

7. Family *Kossmaticeratidae* from Hokkaido and Saghalien*

(*Studies on the Cretaceous Ammonites from Hokkaido and
Saghalien-VI*)

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(With Plates VIII-X)

Introduction

The Kossmaticeratids have a complicated taxonomic history but include interesting examples in the evolution of ammonites. When KOSSMAT (1897) published the Cretaceous ammonites of Southern India, he described a number of Upper Cretaceous forms under the generic name *Holcodiscus* UHLIC, which is now restricted to the group of *H. caillaudianus* (D'ORBIGNY) of the Barremian, although he established the closely related *Brahmaites* as an independent genus. A. DE GROSSOUVRE (1901) pointed out that there was no direct connexion between the true *Holcodiscus* of the Lower Cretaceous and KOSSMAT's *Holcodiscus* of the Upper Cretaceous and established *Kossmaticeras* for the latter, designating *Ammonites theobaldianus* STOLICZKA as type species. Another French palaeontologist, KILIAN intended to introduce the name *Pseudoholcodiscus* for the same group, but abandoned it as a synonym of *Kossmaticeras*.

KILIAN and REBOUL (1909), their paper on the ammonites of the Antarctic region, tried to demonstrate interesting examples of convergence, including that between *Holcodiscus* and *Kossmaticeras* and between certain Jurassic ammonites and several subgenera (subsequently ranked as genera) of *Kossmaticeras* newly established by themselves. Some doubtful forms were assigned to the genera, such as *Seymourites* and *Grahamites*, which were based on Jurassic type species. SPATH (1953) has recently clarified the position of these forms.

The same author (SPATH, 1922) had previously set up the subfamily Kossmaticeratinae under Desmoceratidae. He separated as *Holcodiscoides* certain Indian species from the true Kossmaticeratids. However the true systematic position of this genus and certain other genera established in the same paper—for example, *Kitchinites* and *Pseudojacobites*,—has not been free from doubt.

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MARSHALL (1926, 1927) added a number of interesting kossmaticeroid ammonites from New Zealand. Some of them, such as *Aucklandites* and *Tainuia*, are superficially similar to *Acanthoceras* and *Romaniceras*, while some other form, such as *Maorites*, was described as resembling *Parapuzosia*.

Thus members of the Kossmaticeratids are occasionally very difficult to identify correctly because of the superficial resemblance to certain other ammonites which have no direct genetic connexion with them.

The subfamily Kossmaticeratinae was ranked as a family in SPATH'S 1940 paper without mentioning a reason. WRIGHT (1952) also listed family Kossmaticeratidae in his comprehensive classification of the Cretaceous ammonites. In this paper I adopt it because it includes various genera which are fairly specialized.

In the Japanese Cretaceous province the Desmocerataceae are in general very common. Kossmaticeroid forms occur fairly frequently but are not so common as in Southern India, New Zealand and the Arctic. In Hokkaido and Saghalien they occur at various horizons ranging from the Upper Albian to Upper Senonian. Curiously they occur rather frequently in the Paleogyliakian and Urakawan parts of the Japanese succession, while they are very rare or absent altogether in the Neogyliakian and the Hetonaian parts (MATSUMOTO, 1942-43; MATSUMOTO (Editor), 1954). As I have already mentioned, the Neogyliakian is correlated approximately with the Turonian, in which kossmaticeroid ammonites are quite rare also in foreign countries, whereas the main part of the Hetonaian is equivalent to the Upper Campanian plus Maestrichtian, from both of which the various kinds of the specialized Kossmaticeratids have been reported in foreign countries—especially in the Indo-Southern Pacific realm. According to STOLICZKA (1865) and KOSMAT (1897) kossmaticeroid ammonites are known at various horizons ranging from the lower part of the Ootatoor [Utatur] group to the lower part of the Arrialoor group and further up (?) to the Valudayur beds of Southern India. In that area they seem to be rare in the Upper Ootatoor group and the Lower Trichinopoly group, the approximate equivalent of the Turonian and its adjacent portions.

Although SPATH intended to place his *Holcodiscoides* in the family Pachydiscidae, the evidence is not yet convincing. Morphologically the forms in the Japanese Paleogyliakian are more kossmaticeroid than pachydiscoid, since most of them have well-marked, oblique constrictions and numerous, fine, diverging ribs which generally start from the umbilical elevations. Furthermore some of them are highly specialized in having tuberculation, globose

shape, or flared or spinose irregular ribs, as in the case of the Upper Senonian Kossmaticeratids.

