl. 7, figs. 1–7; pl. 8, figs. 1 3; pl. 9, fig. 1).

Forresteria cf. *allaudi* [sic] of PARNES (1964, p. 23, pl. 2, figs. 7–8), from Israel, which has compressed whorls and somewhat upward shifting lateral tubercles, is probably distinct from *F. alluaudi,* unless the compression owes to secondary deformation. It may be closer to, if not identical with, *Forresteria basseae* (BENAVIDES-CÁCERES) (1956, p. 477, pl. 58, fig. 5) [=*Barroisiceras haberfellneri,* BRÜGGEN, 1910, (*non* HAUER), p. 730, text-fig. 10] [=*Barroissiceras haberfellneri,* STEINMANN, 1930, text-fig. 195], from Peru, or *F. peruanum* (BRÜGGEN), emend.

Forresteria (*Forresteria*) *vinassai* (VENZO) (1936, p. 88, pl. 7[3], fig. 12; text-fig. 1) from Zululand, South Africa, closely resembles *F.* (*F.*) *alluaudi,* but has stronger ribs. In the latter species the tubercles are rather prominent over ribs.

Occurrence.—Gono-sawa, Pombets, a tributary of the Ikushumbets, zone of *Inoceramus uwajimensis;* pebbles of the main course of the Ikushumbets, at Yayoi, together with *Inoceramus yokoyamai* NAGAO and MATSUMOTO. Summarizing these records of occurrence in central Hokkaido, the species seems to occur in the main or middle part of the Lower Urakawan [=approximately Coniacian] in the Japanese scale.

Forresteria (*Forresteria*) *alluaudi* seems to show a world-wide distribution in the Coniacian, since there are available records of its occurrence in Madagascar, South Africa, Peru, Utah (U.S.A.) and Japan. In Madagascar, according to COLLIGNON (1965), it occurs in the zone of *Kossmaticeras theobaldianum-Barroisiceras onilahyense,* Middle Coniacian. In South Africa VAN HOEPEN reported the occurrence of *F. peregrinator* from his *Peroniceras* beds (Coniacian).

Forresteria (*Forresteria*) *armata* sp. nov.

Pl. 41 [29], Fig. 1; Text-fig. 8

Holotype.—GK. H5621, from loc. Ik 2144p, Gono-sawa, Pombets (Coll. T. TAKAHASHI 42–10–1–1).

Specific diagnosis.—A species of *Forresteria* (*Forresteria*) which has comparatively higher whorls, less inflated flanks, rather prorsiradiate ribs and prominent mediolateral tubercles. The umbilical tubercles are indistinct and the ventral ones are of moderate intensity. On the body-whorl the ribs are much separated and the mediolateral tubercles become bullate and sharp-headed. The first lateral lobe of the adult suture is narrow and deep.

Measurements.—

GK. H5621	Diameter	Umbilicus	Height	Breadth	B./H.
at the last septum (ic)	82.0(1)	24.6(.30)	40.0(.49)	26.0(.32)	.65
behind (c)	—		34.2	33.6	.98

Descriptive remarks.—Only a single specimen is before me and its body-whorl is crushed, but the observable characters are distinct.

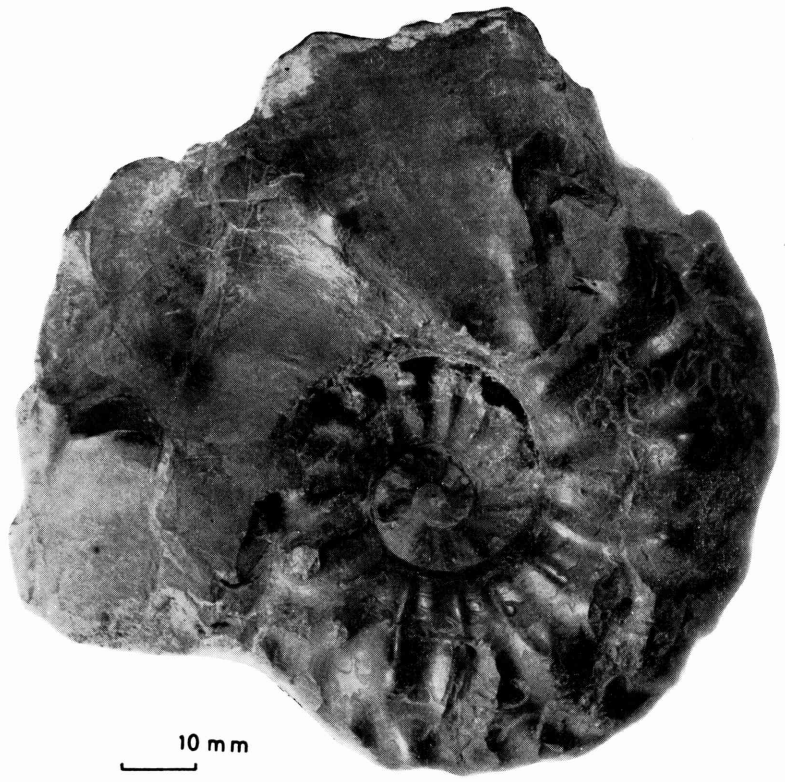


Fig. 8. *Forresteria armata* sp. nov.

GK. H5621, holotype. Lateral view showing sutures (the same view as Pl. 41, Fig. 1a under different light). (I. HAYAMI photo)

The whorl is moderately involute, increasing fairly rapidly. The umbilical seam is just above the row of mediolateral tubercles of the inner whorl. The umbilical wall is steep, nearly vertical or even overhanging and the umbilical shoulder is abruptly rounded. The flanks of the whorl are only gently inflated and the whorl is higher than broad in the intercostal section, being broadest at the middle of the flank.

The ribs are more or less prorsiradiate and slightly concave from the umbilical margin to the middle of the flank. They are separated by somewhat wider interspaces, being counted as much as 15 to 16 per whorl in the phragmocone, although the shell of early stage of less than 10 mm. diameter seems to be smoothish. They are moderately strong. Some of them have bullate umbilical tubercles, but some others are almost free from the umbilical bullae and occasionally weakened near the umbilical margin. The mediolateral tubercles are prominent on the inner whorl, stretching laterally along the vertical umbilical wall of the outer whorl. On the outer half of the last whorl of the phragmocone, some of the mediolateral tubercles are large and rounded but others are less strong and somewhat bullate.

The ribs are usually bifurcated at the mediolateral tubercles. The ventro-

lateral tubercls are, accordingly, twice as numerous as the mediolateral ones. They are of moderate intensity and somewhat obliquely clavate, extending to projected weak, ventral ribs. The medioventral tubercles are clavate, each of which is placed considerably forward of the ventrolateral tubercle. They are aligned on a keel.

On the adult body-whorl the ribs are distant, being separated by very wide interspaces. They are low and prorsiradiate up to the middle of the flank. The umbilical tubercles are faint or obsolete. The mediolateral tubercles are much elevated, with a broad base and a narrow but sharp summit which are elongated obliquely forward. The secondary ribs which should run in pairs from the mediolateral tubercles are much weakened, broadened, and accordingly, indistinct, while the ventrolateral tubercles persist as low clavi. Owing to the incomplete preservation the character of the median-ventral part of the body-whorl is not known.

The suture is similar to that of *Forresteria* (*Forresteria*) *alluaudi*, but the first lateral lobe has a narrower stem and the lobules are generally deeper than in the latter. The folioles show somewhat phylloid aspects.

Comparison.—In the strong tubercles the present species is similar to *Forresteria* (*Forresteria*) *razafiniparani* COLLIGNON (1965, p. 78, pl. 449, figs. 1829–1831), from the middle Coniacian of Madagascar, but is clearly distinguished by higher, instead of depressed, whorls, more slender and prorsiradiate ribs and weaker or obsolete umbilical tubercles.

In the less depressed whorls and prominent mediolateral tubercles *F.* (*F.*) *armata* is allied to *F.* (*F.*) *itwebae* VAN HOEPEN (1968, p. 169, pl. 10, text-fig. 3c) from the Coniacian of South Africa, but is distinguished in its radially elongated, sharp-headed mediolateral tubercles on the outer whorl, somewhat prorsiradiate ribs, and broader umbilicus.

In the less inflated flanks with slender and prorsiradiate ribs, the present species is somewhat similar to *Forresteria* (*Edenoceras*) *pitalensis* (STEINMANN) (*in* GERHARDT, 1897, p. 198, pl. 5, fig. 21) (also BASSE, 1947, p. 130, pl. 13 [7], fig. 4), from the Coniacian *Prionocycloceras guayabanum* bearing bed of Colombia, and also to *F.* (*Edenoceras*) *stantoni* REESIDE (1932, p. 17, pl. 7, figs. 1–7; pl. 8, figs. 1–3; pl. 9, fig. 1), from the Frontier Formation of Wyoming, U. S. A. In our species the mediolateral tubercles are very prominent at the middle growth-stage and persist onto the adult body-whorl, being predominant over the ribs. In the two species from the Americas the mediolateral tubercles tend to be absorbed by the sharpened radial ribs on the outer whorl. The umbilical tubercles are fairly distinct in *F.* (*E.*) *stantoni*.

