Mid-Cretaceous Ammonites from the Shumarinai-Soeushinai Area, Hokkaido Part Ⅰ : Studies of the Cretaceous Ammonites from Hokkaido and Saghalien-XXIX

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Mid-Cretaceous Ammonites from the Shumarinai-Soeushinai Area, Hokkaido

Part I
(Studies of the Cretaceous Ammonites from Hokkaido and Saghalien-XXIX)

Tatsuro MATSUMOTO and Akitoshi INOMA

Abstract

This paper is to report the unique assemblages of ammonites from the middle part of the Cretaceous sequence in the Shumarinai-Soeushinai area, Hokkaido. Part I contains descriptions of eleven species belonging to *Stoliczkaia*, *Mantelliceras*, *Graysonites* and *Ficheuria*. A new subgenus is proposed under *Stoliczkaia*.

Introduction

Purpose.—This paper is to give the systematic descriptions of the ammonites from a particular part of the Cretaceous sequence in the Shumarinai-Soeushinai area, Hokkaido. For some reasons the assemblages of ammonites from the designated part are unique which have not been reported elsewhere in Hokkaido. The palaeontological descriptions would give some new information to enrich and improve our knowledge on the mid-Cretaceous ammonite faunas. In other words the results of this study would be concerned with the international correlation of Upper Albian and Lower Cenomanian and accordingly with the problem of Albian-Cenomanian boundary.

This paper is one of the results of works in the framework of the IGCP Project "Mid-Cretaceous Events."

Material.—The Shumarinai-Soeushinai area is located between the better known Saku area in the north and the Obira [=Obirashibetsu=Opirashibets] area in the south (see Fig. 1). It is in the southern part of the Teshio Mountainrange of northwestern Hokkaido. The longitudinal valley of the River Uryu, a large tributary of the River Ishikari, runs meridionally in the eastern part of the area. Shumarinai and Soeushinai, about 10 km apart from each other, are located in the valley as local centers of forestry. A number of branches run from the western main range eastward to the Uryu, of which the Shumarinai and the Sounnai are longer than others, such as the Sakin-zawa and the Sanjussen-zawa (Fig. 2).

The specimens to be described in this paper were mostly obtained from the exposures and fallen or floated calcareous nodules in these streams. Especially those in the middle course of the Shumarinai are prolific, containing particular

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Akitoshi INOMA: Japan Petroleum Exploration Co., Tokyo.

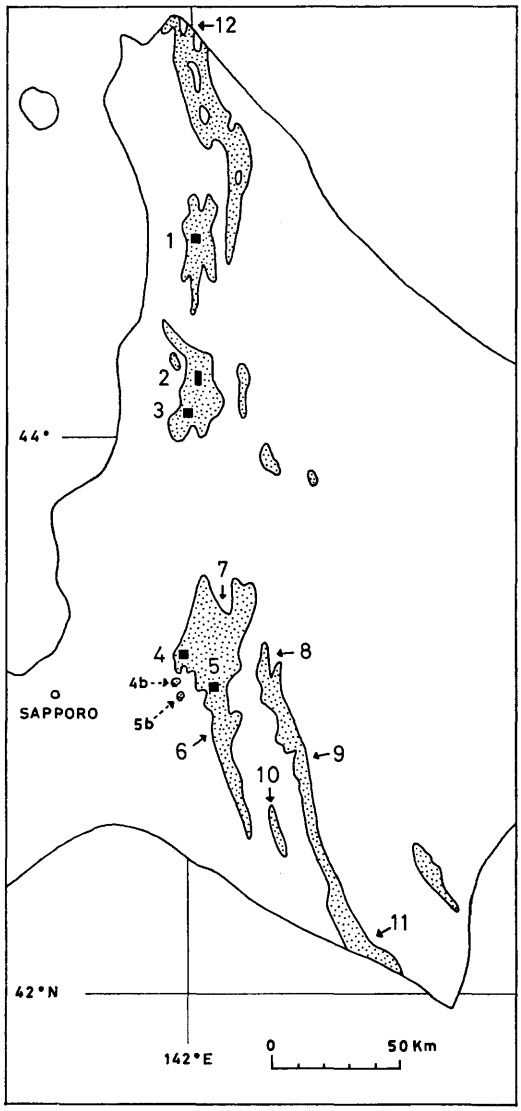


Fig. 1. Outline map of central zone of Hokkaido showing the outcrops of the post-Aptian Cretaceous deposits with dotted marks. The areas mentioned in the text: 1: Saku, 2: Shumarinai-Soeushinai, 3: Obira, 4: Ikushumbetsu, 4b: Manji, 5: Oyubari, 5b: Yubari, 6: Hobetsu, 7: Ashibetsu, 8: Furano, 9: Hidaka, 10: Yamamonbetsu, 11: Urakawa, 12: Mineoka.

assemblages of species.

The first information of the interesting locality was brought by Dr. Sutekazu NAGAO and Mr. Hikosuke WATANABE during the geological survey for the exploration of Tertiary coal, in the summer of 1958, by a team led by Professor Wataru HASHIMOTO, with Saburo KANNO, Sutekazu NAGAO, Takashi KOIWAI, Yutaka SHINADA, Hikosuke WATANABE, Takeo YOSHIZAWA and Akitoshi INOMA as members. At Professor HASHIMOTO's suggestion INOMA, in 1959, was engaged in the investigation of the Cretaceous stratigraphy of this area, getting more specimens. Subsequently Professor HASHIMOTO continued the geological survey with Dr. S. NAGAO and Dr. S. KANNO to complete the geological map of the quadrangle "Soeushinai". At one time during the survey Professor HASHIMOTO showed the other of us (T. M.) the Shumarinai locality, collecting some fossils. In the meanwhile MATSUMOTO and OKADA investigated the Cretaceous sequence along the newly constructed highway from Soeushinai to Kotambetsu and obtained some Upper Albian and Cenomanian fossils.

The specimens to be described in this serial reports were obtained through these investigations for years. They were developed from the rock matrix mainly by A. INOMA. The collections of W. HASHIMOTO, S. KANNO and A. INOMA are preserved at the Department of Geology and Mineralogy, Tokyo Kyoiku Daigaku (TKD.) [=Tokyo University of Education (TUE.)] and those of T. MATSUMOTO and H. OKADA are at the Department of Geology, Kyushu University (GK.).

As to the general stratigraphy of the area readers may refer to the geological

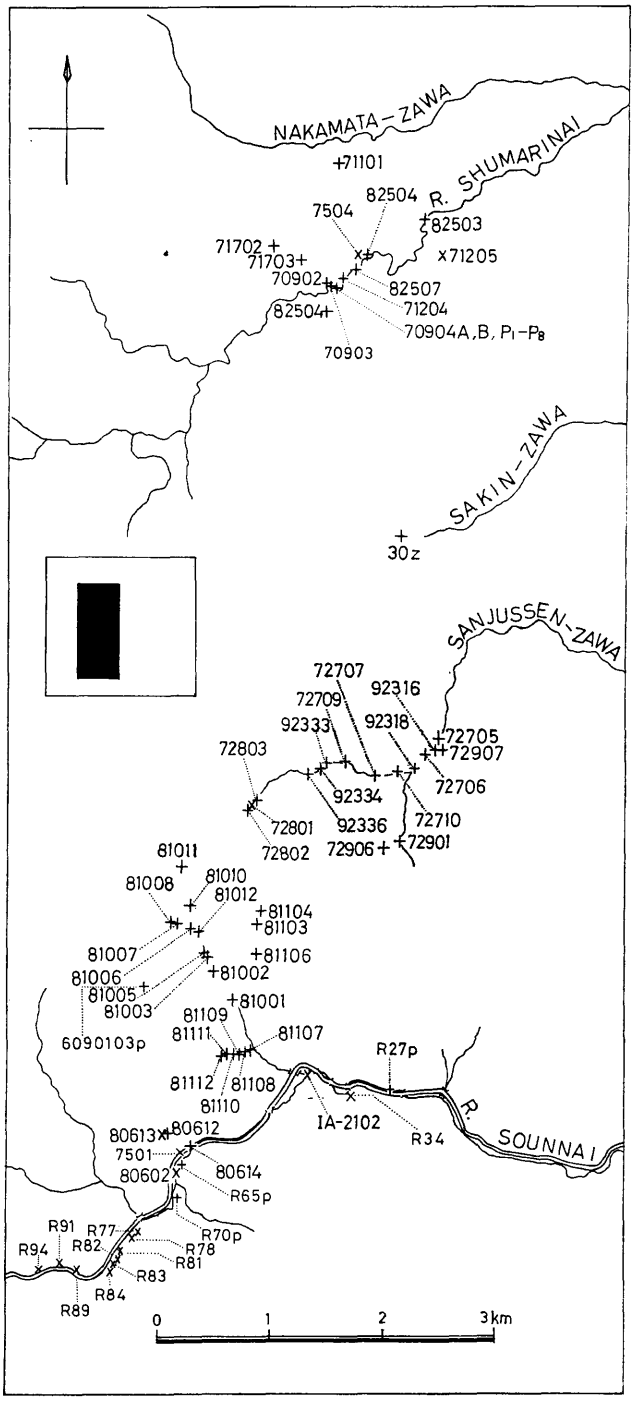


Fig. 2. Route map showing the localities of the described ammonites. × in situ, + fallen or floated nodules, mostly TKD collection. Localities of Kyushu University collection are shown with prefix R. Inset quadrangle is the outline of the Geological Map of Soeushinai (scale 1: 50,000) in which the location of this route mapped area is indicated with black rectangle.

map and its explanation by HASHIMOTO et al. (1965) and MATSUMOTO and OKADA (1973). IGCP report by MATSUMOTO et al. (1975) may also be referred to for general and up-to-date explanation. The relevant Cretaceous sequences are grouped

in the Middle Yezo Group, which is lithostratigraphically subdivided into units My1 to My6 in ascending order. The ammonites to be described in this paper came from My2 (alternating sandstone and mudstone) and My3 (mudstone). As a local formational name the Takimibashi Formation may be written, which includes Members My1, My2 and My3, although one of us (T. M.) considers it unnecessary to use such a local name. More details of stratigraphy will be dealt with in a later part, together with the discussion of correlation.

Acknowledgements.—We are much indebted to Professor Wataru HASHIMOTO who generously provided all the specimens of TKD collections for the present study with necessary information as well as with encouragement. Thanks are extended to Dr. Saburo KANNO, Dr. Yutaka IKEBE and Dr. Ikuwo OBATA for giving us facilities to complete this study, to Dr. Sutekazu NAGAO, Dr. Takashi KOIWAI, Dr. Hakuyu OKADA, Messrs Yutaka SHINADA, Hikosuke WATANABE, and Takeo YOSHIZAWA who were engaged in the field work with either of us in 1958 (A. I.) or 1967 (T. M.), to Messrs Kei ICHIKAWA, Yasuhiro MATSUO, Hitoshi KAITEYA, Kazuo SHIMADA, Tatsuo MURAMOTO and Tamio NISHIDA who assisted either of us in the geological field work in 1959 (A. I.) and in 1967 (T. M.), to Dr. Masahisa AMANO who presented his valuable collection of ammonites from Shishijima to Kyushu University, to Mr. C. W. WRIGHT who kindly gave us comments with his unpublished information on *Stoliczkaia* from England, to Dr. Seijuro MAIYA who give us micropalaeontological information and finally to Dr. Kametoshi KANMERA, Dr. Hiromichi HIRANO and Miss Mutsuko HAYASHIDA who helped us in publishing this paper.*

Systematic Description

Superfamily Acanthocerataceae

Family Lyelliceratidae SPATH

Genus *Stoliczkaia* NEUMAYR, 1875

Type-species.—*Ammonites dispar* D'ORBIGNY, 1841 (by original designation).

Generic diagnosis.—The shell is of small to moderate size, about 140 mm in the known maximum diameter. It is rather involute and narrowly umbilicate, but sometimes the umbilicus tends to widen as the adult whorl tends to be scaphitoid. The whorl is normally higher than broad, with more or less compressed section, but exceptionally nearly as high as broad in certain species (e. g. *S. tetragona* NEUMAYR).

The shell is nearly smooth in the very young stage, and rather finely costate in the middle stage, with straight or more or less flexuous, alternating long and short ribs, with or without ventrolateral tubercles and in a few species midventral tubercles. The long ribs normally have umbilical bullae. The adult body-chamber has more distant or coarser ribs which run continuously across the venter with thickening or broadening. The last part of the adult body-chamber may become smoothish.

The suture is of acanthoceratacean type, consisting of E, L, U2, U4, U5, U3, U1, I, with broad bifid external saddle, comparatively narrower and moderately

* This paper is that develops a part of the systematic description in "Upper Albian to Cenomanian Ammonites from Central Hokkaido" with which A. INOMA, the junior author, was conferred a doctorate by Tokyo University of Education.

deep lateral lobe and smaller auxiliaries. The folioles are well rounded and the suture tends to simplify.

Discussion.—*Stoliczkaia* is a well known genus, because it is old established and because the zonal index at the top of the Albian, *S. dispar*, is frequently cited. Despite this situation, the extent of variation of previously established species and the relationships among them have not yet been satisfactorily known. Previous studies of *S. dispar* itself, for example, do not meet with such requirements.

Under these circumstances we feel it fairly hard to determine precisely the specific names of the specimens from Hokkaido. One of us (T. M.) had fortunately opportunities to examine the type-specimens of certain species at the institutions in London, Paris, Bonn, Austin and Calcutta. Some of the observed facts may be mentioned in connexion with the descriptions of the species from Hokkaido. Our specific identification has thus been done rather on typological grounds but may be provisional for the reason of uncertainty about the extent of variation.

Species of *Stoliczkaia* occur in both Upper Albian and Lower Cenomanian, but no clean-cut distinction can be made between the species groups of the two substages. Taxonomically four subgenera can be distinguished, *Stoliczkaia* (s. s.), *Faraudiella* BREISTROFFER, 1947 and *Shumarinaia* nov. (to be defined in p. 276), which all seem to range across the boundary, and *Villoutreysia* CASEY, 1965, which is known only in Upper Albian.

Subgenus *Stoliczkaia* NEUMAYR, 1875

Remarks.—This subgenus includes the species which are closely allied to *S. dispar*.