In my previous stratigraphical notes (1942-43) I referred most of the Paleogyliakian forms to *Maorites*, *Neomadrasites* and *Jacobites*, since I failed to find any important difference between ours and the so-called Upper Senonian forms of New Zealand and the Arctic area. Furthermore, I ventured to state that the fossils from those areas might comprise mixed material from different horizons, even if the problematic Jurassic part is excluded. One new genus, *Eogunnarites*, which was listed in that paper, has quite recently been validated by WRIGHT & MATSUMOTO (1954).

In the meanwhile Dr. SPATH has recently (July, 1953) published an important paper on the Upper Cretaceous cephalopod fauna of Graham Land and criticised my opinion. He concluded that the cephalopods of Graham Land are largely of one date, Upper Campanian, and belong to a typical Antarctic fauna. I read the paper after I arrived at the British Museum (Natural History), where under the kind advice of Dr. SPATH I continued my work on the kossmaticeroid ammonites.

Although I have had no opportunity of examining many of the original specimens of STOLICKA (1865), STEINMANN (1895) and KOSSMAT (1897), I have fortunately been able to study a few specimens of FORBES (1846) and some of KOSSMAT (1897) from India in Mr. KAYE and Mr. CUNLIFE's collection and plaster casts of the original specimens of KILIAN & REBOUL (1909), owing to the kindness of the authorities of the British Museum (Natural History). Furthermore, due to the kindness of Mr. C.W. WRIGHT I have studied a number of specimens of New Zealand collected by his brother, Mr. E.V. WRIGHT, and Mr. A.P. MASON of Auckland and also some of MARSHALL's and WOODS' original specimens which have been sent on loan to Mr. WRIGHT and me by Dr. FLEMING and Mr. MASON.

Through the study of these specimens, as well as the Japanese ones, I now understand the natural state of the family better than before. I have changed my old opinion and recognized that what I called *Maorites*, *Neomadrasites* and *Jacobites* in the Japanese province belong in fact to new genera, whereas the reason of the scarcity of typical Kossmaticeratidae in the Heteroan (Campanian and Maestrichtian) of Japan is probably palaeogeographical. Kossmaticeratids of the Antarctic type have not yet been discovered in Hokkaido and Saghalien, while the Urakawan (mainly Coniacian and Santonian) contains members of true Kossmaticeratidae. In this paper I describe kossmaticeratids from Hokkaido and Saghalien, present my scheme of classification with some necessary remarks of foreign forms and finally summarize

concisely the history of the family in our present knowledge.

The material of our side which I have studied is half my own collection and half the old collections of K. JIMBO (1894), H. YABE (1909) and M. KAWADA (1929). The specimens are preserved partly in the Geological Institute, University of Tokyo (GT.) and partly in the Department of Geology, Kyushu University (GK.). Furthermore several specimens preserved in the Department of Geology & Mineralogy, Hokkaido University and also in the Geological Survey of Japan have been examined. As to the localities, horizons and stratigraphical problems readers are requested to refer to my previous papers (T.M. 1942-43 and also T.M. (Editor) 1954).

Systematic Description

Order Ammonoidea

Superfamily Desmocerataceae

Family Kossmaticeratidae SPATH, 1922

The characters common to all the forms of the family are well marked constrictions each cutting obliquely several ribs behind, numerous ribs diverging from tubercles or at least elevations at the umbilical edge; all these features are found in most or part of the growth-stages. The shell-form is essentially constant in the very young stage, being similar to that of many young Desmoceratids, but with growth acquires various special features, varying in form between the compressed and evolute, typical Puzosiid and the inflated and fairly involute, normal Pachydiscid. Size of the shell is usually moderate or rather small but is occasionally fairly large. The suture-lines are essentially similar in general pattern in the young stage to that of young *Desmoceras* but varies in the later stage, being sometimes *Pachydiscus*-like, as in *Kossmaticeras* (s.s.), and sometimes *Puzosia*-like, as in *Maorites*.

From the evidences which will be described in detail in the following pages the kossmaticeratoid ammonites seem to comprise at least two different groups which flourished at different ages and were distributed mainly in different geographical provinces. In other words the large superfamily Desmocerataceae gave rise two main kossmaticeratoid offshoots which were, however, analogous. In our present state of knowledge it is still doubtful whether a few of the earlier group are the direct ancestors of the later group or whether the two groups are entirely distinct. At any rate most of the members of the two groups have similar but not identical morphological characters and can be regarded as derived from the Puzosiidae or a *Puzosia*-like member of Desmocerataceae, so that the separation into the subfamilies

is natural and reasonable. The problem of the origin of the subfamilies will be discussed in more detail below.

Subfamily **Marshallitinae**, nov.

This is a group which should be separated from the true *Kossmaticeratinae* (s.s.) because its various members have mostly no direct connexion with the latter. It includes, besides the hitherto described *Holcodiscoides* SPATH, 1922 and *Eogunmarites* WRIGHT & MATSUMOTO, 1954, several new genera to be described below.