Occurrence.—Loc. Ik 2144p, Gono-sawa, Pombets, zone of *Inoceramus uwajimensis*, Coniacian.

Subgenus ***Muramotoa*** nov.

Synonymy.—*Basseoceras* VAN HOEPEN, 1968 (*non* COLLIGNON, 1965).

Etymology.—Dedicated to Mr. Tatsuo MURAMOTO, who has contributed much

in collecting numerous, valuable specimens of ammonites from Hokkaido.

Type-species.—*Forresteria* (*Muramotoa*) *yezoensis* sp. nov., to be described below.

Generic diagnosis.—The whorl is moderately involute, with a fairly narrow umbilicus. It is somewhat higher than broad at least in the adult stage and has rather gently inflated flanks.

In the early to middle growth-stages ribs and tubercles are distinct. The mediolateral tubercles are the strongest and do not fuse with ventrolateral nor with umbilical tubercles. In the late growth-stages the ribs and tubercles are weakened and typically the shell becomes smoothish, with a faint, unserrated ventral keel as an extended trace of the row of ventral clavi.

The suture is fundamentally of the same type as that of *Forresteria* (*Forresteria*). In the adult stage it has a comparatively deeper lateral lobe (L) and deeper lobules of the external saddles.

Remarks.—In addition to the type-species, *Forresteria* (*Muramotoa*) *yezoensis*, another new species to be described below, and *Barroisiceras* (*Forresteria*) *ampozaloakaense* BASSE, 1947, are referred to the subgenus *Muramotoa*.

Basseoceras krameri VAN HOEPEN (1968, p. 164, text-figs. 2b-g. pl. 7), from the Coniacian of South Africa, has a *Forresteria* (s.s.) like immature shell and a feebly ornamented adult whorl. No photograph of the holotype (Z935) was shown by VAN HOEPEN, but its plaster cast has been kindly sent to me from the Geological Survey of the Republic of South Africa. It is larger, about 107 mm. in diameter, and has much weaker ornament than the illustrated paratype (Z1437). On the earlier half of the outer whorl of the holotype weak mediolateral tubercles are discernible in addition to the umbilical, ventrolateral and ventral ones of moderate intensity. On the later half of the outer whorl, which is still septate, the mediolateral tubercles and the ribs disappear, the umbilical and ventrolateral tubercles are much weakened, the keel is lowered and the ventral clavi on the keel persist for a somewhat longer period than others but finally tend to disappear. In fact the South African species is fairly close to *Forresteria* (*Muramotoa*) *ampozaloakensis* from Madagascar. *Basseoceras krameri* is, thus, referred to the above defined subgenus *Muramotoa*.

Basseoceras krameri was designated as the type-species of *Basseoceras* VAN HOEPEN, 1968. I agree with VAN HOEPEN in regarding this species group as a new taxon. However, *Basseoceras* VAN HOEPEN, 1968, is a homonym of and preoccupied by *Basseoceras* COLLIGNON, 1965. We should use the subgeneric name *Muramotoa* for this species group, since *B. krameri* is referred to *Muramotoa*.

Comparison and affinity.—*Muramotoa* resembles a relatively compressed species group of *Forresteria* (s.s.) especially in immature stages, but is distinguished by its weakening and final disappearance of the ornament in the adult whorl. They are not so much separated from each other that the subgeneric separation is adequate. Some species of *Forresteria* (*Forresteria*) have more inflated whorls on which tubercles are generally strengthened or exaggerated.

In the less inflated shell it is somewhat similar to *Forresteria* (*Reesideo-*

ceras) especially in the immature stages. On the outer whorl of the latter subgenus the mediolateral tubercles are united with the umbilical ones, the keel disappears and the venter becomes flat or concave instead of roof-shaped.

In the attenuation of the ornament *Forresteria* (*Muramotoa*) is allied to *Solgerites* REESIDE, 1932. In the immature stages of the former the *Forresteria* type general characters are better retained, whereas the latter is so specialized that it considerably deviates from *Forresteria* as seen by the flattened shell-form and fine, dense ornaments even in the immature stages.

Muramotoa is superficially similar to *Basseoceras* COLLIGNON, 1965 (see p. 301 of this paper) in the smoothish outer whorl. In the earlier growth-stages the distinction is unmistakable, since the former has the same type of characters as that of immature *Forresteria* (s.s.), having distinct mediolateral tubercles, and the latter has essentially the same type of characters as that of *Barroisiceras* (s.s.). The upward shifted umbilical tubercles on the outer whorl of *Barroisiceras* (*Basseoceras*) *colcanapi* COLLIGNON, 1965, do not correspond with the independent mediolateral tubercles of *F.* (*Muramotoa*) *yezoensis* and other species of *F.* (*Muramotoa*).

Forresteria (*Muramotoa*) *yezoensis* sp. nov.
Pl. 42 [30], Figs. 1–2; Text-figs. 9–10

Material.—Holotype, GK. H5462, from loc. 2155p1, Gono-sawa, Pombets, zone of *Inoceramus uwajimensis*, collected by T. MURAMOTO. Paratypes, GK. H5463 [=T. MURAMOTO's coll. no. P5-6323] and GK. H5557 [=T. TAKAHASHI's coll. no. 41-6-1.1], from Gono-sawa, Pombets.

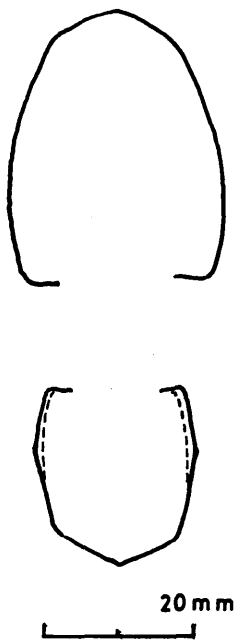


Fig. 9. *Forresteria* (*Muramotoa*) *yezoensis* sp. nov.
GK. H5462, holotype. Diagrammatic whorl-section. (T. M. *delin.*)

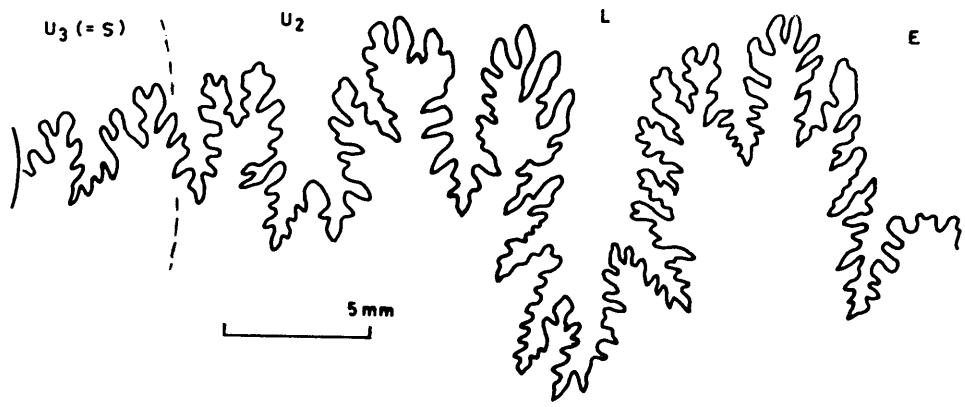


Fig. 10. *Forresteria* (*Muramotoa*) *yezoensis* sp. nov.
External suture of the holotype, GK. H5462, at h=25.5 mm.
(T. M. *delin.*)

Specific characters.—The whorl is moderately involute, embracing a fairly narrow umbilicus. It is higher than broad, having a proportion of 10 : 8.5 between height and breadth. The umbilical wall is rather low and nearly vertical or slightly overhanging. The umbilical shoulder is abruptly rounded. The flanks are only gently convex or nearly flat and gradually convergent, form rather blunt ventrolateral shoulders and then pass to a low roof-shaped venter. The whorl is broadest at about the lower one third of the height. The ventral keel is low.

The immature shell, up to the diameter of 40 or 45 mm., is ornamented with tubercles and radial ribs of moderate intensity. The mediolateral tubercles are the most predominant on the whorl of the middle growth-stage (diameters from 25 to 40 mm.), being situated at the umbilical seam of the outer whorl, whereas the umbilical tubercles are small or indistinct, being sometimes discernible only as slight angulation of the radial ribs at the umbilical shoulder. The ribs are rectiradiate, moderately strong and separated by somewhat wider interspaces on the inner part of the flank from the umbilical shoulder to the mediolateral tubercle. Then they are bifurcated there or inserted at about the same level. Some of the bifurcated or inserted ribs are prorsiradiate. The secondary ribs are somewhat weaker than the major ones. The ventrolateral tubercles are of moderate intensity in the immature stages and about twice (or slightly less than twice) as numerous as the mediolateral ones. The lowered ribs are projected from the ventrolateral tubercles to the ventral clavi, forming chevrons on the venter. The ventral clavi are at first moderately strong, giving distinct serration on the keel, but in the middle growth-stage they are already weakened and the serration on the keel becomes less distinct.

