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601. TWO SMALL DESMOCERATID AMMONITES FROM HOKKAIDO

(STUDIES OF THE CRETACEOUS AMMONITES FROM HOKKAIDO AND SAGHALIEN—XXIV)*

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北海道産デスモセラス科小型アンモナイト2種：その1は幾春別地方白亜系の下部セノマニアンの *Mantelliceras japonicum* 帯から産したもので，新属新種としてここに記載する。これは成体殻の径が 2 cm 足らずの小型で，四角い螺環断面をもち，螺旋曲線が少しずれている。殻表面には装飾がほとんどない。殻をはずすと弱いくびれが周期的に認められる。縫合線はかなり単純化しているが，個体発達的に辿るとデスモセラスの型である。幼殻はまるこい。このような特異形態を示す小型のものはアンモナイトの進化史上いろいろな科に正道からそれた小分枝として認められる。他例と同様その直接起源が正確に辿れず，見掛上不連続的に見いだされている。このものは普通のデスモセラス亜科のメンバーに比べて，あまり活発でない生活様式をもっていたのではないかと推察される。　松本達郎・村本辰雄

その2は羽幌地域のサントニアンから得られたもので，*Kitchinites* (*Neopuzosia*) の新種として記載する。プゾシア亜科には大型のものがよく知られているが，これは成体殻の直径が僅か 3 cm 程度であるとともに，その殻口縁に顕著な耳があることが特異である。その未成年殻は *K.* (*N.*) *ishikawai* のそれと酷似するが，耳の発達の前兆がすでに認められ，成体殻では明確に異なる。これに関連して，ジュラ紀アンモナイトで雌雄異形の実例と解釈されている場合との相似が気付かれるので，プゾシア亜科における雌雄異形の可能性につき一応検討したが，答はむしろ否定的である。本亜科のアンモナイトは，一定の型の縫合線をもっているが，大きさ，殻の装飾とくに住房の装飾，殻口の性質などにおいて，かなりの多様性を示す。本種はそうした分化発達の一端を示す実例とみなされる。

松本達郎・猪間明俊

Introduction

In this paper descriptions and remarks are given on two small, peculiar ammonite species which are assignable to the family Desmoceratidae. The authorship for one of them, belonging to the subfamily Desmoceratinae, is T. MATSUMOTO and T. MURAMOTO and that for the other, belonging to the subfamily Puzosiinae, is T. MATSUMOTO and A. INOMA.

Before going further we thank Dr. Itaru HAYAMI, Miss Yuko WADA and Miss Seiko HAYAKAWA in their kind assistance in preparing the plates and typescript. For the study of the second species we thank the Japan Petroleum Exploration Company and Professor Wataru HASHIMOTO for their kind support.

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Systematic description

Family Desmoceratidae

Subfamily Desmoceratinae*

Several years ago when we were concentrated in a field work to obtain fossils from the Cenomanian of the Ikushumbets area, central Hokkaido, one of us (T. MURAMOTO) was successful to find four small, peculiar ammonite specimens. They show very distinctive characters of one and the same species, which requires a new genus in the Desmoceratinae.

Genus ***Microdesmoceras*** MATSUMOTO and MURAMOTO, nov.

Type-species.—Microdesmoceras tetragonum sp. nov., to be described below.

Generic diagnosis.—A small desmoceratid, with somewhat simplified pattern of sutural elements, showing a broad and trifid lateral lobe (L) and somewhat phylloid terminals of saddles aligned on a descending line.

Coiling of moderate involution; slightly deviated from normal spire in the last whorl. The body-whorl and the preceding part of the late, septate whorl characterized by somewhat tetragonal outline in cross-section. The surface of the shell nearly smooth, only with flexuous weak lirae, which show a moderately projected curve on the venter and another on the middle part of the flank. Gently sigmoid, periodic constrictions marked on the internal mould of late whorls, but not accompanied with a perceptible elevation on the surface of the shell.

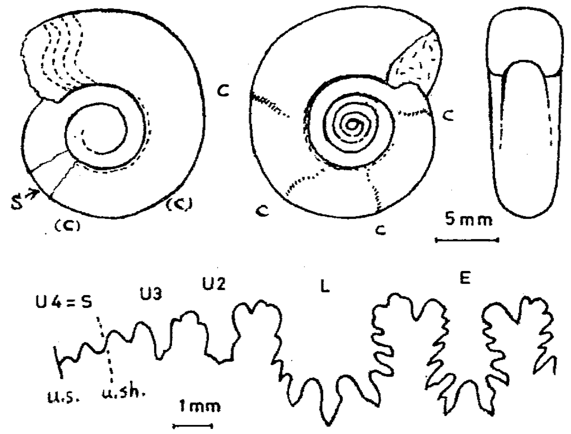
Remarks.—This genus is at present represented by only a single species from the Lower Cenomanian of Hokkaido. Its comparisons and affinities with other genera are to be given after the description of the species.

Microdesmoceras tetragonum MATSUMOTO and MURAMOTO, sp. nov.

Pl. 47, Figs. 1–4; Text-figs. 1–4

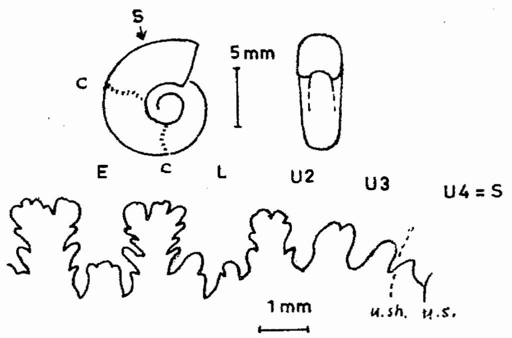
Material.—Holotype, GK. H5653, from loc. Ik 1101, Kami-Katsurazawa, Ikushumbets. Three paratypes, of which one from loc. Ik 1101 and another from Ik 1051b are preserved in the MURAMOTO Museum and the last from loc. Ik 1067bp is in Kyushu University (GK.) with register number H5650. The last one has been cut into two main parts and a few minute pieces (of the first whorl) to examine the characters of the inner whorls.

Specific characters.—The shell is small. The holotype, which is regarded as representing an adult stage, is 18 mm in

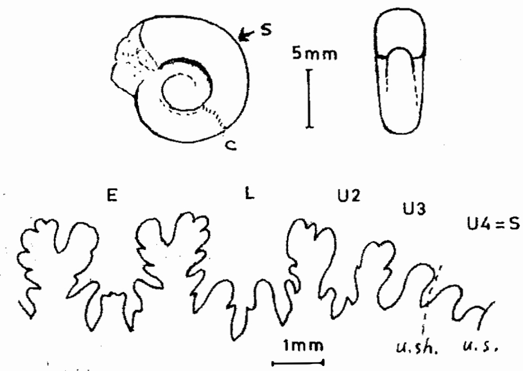


Text-fig. 1. *Microdesmoceras tetragonum* sp. nov. Diagrammatic sketch of the holotype in two lateral and an apertural views (above). A part of the lirate surface (left) and constriction on the internal mould (center) are shown. The external part of the second last suture (below) exposed at s. u.s. = umbilical seam; u.sh. = umbilical shoulder. (T. MAT. *delin.*)

* The authorship of the description under subfamily Desmoceratinae is Tatsuro MATSUMOTO and Tatsuo MURAMOTO.



