

9. Notes on Two Cretaceous Ammonites from the Tomochi Formation of Kyushu*

Tatsuro MATSUMOTO, Kametoshi KANMERA
and Hidehiko SAKAMOTO

Contribution from the Department of Geology, Kyushu University

[With Plate II]

Introduction

Some Mollusca have been found from the Cretaceous Tomochi Formation, Kyushu. This paper gives a concise stratigraphic note on the fossiliferous formation, descriptions of two selected ammonites, and comments on the age of the Tomochi Formation. As an appendix remarks are given on some bivalves by Itaru HAYAMI.

Note on Stratigraphy

The Tomochi Formation is a unit of Cretaceous deposits exposed in a mountainous area to the south of Tomochi, about 30 km. northeast of Yatsushiro city, Kumamoto Prefecture (Fig. 1). It is distributed in a narrow belt, about 500 to 1200 m in breadth, of NEE-SWW trend, on the south side of a major fault, called the Usuki-Yatsushiro tectonic line, in contact with the metamorphics of the Upper Palaeozoic Ryuhozan Group. It rests unconformably on, and is in part in fault contact with, another Mesozoic formation and an unnamed Permian formation in the south.

On the north side of the Usuki-Yatsushiro tectonic line there is a valley of the Midori-kawa, which is mainly covered with the Aso welded tuff. To this main valley run several tributaries from the southern mountains, where the sequence of the Cretaceous strata is well observable. Fig. 2 shows the measured stratigraphic sections of the Tomochi Formation along the three selected tributaries, Tsubaki (A), Abe (B) and Kashiwa-gawa (C).

For some reasons the formation is thickened eastward, being estimated at about 400 m in the section of A and 820 m in that of C. The strata show the general trend of N80°E, incline northward with angles of 60° to 85° in the main part of the belt, and show minor folding in the northernmost part.

The Tomochi Formation is stratigraphically tripartite as follows:

- (a) Lower member (180 m, in the section of C)—Basal conglomerate, about 80 m., followed by sandstone and then black, fine-sandy siltstone. Ammo-

* Received April 22, 1968. Present address of H. SAKAMOTO: the Meiji Consultants Co., Kyushu Office, Fukuoka.

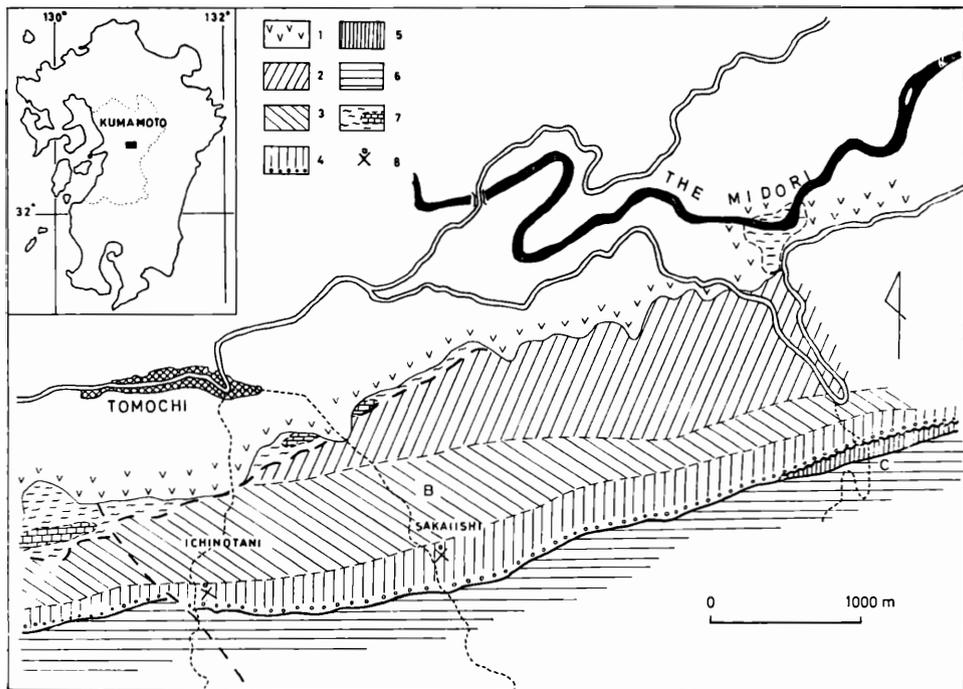


Fig. 1. Geological map of the Tomochi area, showing the localities of the described ammonites.