In the late growth-stage, i.e. from the last part of the septate whorl to the adult body-whorl, all the ornaments are sooner or later weakened and finally disappear. In the holotype the ventrolateral tubercles are gradually weakened and persist to a slightly later stage than the rapidly weakened mediolateral ones,

but they finally disappear and only blunt ventrolateral shoulders remain. The ventral keel persists for the longest period, but it is lowered and becomes smooth, as its serration is lost.

The suture in the late growth-stage is comparatively deeply incised than other species of *Forresteria*. The two lobules which subdivide the head of the first lateral saddle (between E and L) are fairly deep and a lobule which asymmetrically divides the second lateral saddle (between L and U2) is very deep. The first lateral lobe(L) is the deepest and much deeper than broad, being asymmetrically bipartite, having four, fairly deep lobules in the lower part. The second lateral lobe (U2) is about a half of L in size. Three other, smaller, auxiliary lobes are discernible in the external suture.

Measurements.—

Specimen	Diameter	Umbilicus	Height	Breadth	B./H.
GK. H5462	73.3(1)	17.7(.24)	35.6(.49)	30.3(.41)	0.85
GK. H5463	20.5(1)	3.6(.17)	11.2(.54)	9.2(.45)	0.82
GK. H5557 (secondarily compressed)	55.0	10.5(.19)	27.5(.5)	19	0.7

Remarks.—Although the three specimens before me are not quite identical, I regard them as one and the same species. Minor differences are probably due to difference with growth-stages as well as to variation.

The shell seems to be more involute and more narrowly umbilicate in earlier growth-stages. The ribs and the tubercles are coarser in the middle growth-stage than in the earlier ones.

Comparison.—In the comparatively compressed whorl the immature shell of the present species resembles that of *Forresteria* (*Forresteria*) *seviriense* (REESIDE) (1932, p. 16, pl. 4, figs. 4–8), from the Mancos Shale of Utah, and *Forresteria* (*Forresteria*) *basseae* BENAVIDES-CÁSERES (1956, p. 477, pl. 58, fig. 5) [=*Barriosiceras haberfellneri*, STEINMANN (*non* HAUER), 1930, text-fig. 195] from the Coniacian of Peru. It is distinguished from the North American species by its somewhat finer ribs, more numerous ventrolateral and ventral tubercles, weaker or obsolete umbilical tubercles; from the Peruvian species by its stronger mediolateral tubercles which are situated at a longer distance from the ventrolateral tubercles and also by weaker or obsolete umbilical tubercles. The distinction in the adult stage is unmistakable.

The present species closely resembles *Forresteria* (*Muramotoa*) *ampozaloakensis* (BASSE) (1947, p. 131, pl. 9, fig. 4; also COLLIGNON, 1965, p. 80, pl. 450, fig. 1832), from the Coniacian of Madagascar, in both of which the attenuation of the ornament is characteristic. In the immature stages the latter has distinct umbilical tubercles. The major ribs and the mediolateral tubercles in the middle growth-stage are stronger in the former than in the latter. Furthermore, the latter seems to have somewhat broader whorls than the former. (BASSE, 1947, did not record the measurements of the holotype. COLLIGNON's, 1965, measurements of another specimen give the proportion of breadth to height = 8.8 : 10.0).

Occurrence.—Loc. Ik 2155pl and nearby localities in the stream called Gonosawa, Pombets, a tributary of the Ikushumbets, central Hokkaido. All the

examined specimens came from the zone of *Inoceramus uwajimensis,* Coniacian, and were contained in calcareous nodules of fine-sandy siltstone. They are coated with black green, serpentine like matter.

Forresteria (Muramotoa) muramotoi sp. nov.
Pl. 43 [31], Fig. 1; Text-figs. 11

Material.—Holotype, GK. H5620, from loc. Ik 2150p, Gono-sawa, Pombets (Coll. T. MURAMOTO). Paratype, T. TAKAHASHI's collection from Gono-sawa, Pombets.

Specific characters.—The shell is rather small and fairly narrowly umbilicate, with a variable degree of involution of whorls. The umbilical wall is moderately high and overhanging. The umbilical shoulder is subangular to abruptly rounded. The immature whorl is less compressed than the adult and has considerably convex flanks. It is somewhat higher than broad in the intercostal section but broader than high in the costal section, being broadest between the tubercles at about the lower one third of the height. The adult whorl is higher than broad and has gently inflated and rather convergent flanks. The venter forms a low roof shape, but the ventrolateral shoulder becomes blunt and then subrounded in the adult shell. A low ventral keel, which is distinct on the inner whorls, tends to disappear in the last part of the adult whorl.

The mediolateral tubercles are comparatively large and strong on the inner whorls, ten or so per whorl. The umbilical tubercles are indistinct or undeveloped. The radial ribs which arise at the umbilical shoulder are broadened toward the mediolateral tubercles. The ventrolateral tubercles are small, somewhat clavate and numerous, being about three times as numerous as the medio-

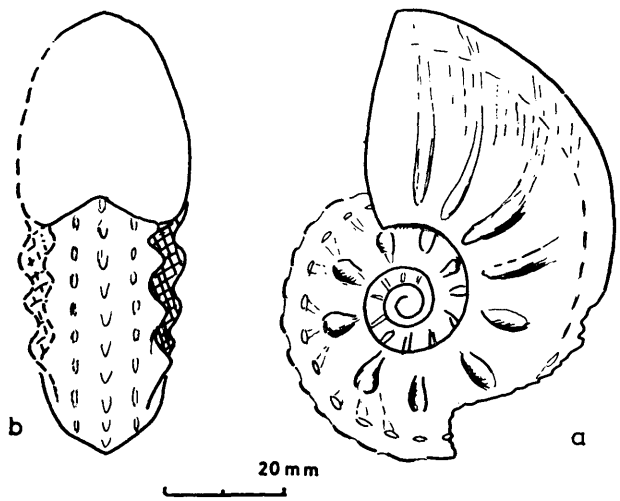


Fig. 11. *Forresteria (Muramotoa) muramotoi* sp. nov.

Paratype, T. TAKAHASHI Coll., from Gono-sawa, Pombets. Lateral (a) and frontal (b) views in sketch. (T. M. *delin.*)

lateral tubercles. The secondary ribs, which run from the mediolateral tubercles to the ventrolateral ones, are weak. They are bent somewhat forward on the venter. The ventral clavi are moderately distinct in the middle growth-stage and then weakened.

On the adult body-whorl the mediolateral tubercles are gradually weakened, sooner or later suppressed to bullae that extend to blunt ribs, which, in turn, are still more weakened and finally disappear. The ventrolateral and ventral clavi and the secondary ribs are weakened and then disappear at a distinctly earlier growth-stage than the mediolateral tubercles. Consequently the outer part of the body-whorl looks smoothish. On the smoothish last part of the body-whorl faint lirae are discernible. They show a gently concave curvature on the main part of the flank and are gradually bent forward at the rounded ventrolateral shoulder.

Sutures, though not well exposed, seem to be similar to those of *F.* (*M.*) *yezoensis*.

Measurements.—

Specimen	Diameter	Umbilicus	Height	Breadth	B./H.
GK. H5620	56.0(1)	10.2(.18)	30.0(.53)	24.0(.43)	0.80
−1/2 vol.	—	—	17.9	16.0	0.88(ic)
	—	—	16.4	18.4	1.12(c)
Paratype	73.0(1)	20.7(.28)	35.5(.48)	29.0(.40)	0.81

Remarks.—As is shown by the above measurements, the two examined specimens are somewhat dissimilar in the relative width of umbilicus or in the degree of involution. This is taken here as variation and to some extent as a change with growth-stages as in the case of the preceding species.

Comparison.—This species resembles *Forresteria* (*Muramotoa*) *yezoensis* sp. nov. (described above), but is distinguished by more convex flanks, more distant ribs, stronger and larger mediolateral tubercles, which persist to a later growth-stage, and comparatively more numerous and smaller ventrolateral tubercles.

The immature shell of the present species is somewhat similar to that of *Forresteria* (*Forresteria*) *alluaudi* (BOULE, LEMOINE and THEVENIN) (see description in p. 308), although the distinction in the adult shell is unmistakable. Even in the immature stage the two species can be distinguished in that the whorl is less depressed and the difference in intensity and density between the mediolateral and the ventrolateral tubercles are more remarkable in *F.* (*M.*) *muramotoi* than in *F.* (*F.*) *alluaudi*. Moreover, the umbilical tubercles are faint or undeveloped in the former, whereas they are distinct in the latter.