Text-fig. 2. *Microdesmoceras tetragonum* sp. nov. Diagrammatic sketch of a paratype, from loc. Ik 1101, in lateral and apertural views (above) and the suture exposed at s. (T. MAT. *delin.*)



Text-fig. 3. *Microdesmoceras tetragonum* sp. nov. Diagrammatic sketch of a paratype, from loc. Ik 1051b, in lateral and apertural views (above) and the external part of the last suture exposed at s. (T. MAT. *delin.*)

diameter. The involution is moderate and the umbilicus is of moderate width, about 34(±1) percent of the shell diameter. The mode of coiling of the adult whorl, as seen in the holotype, is slightly deviated from the normal spire, i.e. slightly scaphitoid.

The body-whorl occupies about three quarters of the last volution. It is nearly as high as broad and approximately tetragonal in cross-section, having flat and parallel flanks, a broadly arched venter and vertical umbilical walls. The preceding septate part of at least a half volution has also flat and parallel flanks but is somewhat broader than high. Still inner whorls are much broader than high and rounded to reniform in cross-section. They are more evolute than the outer whorls. The above mentioned change of shell-form with growth may be illustrated by a cross-section (Text-fig. 4).

The surface of the shell looks nearly smooth, having only weak lirae. As far as the observed outer whorls (of 10 to 20 mm in diameter) are concerned, the lirae show a sigmoid curvature, running fairly strongly forward from the umbilical edge to the mid-flank, curved somewhat backward on the outer half of the flank and then recurved at the ventrolateral part passing to a moderate ventral projection. The lateral and the ventral projections are rounded. The outline of the apertural margin is not precisely known.

There are three or four constrictions per whorl in the late growth-stages. They are roughly sigmoid on the flank but not so much projected as the lirae on the venter. They are impressed only on the internal mould and the corresponding elevations on the test are hardly discernible. The constrictions of the body-whorl is very faint on the flanks but better marked on the venter.

Generally speaking the suture is of desmoceratid type, but is particular in its more simple pattern as compared with those of the nearly contemporary *Desmoceras* (*Pseudouhligella*) and *Puzosia*. The external suture of the last whorl (at the whorl height of 4 or 5 mm) is characterized by a somewhat narrowed stem of the external lobe, asymmetrically divided first lateral saddle, broad and trifid first lateral lobe (L), which is situated on the ventrolateral shoulder, much

Measurements.—

Specimen	Diameter	Umbilicus	Height	Breadth	B./H.
GK. H5653	18.0(1)	6.2(.34)	6.0(.33)	6.0(.33)	1.0
Paratype from Ik 1101	9.8(1)	3.3(.33)	4.0(.41)	4.0(.41)	1.0
Paratype from Ik 1051b	11.2(1)	3.8(.34)	4.2(.37)	4.2(.37)	1.0
GK. H5650	12.5(1)	4.4(.35)	4.8(.38)	5.1(.41)	1.0

smaller and narrower second lateral lobe (U2) and gradually descending auxiliaries. Minor incisions are less numerous and shallower than in the typical *Desmoceras* or *Puzosia* and each of the saddles and folioles show a rather entire outline, resulting in a somewhat phylloid aspect in the sutural pattern.

The development of the suture with growth has not been completely traced, because of unfavourable state of preservation. So far as the observation on the available material is concerned, the formula is probably E, L, U_2, U_3, U_4=S, U_{1v}, U_{1d}, I, but could be interpreted otherwise. The saddle between E and L is bipartite in early stages (from a certain stage of the second whorl) and then modified in late stages, normally by subdivision of the larger dorsal branch.

The protoconch is comparatively large as in other examined examples of the desmoceratids.

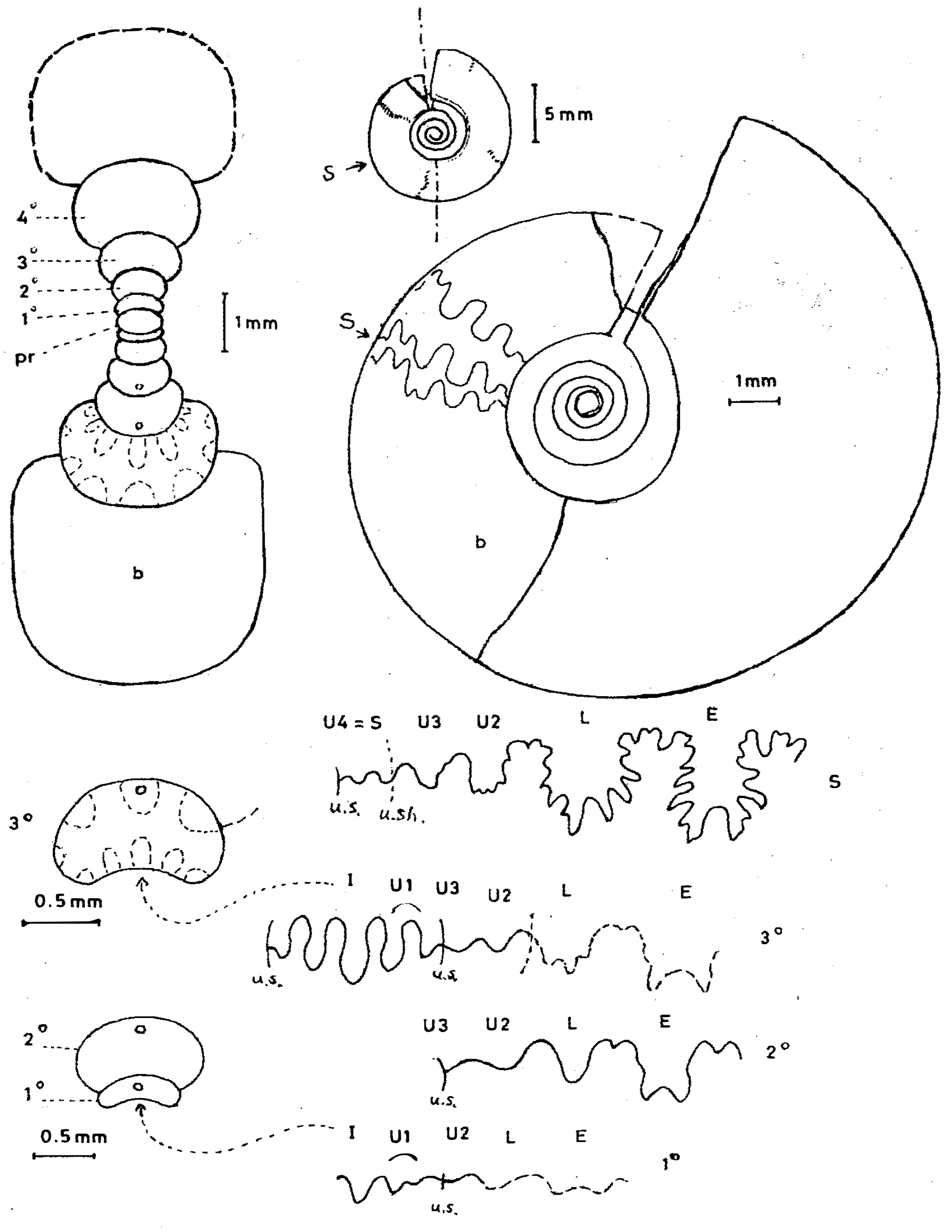
Remarks.—The holotype and the third paratype (GK. H5650) are regarded as representing an adult shell, because the last two septa are approximated and because the last whorl presents a particular shape as compared with earlier whorls.

The variation in shell-form between individuals seems to be little, as is indicated by the above measurements, but the number of the examined specimens is by no means enough to lead a conclusion. There is some extent of difference in the details of the suture, such as the mode of subdivision of the first lateral saddle, even among the four specimens, although the fundamental pattern of the suture is the same.