1: Aso welded tuff (Quaternary), 2-4: Tomochi Formation, upper, middle and lower members, 5: unnamed, pre-Tomochi shale, 6: unnamed Permian formation, 7: Ryuhozan Metamorphic Group (Upper Palaeozoic), containing limestone, 8: locality of fossils. B: Abe, C: Kashiwagawa.

Map of Kyushu (upper left) indicates with a black rectangle the location of Tomochi.

nites are embedded in the lower part of the siltstone.

- (b) Middle member (380 m)—Basal pebbly sandstone, about 70 m, succeeded by a unit of black shale and sandy shale, about 150 m, and then by another unit, 160 m or so, of alternating sandstone and shale, in which medium-grained sandstone is predominant over shale.
- (c) Upper member (260 m +)—Coarse- to medium-grained, massive sandstone, with several layers of black shale, in the main part; alternating medium-grained sandstone and black fine-sandy shale in the upper 40 m.

The three members form a conformable series, but the upper limit is unknown because of the great faulting in the north.

The siltstone in the lower member is fossiliferous, containing some ammonites and other molluscs. Although the fossils are more or less incompletely preserved, the selected two interesting ammonites are described below. Some crushed ammonites and other molluscs are also contained in the middle member, awaiting further careful collecting.

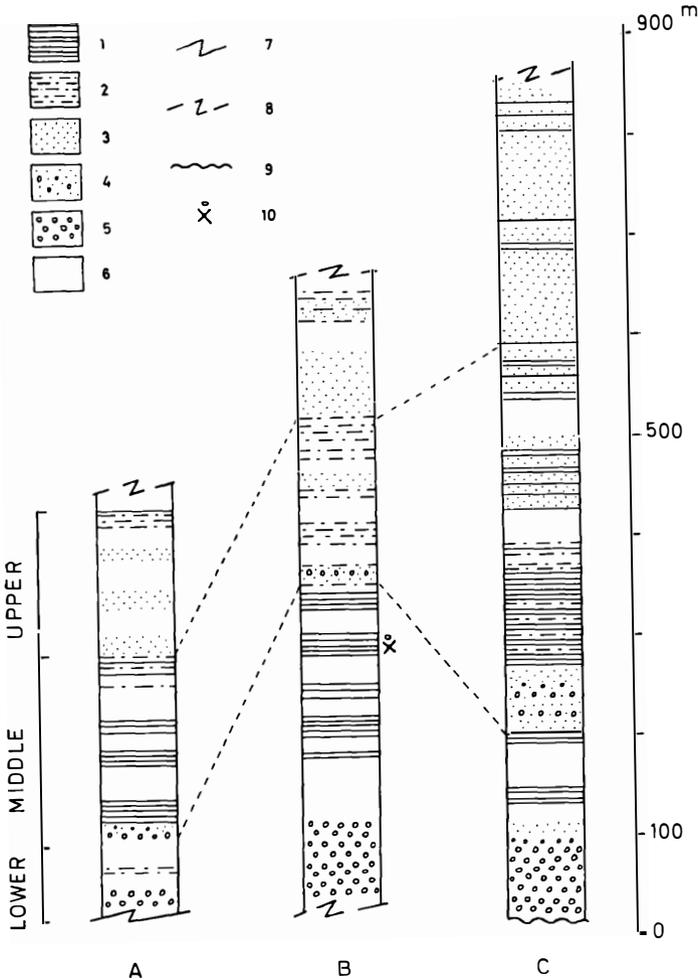


Fig. 2. Stratigraphic sections of the Tomochi Formation at three localities, A: Tsubaki (about 6 km west of B, outside the map in Fig. 1), B: Abe, C: Kashiwagawa.