Stoliczkaia (*Stoliczkaia*) sp. cf. *S.* (*S.*) *clavigera* NEUMAYR
Pl. 38, Fig. 1; Text-fig. 4

Compare.—

1865. *Ammonites dispar*, STOLICZKA (*non* D'ORBIGHY), *Pal. Indica*, vol. 1, p. 85, pl. 45, fig. 1.
1875. *Stoliczkaia clavigera* NEUMAYR, *Zeitsch. Deutsch. Geol. Gesells.*, vol. 27, p. 933.
1895. *Stoliczkaia dispar*, KOSSMAT, *Beitr. Geol. Palaeont. Oesterr. Ungarns*, vol. 9, p. 194 (pars).

Holotype of S. clavigera.—GSI. No. 191, illustrated by STOLICZKA (1865, p. 85, pl. 45, fig. 1) (Fig. 3 in this paper).

Material.—TKD. 30596, from loc. 82507 (Coll. W. HASHIMOTO), secondarily compressed adult specimen, on which the test is partly preserved.

Description of the holotype.—By courtesy of Mr. M. V. S. SASTRY, one of us (T. M.) had an opportunity to observe the holotype at Calcutta. It is a fairly well preserved specimen, although the body-chamber is somewhat squashed. The measurement data are shown below together with those of the Hokkaido specimen.

The shell is involute, rapidly increasing in whorl-height, and narrowly umbilicate in most parts, with U/D about 0.17–0.18. The body-chamber, which occupies slightly more than a half whorl, shows a scaphitoid character with widening the umbilicus by eccentric coiling and decreasing the whorl-height at the last part. The whorl is much higher than broad, with B/H about 3/4 to 2/3 from the septate stage to the posterior part of the body-chamber. The venter is narrowly

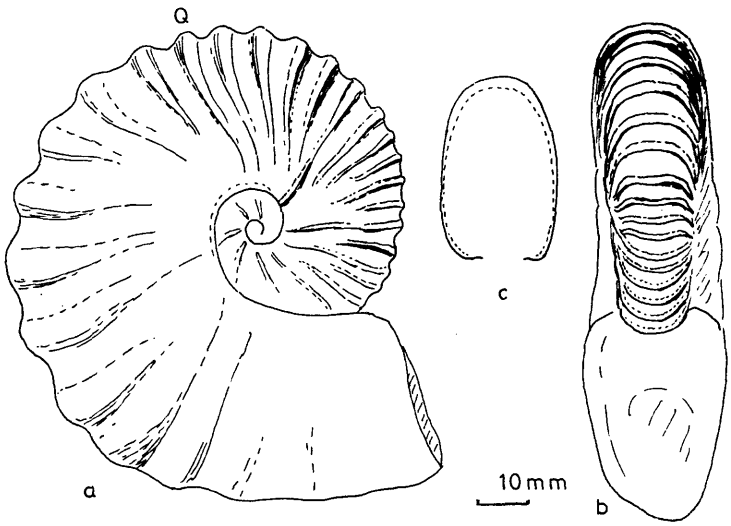


Fig. 3. *Stoliczkaia* (*Stoliczkaia*) *clavigera* NEUMAYR. Diagrammatic sketch of the holotype, GSI. No. 191. Lateral (a) and frontal (b) views and whorl-section (c) at Q. (T. M. *delin.*)

rounded and the flanks are only slightly convex or nearly flat.

The umbilical wall is low and steep or nearly vertical in the septate whorl, but inclined without angular shoulder in the main part of the body-chamber.

The ribs are narrow and numerous on the visible earlier part, gradually changing to moderately strong and moderately distant ribs at about the last stage of the septate whorl. They are irregularly long and short; the longest rib which arises from the umbilical bulla occurs rather periodically. They are prorsiradiate and some of them are gently sigmoidal on the flank. At the ventrolateral shoulder they may be somewhat accentuated but distinct tubercles are not discernible. The ribs run across the venter in perpendicular to the siphonal line.

The ribs on the body chamber are broad, moderately distant, alternating long and short, stronger on the outer half of the flank and thicken on the ventral part. They are slightly prorsiradiate on the inner part of the flank, nearly straight on the main part and gently bent backward at the thickest ventrolateral shoulder. On the last part (about 30°) the ribs are much weakened and the shell looks nearly smooth. The shape of the very apertural margin is not known.

The suture is generally as described in generic diagnosis. Its illustration by STOLICZKA (1865, pl. 45, fig. 1b) shows too much florid aspects. Actually the folioles show more rounded, simpler outline.

Measurements.—

Specimen	Diameter	Umbilicus (%)	Height	Breadth	B./H.
GSI. 191 (end)	100.0	28.0(28)	~42	27.5	(deform.)
〃 (− 90°)	84.5	15.0(18)	44.5	≥16.5	〃
〃 (−180°)	70.5	13.0(18)	36.5	24.5	0.67
〃 (−270°)	—	—	23.8	18.0	0.76
TKD. 30596 (end)	82.0	23.9(29)	32.2	—	(second.
〃 (− 90°)	73.6	16.0(22)	35.0	>20.0	compressed)
〃 (−180°) (c)	60.5	10.8(18)	31.0	>14.0	

Description of the Hokkaido specimen.—The specimen from Shumarinai is an adult shell in which the body-chamber occupies about 210°. It is somewhat

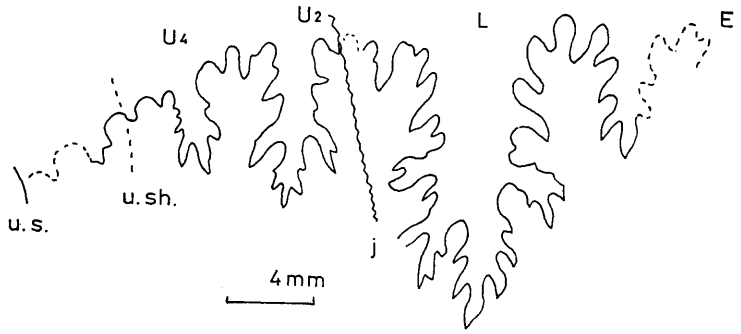


Fig. 4. *Stoliczkaia* (*Stoliczkaia*) sp. cf. *S.* (*S.*) *clavigera* NEUMAYR. The last suture exposed on the flank of TKD. 30596. j: joint. (T. M.*delin.*)

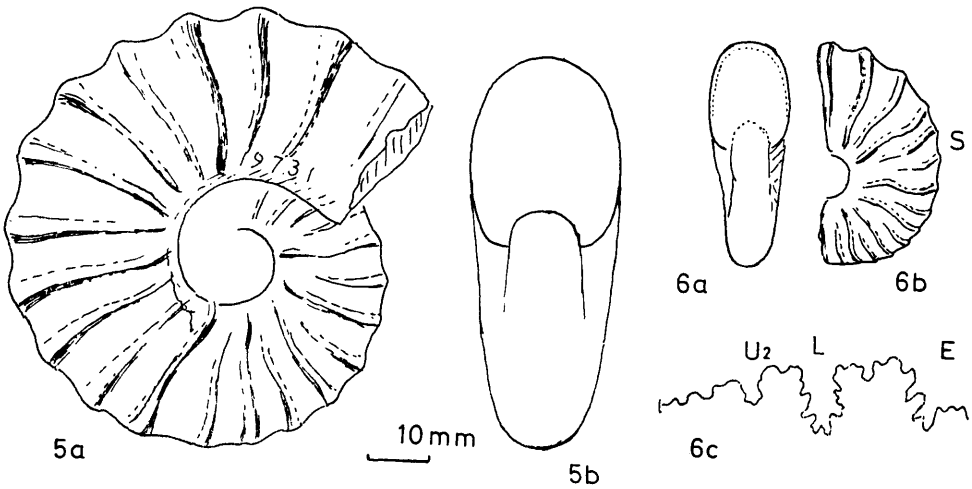
smaller than the holotype of *S. clavigera* and secondarily compressed. Otherwise it shows essentially the same characters as that holotype described above. Therefore we are inclined to conclude that it is probably identified with *S. clavigera.* The last rib immediately behind the smoothish part is fairly strong even on the inner half of the flank in this specimen, but this is regarded as a variable character. The last external suture is exposed, showing the pattern as illustrated in Fig. 4.

Discussion.—So far as the holotypes and other typical examples are concerned, *Stoliczkaia clavigera* is distinguishable from *S. dispar* (D'ORBIGNY, 1841). The latter has sparser, narrower and straighter ribs on the adult body-chamber which shows more remarkable tendency to smoothness, whereas the former has coarser, more predominant ribbing on the adult body-whorl, with a smoothish part restricted only near the anterior end. On the septate whorl the ribs are rectiradiate and provided with ventrolateral tubercles in *S. dispar,* whereas they are remarkably prorsiradiate, sometimes gently flexuous and only slightly accentuated but not distinctly tuberculate at the ventrolateral shoulder in *S. clavigera.* Although the two species closely resemble each other in shell-form, we would agree with BOULE et al. (1907), SPATH (1931) and COLLIGNON (1963) in separating *S. clavigera* from *S. dispar,* unless the great variability were known in each province.

BOULE et al. (1907, p. 34) mentioned that *S. clavigera* from Madagascar could be a mere variety or a geographical subspecies of *S. dispar.* The illustrated specimen from Mont-Raynand, Diego Suarez, Madagascar (BOULE et al., pl. 2 [9], fig. 1, 1a, which was indicated as natural size by mistake and reillustrated by COLLIGNON, 1963, pl. 316, fig. 1341) is not quite identical with the holotype and the Shumarinai specimen in that it has more flattened flanks and distinctly more numerous, more crowded, weaker ribs on the adult whorl (numbering 15 or 16 on the last half whorl as compared with 11 or 12 in the latter two). This Madagascar specimen was at first recorded as Cenomanian but evidently Upper Albian as far as it came from the Zone of *Mortoniceras inflatum* (COLLIGNON, 1963). One of STOLICZKA's specimen, GSI. No. 193 (STOLICZKA, 1865, pl. 45, fig. 3; KOSSMAT, 1894, pl. 24 [10], figs. 2, 3) is allied to the Madagascar specimen in the same respects but is smaller inspite of its probable adult stage. We would temporarily call these two specimens *S.* sp. aff. *S. clavigera.*

On the other hand *S. tetragona* NEUMAYR, 1875, based on another of STOLICZKA's specimens, i.e. GSI. No. 192 (STOLICZKA, 1865, pl. 45, fig. 2, 2a, 2b), has much broader, tetragonal whorls and stronger ribs than *S. clavigera.*

Stoliczkaia aff. *dispar* of BÖSE (1928, p. 212, pl. 5, figs. 1–8), from the Lower



Figs. 5–6. *Stoliczkaia* (*Stoliczkaia*) *texana* (CRAGIN). 5. Lateral (a) and frontal (b) views (ribbing omitted in b) of the lectotype, BE. UT. 19731. 6. Frontal (a) and lateral (b) views and external suture (c) at S of BE.UT. 19740 b, one of CRAGIN's syntypes, probably the original of CRAGIN's (1893, pl. 44, fig. 2) illustration of suture. (T. M. *delin.*)

Cenomanian Del Rio Clay of Coahuila, Mexico, resembles *S. clavigera* in its compressed whorl, fairly distant, coarse ribbing (numbering 11 per half whorl) on the last whorl, but is distinguished in that the strong, long ribs predominate on the last whorl with scarce intercalation of shorter ones and that the ribs are somewhat flexuous, showing ventral projection, and provided with weak ventrolateral tubercles on the immature whorl, which has a subrectangular section with a flat venter and rather angular ventrolateral shoulders.

Stoliczkaia texana (CRAGIN, 1893), from Texas, likewise resemble *S. clavigera* in its fairly distant ribbing on the outer whorl (numbering 10 on the last half whorl), but it is also characterized by the predominance of long ribs on the adult body-chamber, without or with scarcely intercalated short ribs and has somewhat broader whorl. Among the five syntypes preserved at the Bureau of Economic Geology, University of Texas, Austin, the largest one (BE. UT. 19731) figured by CRAGIN (1893, pl. 44, fig. 1) is here designated as the **lectotype** (see Text-fig. 5). In this lectotype the body-chamber occupies about 220° and its last part is decreased in whorl-height, as in the adult whorl of *S. clavigera,* but still costate, although the ribs are weakened. On the septate part of this specimen and also probably immature, other smaller syntypes the ribs are alternating long and short, more or less flexuous, but clearly more distant than those on the septate part of *S. clavigera.* The ribs sometimes, but not always, show a bulge at the ventrolateral shoulder. The immature shell has less inflated flanks than the adult. The suture of *S. texana* (see Fig. 6) is less deeply incised than in *S. clavigera.*

On examining the syntypes we are strongly inclined to regard *Stolizckaia uddeni* BÖSE, 1928 (p. 211, pl. 4, figs. 12–15) as probably identical with *S. texana,* as ADKINS (1928, p. 236) has already suggested. The measurements below by one of us (T. M.) may serve for this statement.

Specimen	Diameter	Umbilicus (%)	Height	Breadth	B./H.
BE. UT. 19731	75.0	21.5(29)	30.0	25.8	.86
〃 (−90°)	65.0	16.3(25)	31.0	24.8	.80
BE. UT. 19741	51.0	14.4(28)	23.0	20.4	.89
BE. UT. 19740b	36.5	~ 7.5(21)	18.0	13.4	.74
S. uddeni BÖSE	47.3*	12.0(25)	22.2	19.5	.88

(pl. 4, f. 14–15) *BÖSE's measurements (p. 211) probably include misprint.

The lectotype of *S. texana* is recorded to have occurred in the *Vola* Limestone, Denton Co., Texas. ADKINS (1928) assigned this limestone to the Buda Limestone, but could be Upper Grayson Member, as informed by J. T. TWINING (oral communication). One of us (T. M.) has seen a probable example of *S. texana* at the University of Kansas (KU. loc. 10641), whose stratigraphic position was recorded as Grayson Member. The two syntypes of *S. uddeni* came from the Del Rio Clay (BÖSE, 1928, p. 212), which is about the same age as the Grayson. Anyhow the age of the Texas species is Lower Cenomanian.

Occurrence.—A single example from Hokkaido was collected by W. HASHIMOTO from Loc. 82507, the River Shumarinai. It was solitarily included in a calcareous nodule.

The holotype of *S. clavigera* was recorded to be of Ootatoor Group (STOLICZKA, 1865, p. 86) and later interpreted as Lower Ootatoor [Utatur] (KOSSMAT, 1895, p. 195 [99]). Whether this species occurs in the Lower Cenomanian or the Upper Albian or ranges in both stages should be determined in the future.

Stoliczkaia (*Stoliczkaia*) *amanoi* sp. nov.