Comparison.—At first sight this species looks like a certain species of *Tetragonites* in shell-form, but it is not related with the Tetragonitidae, because its suture is fundamentally different from those of the Tetragonitidae. In the latter the first lateral saddle is tripartite, the lateral lobes [L and U_2] are bipartite and the internal lobe forms a septal lobe [Is].

In its simplicity of suture (or better to say simplified suture), small size and smooth shell the present species reminds us of such species as *Flickia simplex* PERVINQUIÈRE, 1907, but it differs from them by its rather desmoceratid basic pattern of sutures, different shell-form and the existence of constrictions. Certainly it has no affinity with the Flickiidae which, in turn, are apparently related to *Mojsisoviczia* or *Falloticeras* of the Brancoceratidae (see WRIGHT, 1957, p. L409), hence provisionally placed in the Acanthocerataceae.

On account of its phylloid aspect of sutures, smooth shell with sigmoid lirae and more or less evolute whorls, this species is apparently similar to certain early representatives of the Phyllocerataceae, such as *Eopsiloceras planorboides* (GÜMBEL) (see WIEDMANN, 1970) and *Wopfingites krystyni* WIEDMANN, 1970,



Text-fig. 4. *Microdesmoceras tetragonum* MATSUMOTO and MURAMOTO, sp. nov. Diagrammatic illustration of a paratype, GK. H5650, showing growth of whorls in cross-section and lateral view (above) and also that of sutures (below). pr=protoconch, 1°=the first whorl, 2°=the second whorl, 3°=the third whorl, 4°=the fourth whorl, b=early part of the body-whorl [living-chamber]. s=the last second suture. A concealed but presumed part of a suture is drawn with a broken line, with the aid of the observed feature in cross-section. (T. MAT. *delin.*)

from the Upper Triassic of Europe. The similarity is regarded again as homeomorphy, because it has no lituid internal lobe of the phylloceratacean type and because its geological age is much separated from them.

This species is somewhat allied to *Desmoceras* (*Pseudouhligella*) *japonicum*

YABE (see MATSUMOTO, 1954a), from the Cenomanian of the northern Pacific region, in the flattened flanks, perpendicular walls and sigmoidal constrictions of an adult shell, although the shell of the latter species is more compressed, much more involute and about six times as large as the former in diameter. The suture of the former resembles that of an immature shell of the latter (see MATSUMOTO, 1954, text-fig. 6 [52]), in the general pattern and probably also in the mode of development with growth, although much broader L and more simple, phylloid outline of the saddles are characteristic of the former. *D.* (*P.*) *japonicum* and other species of *Desmoceras* have more finely and deeply incised, complex sutures in late growth-stages.

The present species resembles certain species of *Puzosia* [e.g. *P. mayoriana* (D'ORBIGNY)] in the degree of involution, width of umbilicus and sigmoid constrictions. The suture of immature *Puzosia* or its allies (see SCHINDEWOLF, 1966, text-figs. 373-377) is fairly similar to that of the present species, but the former is more incised and the auxiliaries are strongly descending* even if the shells of the same size are compared. Species of *Puzosia* have generally more distinctly marked constriction and numerous ribs. They are evidently larger than the present species in the adult stage.

Occurrence.—The holotype and a paratype came from loc. Ik 1101 and another paratype from loc. Ik 1051b on the northern wall of the V-shaped valley of the Ikushumbets (see MATSUMOTO *et al.*, 1969, text-fig. 9). They were contained in calcareous nodules from the lower part of unit IIb, Mikasa Formation. The bed belongs to the zone of *Mantelliceras japonicum*, Lower Cenomanian. The third paratype was found in a rolled calcareous nodule collected at loc. Ik 1067bp, which was probably derived from the same zone exposed on the southern wall of the Shimo-ichino-sawa [locally called Tori-sawa], a tributary of the Ikushumbetsu near an electric power station, because *Zelandites inflatus*, *Hypoturilites* sp. and *Eogunnarites* sp., among many other mollusks, were found in the same nodule.

Discussions.—On the basis of the preceding description it can be concluded that the genus *Microdesmoceras*, as represented by *M. tetragonum*, should be ascribed to the family Desmoceratidae. *M. tetragonum* is, however, so peculiar that it is not directly connected with any known species of the Desmoceratidae. In other words the origin of the species is obscure.

Microdesmoceras is not so closely connected with main representatives of the Desmoceratinae or those of the Puzosiinae that it could possibly be accomodated in a new subfamily. However, we still hesitate to propose a new subfamily name, because we have not yet discovered any descendants or relatives which could be closely grouped with *Microdesmoceras* under the same subfamily. It is indeed a particular offshoot of the Desmoceratidae, in view of its small size, simplified suture, less prominent constrictions and tetragonal, smooth, slightly scaphitoid outer whorl. For the time being we have to assign it to either the subfamily Puzosiinae or to the subfamily Desmoceratinae. Someone might prefer the former assignement on account of its less involute coiling, but we are rather inclined to the latter assignement, though provisionally, on the grounds of the pattern of its suture.

* This character is not well shown in SCHINDEWOLF's text-figs. See MATSUMOTO, 1954b, text-figs. 2-4 for this point.

It is interesting to see the appearance of peculiar micromorphic offshoots in the evolutional history of various branches of the Ammonoidea. The Upper Albian to Cenomanian Flickiidae, which are provisionally ascribed to the Acanthocerataceae (see WRIGHT, 1957, p. L409), are good examples. Lower Cenomanian genus *Neosaynoceras*, which is included at present in the family Acanthoceratidae may be another minor example which considerably deviates from the principal genera of the family in many characters. *Microdesmoceras* can be taken as another example of a special, dwarfish derivative which appeared in the course of the evolutional history of the Cretaceous great family Desmoceratidae.

Aside from the Cretaceous examples, *Cymbites* and *Paracymbites* in the Arietitidae, *Protocymbites* in the Psiloceratidae and *Metacymbites* in the Liparoceratidae, *Primelites* and *Diaphorites*, provisional members of the Eoderoceratidae, and *Oecoptychius* and *Protophites* in the Stephanocerataceae are examples of peculiar dwarfs or degenerated, simplified (or specialized) derivatives in several families or superfamilies of Jurassic ammonites (see ARKELL, 1957, p. L240, L248, L296).

The origin of this kind of ammonites is more or less obscure and they are often called cryptogenic. In other words the peculiar character appeared seemingly suddenly, with little evidence of intermediate forms. Why this is so is one of the problems of evolution in palaeontology. How were the habitats or ecological conditions of these ammonites may be another problem to be worked out in the future. We generally presume that they may have been less aggressive animals.

Subfamily Puzosiinae*

The subfamily Puzosiinae include many species which have a large shell. A giant example, which is more than a meter in shell-diameter, was reported by MILLER and YOUNGQUIST (1946) from the Senonian of Montana under the specific name of *Parapuzosia bradyi*. A specimen of *Pachydesmoceras denisoni* (STOLICZKA) (1865, pl. 66a), GSI. No. 208, which one of us (T.M.) examined in the Museum of the Geological Survey of India, Calcutta, is nearly as large as 100 cm in diameter at the middle of the coarsely ribbed body-whorl. The holotype of *Lytodiscoides conduciaensis* (CHOFFAT, 1903) and that of *L.* [=" *Achileoceras* "] *erasmusi* (VAN HOEPEN, 1951), which have magnificently ornate body-whorl, are likewise large.