1: shale or siltstone, 2: sandy shale, 3: sandstone, 4: pebbly sandstone, 5: conglomerate, 6: unexposed rock, 7: fault (exposed), 8: fault (presumed or unexposed), 9: unconformity, 10: ammonite locality.

Palaeontological Descriptions

(by Tatsuuro MATSUMOTO)

Order Ammonoidea

Family Parahoplitidae SPATH, 1922

Genus *Diadochoceras* HYATT, 1900

Type-species.—*Ammonites nodosocostatus* D'ORBIGNY, 1841, from the Upper Aptian ("Clansayes" horizon) of France, by original designation.

Remarks.—I follow here CASEY (1961, p. 193; 1965, p. 416) in assigning *Diadochoceras* to the subfamily Acanthohoplitinae of the Parahoplitidae.

This genus has recently been reviewed by MIKHAILOVA (1963), who has illustrated the ontogenetic development of several species.

Diadochoceras sp. cf. *D. nodosocostatiforme* (SHIMIZU)

Pl. II, Fig. 1

Compare.—

1931. *Douvilleiceras nodosocostatiforme*, SHIMIZU, *Sci. Rep. Tohoku Imp. Univ.*, 2nd Ser., 15, (1), p. 35, pl. 1, figs. 6-7.
 1959. *Diadochoceras nodosocostatiforme*, MATSUMOTO, *Mem. Fac. Sci., Kyushu Univ.*, Ser. D, 9, (2), pl. 8 (indicated only).
 1968. *Diadochoceras nodosocostatiforme*, HANAI et al., *Mem. Nat. Sci. Museum*, 1 (1), pl. 4, fig. 7.

Material.—GK. H6903, from loc. Km. 4079B, Ichinotani (Coll. K. KANMERA), internal and external moulds.

Description.—This is a small deformed specimen, about 25 mm. in diameter, in which the last half whorl is unseptate. The shell is less involute and has an umbilicus of moderate size. The whorl seems to be subrounded in costal section, although the proportion of breadth to height cannot be accurately measured owing to the secondary compression.

Radial ribs are simple, consisting of primaries and secondaries. The primary ribs are moderately strong, 12 or 13 in number on the last volution, much separated, and provided with tubercles in three rows. One to three, narrower secondaries are seen on each interspace. They are distinct in earlier growth-stages, but weakened as the shell grows and very faint or absent on the main part of the body-whorl. The umbilical tubercles are elongated radially and highest somewhat above the umbilical margin. The inner ventrolateral tubercles are pointed, of moderate intensity and situated somewhat above the middle of the flank. The outer ventrolateral tubercles are the largest and somewhat clavate, especially so on the body-whorl. The major ribs are broadened on the ventral half of the whorl, passing across the venter with some flattening. Thus, the tubercles are predominant over the ribs on the outer part of the whorl.

The suture is rather simple in this small shell, having shallow minor incisions in both saddles and lobes. It is unfortunately incompletely preserved.

Remarks.—The above described characters strongly suggest the probable identity of this specimen with the holotype and other examples* of *Diadochoceras nodosocostatiforme* (SHIMIZU, 1931), from the Hiraiga Formation of the Miyako Group on the Pacific side of northeast Japan (see HANAI et al., 1968), although the deformed condition prevents us from the definite conclusion of the identity.

* I thank Dr. Ikuwo OBATA who showed me the specimens.

D. nodosocostatiforme is closely allied to *D. nodosocostatum* (D'ORBIGNY) (1841, p. 258, pl. 75, figs. 1-4), from the "Clansayes" horizon of France, but is distinguished in having larger and more clavate, outer ventrolateral tubercles and bullate umbilical ones. The secondary ribs fade away on the body whorl of our species, while they persist in the French one.