Pl. 38, Figs. 2–4

Material.—Holotype, GK. H4214, from Shishijima (coll. M. AMANO), an internal mould showing the adolescent and the preceding stages. Paratypes, TKD. 30175, from loc. 70904 A (Coll. A. INOMA and W. HASHIMOTO), probably immature, somewhat deformed specimen, in which the test is preserved; TKD. 30176, from loc. 81011 (Coll. A. INOMA), a fragmentary internal mould of a living chamber.

Diagnosis.—The shell is rather small, fairly involute and narrowly umbilicate at least up to the adolescent stage. The whorl is higher than broad, compressed elliptical to subrectangular in cross-section, with a nearly flat to slightly convex, narrow venter, subangular to subrounded ventrolateral shoulders and gently inflated or nearly flat flanks.

In the immature stages, less than 30 mm in diameter, the shell is ornamented with dense, numerous ribs, numbering 16 or more per half whorl, which are as a rule alternately long and short but sometimes modified to have two shorter ones of unequal length between the longer ones. They are somewhat prorsiradiate and more or less flexuous on the flank, bend at the ventrolateral shoulder to run across the venter nearly perpendicular to the siphonal line, without showing forward curvature. At the ventrolateral shoulder the ribs are weakly tuberculated in the earlier stages (up to whorl-height=10 mm) but slightly accentuated or without perceptible bulge in the later stages. The long ribs have an umbilical bulla, but the bullae are of unequal strength, some being more elevated than others at irregular intervals.

At the adolescent stage, as represented by the preserved last part of the holotype, the ribs become to be moderately strong, coarse and separated by somewhatt

wider interspaces. They run straight across the venter with distinct intensity, without showing a forward convexity. On the flank some of them are nearly rectiradiate and some others slightly prorsiradiate. Some long ribs are gently sigmoidal and may be slightly elevated or thickened at the curved part of the mid-flank. There are no ventrolateral tubercles at this stage.

The adult body-chamber, as represented by a paratype, TKD. 30176, is higher than broad and subrectangular in cross-section, although the actual specimen is somewhat deformed. The long ribs are almost straight and somewhat prorsiradiate on the flank, with (but at one place without) intercalated shorter ribs. The ribs are moderately strong and separated by slightly wider interspaces. They run across the venter almost in perpendicular to the siphonal line, without forward curve, and without notable thickening or broadening. Near the umbilical margin the long ribs may be slightly elevated, if not forming a distinct bulla. No ventrolateral tubercles are perceptible.

The suture is only faintly exposed on the holotype and partly seen on the paratype, TKD. 30175, which shows subquadrate and distinctly bifid saddle between E and L, moderately deep lobules and well rounded folioles at an early stage (whorl-height=6 mm).

Measurements.—

Specimen	Diameter	Umbilicus (%)	Height	Breadth	B./H.
GK. H4214	45.0	8.5(18.9)	22.0	17.0	0.77
TKD. 30175	~25.0	~4.5(18)	~12.5	~ 9.5	0.76
TKD. 30176 (deformed)	—	—	~24.0	~16.6	0.69

Discussion.—This species is closely allied to *Stoliczkaia dorsetensis* SPATH (1931, p. 337, pl. 31, figs. 2, 3, 10, 13, 14; pl. 32, fig. 7, pl. 33, fig. 1), from the Upper Albian (*dispar*-subzone) of southern England, but is distinguished by its straight ribbing on the venter, without showing a gently forward curvature as seen in the latter. So far as the described types are concerned, *S. dorsetensis* has a somewhat broader whorl, approaching to *S. tetragona* NEUMAYR in aspects, and somewhat more crowded ribs than our species, although these characters may be variable to some extent.

Occurrence.—The holotype was collected by Dr. M. AMANO from a locality indicated by a cross mark (+) in an index map (AMANO et al. in MATSUMOTO, 1960, p. 56, fig. 11), Shishijima, western Kyushu. It came from Member IIe of the Goshonoura Group, as confirmed later by YAMAMOTO and HAYAMI (1971). This member is referred to the lower part of Lower Cenomanian on the grounds of *Graysonites* cf. *fountaini* YOUNG and *Graysonites* spp. (see MATSUMOTO, 1960).

The paratypes from Shumarinai were included in a calcareous nodule at loc. 70904 A, together with many other ammonites and in another at loc. 81011, together with *Zelandites* sp.

Stoliczkaia (*Stoliczkaia*) sp. aff. *S.* (*S.*) *tetragona* NEUMAYR
Pl. 38, Fig. 5; Text-fig. 8

Compare.—

1865. *Ammonites dispar*, STOLICZKA (pars.) (*non* D'ORBIGNY). *Pal. Indica*, vol. 1, p. 85 pl. 45, fig. 2.

1875. *Stoliczkaia tetragona* NEUMAYR. *Zeitsch. Deutsch. Geol. Gesells.*, vol. 27,

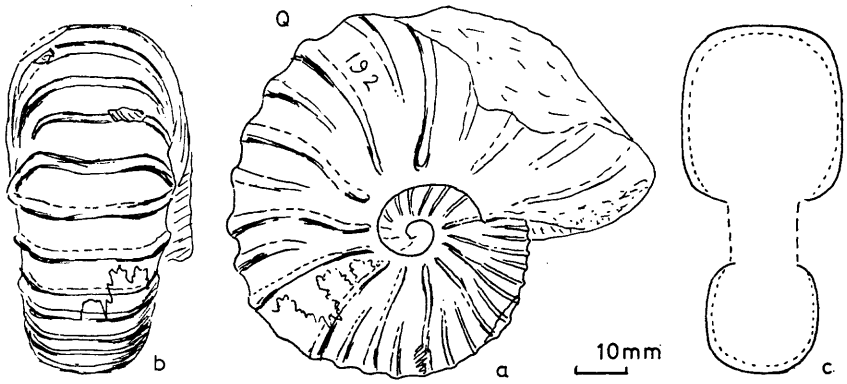


Fig. 7. *Stoliczkaia* (*Stoliczkaia*) *tetragona* NEUMAYR. Diagrammatic sketch of the holotype, GSI. 192. Lateral (a) and ventral (b) views and cross-section (c). (T. M. *delin.*)

p. 932.

1895. *Stoliczkaia tetragona*, KOSSMAT. *Beitr. Geol. Palaeont. Oesterr. Ungarns*, vol. 9, p. 195.

Holotype of S. tetragona.—GSI. No. 192, from the Ootattor Group, illustrated by STOLICZKA (1865, pl. 45, fig. 2) (Text-fig. 7 in this paper).

Material.—TKD. 30601, a single, small, probably immature specimen, consisting of an internal mould of a quarter outer whorl and an inner whorl with test.

Description of the holotype.—This is a probably adult shell, 85 mm or so in diameter, in which about a half of the outer whorl is occupied by the living chamber. The last part tends to have scaphitoid aspects, with somewhat widened umbilicus (U./D. about 0.25). Otherwise the shell is fairly involute and narrowly umbilicate (U./D. about 0.17).

The whorl is broad for the genus, nearly as high as broad in the living chamber and slightly broader than high in the septate part. It is roughly tetragonal in section, with a flat venter, flat and parallel flanks, subrounded ventrolateral and umbilical shoulders and steep umbilical walls. The septate whorl is somewhat more rounded.

The ribs are rather narrow and fairly numerous on the main part of the septate shell, numbering about 10 per quarter whorl. They are as a rule alternately long and short, but occasionally two shorter ones are inserted. They are somewhat prorsiradiate and sometimes gently flexuous on the flank but do not show forward projection on the venter. The long ribs are bullate near the umbilical margin. The bulges at the ventrolateral shoulders are weak.

At the adolescent stage, i.e. near the last part of the septate whorl, the ribs become gradually stronger and more distant. On the main part of the body-chamber the ribs are very strong, coarse and distant, numbering 12 per half whorl. They are still alternating long and short. The long rib arises from the bulla at the umbilical shoulder, at first somewhat prorsiradiate but gently curved backward at about the middle of the flank. All the ribs are rursiradiate on the outer part, crossing the venter almost vertically or with a gently backward sinus. The ribs somewhat strengthen at the ventrolateral shoulder; otherwise they do not particularly thicken nor broaden on the ventral part. On the last part, which is not com-

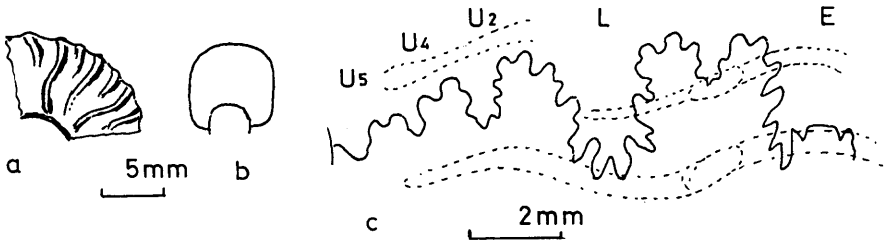


Fig. 8. *Stoliczkaia* (*Stoliczkaia*) sp. aff. *S.* (*S.*) *tetragona* NEUMAYR. Sketch of TKD. 30601. Lateral view (a), whorl-section (b) and external suture (c). (T. M. *delin.*)

pletely preserved, the ribs seem to weaken.

The suture has relatively broader L than that of other species.

Measurements.—

Specimen	Diameter	Umbilicus (%)	Height	Breadth	B./H.
GSI. 192 (end)	84.0	21.5(26)	~36	~35.5	≤1.0
〃 (− 90°)	69.0	12.0(17.4)	35.0	35.5	1.01
〃 (−180°)	60.5	10.5(17.4)	31.0	33.7	1.09
TKD. 30601	~15	—	7.5	7.0	0.93
〃 (− 90°)	12.3	2.4(20)	6.5	6.0	0.92
S. dorsetensis (holotype)	60.0	7.8(13)	31.8	25.2	0.79
〃 (paratype)	28.0	3.9(14)	14.3	12.6	0.88

Description of the Hokkaido specimen.—This small specimen (TKD. 30601) shows fairly distinctive characters. Its whorl is slightly higher than broad, with a subquadrate section. It is costate on its last quarter whorl (12 to 15 mm in shell diameter), but smoothish in earlier stages, except for a periodic long rib appearing at diam.=8.0 mm. The ribs on the outer whorl are moderate in strength and density, numbering 7 per quarter whorl, alternating long and short, of which the longer ribs are alternately elevated to form a bulla near the umbilical margin. They are flexuous on the flank, slightly accentuated but not distinctly tuberculate at the ventrolateral shoulder. They are weakly but distinctly projected on the venter.

The suture is of general *Stoliczkaia* type and its L has a comparatively broad stem and the saddle between E and L is subquadrate and distinctly bipartite despite the small immature stage (see Text-fig. 8).

Discussion.—In the roughly tetragonal whorl-section and the pattern of the suture this specimen resembles *S. tetragona,* but differs in the ribbing. Unless the characters of the early immature shell as small as this specimen be known in *S. tetragona,* or unless those of the mature shell in our species be known, it is difficult to do exact comparison.

In the curvature of the ribs on the venter and in the subrectangular whorl-section the present form is somewhat allied to *S. dorsetensis* SPATH, but that species has narrower whorls, more numerous, denser, finer and less flexuous ribs.

As the available material is insufficient, the present form is provisionally called *S.* (*S.*) sp. aff. *S.* (*S.*) *tetragona,* without giving a new specific name.

Occurrence.—The described specimen was found in a calcareous nodule of

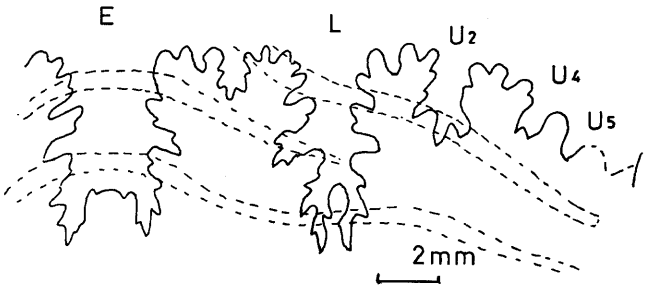


Fig. 9. *Stoliczkaia (Stoliczkaia) yezoana* sp. nov. External suture of holotype, TKD. 30177 at whorl-height=12 mm. (T. M. *delin.*)

HASHIMOTO's loc. P7, the Shumarinai, together with many other ammonites.

Stoliczkaia (Stoliczkaia) yezoana sp. nov.
Pl. 39, Fig. 8; Text-fig. 9

Material.—Holotype, TKD. 30177, from loc. 70904 A (coll. A. INOMA and W. HASHIMOTO), in which the shell layers are partly preserved though altered. It is small but probably of adolescent stage, if not full-grown. The preserved last part of its outer whorl, about 150°, is a living-chamber, which shows different characters from the septate part.

Diagnosis.—The septate part is compressed, with rather flat flanks, subrounded ventrolateral shoulders and a narrow and less convex venter. The ribs on the septate part are rather narrow, not crowded, alternately long and short, sigmoidal on the flank, showing a forward inclination near the umbilical margin and again near the ventrolateral part, but cross the narrow venter almost vertically with slight lowering and broadening. The ribs have no distinct tubercles at the ventrolateral and umbilical shoulders at the stage of about 10 mm in whorl-height. Presumably they may show bulges at the ventrolateral shoulder on still younger whorl.

The suture is of general *Stoliczkaia* type, with rounded outline at the end of folioles, but the lobules are fairly deep. L is distinctly bifid, its stem is fairly narrow, with lateral folioles tending to overhang on the median foliole at the bottom.

The body-chamber is subelliptical in section, with a rounded venter, gently convex flanks and low but steep umbilical walls. The whorl broadens with growth, ranging from 0.8 to 0.9 in B./H. The ribs become moderately strong and coarse, numbering 9 in a quarter whorl. They are as a rule alternately long and short, but at one place two shorter ribs of unequal length are inserted. The ribs are gently flexiradiate or prorsiradiate on the flank and bend considerably forward on the ventral part. There are no tubercles at the ventrolateral shoulder and at the umbilical margin, but the long ribs are slightly accentuated at a bending point about one third of the height from the umbilical margin. The ribs are normally separated by a slightly broader interspace but at one place a shorter rib immediately in front of the long rib is close to the latter.

Measurements.—

Specimen	Diameter	Umbilicus (%)	Height	Breadth	B./H.
TKD. 30177 (end)	33.0	5.5(16.6)	16.4	14.8	0.90
〃 (− 90°)	~29	4.6(16)	14.5	11.8	0.81
〃 (−180°)	—	—	11.0	8.5	0.77

Discussion.—Although a single specimen is available the observed characters are so distinctive that we regard it as representing a new species.