In the Cretaceous deposits of Hokkaido and Saghalien large ammonites are not infrequently found at various stratigraphic levels. Some of them certainly belong to the subfamily Puzosiinae. Thus an example of *Mesopuzosia* sp., which came from the Upper Turonian (upper most part of the Mikasa Sandstone) of the Yubari area, now exhibited in the National Science Museum, and two other examples of *Pachydesmoceras* cf. *pachydiscoide* MATSUMOTO, from the Turonian Saku Formation of the Saku area, one of which was presented to the Akiyoshidai Science Museum (from T.M.) and the other in the possession of Kyushu University (T.M. Coll.), are about 70 to 80 cm in diameter. They are, however, nearly wholly septate and, accordingly must have exceeded a meter, if their body-whorls were completely preserved. Aside from these giant examples, we see more

* The authorship of the description under the subfamily Puzosiinae is Tatsuro MATSUMOTO and Akitoshi INOMA.

frequently puzosiine ammonites of about 30 to 40 cm in diameter.

In contrast to the above mentioned large ammonites of the Puzosiinae there are very small specimens which represent a species of the same family. They were collected by one of us (A.I.) from the Upper Cretaceous of the Haboro area, northwest Hokkaido, preliminarily studied by A. INOMA, then sent to T. MATSUMOTO of Kyushu University for further study and now preserved in the Type-Specimen Room, Department of Geology, Kyushu University. They are assigned to a new species of *Kitchinites* described below, with some discussions.

Genus *Kitchinites* SPATH, 1922

Subgenus *Neopuzosia* MATSUMOTO, 1954

Type-species.—*Kitchinites* (*Neopuzosia*) *japonicus* SPATH, 1922.

Remarks.—*Neopuzosia* was proposed as an independent genus, because the distinction between the type-species of *Neopuzosia* and that of *Kitchinites* [*K. pondicherryanus*] was very clear. There are, however, certain species which show apparently intermediate or even mixed characters (see MATSUMOTO, 1954b, p. 89; HOWARTH, 1965, p. 387). At present we would agree with WRIGHT (1957) and HOWARTH (1965) in admitting *Neopuzosia* as a subgenus of *Kitchinites*.

Species of *Kitchinites*, including those of the subgenera *Neopuzosia* and *Kitchinites* (s.s.), have a shell of moderate to small size even at the mature stage, being generally smaller than many other species of the Puzosiinae. This point was mentioned by MATSUMOTO (1954b, p. 90) and has been ascertained by subsequent descriptions of HOWARTH (1965) and HENDERSON (1970). The species to be described below may exemplify the smallest form.

Kitchinites (*Neopuzosia*) *haboroensis* MATSUMOTO and INOMA, sp. nov.

Pl. 47, Figs. 5–6; Text-figs. 5–9

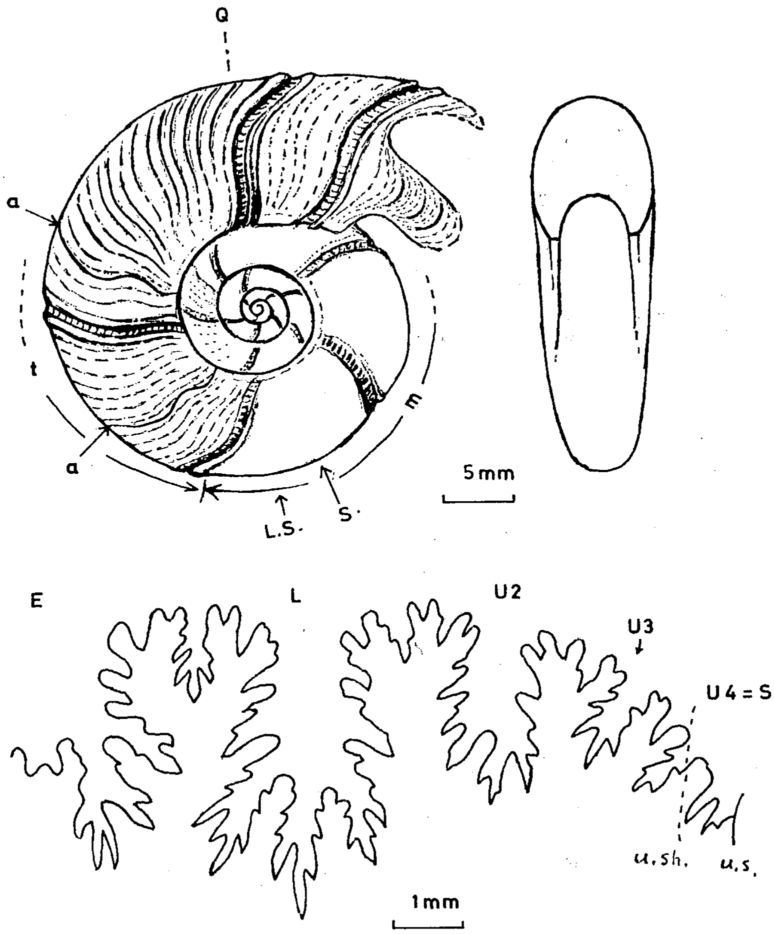
Material.—Holotype, GK. H5654, from loc. IA-1564. Paratypes, GK. H5655, from loc. IA-1562; GK. H5656; from loc. IA-1561; GK. H5657, from loc. IA-1599; GK. H5660, from loc. IA-1557; GK. H5661, from loc. IA-1570; GK. H5658, from loc. IA-1577, Haboro area. Probably referable specimens, GK. H5659, from loc. IA-1536, Haboro area; IGPS. 57746, Ikushumbets area.

Specific characters.—Shell is small, about or slightly less than 30 mm in diameter at the adult stage. It is moderately evolute, about a half of the inner whorl being embraced by the outer one. Its umbilicus is also fairly wide, occupying about 34–38 percent of a diameter in the holotype and measurable paratype. The umbilicus is shallow and encircled by a very low but nearly vertical or steeply inclined wall.

The outer whorl is compressed, showing about 0.7 to 0.8 in the proportion of breadth to height. Its flanks are, however, gently convex, passing to a rather narrowly arched venter. Its cross-section is, therefore, subelliptical. The inner whorls are less compressed and subrounded; the innermost one is depressed.

Constrictions are well marked (i.e. deep and moderately broad on the internal mould) and fairly frequent, about five to six per whorl. They are gently sigmoid on the flank and projected on the venter. On the body-whorl the linguiform ventral projection is remarkable, being accompanied with the notable elevation behind the constriction.

The inner whorls are nearly smoothish.