Occurrence.—Loc. Km. 4079B of K. KANMERA, Ichinotani, about 1500 m south from the street of Tomochi, Shimomashiki-gun, Kumamoto Prefecture, in the siltstone of the lower member of the Tomochi Formation.

Family Douvilleiceratidae PARONA and BONARELLI, 1897

Genus *Eodouvilleiceras* CASEY, 1961

Type-species.—*Douvilleiceras horridum* RIEDEL, 1937, from the uppermost Aptian of Colombia (original designation).

Remarks.—CASEY (1961, p. 191, footnote) gave a concise generic diagnosis as follows:

"Douvilleiceratinae with the simple ribbing and mammilliform ventral tubercles of *Douvilleiceras* but with tubercles undivided until advanced stage of growth."

In addition to the type-species *Douvilleiceras santafecinum* BURCKHARDT, 1925, from the uppermost Aptian of South America, *Douvilleiceras clansayense* JACOB, 1905, from the "Clansayes" horizon of France, and *Epicheloniceras badkhyzicum* URMANOVA, 1962, from the Upper Aptian of Turkmenia, have been referred to *Eodouvilleiceras* by CASEY (1961, 1962). CASEY, furthermore, expects probable examples of this genus occurring in the Aptian of Venezuela and California.

The ammonite from the Tomochi Formation, Japan, is, in my identification, another example of *Eodouvilleiceras*.

Eodouvilleiceras n. sp. (?)

aff. *E. horridum* (RIEDEL)

Pl. II, Fig. 2

Compare.—

1937. *Douvilleiceras horridum*, RIEDEL, *Estudios geol. y paleont. sobre la Cordillera Oriental de Colombia*, pt. 2, p. 27, pl. 6, figs. 1, 2; pl. 14, fig. 11.

Material.—GK. H6904, from loc. Km. 4043B, Sakaiishi, Abe (Coll. H. SAKAMOTO), internal and external moulds.

Description.—The inner whorls are highly weathered and only a fragmentary outer whorl deserves observation. The whorl is broader than high, 19.5 mm broad and 13.4 mm high, and depressed in section with a broadly rounded venter, inflated flanks, abruptly rounded umbilical shoulder and deep umbilical wall. The umbilicus is probably moderately broad, though not

exactly measured. The shell seems to be rather evolute.

The ribs are simple, rectiradiate, almost equally long, moderately strong, rather narrow on the flank, separated by slightly broader interspaces, and somewhat broadened on the venter which they cross without interruption. They are fairly numerous, about 5 in the distance of the whorl-height on the venter. The tubercles at the umbilical shoulder are small and bullate, those at the middle of the flank moderately strong, and those on either side of the median zone of venter the largest, elongated radially, and becoming double in the late growth-stage, with the outer one more elevated than the inner. A few striae may be discernible on the interspaces of the ribs.

Sutures are not clearly exposed.

Remarks.—The described specimen resembles the illustrated specimen (holotype by monotypy) of *Eodouvilleiceras horridum* (RIEDEL) (1937, p. 29, pl. 6, figs. 1, 2; pl. 14, fig. 11), from the Upper Aptian of Colombia in the shell-form and the general configuration of ornaments. It is distinguished by its more crowded ribs which are somewhat lowered on the venter. Although the extent of variation of the Andean species is not precisely known, the holotype has stronger, more distant ribs which are separated by much wider interspaces. Our specimen may represent a distinct species, but it is so fragmentary that the proposal of a new name is refrained.

Epicheloniceras badkhyzicum URMANOVA (1962, p. 76, text-figs. 1, 2), from the Upper Aptian of Turkmenia, seems to be indistinguishable from *Eodouvilleiceras horridum* (RIEDEL), although the author did not compare the Turkmenian specimens with the Andean one. Our specimen is distinguished from it by less distant and narrower ribs.