Stoliczkaia adkinsi BÖSE (1928, p. 193, pl. 18, figs. 9–17), from the Pawpaw Clay near Fort Worth, Texas, is somewhat allied to the present species in the elliptical whorl section and the forward bend of the ribs. In that Texas species, these characters are also seen in the septate shell. In our species the septate stage shows different characters as described above. There is also a difference in the suture. As BÖSE described, the saddle between E and L is apparently tripartite in *S. adkinsi*, while it is distinctly bipartite in *S. yezoana*. The narrow stem of L is a diagnostic character of the latter.

The specimen from the Cenomanian of Madagascar described as *Stoliczkaia dispar* by COLLIGNON (1933, p. 60, pl. 6, fig. 1) seems to be allied to the present species, but it is more widely umbilicate and the ribs are less prorsiradiate than in ours.

Occurrence.—The holotype came from loc. 70904 A of the River Shumarinai, Hokkaido, together with numerous other ammonite species.

Subgenus ***Shumarinaia*** nov.

Type-species.—*Stoliczkaia* (*Shumarinaia*) *hashimotoi* sp. nov., to be described below.

Subgeneric diagnosis.—This subgenus is characterized and distinguished from subgenus *Stoliczkaia* by the accelerated development of the adult type coarse ribbing, the small size of the adult shell and typically the simpler suture.

Discussion.—In addition to the holotype, *S. asiatica* sp. nov. (to be described below) and *S. africana* PERVINQUIÈRE, 1907 are to be assigned to *Shumarinaia*.

In these species the smooth shell of the young stage is followed soon by the coarsely ribbed whorl and the adult stage is attained earlier and is accordingly smaller than in the typical species of *Stoliczkaia* (s.s.). A weakly ribbed stage may appear between the smooth and the coarsely costate stages but it lasts only for a short while and the ribs are not crowded.

In the type-species the adult shell is less than 25 mm in diameter. In the second

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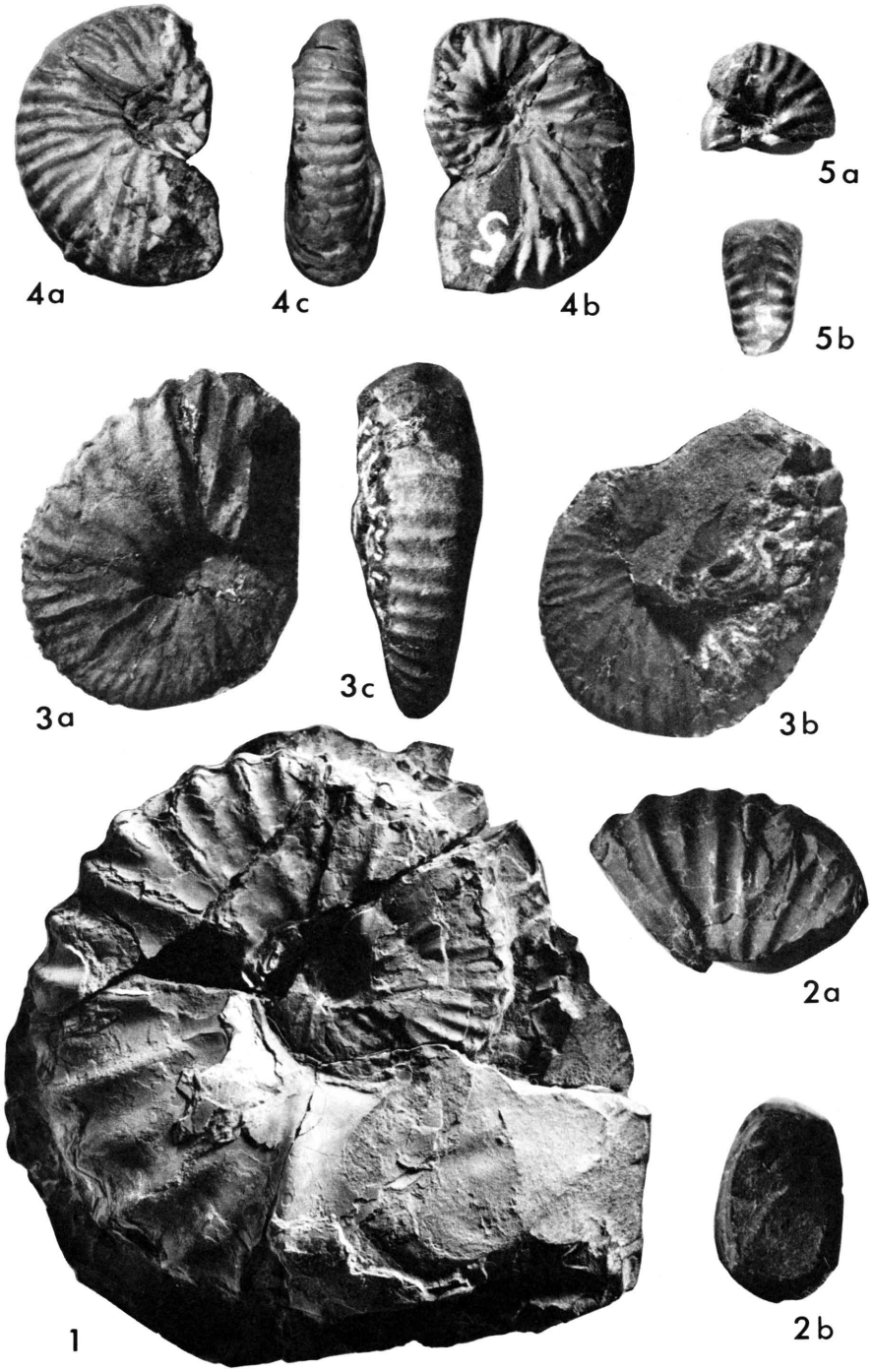
Explanation of Plate 38

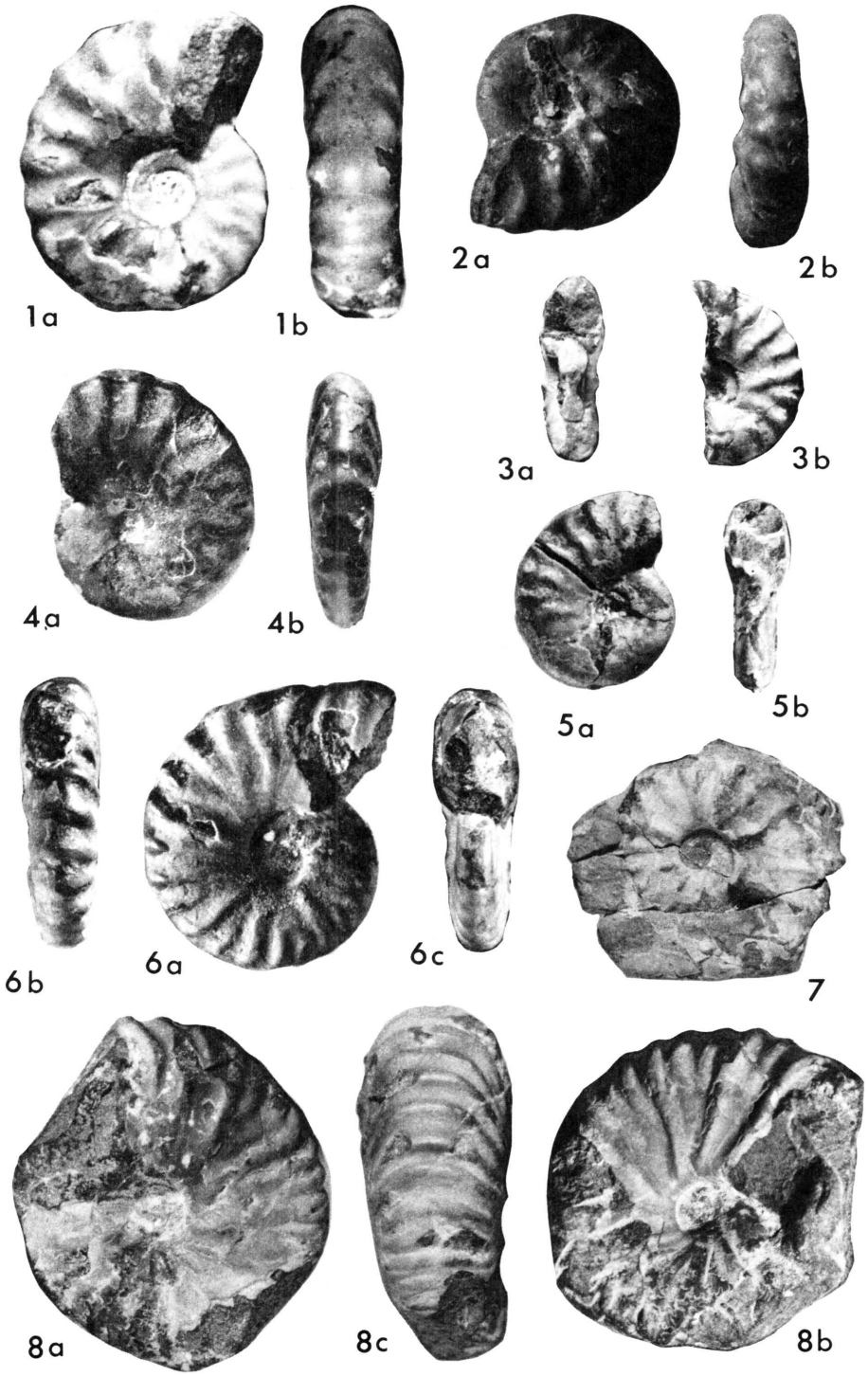
Fig. 1. *Stoliczkaia* (*Stoliczkaia*) sp. cf. *S.* (*S.*) *clavigera* NEUMAYR ...Page 267
TKD. 30596 (W. HASHIMOTO Coll.), from loc. 82507, the Shumarinai. Lateral view, ×1.

Figs. 2–4. *Stoliczkaia* (*Stoliczkaia*) *amanoi* sp. nov. .....Page 271
2. TKD. 30176 (A. INOMA Coll.), from loc. 81011, a branch of the Sounnai, west of Soeushinai. Lateral view (a) and whorl-section (b) (upside down) of a fragmentary living chamber, ×1.
3. Holotype, GK. H4214 (M. AMANO Coll.), from Shishijima, Member IIe, Goshonoura Group, western Kyushu. Two lateral (a, b) and ventral (c) views, ×1.
4. TKD. 30175 (A. INOMA & W. HASHIMOTO Coll.), from loc. 70904 A, the Shumarinai. Two lateral (a, b) and ventral (c) views, ×1.5.

Fig. 5. *Stoliczkaia* (*Stoliczkaia*) sp. aff. *S.* (*S.*) *tetragona* NEUMAYR ...Page 272
TKD. 30601 (W. HASHIMOTO Coll.), from loc. P7, the Shumarinai. Lateral (a) and ventral (b) views, ×1.5.



T. MATSUMOTO & A. INOMA: Mid-Cretaceous Ammonites



T. MATSUMOTO & A. INOMA: Mid-Cretaceous Ammonites

species it is probably less than 40 mm and in the third probably less than 50 mm. The adult living chamber does not seem to show a scaphitoid shape and smoothing.

It is unlikely that these forms represent dimorphs of other species, since there are no corresponding macroforms.

Shumarinaia is somewhat similar to *Salaziceras* BREISTROFFER, 1936 in its small size, coarse ribbing and simplified suture, but is distinguished by its more compressed, less inflated whorl and alternating long and short ribs.

The similarity in some respects to *Pseudosonneratia* SPATH, 1925, a genus of the Hoplitidae, is evidently a case of homeomorphy.

Shumarinaia seems to occur near the Albian-Cenomanian boundary, probably ranging across the boundary, but the basic data are yet insufficient.

Stoliczkaia (*Shumarinaia*) *hashimotoi* sp. nov.
Pl. 39, Figs. 1–3; Text-fig. 10

Material.—Holotype, TKD. 30178 A, a well preserved specimen from loc. 70904 A (coll. A. INOMA and W. HASHIMOTO) of Shumarinai, Hokkaido. Paratypes, TKD. 30178B, a smaller specimen from the same locality (the same calcareous nodule) as the holotype, and TKD. 30602, from loc. P8 of W. HASHIMOTO, Shumarinai, a well preserved septate internal mould up to the last septum.

Etymology.—The species is dedicated to Professor Emeritus Wataru HASHIMOTO, who has contributed much to the geology of Hokkaido.

Diagnosis.—The shell is small, only about 22 mm in diameter at the adult stage in the holotype. It is moderately involute, about half of the inner whorl being overlapped by the outer. The whorl grows rather slowly. The umbilicus is shallow and fairly narrow, about 25 to 29 percent of the shell diameter. The whorl is higher than broad. The smoothish inner whorl is compressed, with a narrowly rounded venter, rather flat flanks and sloping umbilical walls. The costate outer whorl has a moderately rounded venter, gently inflated flanks, well rounded umbilical shoulders

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Explanation of Plate 39

Figs. 1–3. *Stoliczkaia* (*Shumarinaia*) *hashimotoi* sp. nov. ..... Page 277
1. Holotype, TKD. 30178 A (A. INOMA & W. HASHIMOTO Coll.), from loc. 70904 A, the Shumarinai. Lateral (a) and ventral (b) views, ×2.
2. Paratype (immature), TKD. 30178 B (A. INOMA & W. HASHIMOTO Coll.), from loc. 70904 A, the Shumarinai. Lateral (a) and ventral (b) views, ×2.
3. Paratype, TKD. 30602 (W. HASHIMOTO Coll.), from loc. P8, the Shumarinai, Lateral view (a) and natural cross section (b), ×1.5.

Figs. 4–7. *Stoliczkaia* (*Shumarinaia*) *asiatica* sp. nov. ..... Page 279
4. Paratype (immature), TKD. 30173 B (A. INOMA & W. HASHIMOTO Coll.), from loc. 70904 A. Lateral (a) and ventral (b) views, ×2.
5. Another immature example, TKD. 30174 C (A. INOMA & W. HASHIMOTO Coll.), from loc. 70904 B. Lateral (a) and forntal (b) views, ×2.
6. Holotype, TKD. 30173 A (A. INOMA & W. HASHIMOTO Coll.), from loc. 70904 A, the Shumarinai. Lateral (a), ventral (b) and frontal (c) views, ×2.
7. TKD. 30174 A (A. INOMA & W. HASHIMOTO Coll.), from loc. 70904 B. Lateral view, ×1.