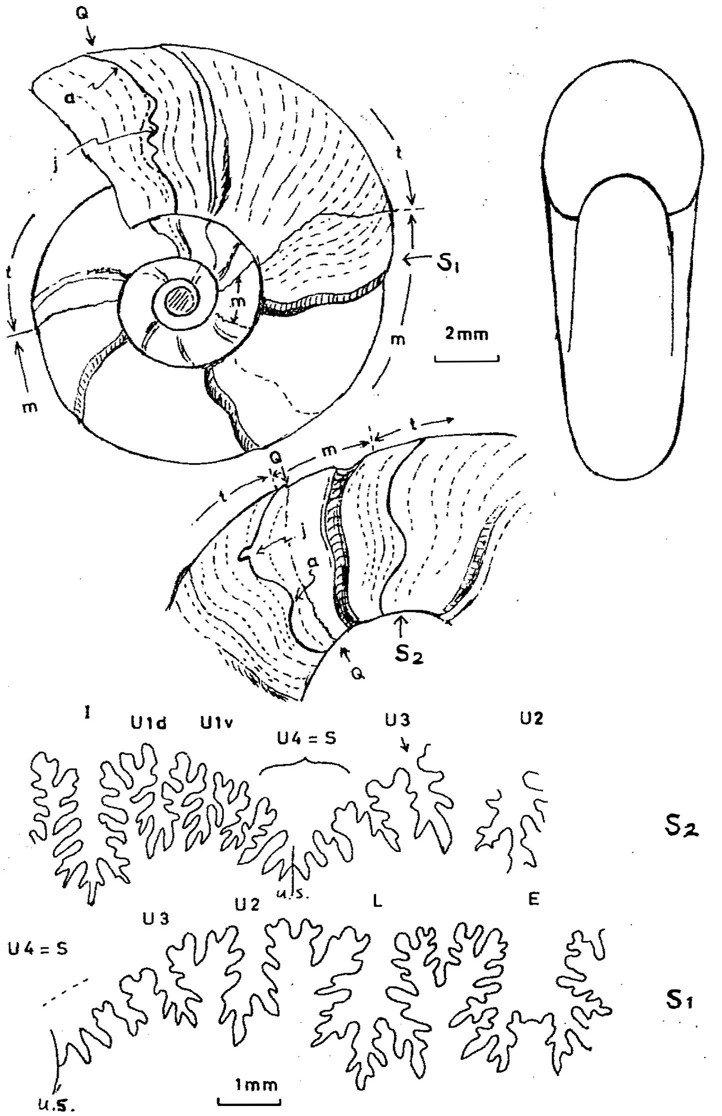


Text-fig. 5. *Kitchinites* (*Neopuzosia*) *haboroensis* MATSUMOTO and INOMA, sp. nov. Diagrammatic sketch of the holotype, GK. H5655, in lateral view and its front view, with body-whorl cut at Q (above); external part of the second last suture at S (below). m=internal mould; t=test preserved; a=line of demarcation showing the apertural margin at an earlier growth-stage; u.s.=umbilical seam, u.sh.= umbilical shoulder. (T. MAT. *delin.*)

The septate part of the outer whorl has fine and weak, sigmoidal ribs. The body-whorl has more distinct, but fairly fine and dense, ribs, which are more or less sigmoidal on the flank and projected on the venter. The ribs which are situated at some distance in front of the constriction are normally more sigmoid than the others, although there may be a variation in the details.

Near the apertural margin of the adult shell there are two approximated constrictions which show a very strong ventral projection. Aside from the elevations which are accompanied with the two constrictions, ribs are very faint, whereas fine, sigmoid lirae are discernible on the shell-surface of the interval between these two constrictions. In front of the last constriction there are elongated lappets which are situated at about the inner one third of the flank. The ventral part of the peristrome is moderately projected.

A distinct line of demarcation which probably marks the apertural margin of



Text-fig. 6. *Kitchinites* (*Neopuzosia*) *haboroensis* MATSUMOTO and INOMA, sp. nov. Diagrammatic sketch of an immature shell, paratype no. 5, GK. H5658, in lateral and frontal view (above) ; the other side, in part (center) ; internal suture, with adjacent portion of external suture, at S2; external suture at S1 (below). symbols m, t, a, and u.s. same as in Text-fig. 5, j=injured part of the apertural margin at an early growth-stage. (T. MAT. *delin.*)

the immature shell is sometimes preserved at some distance in front of the constriction, showing a moderate flexuosity on the flank and a ventral projection. Its convexity on the lower part of the flank is somewhat stronger than the ribs or lirae on the adjacent parts (Text-figs. 5–7).

Sutures are of *Puzosia* pattern. Those in the late part of the septate whorl have a somewhat asymmetrically tripartite first lateral lobe (L) which is deeper than the external lobe (E). The auxiliary elements beyond the second lateral lobe (U_2) are aligned on a strongly descending line.

Measurements.—

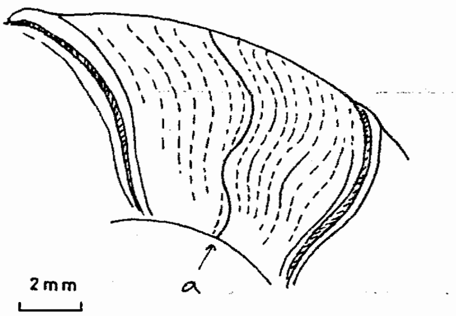
Specimen	Diameter	Umbilicus	Height	Breadth	B./H.
GK. H5654	29.0(1)	11.2(.38)	11.5(.40)	8.9(.31) (c) 8.7(.29) (ic)	.77
" (−180°)	——	——	7.2	6.2	.86
GK. H5655	28.0(1)	10.4(.37)	11.2(.40)	7.3(sec. compr.)	
GK. H5656	29.5(1)	10.2(.34)	12.2(.41)	8.7(.29)	.71
GK. H5658	14.3(1)	4.3(.30)	5.5(.38)	5.5(.38)	1.0

The saddles are bipartite and their stems tend to be narrowed by deep incision of the branches of the lobes. The sutural formula is probably E, L, U_2, U_3, U_4=S, U_{1v}, U_{1d}, I, but could be interpreted otherwise [E, L, U_2, U_3=S, U_1, I, as one of us (T.M., 1954b, text-fig. 3) thought so on *K.* (*N.*) *ishikawai*] (see also SCHINDEWOLF, 1966, text-fig. 377).

Remarks.—There is some extent of variation in the relative width of umbilicus and the proportion between breadth and height of the whorl, even if the shells of corresponding size are compared. The details in the rib curvature may also vary as shown in the illustration.

Comparison.—The shell of this species closely resembles the small immature one of *Kitchinites* (*Neopuzosia*) *ishikawai* (JIMBO, 1894) (see also MATSUMOTO, 1954b). In fact the two species are apparently indistinguishable up to the shell diameter of about 20 mm, if we ignore the minor variation. One point which may serve as a distinction even in this immature shell is that a remarkably sigmoidal line of demarcation, probably the peristome of the immature shell, is distinct at some distance ahead of the constriction on a well preserved shell of *K.* (*N.*) *haboroensis*. A similar line may be discernible in front of the constriction on some well preserved inner whorl of *K.* (*N.*) *ishikawai*, but its curvature seems to be more gentle, with a less pronounced lateral projection.

The distinction in the succeeding later whorls of the two species is unmistakable. The adult shell of *K.* (*N.*) *haboroensis* is much smaller and more widely umbilicate than that of *K.* (*N.*) *ishikawai* and ends at the peristome which is characterized by pronounced lateral lappets. The mode of curvature of the ribs on the body-whorl of *K.* (*N.*) *haboroensis* is more sigmoid than those of *K.* (*N.*) *ishikawai*. The ribs are remarkably strong on the ventral part of the adult body-whorl of *K.* (*N.*) *ishikawai*, except for the faintly ribbed apertural part. Such a sudden increase in the rib-intensity does not occur in *K.* (*N.*) *haboroensis*, although the ribs gradually become distinct on its outer whorl. The probably adult shell of *K.* (*N.*) *ishikawai* has at least two more whorls, attaining to about 120 or 130 mm in diameter, as represented by GK. H5663 (Y. UEDA Coll.) from the generally same Haboro-Chikubetsu area (UEDA *et al.*, 1962). Its very apertural margin is not completely preserved, but there are two, fairly approximated constrictions which are prorsiradiate and very gently sigmoid on the flank and strongly projected on the venter. The weak ribs and lirae on the interval of the two constrictions and immediately in front of the last one show a similar curvature. Although the very margin is not completely preserved, judging from the curvature of the lirae in the



Text-fig. 7. *Kitchinites* (*Neopuzosia*) *haboroensis* MATSUMOTO and INOMA, sp. nov. Diagrammatic sketch of a part of an immature shell, paratype no. 6, GK. H5661, in lateral view (test preserved).
(T. MAT. *delin.*)

preserved last part, it does not seem to have long lateral lappets.