In the comparatively less distant and narrower ribbing the described specimen from Tomochi resembles the holotype of *Eodouvilleiceras santafecinum* (BURCKHARDT) (1925, p. 26) [= *Douvilleiceras stoliczkanum*, R. DOUVILLÉ, 1905, pl. 1, fig. 2 only, *non* GABB], from the Upper Aptian of Colombia. The latter has less depressed whorl, with a more rounded intercostal section. Furthermore, in *E. santafecinum*, with which *Cheloniceras boulei* BASSE (1928, p. 139, pl. 8, fig. 4) is synonymized by CASEY (1961), the undivided condition of the ventral tubercles persist for a longer period than in the species from Japan.

Occurrence.—Loc. Km. 4043B, Sakaiishi of Abe, about 1700 m southeast from the street of Tomochi, Shimomashiki-gun, Kumamoto Prefecture, in the siltstone of the lower member of the Tomochi Formation.

Age of the Tomochi Formation

The Tomochi Formation was previously referred to the Gyliakian (Cenomanian-Turonian) for the reasons of stratigraphic relation, lithologic similarity to certain formations, and faunal assemblage (MATSUMOTO and KANMERA, 1952; MATSUMOTO, 1954). Now this conclusion is not tenable, because the

described two ammonites indicate an Upper Aptian age for the fossiliferous lower part of the Tomochi Formation in the type area.

On account of the homoeomorphic similarity, *Diadochoceras* cf. *nodosocostatiforme* described in this paper was previously misidentified with some acanthoceratid (*Mantelliceras* or *Watinoceras*) and associated, crushed ammonites were tentatively referred to *Marshallites* or primitive *Kossmaticeras*. Indeed the latter specimens are so strongly crushed that their precise identification is difficult, but they seem to be better referred to *Hulenites*, since the umbilical tubercles are not so distinctly developed as in the Upper Cretaceous *Kossmaticeratids*. Examples of *Hulenites* occur in the Upper Aptian Miyako Group of northeast Japan as does *D. nodosocostatiforme* (see HANAI et al., 1968). *Eodouvilleiceras* aff. *horridum* is of recent discovery which was not known in the previous work.

Diadochoceras and *Eodouvilleiceras* are good guide genera indicating the uppermost Aptian. Although the described specimens are defective in preservation, the ammonite bearing siltstone of the lower member of the Tomochi Formation is probably the uppermost Aptian. How far the middle and upper members go up in the Albian is not decided by the available evidence. Although poorly preserved anisoceratid ammonites occur in the shale of the middle member, more and better preserved ammonites are needed for final determination of the age of the Tomochi Formation. Dr. M. TAMURA and his students, who are undertaking field work in the area, have informed us that they are collecting more fossils.

In regard to the bivalvian fossils Dr. Itaru HAYAMI has kindly identified some of our collections as listed in the Appendix. To cite from it the bivalvian faunule suggests the Lower Cretaceous rather than the Upper.

A question arises as to the stratigraphic relation. The Tomochi Formation was considered as extending southwestward to the Miyaji area, immediately south of the city of Yatsushiro, where conglomerate and sandstone predominate. The sandstone contains, among others, trigonians and glycymeridids. The conglomerate unconformably lies on the Albian Yatsushiro Formation. This was one of the reasons why the Tomochi Formation was referred to the Gyliakian. A series of strata in the Miyaji area may indeed be Gyliakian and should be separated as another formation. But its relation to the type Tomochi Formation is still questionable and should be resolved by further field work. The relation of the Tomochi Formation with the Hinagu Formation is another question to be settled. The Hinagu Formation, which is unconformably overlain by the Yatsushiro Formation in the area of the Kuma River, could either be entirely older than or in part synchronous with the Tomochi. Further collecting of the fossils may give a key to resolve the question.