Fig. 8. *Stoliczkaia* (*Stoliczkaia*) *yezoana* sp. nov. ..... Page 275
Holotype, TKD. 30177 (A. INOMA & W. HASHIMOTO Coll.), from loc. 70904 A, the Shumarinai. Two lateral (a, b) and ventral (c) views, ×1.5.

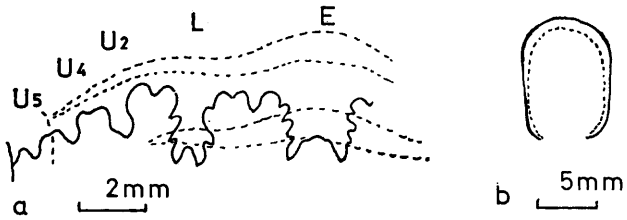

Fig. 10. *Stoliczkaia* (*Shumarinaia*) *hashimotoi* sp. nov. Last suture (a) at whorl-height=6.0 mm and diagrammatic whorl-section (b) of the holotype. (T. M. *delin.*)

and low umbilical walls. Thus the outer whorl is elliptical in cross-section.

The shell is smooth up to 10 mm or so in diameter, where ribs begin to appear. The first two or three ribs are somewhat weaker than but nearly as distant as the later ones. They show a forward curve on the outer half of the flank and end at the ventrolateral shoulder, where they are somewhat thickened, but not tuberculate, and inclined forward at the ventrolateral shoulder, fading away on the venter with lowering and broadening. The succeeding full outer whorl, of which the living chamber occupies about 210°, is fairly strongly costate. The ribs are robust, round-headed, disposed at moderate and regular intervals, and as a rule alternately long and short. The long ribs arise at the umbilical shoulder, sometimes but not always forming a bulla at some distance from the umbilical margin. The short ribs are inserted or branch slightly below the mid-flank. There are 9 or 10 ribs per half whorl. The ribs are more or less flexuous in lateral view, being prorsiradiate near the umbilical margin, gently bent below the mid-flank to take a nearly recti-radiate or slightly rursiradiate orientation and then curved forward at the ventrolateral shoulder, where the ribs gradually thicken, without showing tuberculation. The thickened, coarse ribs cross the rounded venter, with a projection on the septate whorl and on the living chamber almost vertically on their posterior side and with slight convexity on their anterior side.

The suture is of general *Stoliczkaia* type, consisting of E, L, U2, U4, U5, U3, U1 and I. It is comparatively simpler in having shallower and less numerous incisions in all elements and with entire folioles. L is slightly deeper than E, bifid and has a comparatively wider stem. The first lateral saddle is broad and shallowly and asymmetrically bifid. The second lateral saddle is taller and narrower than the first. The auxiliaries are regularly descending.

Measurements.—

Specimen	Diameter	Umbilicus (%)	Height	Breadth	B./H.
TKD. 30178 A	(c) 21.8	6.1(28)	9.8	7.6	0.78
	(ic) 20.8	5.8(28)	9.2	7.0	0.76
〃 (− 90°)	17.7	5.0(28)	8.2	6.6	0.80
〃 (−210°)	—	—	6.8	4.6	0.68
TKD. 30178 B	14.3	~3.5(24)	6.2	5.1	0.82
TKD. 30602	17.2	5.0(29)	7.3	6.2	0.85

c=costal, ic=intercostal

Discussion.—This species has such particular characters that we have established a new subgenus to accommodate it. Comparison with the allied species of the same subgenus is given under the next species.

Such an example of *Stoliczkaia* (*Stoliczkaia*) *notha* SEELEY, from the Upper Albian of England, as described under *S. notha* var. *ultima* by SPATH (1931, p. 336, pl. 31, fig. 5) resembles this species in the shell-form and ornament of the living

chamber, but that species is much larger and has numerous fine ribs on the immature whorl.

It is interesting to note that certain species of *Pseudosonneratia* apparently resemble the present species. Examples are *P. sakalava* COLLIGNON (1949, p. 82, pl. 17, figs. 1–3) and *P. dondeyi* COLLIGNON (1963, p. 105, pl. 282, fig. 1230), both from the Lower Albian of Madagascar. They belong to the Hoplitidae, which have a different type of suture and ventral ribbing. This is an example of a heterochronous homeomorphy.

Occurrence.—The holotype and one of the paratypes were included in a calcareous nodule at loc. 70904 A, in the main stream of the Shumarinai, together with *Desmoceras kossmati* and many other ammonites; another paratype came from HASHIMOTO's loc. P8, together with *D. kossmati* and some other ammonites of a similar assemblage.

Stoliczkaia (*Shumarinaia*) *asiatica* sp. nov.
Pl. 39, Figs. 4–7; Text-fig. 11

Material.—Holotype, TKD. 30173 A, from loc. 70904 A, Shumarinai (coll. A. INOMA and W. HASHIMOTO), a well preserved shell of probably adolescent stage. Paratypes, TKD. 30173 B (immature shell) and TKD. 30173 C (mature shell, partly destroyed), from the type locality (coll. A. INOMA and W. HASHIMOTO); TKD. 30174 A, B, C (mature, adolescent and immature shells), from loc. 70904 B (coll. A. INOMA and W. HASHIMOTO); TKD. 30600 A, B (adolescent and immature shells), from loc. P7 (coll. W. HASHIMOTO). There is a fragmentary body-chamber, TKD. 30598, from loc. P2 (coll. W. HASHIMOTO), which is probably referable to this species.

Diagnosis.—The shell is small, the known maximum diameter of the adult shell being about 40 mm (restored from the deformed body-chamber of TKD. 30174 A). It is fairly involute, nearly two-thirds of the inner whorl being overlapped by the outer. The whorl grows fairly rapidly in height. The umbilicus is shallow and fairly narrow, about one fifth to a quarter of the entire shell-diameter. The whorl is much higher than broad, showing a ratio of B./H. of less than 0.75. It has a narrowly arched venter, which slopes gently to the flanks without forming angular or subangular ventrolateral shoulders. The flanks are nearly flat or gently convex, with the maximum whorl-breadth below the mid-flank (at about one third of the whorl-height). The flank passes to a gently rounded umbilical shoulder and then to a sloping, low umbilical wall. The cross-section of the whorl is compressed elliptical or thinly lenticular.

The young shell below 10 mm or so in diameter is smooth. Then a few weak ribs appear at a diameter of slightly more than 10 mm. They are as flexiradiate and nearly as distant as the later ribs, but fade away on the venter. Soon the ribs acquire moderate intensity, with gradual coarsening for more than a full whorl (probably 400° or so). They are as a rule alternately long and short, but sometimes two shorter ones are inserted or occasionally two longer ones occur without an intercalated shorter one. The ribs are moderately distant, separated by somewhat wider interspaces in lateral view. The longer ones are mostly but not always provided with an umbilical bulla which is most prominent at some distance from the umbilical shoulder. There are 11 or 12 ribs per half whorl.

The ribs are mostly gently flexuous, showing a forward inclination near the

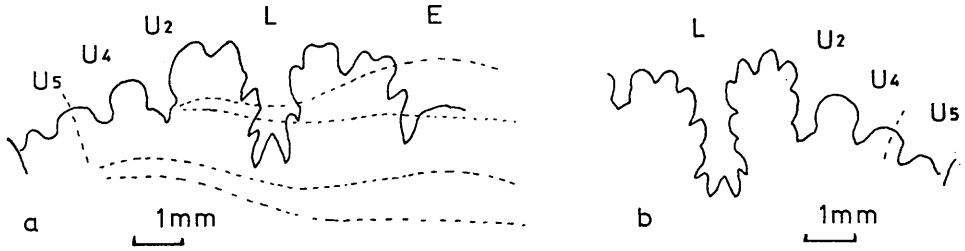

Fig. 11. *Stoliczkaia* (*Shumarinaia*) *asiatica* sp. nov. a. External last suture of the holotype, TKD. 30173 A, at whorl-height=6.4 mm; b, Suture on the flank of another specimen, TKD. 30173 B, at whorl-height=7.0 mm. (T. M. *delin.*)

umbilical margin, a slightly backward curve at about the middle of the flank and again forward bend on the outer part of the flank, and at the ventrolateral shoulder thicken but have no tubercles. The thickened ribs run across the venter with a gently forward convexity on their anterior side and at right angle with the siphonal line on their posterior side. As the ribs are thicken on the ventral part, they are nearly as broad as their interspaces.

The suture is of general *Stoliczkaia* type, but simpler, with shallower and less numerous minor incisions. The first lateral saddle is broadly subquadrate and shallowly bifid; L has a moderately narrow stem; the second lateral saddle is somewhat taller than the first; the auxiliaries are gradually descending.

Measurements.—

Specimen	Diameter	Umbilicus (%)	Height	Breadth	B./H.
TKD. 30173 A	20.6	5.0(24)	9.3	6.2	0.67
〃 (−90°)	16.3	3.5(21)	7.8	5.3	0.68
TKD. 30173 B	18.0	3.7(21)	8.8	5.7	0.65
TKD. 30173 C	~23.8	6.0(25)	11.8	—	—
〃 (−90°)	15.5	3.8(25)	6.8	5.0	0.74
TKD. 30174 A	~32.0	8.0(25)	~14.0	—	—
TKD. 30174 B	~17.5	~3.7(21)	8.1	~5.2	0.64
TKD. 30174 C	14.5	3.2(22)	6.4	4.8	0.75
TKD. 30600	11.5	2.2(19)	5.4	4.0	0.74

Discussion.—The present species resembles *Stoliczkaia* (*Shumarinaia*) *hashimotoi* sp. nov., but is distinguished by its more involute coiling, narrower umbilicus, more compressed, more rapidly growing whorl, somewhat narrower stem of L in the suture and more numerous and somewhat finer ribs.

It is closely allied to *Stoliczkaia* (*Shumarinai*) *africana* PERVINQUIÈRE (1907, p. 389, pl. 12, fig. 10; pl. 16, figs. 19–23; text-fig. 149), whose **lectotype** is designated here as the specimen from Dj. Zrissa, Tunisia, figured by PERVINQUIÈRE, 1907, pl. 12, fig. 10 (as intended by SPATH, 1931, p. 332), in its compressed, involute and fairly narrowly umbilicate shell and mode of ribbing. They are, however, distinguished in that *S.* (*S.*) *africana* has a truncated venter with tuberculated subangular ventrolateral tubercles on its inner whorl, while *S.* (*S.*) *asiatica* has always a narrowly arched venter without such angulate ventrolateral shoulders. The suture is simpler in our species. The ventral projection of the ribs on the adult whorl seems to be more pronounced in *S.* (*S.*) *africana,* as typically shown by a

Nigerian example figured by REYMENT (1955, p. 45, pl. 7, fig. 5). These differences might be regarded as subspecific, but unless the species from Africa and Japan be confirmed to be contemporary, they should be treated as allied but distinct species. *S.* (*S.*) *africana* is recorded as uppermost Albian.

C. W. WRIGHT (*in lit.* 2 July 1975) has kindly informed us that he has a set of specimens of *S.* (*Shumarinaia*) *africana,* from the *dispar* Subzone, Dorset, England. One of them, WW 22970, has very distinct rounded ventrolateral bulges at the beginning of the body chamber. In another example, WW 23063, from the same horizon and locality as WW 22970, the bulges seem to disappear earlier.

Occurrence.—The type locality is 70904 A, main stream of the Shumarinai, where numerous other ammonites were obtained. Also loc. 70904 B and HASHIMOTO's los. P7 and P2., the Shumarinai.

Family Acanthoceratidae DE GROSSOUVRE, 1894

Genus *Mantelliceras* HYATT, 1903

Type-species.—*Ammonites mantelli* J. Sowerby, 1814.

Generic diagnosis.—See KENNEDY, 1971, p. 49.

Remarks.—KENNEDY (1971) defines *Mantelliceras* fairly comprehensively and uses no subgeneric names. This is probably based much on the result of restudy of *Mantelliceras saxbii* and allied species by KENNEDY and HANCOCK (1971). Meanwhile THOMEL (1972) has described numerous species from southeastern France under a number of subgenera, *Submantelliceras* SPATH, 1923, *Couloniceras* BUSNARDO, 1966, *Promantelliceras* THOMEL, 1972, *Pseudomantelliceras* THOMEL, 1972, *Mantelliceras* s.s.; *Neomantelliceras* THOMEL, 1972 and *Bunburyiceras* THOMEL, 1972. As our present material is not sufficiently numerous, we would not discuss the problem of subgeneric classification of *Mantelliceras* on this occasion. Although the species described below may show the so-called submantelliceratine characters, it is described under the genus *Mantelliceras* without giving subgeneric name.

Mantelliceras brazoense BÖSE

Pl. 40, Fig. 1; Text-fig. 12

1928. *Mantelliceras brazoense* BÖSE, *Univ. Texas Bull.*, 2748 (for 1927), p. 220, pl. 6, figs. 5–43.

1928. *Submantelliceras* (?) *brazoense,* ADKINS, *Univ. Texas Bull.*, 2838, p. 239, pl. 23, figs. 5, 11.

Types.—BÖSE (1928) set up this species on numerous, small specimens from the Del Rio Clay, now preserved at the Bureau of Economic Geology, University of Texas, Austin, of which the one figured in his pl. 6, figs. 7, 8, 26, 27 is the holotype, as originally designated by BÖSE (1928, explanation of plate).

Material from Hokkaido.—TKD. 30165, from loc. 70904 A (coll. A. INOMA and W. HASHIMOTO), a small but well preserved specimen, in which test is preserved on the septate whorl and the living chamber is represented by an internal mould.

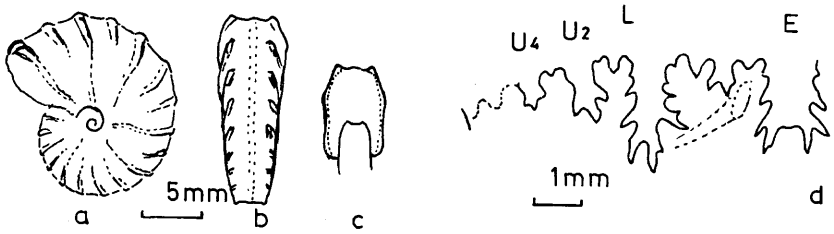

Fig. 12. *Mantelliceras brazoense* BÖSE. Diagrammatic sketch of TKD. 30165. Lateral (a) and ventral (b) views, whorl-section (c) and external suture (d) at whorl-height=5.0 mm. (T. M. *delin.*)

Measurements.—

Specimen	Diameter	Umbilicus (%)	Height	Breadth	B./H.
TKD. 30165	14.2	2.2(15)	7.8	5.3	0.68
BÖSE's I	14.6	2.8(19)	7.3	5.6	0.77

Description of the Hokkaido specimen.—This single specimen is small but has the living chamber for about 200°. The last suture is at about 5 mm in whorl-height.