The disposition of the ornaments in the middle to late growth-stages is somewhat similar to that of *Forresteria* (*Reesideoceras*) *petrocoriensis* (COQUAND) (1859, p. 995) [=*F.* (*R.*) *gallicum* BASSE, 1947, p. 133] [=*Barroisiceras haberfellneri*, GROSSOUVRE, 1894 (*non* HAUER, 1866), *pro parte*, p. 50, pl. 1, figs. 1–5; pl. 2, figs. 1, 3, 5], from the Coniacian of France. If the large specimen of GROSSOUVRE's (1894), pl. 1, fig. 2 is regarded as identical with COQUAND's holotype

[=GROSSOUVRE, 1894, pl. 2, fig. 5], it follows that the ornament is weakened also in the last part of the adult whorl of *F.* (*R.*) *petrocoriensis*. In *F.* (*R.*) *petrocoriensis* the mediolateral tubercles are united with the umbilical ones, resulting in bullate umbilical tubercles in a late growth-stage. In *F.* (*M.*) *muramotoi* the umbilical tubercles are indistinct from the beginning and the prominent mediolateral tubercles become bullate in a late growth-stage, still keeping their highest point at about the mid-flank. *F.* (*M.*) *muramotoi* has a low, roof-shaped venter even in late growth-stages, whereas *F.* (*R.*) *petrocoriensis* has a flat to concave venter in late growth-stages, in which the ventrolateral angulation is remarkable.

I think *Muramotoa* and *Reesideoceras* are fairly close to each other, as BASSE (1947, p. 131) has already suggested with respect to *F.* (*M.*) *ampozaloakensis*. They are, however, considerably deviating from each other and the subgeneric separation can be justified.

Occurrence.—Loc. Ik 2150p and a nearby locality in a stream called Gonosawa, Pombets, a tributary of the Ikushumbets, central Hokkaido. The two examined specimens came from the zone of *Inoceramus uwajimensis*, Coniacian, and were contained in calcareous nodules of fine-sandy siltstone. They are coated with black green matter.

Genus *Yabeiceras* TOKUNAGA and SHIMIZU, 1926

Synonymy.—*Eboroceras* BASSE, 1946.

Type-species.—*Yabeiceras orientale* TOKUNAGA and SHIMIZU, 1926 (original designation).

Generic diagnosis.—The shell is moderately large and widely umbilicate, consisting of evolute whorls which show a remarkable change in characters with growth. The inner whorls are depressed to subrounded, with rounded umbilical shoulders, convex flanks and a weakly keeled venter, and provided with distant radial ribs, strong mediolateral tubercles, numerous, weak, ventrolateral elevations or tubercles and serrations on the keel. The umbilical tubercles may or may not be present. The radial ribs are bifurcated at the lateral tubercles and, accordingly, the ventrolateral nodes on the projected secondary ribs are twice as numerous as the lateral ones. The serrations on the keel correspond in number to the ventrolateral tubercles.

In the next growth-stage, i.e. on the last second whorl, which is still broader than high or nearly as broad as high, the ventrolateral tubercles disappear and the venter becomes smoothish, having only a blunt, smooth keel. The major ribs and/or lateral tubercles remain in this stage, but are sooner or later weakened.

In the full-grown stage, i.e. on the main part of the body whorl, the ornament entirely disappears and even the ventral keel may be lost. The last whorl is typically, but not always, higher than broad, with less convex and more or less convergent flanks, subangular umbilical shoulders, and more or less rounded or sloping ventrolateral shoulders.

The body-whorl is long, occupying nearly an entire outer whorl. At the final part it may be reduced in breadth and height. A constriction may mark the peristome.

The suture, as clearly shown by the type-species, is similar to that of *Forresteria*, but it may be somewhat more finely and deeply incised and may have a narrower first lateral saddle (between E and L).

Remarks.—In addition to the type-species TOKUNAGA and SHIMIZU (1926) described two other species, *Y. kotoi* and *Y. himuroi*, from the lower part of the Futaba Formation (Coniacian), Northeast Japan.

Eboroceras magnaumbilicatum BASSE (1946, p. 73, pl. 2, fig. 2; text-fig. 2), from the Coniacian of Madagascar, is an example of *Yabeiceras*, fairly close to *Y. orientale*, as was pointed out previously (MATSUMOTO et al., 1964, p. 330). Consequently *Eboroceras* BASSE, 1946, falls in a synonym of *Yabeiceras*. This is accepted by COLLIGNON (1965), who added more interesting species of *Yabeiceras* from the Coniacian of Madagascar. They are *Y. bituberculatum* COLLIGNON (1965, p. 82, pl. 451, fig. 1836; pl. 452, fig. 1838), *Y. menabense* COLLIGNON (1965, p. 86, pl. 453, fig. 1840), *Y. costatum* COLLIGNON (1965, p. 87, pl. 454, fig. 1841) and *Y. ankinatsyense* COLLIGNON (1965, p. 87, pl. 454, fig. 1842).

The last species is atypical in that its whorl is less broad even in the septate stage and in that the lateral tubercles are absorbed by the major ribs. In *Y. costatum*, which has broader whorls, the lateral tubercles are discernible in the earlier stages but are weakened and absorbed by the persistent major ribs. The holotypes of these two species are wholly septate and we need more specimens which represent the full-grown stage.

The patterns of the sutures have not been illustrated for some species from Madagascar and need further study in comparison with those of the type-species.

Comparison and affinity.—When I described, together with coworkers (MATSUMOTO et al., 1964), *Yabeiceras orientale* TOKUNAGA and SHIMIZU, from the lower part of the Futaba Formation, I discussed to some extent about the affinity of *Yabeiceras*, but did not clearly decide its systematic position.

Lines of evidence available at present allow us to conclude that it is better to ascribe *Yabeiceras* to the Barroisiceratinae than to any other group. In the evolute and widely umbilicate shell *Yabeiceras* is atypical of the subfamily, but it is allied to *Forresteria* REESIDE, 1932, as is demonstrated by the close resemblance in the immature stage. The subgenus *Muramotoa*, established above, is especially allied to *Yabeiceras*, because it has *Forresteria* (*Forresteria*) like inner whorls but tends to lose the ornament on the outer whorl. *Yabeiceras* is, however, much more evolute and more widely umbilicate than *Muramotoa*. The inner whorls of the latter are compressed, instead of depressed, and have a fastigate, instead of rounded, venter with more distinct ventrolateral and ventral tubercles. The suture of the type-species of *Yabeiceras*, *Y. orientale*, has a narrower first lateral lobe than that of *Muramotoa*, *M. yezoensis*.

In the evolute shell, smoothed outer whorl and other respects *Yabeiceras* is apparently similar to *Ishikariceras* MATSUMOTO, 1965. With respect to the

shell-form, ornamentation and sutures of the inner whorls *Ishikariceras* is closely allied to *Ciryella* WIEDMANN, 1959, a subgenus of *Gauthiericeras* DE GROSSOUVRE, 1894, of the Peroniceratinae, and is unrelated with *Forresteria* of the Barroissiceratinae. This is an example of synchronous homoeomorphy between the two subfamilies.

Distribution.—The hitherto described species occur in the Coniacian of Japan and Madagascar. In view of the long distance between the two regions and also of the world-wide distribution of the Barroisiceratinae, more examples of *Yabeiceras* could be expected to occur in other regions.

Yabeiceras orientale TOKUNAGA and SHIMIZU, 1926

Pl. 44 [32], Figs. 1–2; Pl. 45 [33], Fig. 1; Text-figs. 12–13

1926. *Yabeiceras orientale* TOKUNAGA and SHIMIZU, *Jour. Fac. Sci., Imp. Univ. Tokyo,* sect. 2, vol. 1, pt. 6, p. 201, pl. 22, fig. 7; pl. 27, fig. 1.
1926. *Yabeiceras orientale,* SHIMIZU, *Proc. Imp. Acad. Japan,* vol. 2, no. 10, p. 547.
1964. *Yabeiceras orientale,* MATSUMOTO, OBATA, MAEDA and SATO, *Trans. Palaeont. Soc. Japan,* N. S., No. 56, p. 323, pl. 48, figs. 1–2; text-figs. 1–3.

Type.—The holotype, described and figured by TOKUNAGA and SHIMIZU (1926, indicated above), was almost certainly destroyed by fire in 1944. It came from the lower part of Futabe Group, Fukushima Prefecture. GK. H5556, a specimen from the same locality and described by MATSUMOTO et al. (1964, p. 323, pl. 48, fig. 2; text-fig. 2) should be officially proposed as the neotype and

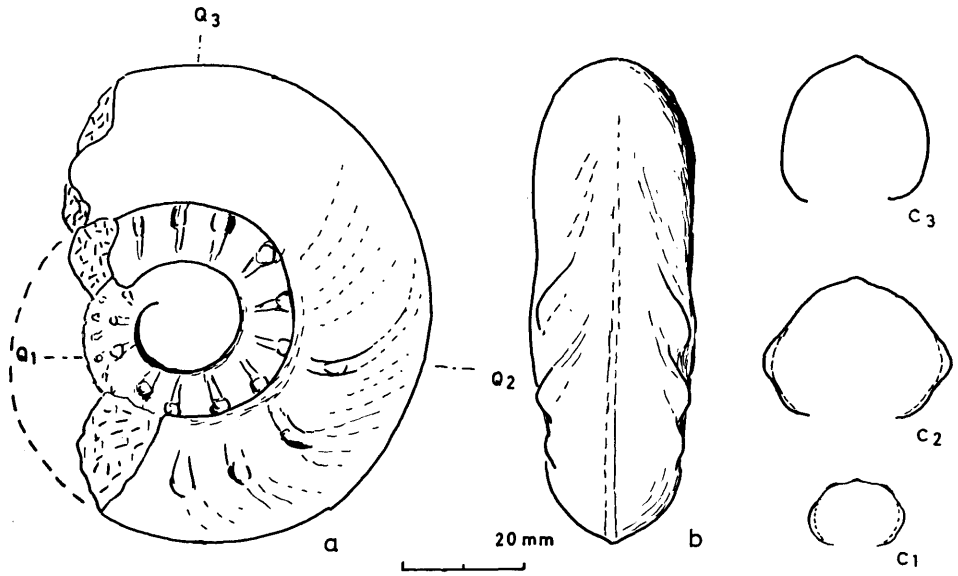


Fig. 12. *Yabeiceras orientale* TOKUNAGA and SHIMIZU.