Appendix

Notes on the Cretaceous Bivalves from the
Tomochi Formation of Kyushu

(by Itaru HAYAMI)

Some fossil bivalves have been known to occur in the lower member of the Tomochi Formation in the type area (MATSUMOTO, 1954 ed., pp. 117-118). When I studied collectively the Lower Cretaceous marine bivalves of Japan, the collection was not taken into consideration, simply because at that time the Tomochi Formation was assigned to the Gyliakian (Cenomanian-Turonian) series. Recently some ammonites indicating an uppermost Aptian age have been discovered from the same member. At the suggestion of Prof. T. MATSUMOTO I re-examined the bivalvian fossils from the type Tomochi Formation on the basis of the collection of the Kyushu University, which was primarily made by Dr. K. KANMERA and subsequently amplified by some other students including myself. As a result nine species listed in Table 1 have been identified. The register numbers at Kyushu University and the localities of the examined specimens are recorded in the same table as a basic information. Some selected specimens are illustrated in this paper (Pl. II, Figs. 3-8).

Table 1. List of fossil bivalves from the lower member of the Tomochi Formation.

Species	Specimens	Locality
<i>Solemya (Acharax)</i> sp.	GK. H6866	Km. 2724
<i>Palaeoneilo</i> n. sp.	GK. H6867	Km. 4080A
<i>Mesosaccella</i> sp.	GK. H6868	Km. 4080A
<i>Nanonavis (Nanonavis) yokoyamai</i> (YABE and NAGAO)	GK. H6869-GK. H6872	Km. 4080A
Chlamydiae gen. and sp. indet.	GK. H6873	Km. 4078B
<i>Variamussium</i> sp. cf. <i>V. kimurai</i> HAYAMI	GK. H6874	F02105
<i>Plicatula kiiensis</i> HAYAMI	GK. H6875-GK. H6879	Km. 4080A
Limidae gen. and sp. indet.	GK. H6880	Km. 4080A
Lucinidae gen. and sp. indet.	GK. H6881	Km. 4080 (boulder)

Locality guide

Km. 4080A: Dark grey siltstone immediately above Km. 4079B, left bank of the stream, at Ichinotani, 1.5 km south of Tomochi town, Kumamoto Pref.

Km. 4078B: Ditto (same level as 4080A, right bank of the same stream).

Km. 2724: Dark grey silty shale at the river bank of Hikawa, west of Washoji, Izumi-mura, about 8.5 km SWW of Ichinotani, Kumamoto Pref.

A specimen in the present collection (Pl. II, Fig. 4) probably represents a new species of *Palaeoneilo*, but I refrain from giving its full description until more material is assembled.

Other specimens are identified with the previously described species or too poorly preserved for accurate specific identification. *Nanonavis* (*Nanonavis*) *yokoyamai* and *Plicatula kiiensis* are represented by specimens of relatively good preservation. The four specimens of the former species, which show a sharp posterior carina, are quite similar to the described specimens from the Ishido Formation of the Sanchu area and the Yatsushiro Formation of the Kuma area (HAYAMI, 1965, p. 238, pl. 27, figs. 8-13). They are clearly distinguishable from the specimens of *Nanonavis* (*Nanonavis*) *sachalinensis* (SCHMIDT) (see NAGAO, 1932, p. 31, pl. 6, figs. 1-5), a common species in the Upper Cretaceous of Japan. The present specimens of *Plicatula kiiensis* have somewhat weaker surface ornamentation than the holotype of this species from the Arita Formation of the Yuasa area (HAYAMI, 1965, p. 322, pl. 46, fig. 7), but they are probably conspecific, because the intraspecific variation of *Plicatula* is generally wide.

So far as I am aware, the stratigraphic distribution of *Nanonavis* (*Nanonavis*) *yokoyamai* and *Plicatula kiiensis* is restricted to the Aritan (upper Neocomian-lower Aptian) and the Miyakoan proper (upper Aptian-Albian) (HAYAMI, 1966, pp. 197-199). *Variamussium kimurai* is also regarded as a Lower Cretaceous species. On the other hand no Upper Cretaceous element has been found in the examined bivalvian specimens from the lower member of the type Tomochi Formation. This evidence seems to agree well with the age consideration of the Tomochi Formation which has been made above by MATSUMOTO and others on the basis of ammonites.