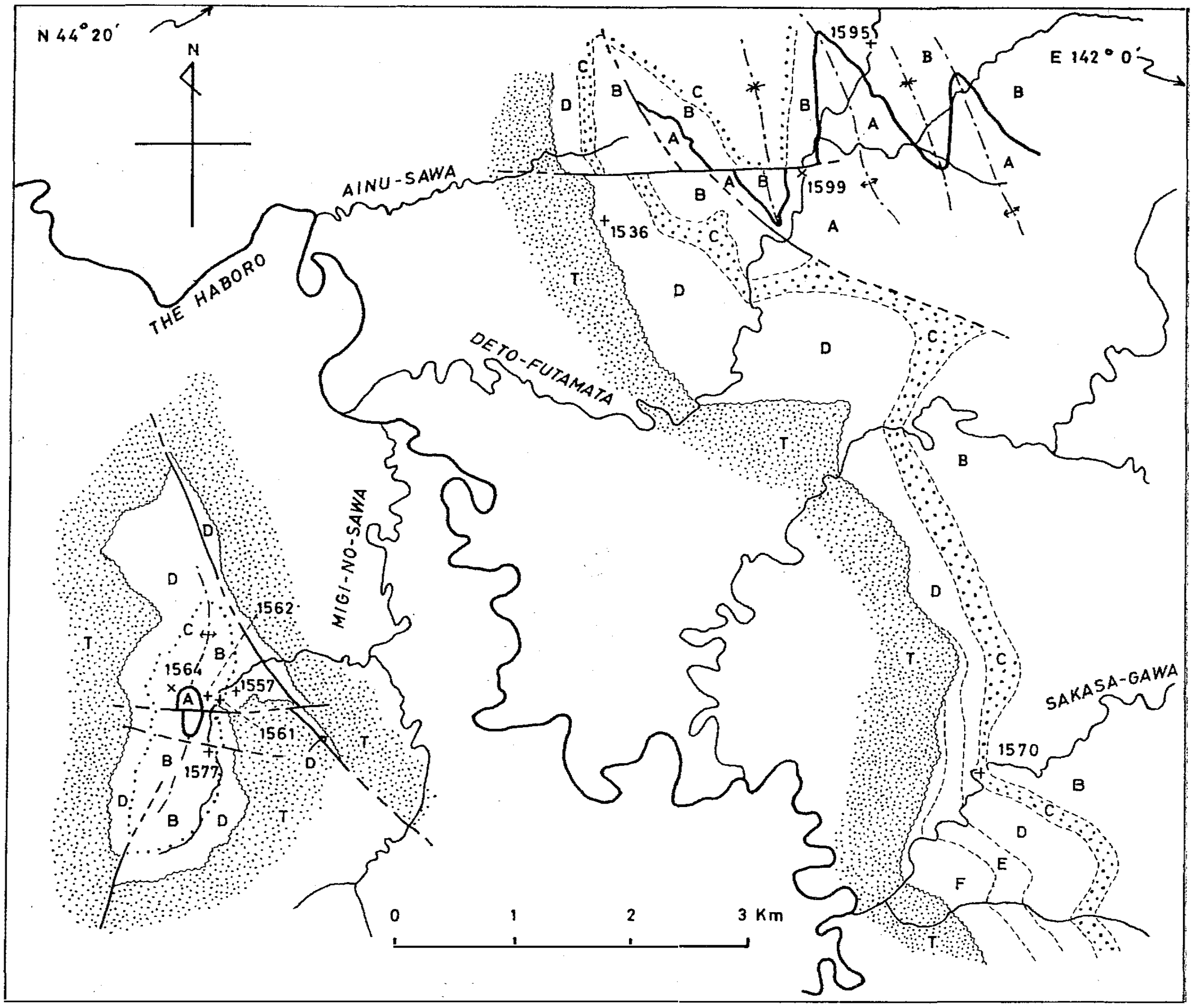
K. (*N.*) *haboroensis* is somewhat similar to *Yokoyamaoceras jimboi* MATSUMOTO (1955, pl. 9, figs. 4, 5; text-fig. 13) in the small size, presence of lateral lappets and other general appearance. The latter has ventrolateral tubercles on a limited part of the body-whorl and prorsiradiate constrictions which cut obliquely numerous ribs behind them. The suture of the former species is of puzosiine type, with remarkably descending auxiliaries, whereas that of the latter is of *Kossmaticeras* type.

Kitchinites (*Kitchinites*) *angolaensis* HOWARTH, 1965 (p. 386, pl. 11, figs. 4-6), from the Campanian of Angola, is considerably small. Its probably adult shell, as represented by the holotype, is 64 mm in diameter. Therefore it is twice as large as *K.* (*N.*) *haboroensis*. *K.* (*K.*) *angolaensis* has somewhat less flexuous ribs and more involute and more compressed whorls than *K.* (*N.*) *ishikawai* and *K.* (*N.*) *haboroensis*, if the shells are compared at corresponding size. Rather rapid strentghening of the ribs on the ventral part of the probably adult whorl is evident in *K.* (*K.*) *angolaensis*, whereas constrictions are stronger in *K.* (*N.*) *haboroensis*.

Unfortunately the peristome of the adult shell has not been clearly described in *K.* (*K.*) *angolaensis* nor in *K.* (*K.*) *pondicherryanus* (KOSSMAT), the type-species from India. The neotype of *K.* (*K.*) *angustus* (MARSHALL), proposed by HENDERSON (1970, p. 34, pl. 14, fig. 1), from the Campanian of New Zealand, shows dense lirae at the preserved last part (diameter about 130 mm), which show a very gently sinuous curvature on the flank and are considerably projected on the venter as in the above mentioned specimen of *K.* (*N.*) *ishikawai*. However, it is not certain whether or not the last part of that New Zealand species marks the very apertural margin.

In view of the gentle inflation of the flanks and the gradual strengthening of the ribs in the adult shell, this species could be referred to *Mesopuzosia*, but we are inclined to assign it to *Kitchinites* (*Neopuzosia*) because of its small size and its close resemblance to *K.* (*N.*) *ishikawai* in immature stages.

Occurrence.—The type-locality is loc. IA-1564, in unit B (siltstone) of the Santonian sequence exposed in the area of the Haboro dome, Rumoi district, Teshio provine, northwest Hokkaido. Paratypes came from loc. IA-1599, Deto-Futamata, a tributary of the Haboro, upper part of unit A (siltstone), and rolled or fallen nodules obtained at loc. IA-1557, IA-1561, IA-1562, IA-1577 (Haboro dome), IA-1570 (Sakasa-gawa), and IA-1536 (Ainu-sawa). The possible sources of the rolled or fallen nodules are from unit A to D within the Santonian sequence (zone of *Inoceramus naumanni*) of the Haboro area (Text-fig. 8). They are all from calcareous nodules in siltstone and often associated with *Inoceramus naumanni*. Thus in the Haboro area, which repre-



Text-fig. 8. Geological map of the upper reaches of the Haboro. A–F = Upper Cretaceous (Santonian) sequence in ascending order, A : dark grey siltstone, with tuffaceous sandstone at the top (indicated by black band), B : dark grey siltstone, C : glauconitic sandstone (coarsely dotted), D : dark grey siltstone, E : green sandstone, F : black mudstone. T = Tertiary (Miocene) conglomerate, sandstone, shale and tuff (finely dotted). × = Locality where the described ammonites were obtained (in situ) ; + *Ditto* (in fallen or rolled nodules). (Geol. Surv. by A. INOMA)

sents a northwestern part of the Yezo geosyncline and probably belongs to a less off-shore facies, the species seems to occur not uncommonly. In other areas the occurrence of the species has not been well ascertained, except for a rare occurrence of a probable example from the Santonian of Kikume-zawa, Ikushumbets area, central Hokkaido.