The shell is much involute and narrowly umbilicate. The whorl is compressed, with flattened and nearly parallel flanks, which gently converge in the ventrolateral part, angular outer ventrolateral shoulders, nearly flat, narrow venter which is bluntly raised along the siphonal line, subangular umbilical shoulders and low but steep umbilical walls. Accordingly the whorl section is narrowly subrectangular to subtrapezoidal. A very faint spiral depression is discernible at about the middle of the flank of the outer whorl.

Ribs are gently sigmoidal and as a rule alternately long and short. On the inner half of the flank they are weak and scarcely perceptible or undeveloped in the early stage of growth. On the outer whorl some of the long ribs are faintly bullate but never distinctly tuberculate around the umbilical margin. The ribs are bent somewhat forward at the inner ventrolateral blunt shoulder, where the ribs are swollen or weakly nodate but not distinctly tuberculate. The ribs become moderately strong on the ventrolateral part of the living chamber between the inner and outer ventrolateral shoulders. The outer ventrolateral tubercles are clavate and moderately strong on the living chamber. The ribs do not cross the venter.

In this specimen there are 18 ribs on the outer whorl, of which 11 are on the living chamber. They are separated by slightly wider interspaces.

The suture resembles rather that of certain *Stoliczkaia*. The last suture at whorl-height=5 mm or so is visible. E is rather narrow. The first lateral saddle is subquadrate in rough outline and distinctly bipartite. L is narrow, deep (deeper than E), fairly deeply branched and asymmetrically bifid at the bottom. It is situated well outside the mid-flank. The second lateral saddle is slender. It is aligned on a gently descending line together with the auxiliaries. The subdivided end of the folioles show a roundish outline.

Discussion.—The described characters essentially agree with the diagnosis of *Mantelliceras brazoense* BÖSE. On the basis of the observation by one of us (T. M.) of BÖSE's numerous specimens, we regard minor differences in the narrowness of the umbilicus, number of ribs per whorl etc., as being within the extent of varia-

tion of that species.

M. brazoense is closely allied to *Mantelliceras wacoense* BÖSE (1928, p. 215, pl. 5, figs. 9–25, pl. 6, figs. 1–4) from the same Del Rio Clay. The latter was established on a smaller number of specimens than the former (5 as compared with about 30). The distinction is in the slightly broader umbilicus, less compressed whorl and somewhat stronger ornament of the latter.

Mantelliceras aumalense (COQUAND, 1862) (see PERVINQUIÈRE, 1907, p. 296, pl. 16, figs. 6–11; 1910, p. 42, pl. 4, figs. 1–19; COLLIGNON, 1929, p. 34, pl. 3, figs. 11–13; 1964, p. 26, pl. 323, fig. 1435), from the Lower Cenomanian of Tunisia, Algeria and Madagascar, which resembles *M. wacoense,* differs from *M. brazoense* in its less compressed whorl and stronger ornaments, having distinct tubercles at the inner ventrolateral and umbilical shoulders, except for very early stage.

Mantelliceras suzannae (PERVINQUIÈRE) (1907, p .298, pl. 16, figs. 12, 13; 1910, p. 42, pl. 4, figs. 30, 31) (also COLLIGNON, 1929, p. 35, pl. 3, figs. 14–15; 1964, p. 27, pl. 323, fig. 1438), from the Lower Cenomanian of Tunisia, Algeria and Madagascar, is somewhat similar to *M. brazoense,* but its whorl is more compressed, more distinctly rectangular in section and has a flat or rather concave venter.

All of the above species are allied to one another and represented by type-specimens of small size. These specimens are generally assumed as nuclei of some larger ammonites, but no adult examples have been confirmed with certainty. Some of them are said to be similar to *Mantelliceras martimpreyi* (COQUAND, 1862) (*sensu* PERVINQUIÈRE, 1910), which, in turn, has proved to be equivalent to immature *Mantelliceras saxbii* (SHARPE, 1857) [=*M. hyatti* SPATH, 1925] (KENNEDY and HANCOCK, 1971). This situation would lead us to suppress *Submantelliceras* SPATH, 1923, whose type-species is *Ammonites aumalensis* COQUAND. However, until the characters of the adult shell of this species be known, the final decision should be suspended.

It should be noted that the described specimen from Hokkaido is not a nucleus of a larger ammonite but itself has a living chamber of considerable length. Whether it is mature or immature is hardly to be decided from the available evidence.

In the recent collection (May 1975) of INOMA, from loc. 7504 of the main stream of the Shumarinai, there is a fragmentary but interesting specimen (TKD. 30642). It represents a part (about 120°) of the body chamber of moderate size (with a whorl height of about 25 mm) and has fairly distant faint ribs, spinose inner and outer ventrolateral tubercles and single weak umbilical bullae at the end of the longer ribs. Its earlier part quite resembles in ornament and whorl-section the above described specimen of *M. brazoense.* The two ventrolateral tubercles become stronger and more distinctly spinose on its later part but they are not amalgamated to a horn. The venter is narrow and tabulate with scarcely perceptible ribbing. The shell is similar to a certain species of *Sharpeiceras* but devoid of lateral tubercles. This may be a middle-aged shell of such a species as *Graysonites adkinsi,* but could possibly be a later or adult (?) whorl of *M. brazoense.* It could be further suggested that *M. brazoense* might be nuclei of *Graysonites adkinsi.* We need more collections for the final conclusion.

Acanthoceras worthense ADKINS (1920, p. 93, pl. 1, figs. 11–13, 15–17, 20–25), from the Pawpaw Formation of Texas, is another species to be taken into consideration. ADKINS (1928, p. 239, pl. 20, figs. 10–11) subsequently transferred it to *Submantelliceras,* whereas KENNEDY and HANCOCK (1971, p. 443) mentioned that it is indistinguishable from *M. martimpreyi* [=*M. saxbii*]. Through the

restudy of the type specimens of this species by one of us (T. M.) at Austin, it is most probably referred to *Stoliczkaia*, because a larger paratype shows the character of *Stoliczkaia* type ribbing in its last part. BÖSE (1928, p. 223) remarked that both *M. wacoense* and *M. brazoense* could have developed from this species. The basal Pawpaw Clay, from which *Stoliczkaia worthense* came together with *Neokentroceras worthense* (ADKINS) is Upper Albian.

Occurrence.—Loc. 70904 A of the River Shumarinai, together with many ammonites. The presence of this species suggests that the ammonites from loc. 70904 A are probably of Lower Cenomanian age.

Genus *Graysonites* YOUNG, 1958

Type-species.—*Graysonites lozoi* YOUNG, 1958 (by original designation).

Generic diagnosis.—The shell is fairly large, being 150 mm or more in diameter at the adult stage. It is moderaty involute and fairly narrowly umbilicate. The inner (immature) whorl is compressed, having a narrow tabulate venter bordered by angular outer ventrolateral shoulders. It is ornamented with numerous ribs which are as a rule alternately long and short or bifurcated near the umbilical margin, somewhat prorsiradiate or gently flexuous on the flank, and normally provided with umbilical bullae, inner and outer ventrolateral tubercles. The tubercles on the immature shell are not prominent and in some forms the umbilical and the inner ventrolateral ones are much weakened.

The outer whorl is somewhat broader than the inner one but still more or less higher than broad in the intercostal section. It is ornamented with distant long ribs which are provided with ventrolateral horns at the adult stage. The horn is developed from the united outer and inner ventrolateral tubercles. Somewhat below the mid-flank there is another, moderately strong tubercle, which is shifted outward (upward) from the umbilical bulla or developed on the elongated umbilical bulla in addition to the swelling at the umbilical margin.

The suture is similar to that of *Sharpeiceras*. The lobes are fairly deep and narrow, and especially L has deep branches. It is situated outside the mid-flank. The first lateral saddle (between E and L) is fairly deeply bipartite. The folioles show rounded outline at their end.

Remarks.—Comparisons of *Graysonites* with *Sharpeciceras, Utaturiceras, Acompsoceras, Mantelliceras* and doubtful *Submantelliceras* have already been discussed (see YOUNG, 1958; MATSUMOTO, 1960; MATSUMOTO et al. 1966; KENNEDY, 1971, especially p. 50–53). The proposal of the subfamily Utaturiceratinae for *Utaturiceras, Graysonites, Sharpeiceras, Acompsoceras, Neopulchellia, Cottreauites* and "*Submantelliceras*" (by MATSUMOTO *in* MATSUMOTO et al., 1969) was rejected

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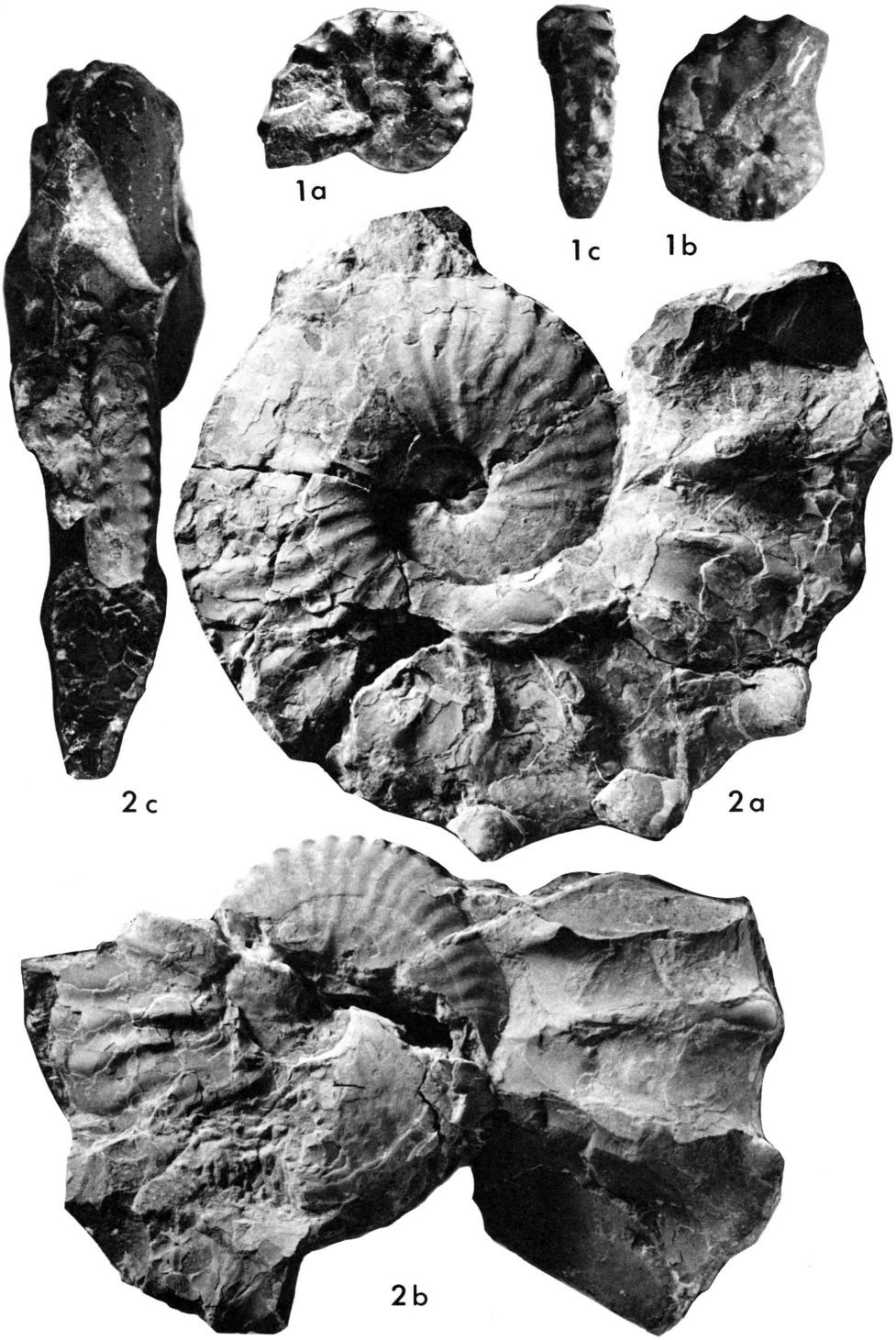
Explanation of Plate 40

Fig. 1. *Mantelliceras brazoense* BÖSE ..... Page 281
TKD. 30165 (A. INOMA & W. HASHIMOTO Coll.), from loc. 70904 A, the Shumarinai. Two lateral (a, b) and ventral (c) views, ×2.

Fig. 2. *Graysonites wooldridgei* YOUNG ..... Page 285
TKD. 30595 (S. KANNO Coll.), from loc. 30z, Sakinzawa, 5 km southwest of Shumarinai. Entire lateral view (a), ×2/3; another lateral view, showing the inner whorl, with a part of the outer whorl excluded (b), ×3/4; ventral view of the inner whorl, with a part of the outer whorl excluded (c), ×3/4.