References Cited

- BASSE, Éliane (1928): Quelques invertébrés créacés de la Cordillère Andine. *Bull. Soc. Géol. France*, [4], 28, 113-148, pls. 7-8.
- BURCKHARDT, Carlos (1925): Faunas del Aptiano de Nazas (Durango). *Inst. Geol. Mexico, Bol.*, 45, 1-71, pls. 1-10, 1 folded table.
- CASEY, Raymond (1961): A monograph of the Ammonoidea of the Lower Greensand. Part III. *Palaeontogr. Soc.*, 1961, 119-216, pls. 26-35.
- (1965): A monograph of the Ammonoidea of the Lower Greensand. Part IV. *Ibid.*, 1965, 399-546, pls. 67-90.
- DOUVILLÉ, Robert (1906): Sur des ammonites du Crétacé Sud-Américain. *Ann. Soc. Roy. Zool. Malac. Belgique*, 41, 142-155, pls. 1-4.
- HANAI, Tetsuro, OBATA, Ikuwo and HAYAMI, Itaru (1968): Notes on the Cretaceous Miyako Group. *Mem. Nat. Sci. Museum*, 1, 20-28, pls. 1-4 (in Japanese with English abstract).
- HAYAMI, Itaru (1965-66): Lower Cretaceous marine pelecypods of Japan. Parts I, III. *Mem. Fac. Sci., Kyushu Univ.*, [D], 15, (2), 221-349, pls. 27-52 (Part I) (1965); 17, (3), 151-249, pls. 22-26 (Part III) (1966).
- HYATT, Alpheus (1900): Cephalopoda. In ZITTEL's *Textbook of Palaeontology*, 1st English edition (EASTMAN), 502-604, London.
- JACOB, Charles (1905): Etudes sur les ammonites et sur l'horizon stratigraphique du gisement de Clansayes. *Bull. Soc. Géol. France*, [4], 5, 399-432, pls. 12-13.
- MATSUMOTO, Tatsuro [Editor] (1954): *The Cretaceous System in the Japanese Islands*,

- 324 p., 36 pls., Japan Soc. Promotion Sci., Tokyo.
- (1959): Zonation of the Upper Cretaceous in Japan. *Mem. Fac. Sci., Kyushu Univ.*, [D], 9, 2, 55-93, pls. 6-11.
- MATSUMOTO, Tatsuro and KANMERA, Kametoshi (1952): *Lower Valley of the Kuma. Guidebook to the Geol. Excursion*, 1-71, pls. 1-6, Dept. Geol. Kyushu Univ., Fukuoka (in Japanese).
- MIKHAILOVA, I. A. (1963): On the systematic position and scope of the genus *Diadochoceras*. *Paleont. Zhurnal*, 1963, (3), 65-77 (in Russian).
- NAGAO, Takumi (1932): Some Cretaceous mollusca from Japanese Saghalin and Hokkaido (Lamellibranchiata and Gastropoda). *Jour. Fac. Sci., Hokkaido Univ.*, [4], 2, (1), 23-50, pls. 5-8.
- ORBIGNY, Alcide D' (1840-42): *Paléontologie Française, Terrains Crétacés, Cephalopoda*, 662 p., 148 pls. (p. 1-120, 1840; p. 131-430, 1841; p. 431-662, 1842), Paris.
- RIEDEL, L. (1937): Amonitas del cretácico inferior de la Cordillera Oriental. *Estudios geol. y paleont. sobre la Cordillera Oriental de Colombia*, pt. 2, 7-80, pls. 3-14, Depart. Minas y Petról. Min. de Indus y Trab. Rep. Colombia.
- SHIMIZU, Saburo (1931): The marine Lower Cretaceous deposits of Japan, with special reference to the ammonites-bearing zones. *Sci. Rep., Tohoku Imp. Univ.*, [2], 15, (1), 1-40, pls. 1-4.
- URMANOVA, S. Kh. (1962): On a species of ammonite from the Lower Cretaceous deposits of Badkhyz, Turkmenia, U. S. S. R. *Paleont. Zhurnal*, 1962, (2), 76-79 (in Russia).