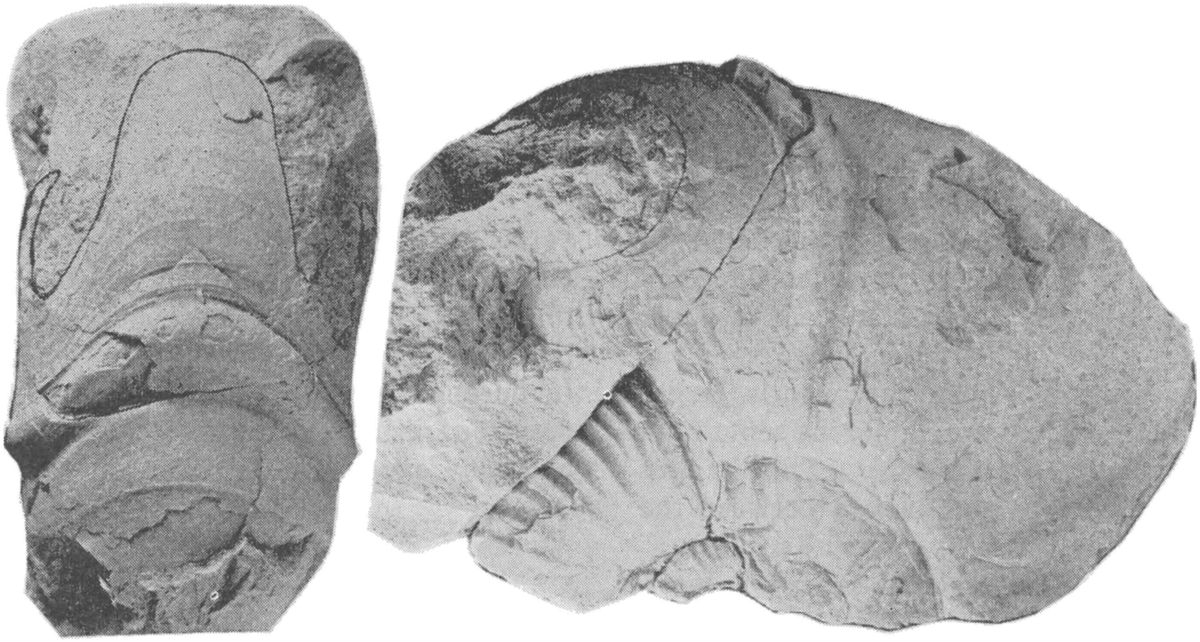
Discussions.—The fact that *Kitchinites* (*Neopuzosia*) *haboroensis* shows almost the same stratigraphical range as *K.* (*N.*) *ishikawai* (JIMBO) and that the former is closely similar to the latter in the immature stages but much smaller in the mature stage, having a particular type of peristome, recalls us of the possibility of sexual dimorphism between the two "nominal species". The situation apparently seems to be analogous with the cases in certain Jurassic ammonites as exemplified by *Cosmoceras spinosum* (SOWERBY) and *Quenstedtoceras mariae* (D'ORBIGNY), which were discussed by MAKOWSKI (1962), and by *Creniceras renggeri* (OPPEL), *Distichoceras bicostatum* (STAHL), and ? *Hecticoceras brightii* (PRATT), which were ontogenetically examined by PALFRAMAN (1966, 67, 69).

We do appreciate these and other authors who took into consideration the problem of sexual dimorphism in the study of ammonites, but it seems to us fairly difficult to present the necessary and sufficient evidence for concluding that A is the female and B is the male of one and the same species.

Aside from the Jurassic ammonites, with which we are not well acquainted, let us consider the problem in the case of the Puzosiinae. Although numerous species of the subfamily have been monographed by various authors, little has been mentioned about the peristome of mature shells. In our experience of field work we observe that the smoothish body-whorl of a large shell of *Puzosia*, *Mesopuzosia* or *Pachydesmoceras* is often squashed probably because of its weaker condition as compared with the septate whorls.

One of a few examples in which the apertural margin was described is a very large specimen of "*Ammonites planulatus*" in STOLICZKA (1865, p. 134, pl. 68). One of us (T.M.) fortunately had an opportunity to examine this specimen in the museum of the Geological Survey of India, Calcutta. There is a broad, deep, concave constriction near the preserved last part of the shell (about 805 mm in diameter). The body-whorl is smoothish and unusually inflated behind the last constriction, with the breadth of 225 mm (about 0.98 of the height). The shell in front of the last constriction is not completely preserved; the ventral linguiform projection is present but the presence or absence of lateral lappets is not know. If we assume that there were no lateral lappets, this specimen could possibly be regarded as representing a female form of *Puzosia* sp. by analogy with the cases of Jurassic ammonites. However, the evidence to conclude so is by no means sufficient and no corresponding male form (somewhat smaller one with lateral lappets) has been confirmed to occur in the same formation.

In the recent collection of one of us (T.M.) there is an interesting specimen, GK. H5665 (Text-fig. 9), from loc. T 1021p of the Turonian Saku formation, in which the peristome is almost completely preserved. Based on the general characters of the shell it is probably referable to *Mesopuzosia pacifica* MATSUMOTO, 1954. It is of moderate size, only somewhat larger than the holotype. On the last part of its body-whorl the ribs are much weakened between two, rather approximated, strong constrictions (elevations on the shell), which are very gently sigmoidal on the flank and projected on the venter. In front of the last constriction there is a remarkable ventral rostrum, which approximately continues the spiral line of coiling, and remarkable lateral lappets, which are as long as the rostrum but somewhat bent inward at their terminal portion. The lirae are gently sigmoidal on the part immediately in front of the last constriction but become more and more strongly flexuous so as to follow the outline of the very apertural margin. Whether every shell of *Mesopuzosia pacifica* has always



Text-fig. 9. *Mesopuzosia* sp. cfr. *M. pacifica* MATSUMOTO. GK. H5665, from loc. T1021p2, Saku Formation, ×0.9. Note the will preserved apertural margin and a marked contribution behind it. (I.H. *photos*)

this kind of peristome in the mature shell or not is not clear. One of the paratypes of this species, GK. H1571 (see MATSUMOTO, 1954b, pl. 15, fig. 2) has a larger outer whorl than the holotype and the above specimen (GK. H5665), but its outer whorl is so incompletely preserved that its apertural margin is not shown. Thus we cannot yet settle the problem of sexual dimorphism in this species.

Be that as it may, it is interesting to see a similarity between the well preserved peristome of the above mentioned *Mesopuzosia pacifica* and that of *Kitchinites* (*Neopuzosia*) *haboroensis*. On these grounds it can be stated that at least some, if not all, of the Puzosiinae have an apertural margin which is characterized by a rostrum and lateral lappets.

We would not completely deny the possibility that *Kitchinites* (*Neopuzosia*) *haboroensis* might represent the male form of *K.* (*N.*) *ishikawai*. So far as the available material is concerned, we should regard them as two different species, inasmuch as we observe a difference even in the immature stage (see description under the heading of comparison). The said difference, however, should be examined more precisely by treating more specimens with respect to ontogeny and variation.