GK. H5624, from Ikushumbets. Diagrammatic sketches of lateral (a) and ventral (b) views and also whorl-sections (C1, C2, and C3) at Q1, Q2 and Q3. (T. M. *delin.*)

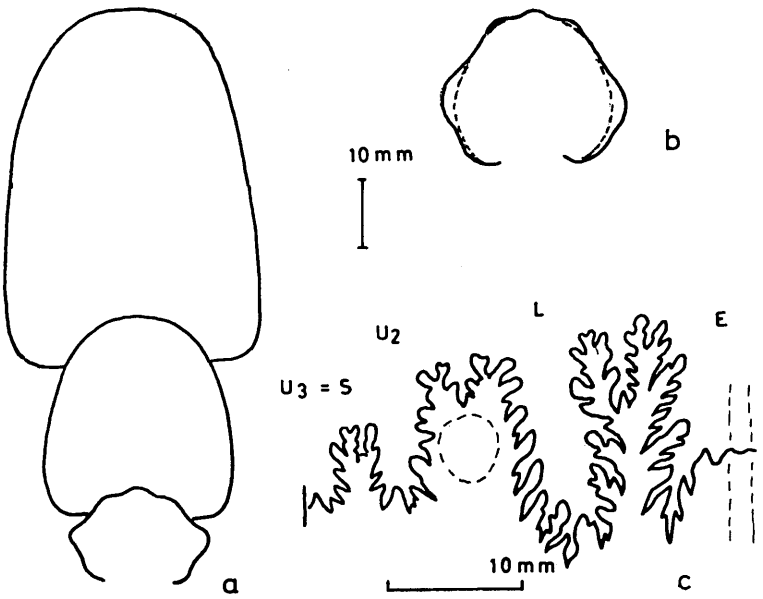


Fig. 13. *Yabeiceras orientale* TOKUNAGA and SHIMIZU.

IGPS. 35342, from Bibai. Whorl-sections (a, b) and an external suture (c). (T. M. *delin.*)

its validity should be acknowledged.

Material.—Two specimens from Hokkaido, GK. H5624, from Ikushumbets (Mikasa High School Collection), and IGPS. 35342, from Bibai (original material of SHIMIZU, 1926). The specimens from Futaba are also taken into consideration.

Specific characters.—The shell is moderately large, about 150 to 170 mm in diameter at the full grown-stage. It is evolute, about a quarter to one third of the inner whorl being embraced by the outer, although the immature shell may be less so. The umbilicus is wide in the middle to late growth-stages, ranging from 40 to 48 percent of the entire shell diameter.

The inner whorls are more or less depressed, broadest in the lower part and subrounded in cross-section, having inflated flanks, subrounded umbilical shoulders, rounded, gently sloping ventrolateral shoulders and a more or less broadly arched, weakly keeled venter. They are ornamented with considerably large, strong, mediolateral tubercles and thick ribs which extend from the umbilical margin to the lateral tubercles. On the ventrolateral part, which is overlapped by the outer whorl, there are in the earlier stages ventrolateral tubercles resting on weak scondary ribs which are bifurcated and projected from the lateral tubercles. They disappear at about the shell diameter of about 60 or 70 mm., when the faint extensions of the major ribs and the lirae are projected from the still strong lateral tubercles. Then, sooner or later, the lateral tubercles and the major ribs are weakened. At this stage the ventral keel remains as a blunt elevation.

In the adult stage, at about the shell diameter of 80 or 90 mm., there is a remarkable change in the shell-form and the ornament. The outer whorl, over that diameter, is higher than broad, having only gently convex, flattened, somewhat convergent flanks, low vertical or rather overhanging umbilical wall, abruptly rounded or rather subangular umbilical shoulder, indistinct, rounded ventrolateral shoulders and a gently arched or rather flattened venter. The faint keel is discernible on the earlier part of this stage but is sooner or later lost on the later part. The whorl is entirely smooth, without costae and tubercles. The lirae which may be discernible on the surface of the test are concave on the flank and gradually projected on the venter. The body-whorl is very long, occupying about an entire outer whorl or more.

The suture consists of E, L, U_2, U_3 (=S), U_1, and I. In the late growth-stage the elements are moderately deeply incised; L is as deep as or slightly deeper than E, longer than broad and rather irregularly subdivided; U_2 is much smaller than L; the first lateral saddle (between E and L) is narrowed at the stem and moderately deeply divided on the head; the second lateral saddle (between L and U_2), situated on the row of lateral tubercles, is rather massive, having a broad base.

Measurements.—

Specimen [Part]	Diameter	Umbilicus	Height	Breadth	B./H.
IGPS. 35342	163.0(1)	68.0(.42)	54.0(.33)	40.0(.25)	0.74
〃 [−1 vol.]	82.0(1)	27.1(.33)	32.3(.39)	31.9(.39)	0.99(ic)
〃 [−3/2 vol.]	—	—	23.0	23.5	1.02(ic)
〃 [〃 〃]	55.3(1)	16.8(.30)	21.2(.38)	28.6(.51)	1.34(c)
GK. H5624	80.0(1)	35.5(.44)	24.0(.30)	25.2(.31)	1.05(ic)
〃 [−1/4 vol.]	67.5(1)	29.5(.43)	23.0(.34)	29.0(.43)	1.26(ic)
〃 [〃 〃]	—	—	23.0(.34)	32.0(.47)	1.39(c)
Holotype	62.0(1)	26.0(.41)	22.0(.35)	26.0(.42)	1.18(ic)
GK. H5556	123.0(1)	59.4(.48)	39.6(.32)	31.6(.25)	0.8

Remarks.—One of the specimens from Hokkaido, GK. H5624, is very similar to the holotype from Futaba. Another example, IGPS. 35342, is less widely umbilicate than the holotype at the corresponding stage (with the diameter of about 80 mm.) and also somewhat less widely umbilicate than a similarly large example from Futaba (i.e. GK. H5556 described by MATSUMOTO et al., 1964) at the full-grown stage. These and other minor differences are regarded as variations in one and the same species. IGPS. 35342 is probably the specimen on which SHIMIZU (1926, p. 547) gave a remark.

Comparison.—*Yabeiceras orientale* most typically represents the general character of the genus *Yabeiceras*. It is so to speak on the average of the variability of *Yabeiceras*, from such a depressed and coarsely tuberclate species as *Y. menabense* to such a less inflated and predominantly costate species as *Y. ankinatsyense*.

As COLLIGNON (1965, p. 82) noticed, *Yabeiceras bituberculatum* COLLIGNON from Madagascar closely resembles *Y. orientale* from Japan. The distinction

is a smaller number of coarser lateral tubercles in the Madagascar species. More than 12 tubercles (or major ribs) are counted per whorl in the middle growth-stage (i.e. immediately preceding to the smooth last whorl) of *Y. orientale*, whereas about 9 or so in that of *Y. bituberculatum*. This difference is by no means great and the resemblance in other respects is so close that the subspecific separation could possibly be considered. This should be examined by comparing populations in the two regions.

Occurrence.—GK. H5624 came from the zone of *Inoceramus uwajimensis*, in the Kamisamata-zawa, a tributary of the upper reaches of the Ikushumbets (17 km point along the abandoned forestry railway); IGPS. 35342 was found in a calcareous nodule of dark green fine-sandy siltstone, as a pebble in the Bibai-gawa, east of Bibai coal-mine, together with *Inoceramus* cf. *uwajimensis*; both in the province of Ishikari, central Hokkaido.

The holotype and the hypotypes of MATSUMOTO et al. (1964) were found in nodular calcareous sandstone in the Lower Conglomerate Member of the Futaba Formation, in the upper reaches of the Sakura-zawa, Oriki, Futaba-gun, Fukushima Prefecture, i.e. the Pacific coast of Northeast Japan. *Inoceramus uwajimensis* occurs abundantly in the same member.

To sum up *Yabeiceras orientale* occurs in the zone of *Inoceramus uwajimensis*, i.e. the main part of the Lower Urakawa, Coniacian.