Alphabetic list of place-name, with Japanese letter (Kanji)

Abe	安部	Ryuzoan	竜峯山
Hinagu	日奈久	Sakaiishi	境石
Hiraigu	平井賀	Shimomashiki-gun	下益城郡
Hikawa	氷川	Tomochi	砥用
Ichinotani	一の谷	Tsubaki	椿
Izumi-mura	和泉村	Usuki	白杵
Midori-kawa	緑川	Washoji	和小路
Miyaji	宮地	Yatsushiro	八代
Miyako	宮古		

Explanation of Plate II

- Fig. 1. *Diadochoceras* sp. cf. *D. nodosocostatiforme* (SHIMIZU). Lateral view of the internal mould (a) and that of a rubber model taken from the external mould (b), $\times 1.5$, of GK.H6903, from loc. Km. 4079B, Ichinotani (Coll. K. KANMERA).
- Fig. 2. *Eodouvilleiceras* n. sp. (?) aff. *E. horridum* (RIEDEL). Ventral (a), two lateral (b, c), and frontal (d) views, $\times 1.5$, of a fragmentary specimen, GK.H6994, from Sakaiishi, Abe (Coll. H. SAKAMOTO).
- Fig. 3. *Solemya (Acharax)* sp. Internal mould of a right valve, $\times 1.5$, GK.H6866, from loc. Km.2724, Washoji (Coll. I. HAYAMI et al.).
- Fig. 4. *Palaeoneilo* n. sp. Internal mould of a right valve (a), its rubber model (b) and rubber model taken from the external mould (c), $\times 1.5$, GK.H6867, from loc. Km.4080A, Ichinotani (Coll. K. KANMERA).
- Fig. 5. *Variamussium* sp. cf. *V. kimurai* HAYAMI. External mould of a left valve, $\times 1.5$, GK.H6874, from loc. Km.2724, Washoji (Coll. I. HAYAMI et al.).
- Fig. 6. *Nanonavis (Nanonavis) yokoyamai* (YABE and NAGAO). Rubber model taken from the external mould of a left valve, $\times 1.5$, GK.H6869, from loc. Km.4080A, Ichinotani (Coll. K. KANMERA).
- Fig. 7. *Plicatula kiiensis* HAYAMI. External mould of a right valve (a) and its rubber model (b), $\times 1.5$, GK.H6875, from loc. Km.4080A, Ichinotani (Coll. K. KANMERA).
- Fig. 8. *Plicatula kiiensis* HAYAMI. Rubber model taken from the external mould of a right valve, $\times 1.5$, GK.K6876, from the same locality (Coll. K. KANMERA).

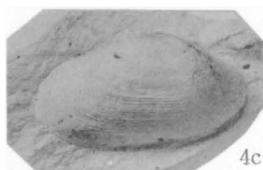
Kyushu University Photos, without whitening.



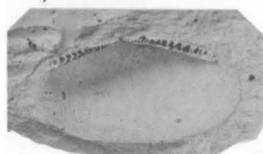
1a



1b



4c



4b



4a



2a



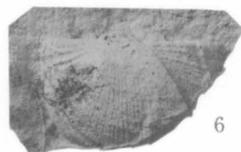
2b



2c



2d



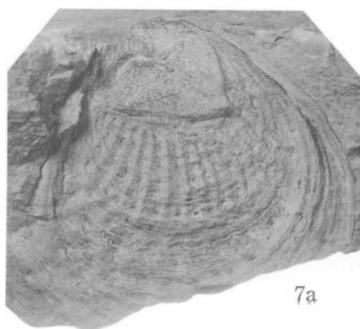
6



3



5



7a



7b



8