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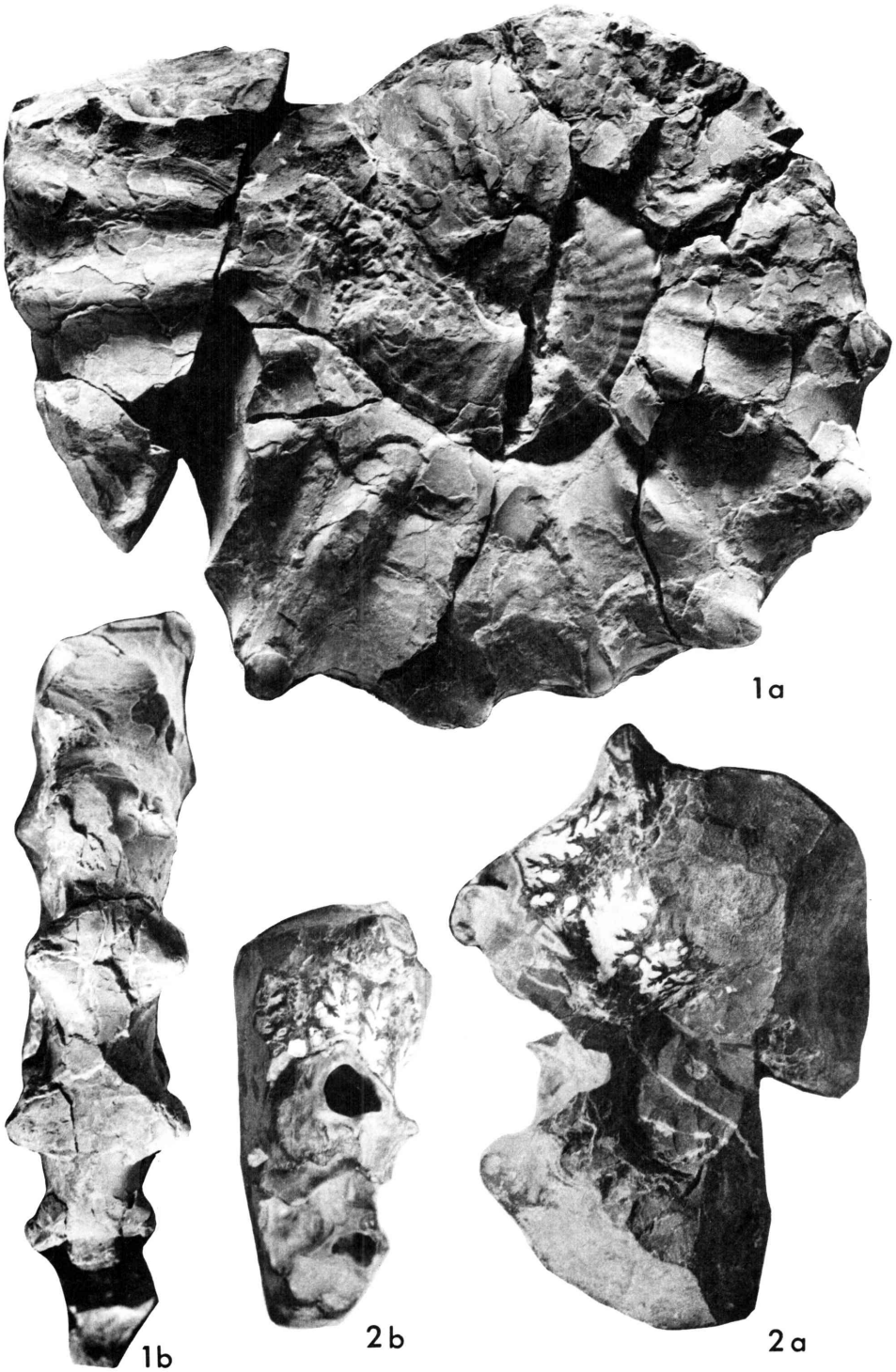

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by KENNEDY and HANCOCK (1971, p. 445), because *Utaturiceras vicinale* (STOLICZKA) could be an extreme variant of the *Mantelliceras saxbii* group. We still hesitate to admit the high variability of sutures in *Mantelliceras*. Anyhow, a reasonable solution of this question should be led through the examination of the characters at population level on some suitable samples.

Distribution.—Species of *Graysonites* have been reported from the Lower Cenomanian of Texas, California, Japan and Spain.

Graysonites wooldridgei YOUNG

Pl. 40, Fig. 2; Pl. 41, Fig. 1; Text-fig. 13

1958. *Graysonites wooldridgei* YOUNG, *Jour. Paleont.*, vol. 32, p. 175, pl. 28, figs. 1–4; pl. 29, figs. 2, 4; Text-figs. 3c, d, f.
1959. *Graysonites wooldridgei*, MATSUMOTO, *Mem. Fac. Sci., Kyushu Univ.*, ser. D, Special vol. 1, p. 66, pl. 18 fig. 1; text-figs. 24–27.

Holotype.—UT. 19819, from the Grayson Formation, Texas (designated by YOUNG, 1958, p. 195).

Material.—TKD. 30595, from loc. 30Z (coll. S. KANNO, 1962), a somewhat secondarily compressed adult shell, with test preserved.

Measurements.—(*on secondarily compressed whorl)

Specimen	Diameter	Umbilicus (%)	Height	Breadth	B./H.
UT. 19819	125.0	26.5(21)	45.0	26.5	0.59
TKD. 30595 *	184.0	52.0(28)	71.5	42.0	0.59
〃 (−270°)*	95.0	21.0(22)	46.4	23.8	0.51
〃 (−450°)	—	—	35.4	21.6	0.61
〃 (−540°)	—	—	28.4	17.6	0.62

Description of the Hokkaido specimen.—The secondarily compressed and somewhat damaged outer whorl was taken out and the undeformed inner whorl was at first observed (see Text-fig. 13 d, e). Then the outer whorl was fixed again.

The shell is fairly involute, nearly a half of the inner whorl being overlapped by the outer whorl, but the last part of the outer whorl becomes less involute, with somewhat widen umbilicus (28 percent of diameter as compared with 21 to 23 percent in the typical part). The whorl is higher than broad, with B./H.=0.61–0.62 in the underformed part. The outer whorl is likewise compressed in the intercostal section, although it is secondarily much compressed in the actual specimen. The venter is narrow and tabulate.

The ribs on the inner whorl are numerous (9 per quarter whorl), fairly crowded, gently flexuous and as a rule alternating long and short but may be sometimes modified. They are weak and rather flat-topped. A weak umbilical bulla is

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Explanation of Plate 41

Fig. 1. *Graysonites wooldridgei* YOUNG ..... Page 285
TKD. 30595 (same as Pl. 40, Fig. 2). The other side view (a), 2/3 and the ventral view (b), ×3/5.

Fig. 2. *Graysonites* sp. aff. *G. adkinsi* YOUNG ..... Page 287
TKD. 30169 (A. INOMA Coll.), from loc. 72907, Sanjussen-zawa, 5 km northwest of Soeushinai. Lateral (a) and ventral view (b) of an incomplete specimen.

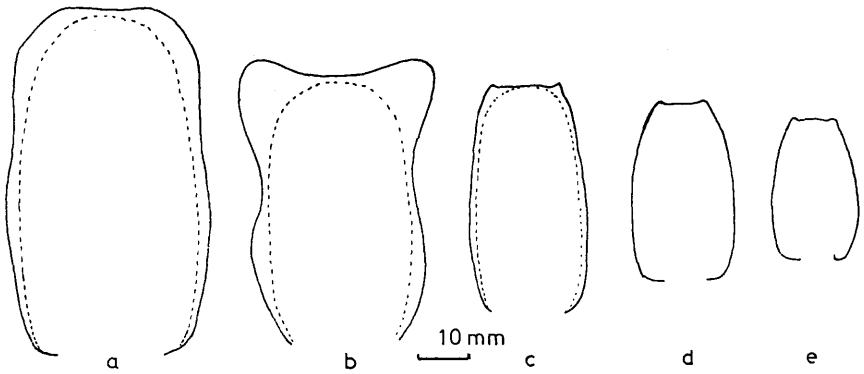


Fig. 13. *Graysonites wooldridgei* YOUNG. Diagrammatic whorl-sections at successive growth-stages. a: along the second last rib, b: near the last septum, c: about 90° behind b, d: about 180° earlier than c, e: about 180° earlier than d. a–c may be somewhat secondarily compressed; d, e undeformed. (T. M. *delin.*)

discernible on some of the long ribs. All the ribs have distinct clavi at the outer ventrolateral shoulders, whereas the inner ventrolateral nodes are very faintly discernible and on some ribs almost imperceptible.

The outer whorl is half septate and the other half is the living chamber. The ribs are still weak up to the part about 90° behind the last suture, showing essentially the same characters as those of the inner whorl. In the last quarter (90°) of the septate whorl the ribs become rapidly distant, but still alternately long and short. The inner ventrolateral nodes are almost imperceptible. In the last part of the septate whorl and in the main part of the living chamber the ribs are equally long, much distant, numbering 9 per half whorl, less flexuous or almost rectiradiate and stronger than those of the preceding stages. They are elevated at a short distance below the mid-flank. On the rib near the last part of the septate stage this lateral tuberculation occurs in addition to the umbilical bulla and on the living chamber the umbilical bullae weaken or almost disappear and the lateral bullae become more distinct. The ventrolateral clavi are developed to the strong horns, which stretch obliquely laterally and somewhat upward.

The last two ribs near the end of the living chamber are again gently flexuous and the tubercles become less prominent.

The apertural margin shows an asymmetric sinus near the umbilical margin and another gentle sinus at the outer lateral part. (This is the first record of the apertural margin of *Graysonites*.)

The suture is incompletely exposed, showing the diagnostic pattern of *Graysonites*.

Discussion.—The described specimen from Hokkaido resembles so closely the holotype of *G. wooldridgei* YOUNG, 1958, pl. 28, figs. 1–4) from Texas that we would regard them as specifically identical. Our specimens, however, have extremely weak and partly obsolete inner ventrolateral tubercles. In the two specimens from California (MATSUMOTO, 1959, p. 66, pl. 18, fig. 1, text-figs. 26, 27) the same tendency has been noticed. As was discussed on that occasion (MATSUMOTO, 1959, p. 69), this minor difference can be reckoned as being within the variation of the species. A possibility that it could deserve subspecific distinction between the Gulf and

the Pacific provinces is reserved until more specimens are obtained from the two provinces.

Occurrence.—Loc. 30Z of S. KANNO, in a stream called the Sakin-zawa, a branch of the River Uryu, about 5 km northwest of Soeushinai, contained solitarily in a calcareous nodule; Member My3, mudstone below the predominant conglomerate and somewhat above the member of alternating sandstone and mudstone.

Graysonites sp. aff. *G. adkinsi* YOUNG
Pl. 41, Fig. 2; Pl. 42, Figs. 1–2; Text-fig. 14

Compare.—

1958. *Graysonites adkinsi* YOUNG, *Jour. Paleont.*, vol. 32, p. 176, pl. 29, figs. 1, 7; text-figs. 2a, e, f, 3a, e.

Material.—TKD. 30169, from loc. 72907; TKD. 30170, from loc. 81003; TKD. 30172, from loc. 80612, all collected by A. INOMA and W. HASHIMOTO.

Measurements.—

Specimen	Diameter	Umbilicus (%)	Height	Breadth	B./H.
TKD. 30169 (intercostal)	150	50(33)	67	60	0.90
TKD. 30170 (〃)	—	—	75	65	0.87

Description.—The above specimens are large but more or less incompletely preserved outer whorls and the above measurements are approximate. TKD. 30172 is a fragmentary living chamber. Inner whorls are unfortunately unpreserved.

The last suture is exposed at intercostal whorl-height=65 mm on TKD. 30169 and accordingly the shell must have been considerably large, if completely preserved.

The whorl is somewhat higher than broad in the intercostal section, with considerably inflated flanks, and broadest in the lower part below the mid-flank. The costal section is nearly as broad as high.

The outer whorl has much distant, nearly rectiradiate, equally long, strong ribs which are provided with prominent ventrolateral horns and another strong elevation at some distance below the mid-flank. This lateral tubercle may mean the upward (i.e. outward) shifted highest point of the umbilical bulla. In TKD. 30172 the top of the ventrolateral horn is indistinctly doubled, showing the amalgamation of an outer ventrolateral clavus with a more prominent inner ventrolateral tubercle. In other two specimens the preserved part of the ventrolateral horns do not retain the doubling feature. The horns are stretched obliquely laterally and upward (i.e. outward) and the interspace between the horns is rather concave in costal section and not tabulate.

The suture, as exposed on TKD. 30169, is considerably deeply incised. The first lateral saddle (between E and L) is deeply bipartite and minor lobules are also deep. The two branches of the saddle are thus so deeply incised that their stem is much narrowed. L is of moderate breadth, much deeper than E, and has four deep branches in its lower part. Other lobes (U2, U4, U5) are much smaller than L and themselves narrow. The folioles show phylloid terminals.

Discussion.—The observable characters show that the described specimens probably represent a species which is closely allied to *Graysonites adkinsi* YOUNG, but in the holotype of that species the double ventrolateral tuberculation persists for a longer period even at the stage of hypernodosity. In our specimens the

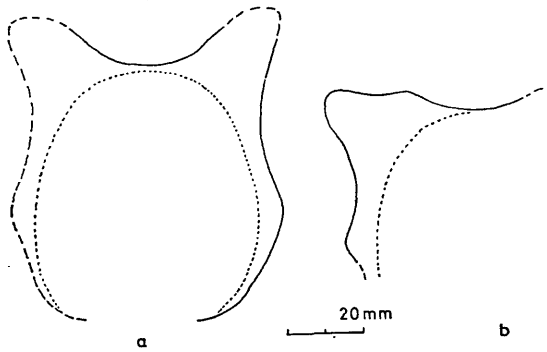


Fig. 14. *Graysonites* sp. aff. *G. adkinsi* YOUNG. Diagrammatic whorl-sections of TKD. 30169 (a) and TKD. 30172 (part) (b). (T. M. *delin.*)

amalgamation of the two tubercles is distinct and probably occurs earlier. Whether this difference deserves specific separation or not is hardly decided on the available evidence. Another difference is much more florid aspects of the suture in our specimen as compared with the illustration by YOUNG (1958, text-fig. 2e, f.). This may have come merely from the difference in the way of drawing. For the time being our specimens are described under *Graysonites* sp. aff. *G. adkinsi* YOUNG.

It should be noted that a fragmentary specimen from Kyushu described under *Graysonites* sp. indet α by MATSUMOTO (1960, p. 49, pl. 8, fig. 1; text-fig. 8) has characters which are closely similar to those of the Hokkaido specimens. It would be better to be regarded as specifically identical and therefore should be called temporarily *G.* sp. aff. *G. adkinsi* rather than *G.* sp. aff. *G. lozoi*. Anyhow, more and better preserved specimens are wanted in both Hokkaido and Kyushu for the final specific identification.