So far as our present knowledge is concerned, the subfamily appears in the late Miyakoan (Albian) and is mainly distributed in the Paleogyliakian (i.e. approximately Cenomanian) of the Northern Pacific and Indian realm and may have possibly survived to the Neogyliakian (Turonian). However the known number of individuals, species and genera is far less than that of the subfamily *Kossmaticeratinae* of the Senonian.

Genus *Marshallites*, nov.

Type species: *Marshallites compressus*, sp. nov.

Generic diagnosis.—*Kossmaticeratoid* ammonites of small or moderate size, fairly involute and fairly narrowly umbilicate, with a rapid growth of whorls, which are higher than broad except in the very young stage. Shell ornamented with numerous, gently flexiradiate, fine ribs branching at the umbilical margin and sometimes between the umbilical margin and the periphery. The ribs when united at the umbilical margin generally form radially elongated, bundle-like, low elevations or 'bullae'. Constrictions frequent and well-marked, prorsiradiate and cutting obliquely several fine ribs. Suture-line like that of *Kossmaticeras*, with a general desmoceroid pattern, formula of E, L, U₂, U₃ (=S), U₁, I and trifold L somewhat longer than E.

Remarks.—In the Japanese Paleogyliakian ammonites there are a number of specimens which are apparently similar to *Maorites* MARSHALL, 1926 of the late Senonian in the South Pacific-South Indian realm. Because of the great difference of age between Cenomanian and Upper Senonian, a new generic name had been preliminarily given to our specimens in manuscript. However, I listed them in my later publication (1942-43) as *Maorites*, as I had failed to find a significant criterion of generic distinction. This resulted in the suggestion in that paper that MARSHALL'S New Zealand ammonites might comprise fossils of various horizons ranging from Cenomanian to Upper Senonian. Through my visit to the British Museum (Natural History) in the

academic year of 1953-1954 I became aware of some constant morphological difference between the two groups, while Dr. SPATH (July, 1953) had just clarified the date of the Upper Cretaceous ammonite-bearing formations around the southern Pacific-Indian Ocean.

When MARSHALL established *Maorites* on the New Zealand species he remarked on some of the Indian species and distinguished two groups, one including *Ammonites aemilianus* STOLICZKA, *A. kandi* STOLICZKA and *A. madrasianus* STOLICZKA of the Arrialoor group and the other comprising *A. pacificus* STOLICZKA, *A. papillatus* STOLICZKA and *A. moraviatoorensis* STOLICZKA. I agree with MARSHALL's suggestion that the former group may be placed in *Maorites*. The first species of the latter group is also an Arrialoor one and was already designated as type species of *Pseudokossmaticeras* SPATH (1922), while the second and the third species were transferred by the same author to *Holcodiscoides* SPATH. I am in harmony with Dr. SPATH in accepting the two genera but hesitate to assign *A. papillatus* STOLICZKA to *Holcodiscoides*, because it lacks the peripheral tubercles. Moreover, in the Japanese Paleogyliakian I found a number of specimens which also have no peripheral tubercles and, accordingly, look very like *Maorites*.

These forms do have elevations at the umbilical edge but the elevations are usually very indefinite without forming prominent tubercles. Examining several species of *Maorites* from New Zealand, Antarctica and South Africa I have confirmed that they have distinct umbilical tubercles from a very early stage of growth (e.g. the third volution at diameter of several millimeters), even if the tubercles are weakened on the outer whorl. The feature is quite different from that observed in the immature of *Marshallites*, which is quite free from distinct tubercles. (See text figs. 1-6.) An apparent mystery is, however, the fact that in *Maorites tenuicostatus* MARSHALL, type species of *Maorites*, the ornament is very delicate. This is a finely ornamented member of the genus and the tubercles in the inner whorl, as seen in Mr. MASON's well preserved specimen, can be said fairly distinct as compared with the finess of the ribs (text fig. 6).

MARSHALL also remarked on the difference in the suture-line between the two groups mentioned above. The suture-line in the first group (i.e. *aemilianus*-group), as well as his *Maorites*, is more finely divided and has an asymmetric first lateral lobe. "In addition, the first lateral lobe is very deep. In the second (which includes *Amm. papillatus* STOLICZKA), on the other hand, the suture-line is far less finely divided; there is also complete symmetry in the first lateral lobes, which is relatively less important and either not deeper or very little deeper than the ventral lobe." Relying upon MARSHALL's detailed