Another point which is unfavorable for concluding the sexual dimorphism in this case is the occurrence. Although there would be some collection failure, the specimens of *K.* (*N.*) *haboroensis* have been known only in a limited area of a particular facies and are not always associated with *K.* (*N.*) *ishikawai*, which, in turn, is more widely distributed. We rather consider that smaller ammonites which possess lappets at the peristome of the shell should have particular habitats and mode of life which are different from larger ammonites without lappets. Presumably the former may have been less active and less rapidly locomotive than the latter and have taken different kinds of food. Too much difference in these respects between male and female seems to be unnatural, if not impossible. In other words, the difference in size and apertural character of the adult shell may not imply sexual dimorphism but may be concerned with taxonomic difference or morphological diversity in evolution, which in turn, is connected with diversity in habitats and mode of life. It is, furthermore, noted that the megaform is about two whorls larger and has much more numerous septa than the compared microform. This implies a considerable gap in age between the two forms.

In spite of a large number of specimens which have been monographed under the subfamily Puzosiinae, examples which have lappets are very few. Smaller shells with lappets should occur more frequently in association with numerous, larger shells, if such sexual dimorphism as analogous to that stated in Jurassic ammonites existed in the Puzosiinae. We would rather expect a different type of sexual dimorphism in the Puzosiinae, such as more inflation of the adult body-whorl or broader aperture and somewhat (but not extremely) larger size of the male shell than the female, as suggested by the living species of *Nautilus*, or difference in fineness or intensity of the ornamentation of the adult shell as suggested by REYMENT (1971) for dimorphic pairs of Cretaceous *Benueites* species.

To sum up, we have considered a possibility of sexual dimorphism in the Puzosiinae but are rather inclined to think that the available evidence is yet insufficient to support it, leaving the problem in the future. In this paper we describe *Kitchinites* (*Neopuzosia*) *haboroensis* as a new species of the Puzosiinae which is characterized by a very small size and a particular type of shell-aperture, stressing that the Puzosiinae include various species from a gigantic size to a very small one. It is noted that the Puzosiinae show a considerable diversity in the character of the adult body-whorl. There would be some diversity in the character of its apertural margin in the same subfamily, although the actual features have not yet been thoroughly known on account of the unfavourable preservation. The species described in this paper presents a rare but good example.

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Ainu-sawa	愛奴沢	Mikasa	三笠
Chikubetsu	築別	Rumoi	留萠
Deto-Futamata	デト二股	Sakasa-gawa	逆川
Ikushumbets	幾春別	Saku	佐久
Kikume-zawa	菊面沢	Shimo-ichino-sawa	下一の沢
Haboro	羽幌	Tori-sawa	鳥沢

Explanation of Plate 47

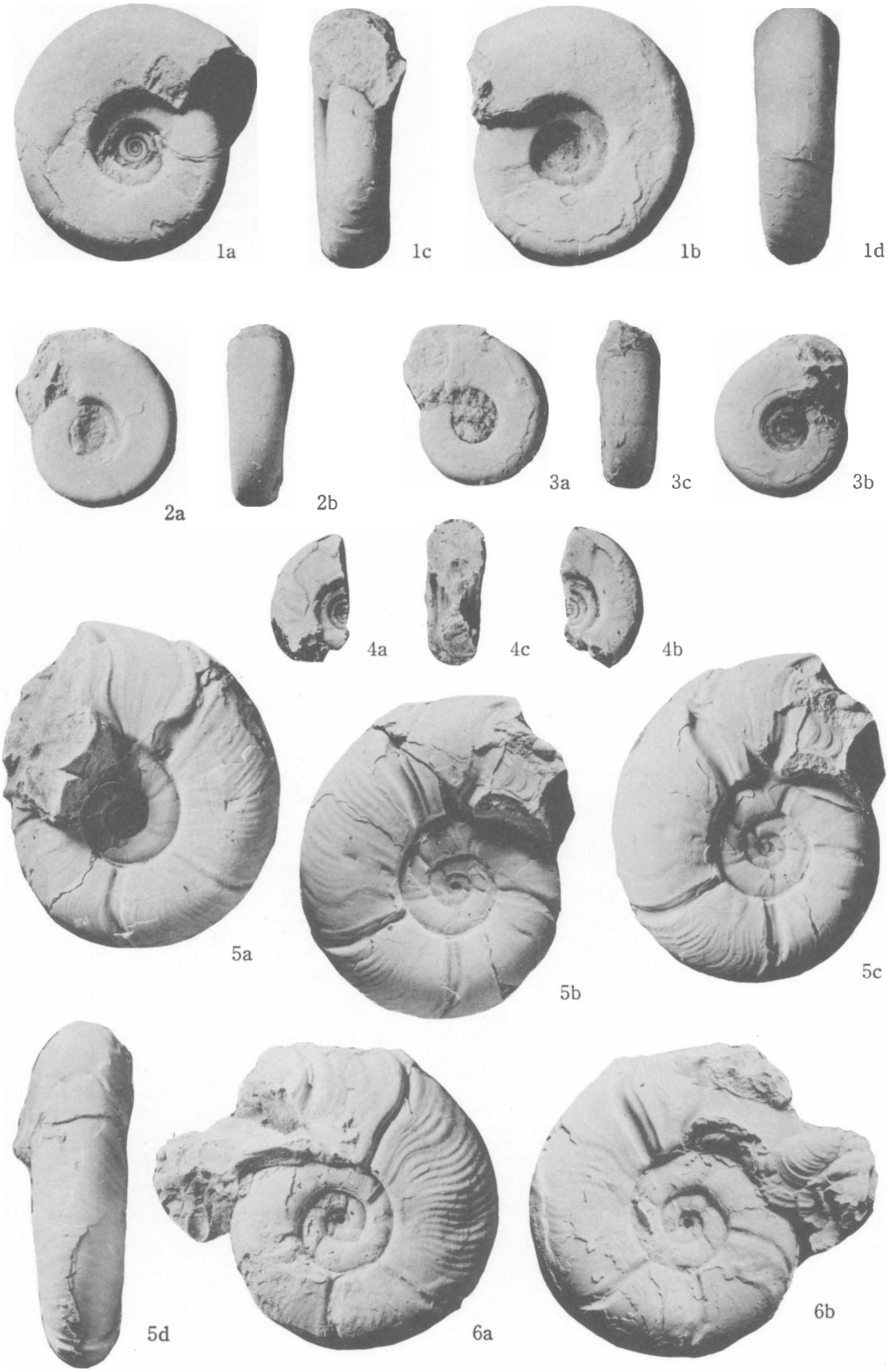
Figs. 1–4. *Microdesmoceras tetragonum* MATSUMOTO and MURAMOTO, sp. nov. ......Page 378

1. Holotype, GK. H5653, from loc. Ik 1101, zone of *Mantelliceras japonicum*, Ikushumbets area. Two lateral (a, b), apertural (c) and external (d) views, approximately ×2.
2. Paratype no. 2, immature specimen, from loc. Ik 1051b, MURAMOTO Museum coll. Lateral (a) and external (b) views, approximately ×2.
3. Paratype no. 1, immature specimen, from loc. Ik 1101, MURAMOTO Museum coll. Two lateral (a, b) and external (c) views, ×2.
4. A half of paratype no. 3, GK. H5650, from loc. Ik 1067bp. Two lateral (a, b) and sectional (c) views, ×2.

Figs. 5–6: *Kitchinites (Neopuzosia) haboroensis* MATSUMOTO and INOMA, sp. nov. ...Page 384

5. Holotype, GK. H5654, from loc. IA-1564, unit B of the Santonian sequence, Haboro area. Two lateral (a, b–c) and external (d) views, ×1.5. To show the ribbing and other features b and c are taken under the light of somewhat different orientation.
6. Paratype no. 1, GK. H5655, from loc. IA-1562. Two lateral view (a. b), ×1.5.

Kyushu University [I. HAYAMI] photos, with whitening.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