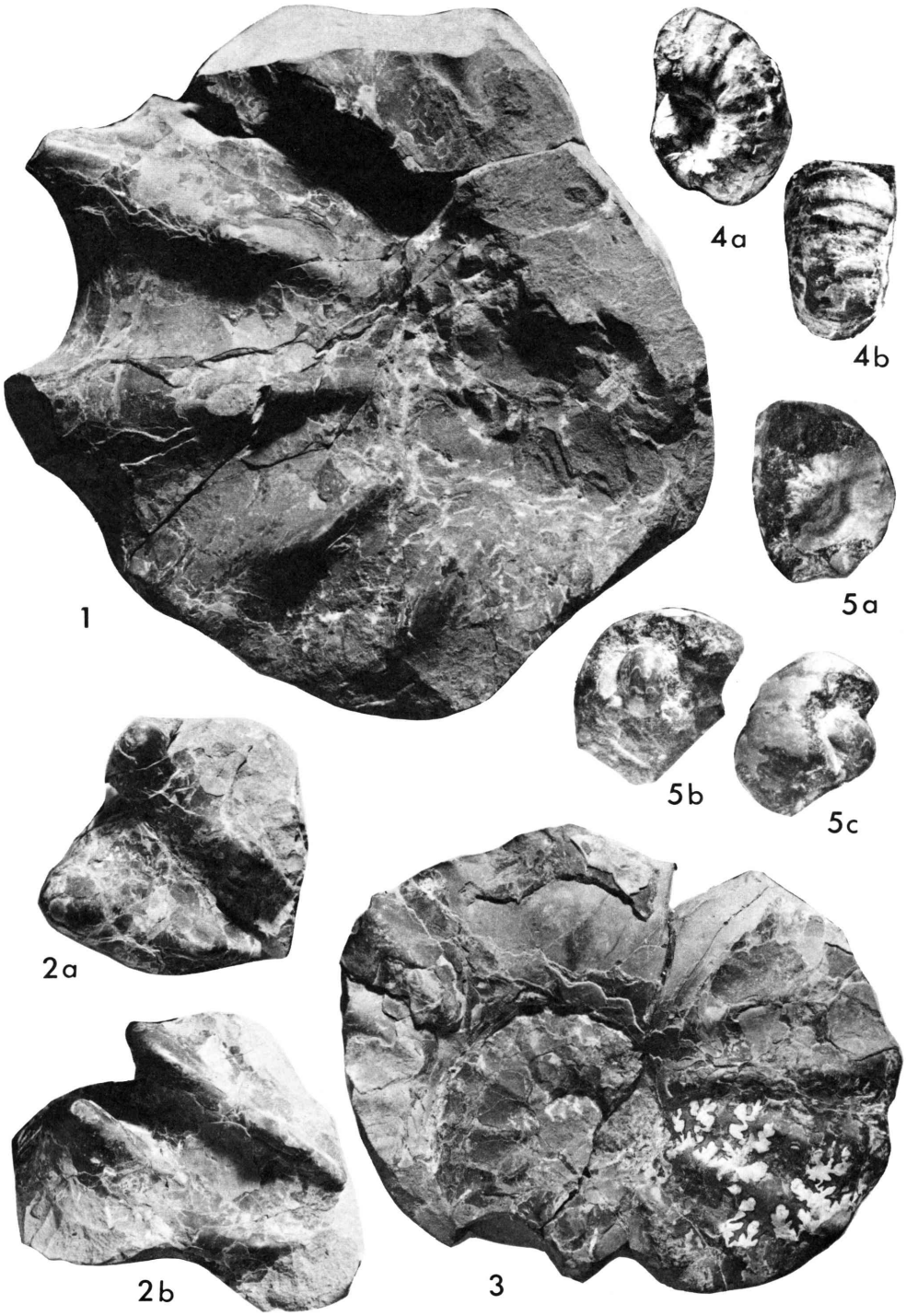
Graysonites fountaini YOUNG, including the holotype and other examples from Texas (YOUNG, 1958, p. 29, figs. 3, 6, 5, text-figs. 2c, 3b, 2b) and probable examples from Kyushu (MATSUMOTO, 1960, p. 44, pl. 6, fig. 1; pl. 7, figs. 1–4; text-figs. 1–7), shows single ventrolateral tuberculation at the adult stage and an oval intercostal whorl-section. It has, however, a wider and rather tabulate venter in the costal section. Anyhow, *G. adkinsi* and *G. fountaini* are closely allied to each other and

Explanation of Plate 42

Figs. 1–2. *Graysonites* sp. aff. *G. adkinsi* YOUNG ..... Page 287
1. TKD. 30170 (A. INOMA Coll.), from loc. 81003, a tributary of the Sounnai, Lateral view, ×2/3.
2. TKD. 30172 (A. INOMA Coll.), from loc. 80612, another smaller tributary of the Sounnai. Lateral view of two fragments (a, b) of the outer whorl, ×1/2.

Fig. 3. *Graysonites* (?) sp. indet. ..... Page 289
TKD. 30171 (A. INOMA), from loc. 81006, a tributary of the Sounnai. Lateral view of an incomplete specimen, ×2/3.

Figs. 4–5. *Ficheuria pusilla* sp. nov. ..... Page 290
4. Holotype, TKD. 30603 (W. HASHIMOTO Coll.), from loc. P5, the Shumarinai. Lateral (a) and ventral (b) views, ×2.
5. TKD. 30168 A, B (A. INOMA and W. HASHIMOTO Coll.), from loc. 70904 A, the Shumarinai. A smaller specimen, 30168 B, is contained in the fragmentary living chamber of a larger specimen, 30168 A, in oblique orientation.
a: lateral view of the larger specimen; b: ventral view of 30168 A and lateral view of 30168 B; c: ventral view of 30168 B; all ×2.



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occur in the same zone of Texas.

Occurrence.—Loc. 72907, in a boulder of Kyoei-Sanjussen-zawa, a tributary of the River Uryu; loc. 81003 and 80612, in boulders of a branch of the Sounnai, a tributary of the River Uryu. They are probably derived from the upper part of the "Takimibashi Formation" (My3) defined by HASHIMOTO et al. 1965.

Graysonites (?) sp. indet.
Pl. 42, Fig. 3

Material.—TKD. 30171, from loc. 81006, an incompletely preserved shell without ventral part (coll. A. INOMA).

Description.—This specimen exhibits the suture which is quite similar to that of *G. fountaini* (e. g. MATSUMOTO, 1960, text-fig. 5), showing large and long L which has four deep branches in its lower part, subquadrate first lateral saddle which is divided by a branching lobule, slender second lateral saddle which is incised deeply by narrow lobules and has a narrowed stem, smaller, apparently tripartite U2 and descending auxiliaries. The terminals of the folioles are phylloid.

Although the specimen is incompletely preserved, the shell seems to be originally compressed and fairly narrowly to moderately umbilicate (in early to later stages). The flanks are rather flattened or only slightly inflated.

Ribs are blunt, moderately distant, separated by gently concave interspaces which are somewhat but not much broader than the ribs. They consist of alternately longer and shorter ones on the septate whorl but the long ribs predominate on the living chamber. The long ribs mostly have blunt umbilical bullae. The shorter ribs start at or below the mid-flank. The inner ventrolateral tubercles are situated on the zone running on the ventral side of L and separated from the outer ventrolateral tubercles, which unfortunately are destroyed away from the outer whorl of this specimen. On the inner whorl the outer ventrolateral tubercles are clavate. The ribs are nearly rectiradiate on the main part of the flank and run somewhat forward from the inner ventrolateral node to the outer. At the early stage about 360° or more before the last septum the ribs are fine and crowded, showing the so-called submantelliceratine features.

Discussion.—In view of the early appearance of the distant ribbing and the pattern of suture this specimen may belong to a species which is closely allied to *Graysonites fountaini* YOUNG (1958) but distinguished by the persistence of umbilical bullae and the larger distance between the inner and the outer ventrolateral tubercles. In other words, *G. fountaini* is characterized by the amalgamated ventrolateral horns and upward shifted, strong lateral tubercles appearing at earlier stage on the outer whorl.

In the compressed whorl this specimen is similar to *G. wooldridgei,* but the crowded fine ribbing persist longer and the two ventrolateral tubercles are approximated in that species. The correct proportion of breadth to height is hardly measured in this incompletely preserved specimen.

We expect that the *Graysonites* type hypernodosity would appear at a still later growth-stage, which is unfortunately missing. Otherwise this specimen could represent an adult shell of a species belonging to the group of *Mantelliceras discoidale* (KOSSMAT) or "*M.* (*Submantelliceras*)".

Occurrence.—Loc. 81006, a floated calcareous nodule in a left branch of the Sounnai, a tributary of the River Uryu, about 4.5 km west of Soeushinai. The

ammonite was contained solitarily in the nodule which probably came from unit My3.

Family Flickiidae ADKINS, 1928

Genus *Ficheuria* PERVINQUIÈRE, 1910

Type-species.—*Ficheuria kiliani* PERVINQUIÈRE, 1910 (by original designation).

Remarks.—The family Flickiidae include the genera *Flickia* PERVINQUIÈRE, 1907, *Ficheuria* PERVINQUIÈRE, 1910 and *Adkinsia* BÖSE, 1928. They are small, inconspicuous Mid-Cretaceous ammonites with much simplified, goniatitic sutures. As in the cases of certain other peculiar dwarf ammonites, they are cryptogenic, although the family is now provisionally assigned to the Acanthocerataceae. As alternative we consider a possibility that the family could be a degenerated offshoot of the Desmoceratidae, because certain species, including the new species described below, are similar in shell-form and ornament to immature shells of some Pachydiscidae (e. g. *Eopachydiscus*). This may, however, be merely a case of homoeomorphy.

Of the three genera, *Flickia* is characterized by the comparatively compressed shell and the smooth surface, *Ficheuria* by the globular shell with a deep umbilicus and angular to subangular umbilical shoulder, and *Adkinsia* by the intermediate shell-form and the distinct umbilical tubercles. The specimens obtained from the Shumarinai area represent a new species of *Ficheuria*.

The representatives of the Flickiidae have been known from the Upper Albian and Lower Cenomanian of Tunisia, Algeria, Madagascar and Texas. The present description marks the first record of this family from the northern Pacific region.

Ficheuria pusilla sp. nov.

Pl. 42, Figs. 4–5; Text-figs. 15–16

Material.—Holotype, TKD. 30603, from loc. P5 (coll. W. HASHIMOTO), with a somewhat deformed body chamber. Paratypes, TKD. 30168 A and B, from loc. 70904 A, (coll. A. INOMA and W. HASHIMOTO), an incomplete (about half) outer whorl (A) and an internal mould of an immature shell (B).

Diagnosis.—The shell is small, only 15 mm in diameter at the probably adult stage, considerably involute and globose in aspect. The whorl is fairly depressed, with a wide and moderately arched venter that passes to inflated flanks and then forms a subangular shoulder around the umbilicus. The umbilicus is fairly narrow and deep, surrounded by a steep and high umbilical wall.

The surface of the inner whorl is smooth. On the earlier part of the outer whorl (which may represent the middle growth-stage) appear shallow constrictions which are accompanied with a faint elevation at the umbilical shoulder behind them. On the body-chamber (of probably adult stage) numerous, rib-like radial elevations of unequal strength cover the surface with irregular spacing. A faint constriction like radial furrow is discernible in the last part.

The sutures are very simple, showing a goniatitic pattern not only in the inner whorl but also on the outer whorl (at the last part of the septate stage). It consists of E, L, U2, U3(?), U1, and I. E is fairly deep and divided by a small median saddle at the bottom. Other elements (saddles and lobes) are all entire,

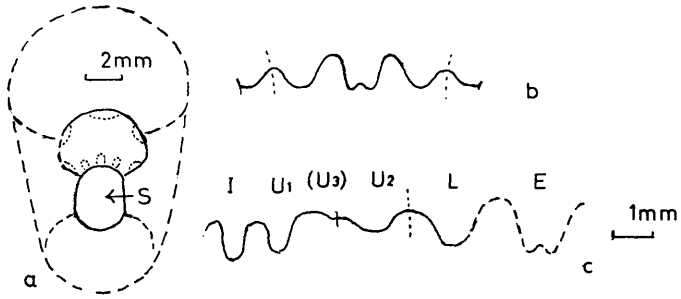

Fig. 15. *Ficheuria pusilla* sp. nov., Holotype, TKD. 30603. a. natural whorl-section of inner whorl, with restored outline of deformed outer whorl; b. external suture of inner whorl (at S); c. Suture (partly restored) of outer whorl (about 360° later than b). (T. M. *delin.*)

without minor incisions.

Measurements.—

Specimen	Diameter	Umbilicus (%)	Height	Breadth	B./H.
TKD. 30603	15.0	—	6.5	8.5	(1.3)
〃 (→360°)					
TKD. 30168 A	13.0	3.5(27)	5.4	7.0	(1.3)

Discussion.—This species closely resembles in shell-form *Ficheuria peroni* DUBOURDIEU (1953, p. 35, pl. 3, figs. 51–54, text-fig. 11), from the Upper Albian (Horizon F) of Monts du Mellègue, Algeria, but is distinguished by its simpler suture. In *F. peroni* the first lateral saddle has a few minor incisions even at a probably immature stage (about 10 mm in diameter), whereas in our species the saddles are entire throughout growth.

Ficheuria kiliani PERVINQUIÈRE (1910, p. 36, pl. 3, figs. 9, 10; text-figs. 16, 17), from the Upper Albian of Algeria, shows less depressed, less inflated whorl section and less acute umbilical shoulder than the present species.

The suture of the present species is apparently similar to that of *Goniatites* of the Carboniferous Goniatitidae, but the sutural formula of that genus is E, A, L, U and I. In other words, A in the Goniatitidae is apparently similar to L in the Flickiidae, so is L in the former to U2 in the latter, and U in the former to U1 of the latter. Thus the homoeomorphy in the suture between the entirely unrelated Goniatitidae and Flickiidae is evident. Moreover in the Goniatitidae the external saddle in E is much larger and divided and A is V shaped instead of U-shaped. As the two ammonite groups are similar in shell-form and suture, they may have had similar mode of life, but the goniatite type hyponomic synus is not seen on the venter of the Flickiidae.

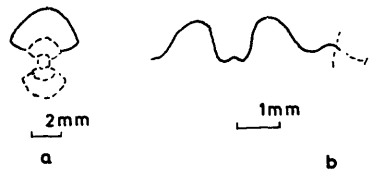

Fig. 16. *Ficheuria pusilla* sp. nov. Diagrammatic whorl-section (a) and external suture (b) of an immature example, TKD. 30168B (A. I. *delin.*)

Occurrence.—The holotype was obtained from a calcareous nodule at P5 of HASHIMOTO in the River Shumarinai, together with *Desmoceras kossmati* and numerous other ammonites, including heteromorpha. Two other specimens came from a prolific calcareous nodule at loc. 70904 A of the River Shumarinai.

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