Genus *Harleites* REESIDE, 1932

Type-species.—*Barroisiceras* (*Harleites*) *harlei* DE GROSSOUVRE, 1894 (original designation).

Generic diagnosis.—The shell is rather small, much involute and compressed. The umbilicus is narrow and surrounded by low but steep umbilical wall. The whorl is much higher than broad, having flattened flanks and a narrow, fastigate venter with a sharp keel persisting throughout growth.

The shell is ornamented with weak, fine, more or less flexuous ribs, with bifurcated or inserted secondaries on the outer part of the flank. They tend to disappear in the last growth-stage. The umbilical tubercles at the end of the primary ribs may be distinct or indistinct (or almost undeveloped). Weak mediolateral tubercles may be discernible on the inner whorls and disappear on the outer whorl in some species, but may not be perceptible in other species. The ventrolateral and ventral clavi are numerous and comparatively distinct, persisting to the last stage.

The suture is of rather reduced type, consisting of massive saddle and less deeply incised lobes. The auxiliary elements may be apparently numerous owing to subdivision.

Remarks.—The following species are examples which are referable to *Harleites*:

H. harlei (DE GROSSOUVRE, 1894)
H. alstadenensis (SCHLÜTER, 1876)
H. castellensis (REESIDE, 1932)

H. brüggeni (BASSE, 1947)
H. byzacenicus (PERVINQUIÈRE, 1907)
H. manasoaensis (BASSE, 1947)
H. bentori PARNES, 1964

These species occur in the Coniacian strata. An example from Hokkaido, described below, is comparable to the first species, although it is incompletely preserved.

Comparison and affinity.—*Harleites* was established by FEESIDE (1932, p. 14) as a subgenus of *Barroisiceras*. REYMENT (1954, p. 268; 1955, p. 67) and WRIGHT (1957, p. L434) treated it as a subgenus of *Forresteria* and regarded *Alstadenites* REESIDE, 1932 [type-species *Ammonites alstadenensis* SCHLÜTER, 1876] as its synonym. PARNES (1964, p. 21) treated it as a distinct genus, because he took little account of the mediolateral tubercles.

I would not disregard the mediolateral tubercles in spite of their apparent variability. This and other characters suggest that *Harleites* is closely related to the compressed subgroup of *Forresteria*. However, the ornaments on the flank are so weakened in *Harleites* that the mediolateral tubercles remain only on the inner whorls of certain species. Apart from this character, *Harleites* can be distinguished from *Forresteria* in several other points. Namely it has much more involute shell, a narrower umbilicus, more compressed whorls, flattened flanks, a narrower venter, finer and weaker lateral ornaments, finer, more numerous and more persistent ventrolateral and ventral tubercles, and more reduced suture-lines.

Harleites is similar to *Solgerites* in the compressed shell and the weakened ornament, but the fastigate venter with numerous ventrolateral and ventral clavi is more persistent in *Harleites*.

Harleites sp. cf. *H. harlei* (DE GROSSOUVRE)

Pl. 43 [31], Fig. 2; Text-fig. 14

Compare.—

1894. *Barroisiceras haberfellneri* var. *harlei* DE GROSSOUVRE, *Mém. Expl. Carte Géol. Dét. France*, 1893, p. 56, pl. 2, figs. 2, 7, 8.
1894. *Barroisiceras haberfellneri* var. *alstadenensis*, DE GROSSOUVRE (*non* SCHLÜTER, 1876), *Ibid.*, p. 55, pl. 2, fig. 4.
1904. *Barroisiceras haberfellneri* var. *harlei*, SOLGER, *Beitr. Geol. Kamerun*, p. 172, figs. 58–61.
1932. *Barroisiceras* (*Harleites*) *harlei*, REESIDE, *U. S. Geol. Surv. Prof. Paper*, 170-B, p. 14.
1947. *Forresteria* (*Harleites*) *harlei*, BASSE, *Ann. Paléont.* vol. 33, p. 139 [43].

Material.—IGPS. 54745, a single, imperfectly preserved specimen from Gonosawa, Pombets.

Descriptive remarks.—The specimen shows the shell-form of *Harleites harlei* in its involute, fairly rapidly growing shell, consisting of compressed, high whorls with flattened, convergent flanks, subangular umbilical shoulders and a fastigate, narrow venter. It is not so compressed as the holotype (DE

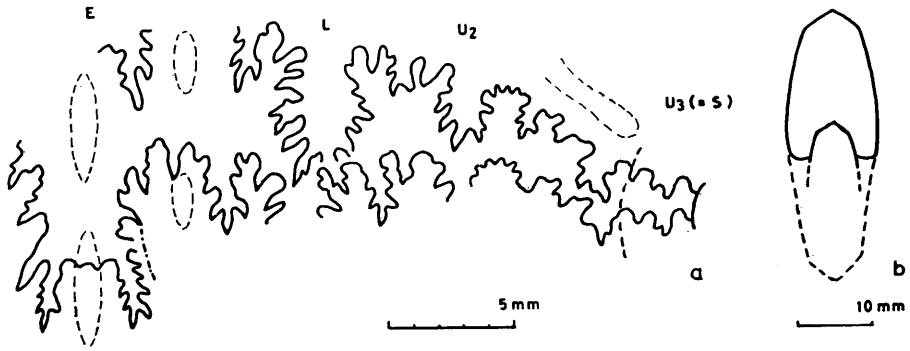


Fig. 14. *Harleites* sp. cf. *H. harlei* (DE GROSSOUVRE).

IGPS. 54745, from Gono-sawa [=Takino-sawa], Pombets. External sutures (a) at d=30 mm. and whorl section (b). (T. M. *delin.*)

GROSSOUVRE, 1894, pl. 2, fig. 2) of *Harleites harlei,* but is similar to the less compressed variety of *H. harlei,* exemplified by the specimen of DE GROSSOUVRE'S (1894) pl. 2, fig. 4.

The observable ornament is also within the variation of *H. harlei,* being similar to that of DE GROSSOUVRE'S (1894, pl. 2, fig. 7) "intermediate variety between var. *alstadenensis* and var. *harlei,*" but the mediolateral tubercles in the Hokkaido specimen are weaker than those of that specimen. The ventrolateral and ventral clavi are as distinct as in that French specimen.

DE GROSSOUVRE (1894) did not illustrate the suture of *H. harlei* itself. The last suture of the Hokkaido specimen shows rather massive lateral saddles, a moderately broad lateral lobes (L and U_2) and apparently numerous, descending auxiliaries. In the general aspects it is similar to, if not identical with, the illustrated suture of *Harleites castellensis* (REESIDE) (1932, pl. 6, fig. 5).

Measurements.—

	Diameter	Umbilicus	Height	Breadth	B./H.
IGPS. 54745	35.5(1)	6.3(.18)	19.8(.56)	13.1(.37)	0.66

Occurrence.—Gono-sawa [="Takinosawa"], Pombets, a tributary of the Ikushumbets, central Hokkaido, zone of *Inoceramus uwajimensis.* The specimen is coated by dark green matter as in other specimens of the same stream.

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The references cited in Part III are mostly listed in the bibliography in Part I. They are not repeated here. The following is a supplementary list of references which should be added to the bibliography. Two misprinted references in Part I are also included in the list, with amendment.

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Tatsuro MATSUMOTO

A Monograph of the Collignoniceratidae from Hokkaido
Part III

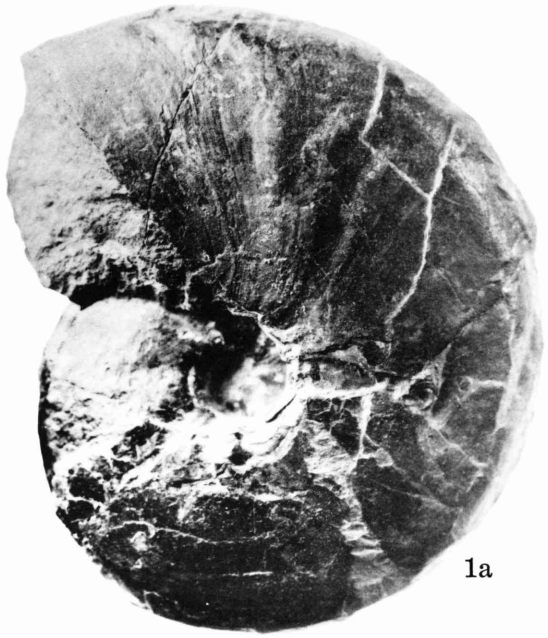
Plates 39 [27]~45 [33]

Kyushu University (I. HAYAMI) photos, without whitening,
unless otherwise stated.

Plate 39

Explanation of Plate 39 [27]

Fig. 1. *Barroisiceras* (*Basscoceras*) *inornatum* sp. nov. .....Page 303
Holotype, GK. H5460 [=MURAMOTO Coll. P5-6234], from Gono-sawa, Pombets, zone of *Inoceramus uwajimensis*, Upper Yezo Group, Ikushumbets area, Ishikari Province, central Hokkaido. Two lateral (a, b), ventral (c) and apertural views of an adult specimen, in natural size (×1).



1a

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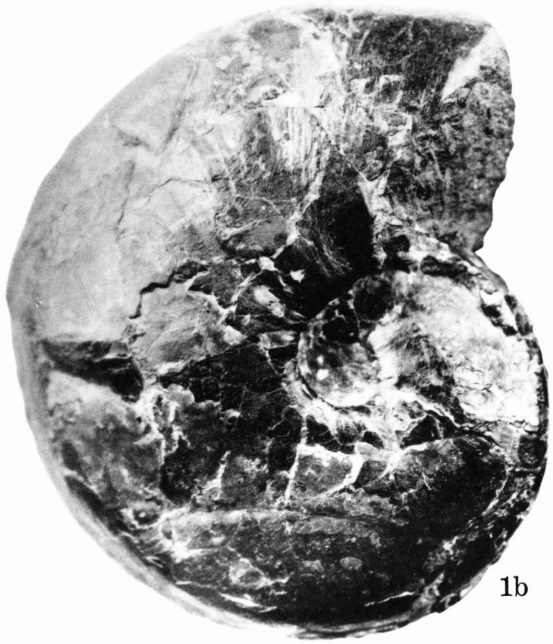


1b

1d

T. MATSUMOTO: Collignoniceratidae [Pl. 27]

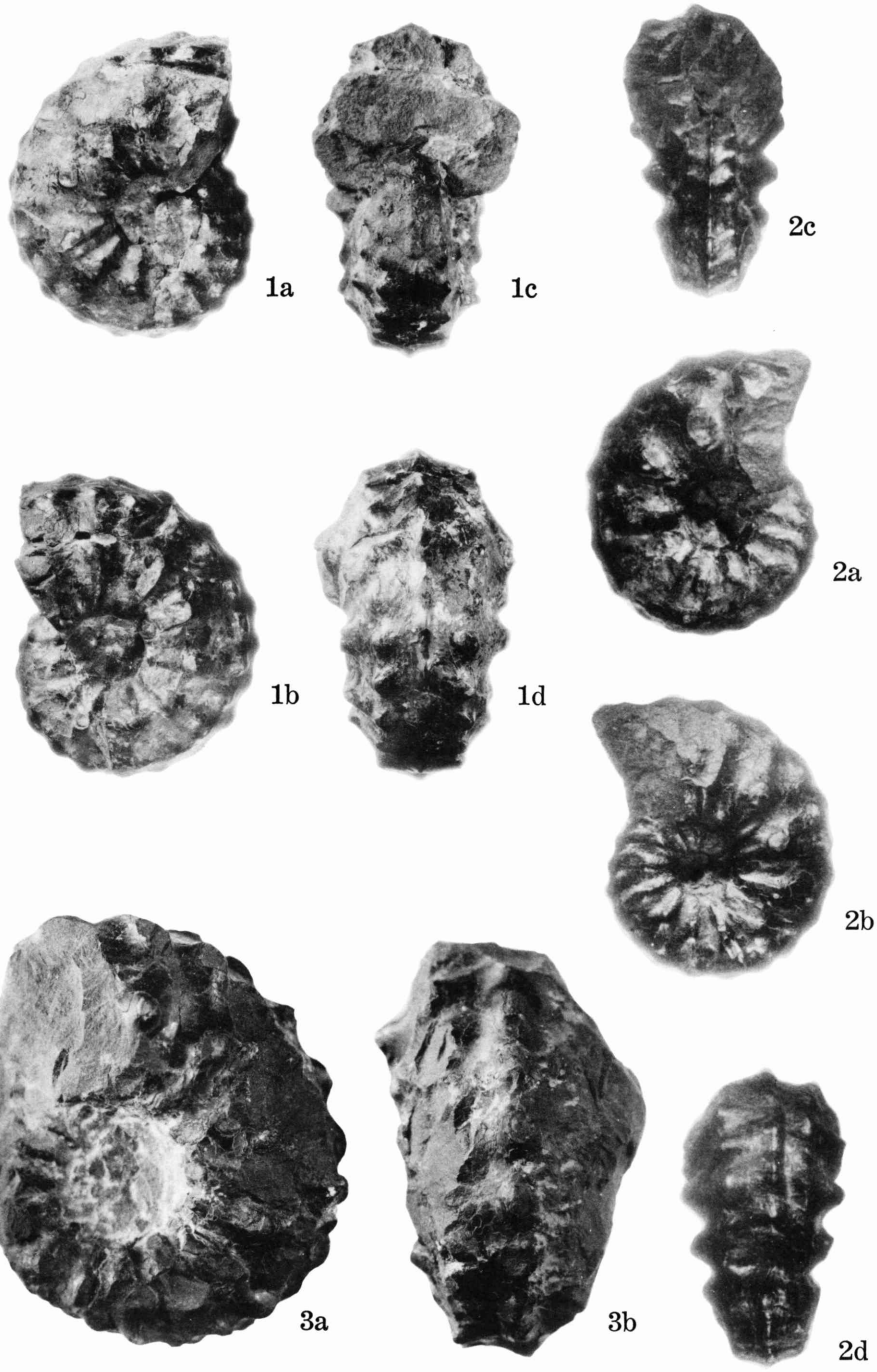
Plate 40

Explanation of Plate 40 [28]

Figs. 1–4. *Forresteria* (*Forresteria*) *alluaudi* (BOULE, LEMOINE and THEVENIN) ..... Page 308

1. GK. H5622, from loc. Ik 2119p, Gono-sawa, Pombets (H. KOKUBU Coll.). Two lateral (a, b), apertural (c) and ventral (d) views of a shell of the middle growth-stage, ×1.
2. GK. H5623, from loc. Ik 2147p, Gono-sawa, Pombets (T. TAKAHASHI Coll.). Two lateral (a, b), ventral (c) and apertural (d) views of an immature shell, ×1.5.
3. GK. H5464 [=T. MURAMOTO Coll. P5-2451], from Gono-sawa, Pombets. Lateral view of another immature specimen, ×1.5.
4. GK. H5442 [=T. MURAMOTO Coll. 2156], from Ik 2156, Gono-sawa, Pombets. Lateral (a) and ventral (b) views of a specimen of a late growth-stage, ×1.

All the figured specimens came from the zone of *Inoceramus uwajimensis*, Upper Yezo Group, Ikushumbets area, Ishikari Province, central Hokkaido.

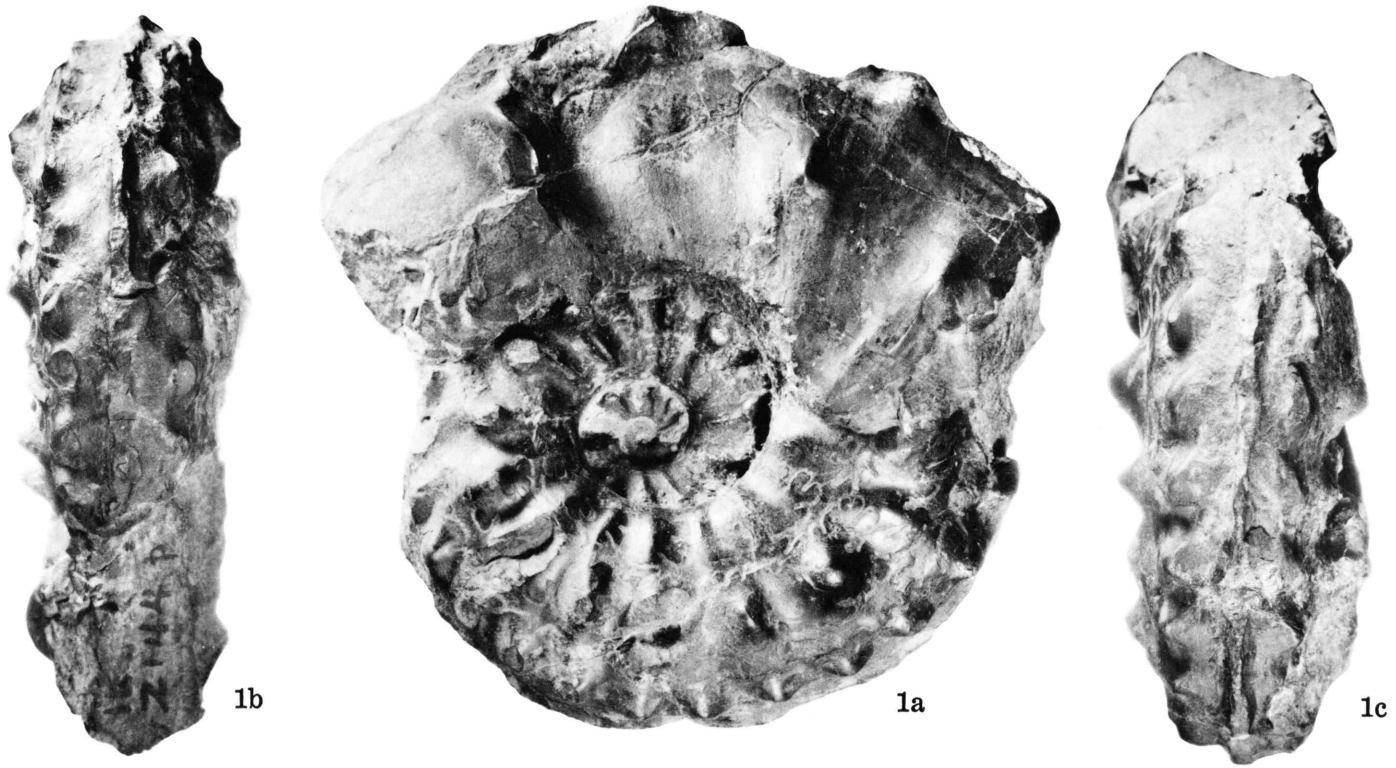


T. MATSUMOTO: Collignoniceratidae [Pl. 28]

Plate 41

Explanation of Plate 41 [29]

Fig. 1. *Forresteria* (*Forresteria*) *armata* sp. nov. .....Page 313
Holotype, GK. H5621, from loc. Ik 2144p, Gono-sawa, Pombets, zone of *Inoceramus uwajimensis*, Upper Yezo Group, Ikushumbets area, Ishikari Province, Hokkaido (Coll. T. TAKAHASHI). Lateral (a) and two ventral (b, c) views of an adult shell, ×1.



1b 1a 1c

T. MATSUMOTO: Collignoniceratidae [Pl. 29]

Plate 42

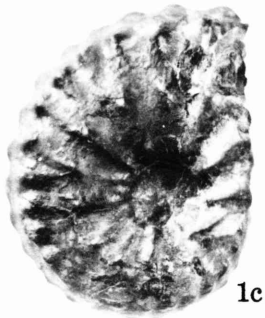
Explanation of Plate 42 [30]

Figs. 1–2. *Forresteria* (*Muramotoa*) *yezoensis* sp. nov. .....Page 317

1. Paratype, GK. H5463, from Gono-sawa, Pombets, zone of *Inoceramus uwajimensis*, Upper Yezo Group, Ikushumbets area, Ishikari Province, central Hokkaido (Coll. T. MURAMOTO). Two lateral (a, b) and ventral (c) views of an immature specimen, enlarged, ×2.2.
2. Holotype, GK. H5462, from loc. Ik 2155 p1, Gono-sawa, Pombets, zone of *Inoceramus uwajimensis*, Upper Yezo Group, Ikushumbets area, Ishikari Province, central Hokkaido (Coll. T. MURAMOTO). Two lateral (a, b), ventral (c) and apertural (d) views of an adult shell, ×1.


1a


1b


1c


2a


2c


2d


2b

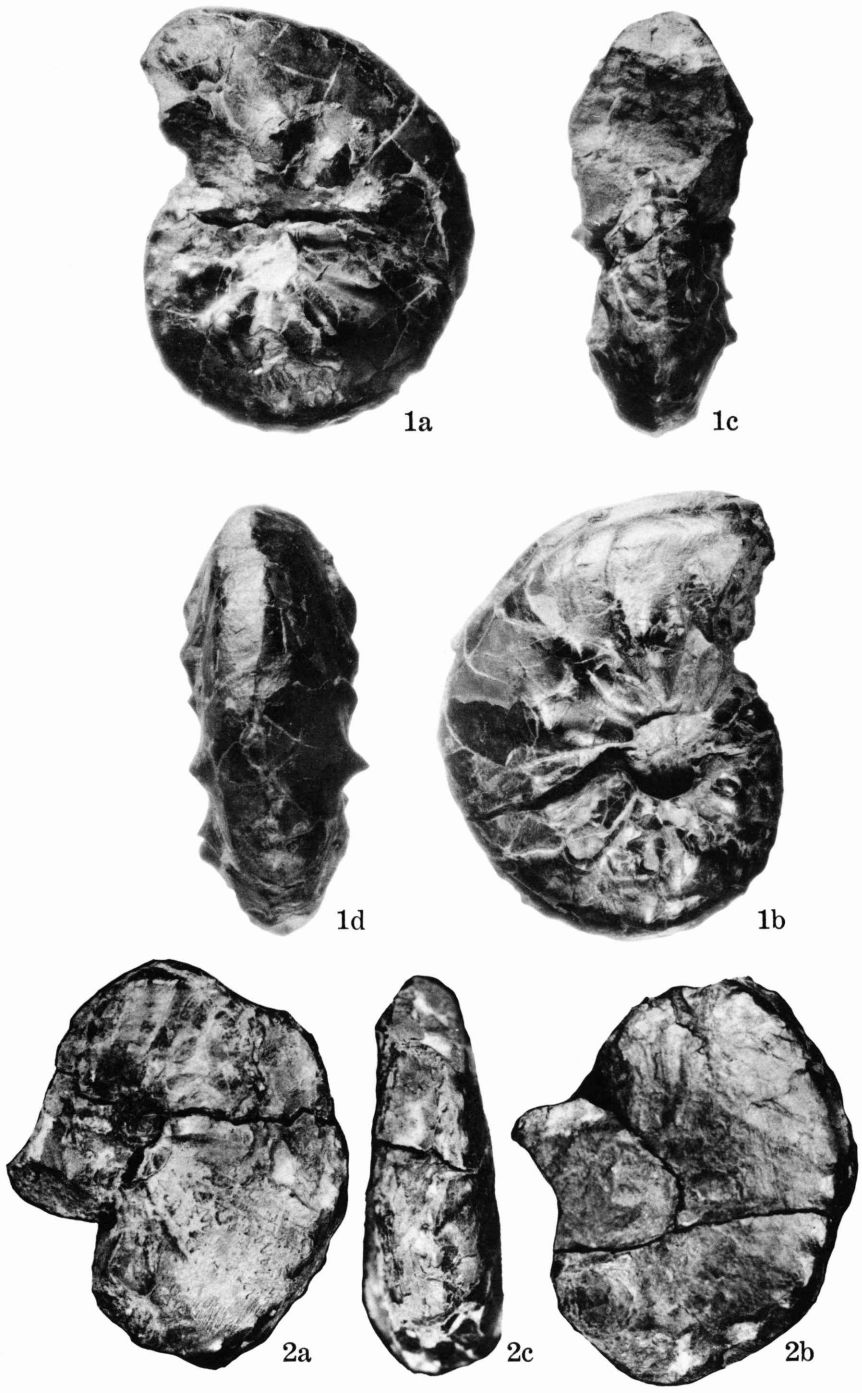
T. MATSUMOTO: Collignoniceratidae [Pl. 30]

Plate 43

Explanation of Plate 43 [31]

Fig. 1. *Forresteria* (*Muramotoa*) *muramotoi* sp. nov. .....Page 320
Holotype, GK. H5620, from loc. Ik 2150p, Gono-sawa, Pombets, zone of *Inoceramus uwajimensis*, Upper Yezo Group, Ikushumbets area, Ishikari Province, central Hokkaido (T. MURAMOTO Coll.). Two lateral (a, b), apertural (c) and ventral (d) views of a probably adult shell, ×1.

Fig. 2. *Harleites* sp. cf. *H. harlei* (DE GROSSOUVRE) .....Page 328
IGPS. 54745, from "Takino-sawa" [=Gono-sawa], Pombets, a tributary of the Ikushumbets, Ishikari Province, central Hokkaido (Tohoku Univ. Coll.). Two lateral (a, b) and ventral (c) (upside down) views of a defective specimen, ×1.5. (Tohoku University photos.)



T. MATSUMOTO: Collignoniceratidae [Pl. 31]

Plate 44

Explanation of Plate 44 [32]

Figs. 1–2. *Yabeiceras orientale* TOKUNAGA and SHIMIZU .....Page 324

1. GK. H5624, from Kamisamata-zawa, a tributary of the upper reaches of the Ikushumbets, near the 17 km. point, zone of *Inoceramus uwajimensis,* Upper Yezo Group, Ikushumbets area, Ishikari Province, central Hokkaido (collected by NAITO, a student of Mikasa High School). Lateral (a) and ventral (b) views, of a probably adult, but small, specimen, ×1.
2. IGPS. 35342, from a pebble in the Bibai, about 8 km. north of Ikushumbets, Ishikari Province, central Hokkaido (Tohoku University Coll.). Lateral view of an adult specimen, ×0.9. See Pl. 45 [33] for other views. (Tohoku University photos.)

1a

1b

2

T. MATSUMOTO: Collignoniceratidae [Pl. 32]

Plate 45

Explanation of Plate 45 [33]

Fig. 1. *Yabeiceras orientale* TOKUNAGA and SHIMIZU .....Page 324
IGPS. 35342, from a pebble in the Bibai, about 8 km. north of Ikushumbets, Ishikari Province, central Hokkaido (Tohoku University Collection). Lateral (a), ventral (b) and apertural (c) views of an adult specimen, ×0.9. See Pl. 44 [32], Fig. 2 for another view. (Tohoku University photos.)

1b

1a

1c

T. MATSUMOTO: Collignoniceratidae [Pl. 33]