illustration of *Maorites tenuicostatus* MARSHALL (1926, pl. 23, fig. 1, la), the formula of suture-line in *Maorites* is interpreted as E, L, U2, U1 (=S), I and its internal suture lacks one pair of elements which can be expected just on both sides of the antisiphonal lobe. *Marshallites* does have this element and the formula is E, L, U2, U3 (=S), U1, I. This point might be another important criterion for the distinction of *Marshallites* from *Maorites*. However the internal suture-line is often difficult to observe and I cannot state with confidence whether other species of *Maorites* have the internal suture similar to that of the type species or not. In this connexion another illustration is found in SPATH's recent paper in which the internal suture of *Maorites pseudo-bhavani* SPATH is drawn (SPATH, 1953, pl. xi, fig. 3c) to have a pair of lobes on both sides of the antisiphonal lobe. I myself also observed the similar feature in a young shell of *Maorites suturalis* MARSHALL in WRIGHT's Collection of New Zealand (Text fig. 5). Accordingly the character of the internal suture is not enough to distinguish the homoeomorphic Cenomanian and Upper Senonian forms in question. The degree of incision in suture-lines varies with growth-stages and I hesitate to place too much importance to this point. As to the character of the first lateral lobe the criterion which MARSHALL pointed out is warrantable, although the difference is not remarkable, especially when the immature shells are treated. The asymmetry of L in the large lectotype of *Maorites tenuicostatus* is so strong that an apparent bipartite L is produced. Such a feature is never found in *Marshallites*.

Marshallites, in our present state of knowledge, includes, besides the type species, another new species and an indefinite form from the Paleogyliakian (approximately Cenomanian) of Hokkaido and Saghalien and *M. papillatus* (STOLICZKA) from the Ootatoor group of India. The genus occurs also in the probable Lower Turonian of Kyushu.

Holcodiscoides SPATH must have intimate relation with *Marshallites*, being perhaps the bituberculated development from this genus. *Ammonites moraviatoorensis* STOLICZKA has no peripheral tubercles and should be separated from *Holcodiscoides*, as SPATH himself recently (1953) suggested. However that species may not be included in *Marshallites*, because it has wider umbilicus, less involution and more rounded whorl. No forms have been found that can connect *Marshallites* with *Maorites* of Upper Senonian. So far as no direct connexion of lineage is found between the two genera, they should be regarded as an example of homoeomorphy, though of a small scale within the same family.

Kossmaticeras (s.s.), to be emended below, is also devoid of distinct umbilical tubercles, but is less involute, more widely umbilicate and provided

typically with coarser ribs than *Marshallites*. According to KOSMAT the suture-line of *K. theobaldianum* (STOLICZKA) (1897, pl. vii, fig. 5) shows a formula of E, L, U2, U4, U5 (=S), U3, U1, I. Although a good intermediate form has not yet been discovered, *Kossmaticeras* (s.s.) may have direct connexion with the Puzosiidae, as I have suggested in my recent paper of family Puzosiidae (1954). As another possibility it may have descended directly from a certain unknown form of Turonian *Marshallites*. At any rate further research is necessary on this point.

From what form is *Marshallites* derived? In connexion with this question I propose here a new genus.

Genus *Hulenites*, nov.

Type species: *Puzosia reesidei* ANDERSON, 1938 (p. 187, pl. 38, figs. 2, 3)

Generic diagnosis.—Rather small and fairly similar to *Melchiorites* in shell-form, being fairly narrowly umbilicate and rather involute. In spite of its small size the surface is ornamented distinctly with fine ribs which start from the umbilical margin with occasional or frequent branching, are flexuous on the sides and cross the venter with slight or moderate forward bend. Constrictions are well-marked, frequent and prorsiradiate with a strong forward projection on the venter, sometimes cutting a few ribs behind them.

Remarks.—The proposed genus includes, besides the type species, *Puzosia diadema* ANDERSON (1938, p. 188, pl. 42, figs. 9–12), *Puzosia jimboi* ANDERSON (1938, p. 188, pl. 42, figs. 5–7) and *Puzosia onona* ANDERSON (1938, p. 188, pl. 42, fig. 8) from the upper Horsetown group (i.e. Hulen beds) of California. The distinction from the typical *Puzosia* is in its involution, narrower umbilicus, more distinct ribs and prorsiradiate constrictions (and also? its smaller size). There may be some apparent intermediate forms, such as *Puzosia octosulcata* (SHARPE), which could be referred in either of the two.

ANDERSON was correct in regarding them as a special group and I agree with him in assuming the origin of this group as *Melchiorites* of just sub-jacent bed. Perhaps it has no direct connexion with *Puzosia* (s.s.) but may be a parallel development from the common ancestor, *Melchiorites*.

On the other hand the development of weak umbilical bullae at the edge of the ribs can well lead to *Marshallites*. In fact such a tendency is found in *Puzosia onona*, a probable passage form between the two genera.

Marshallites compressus, sp. nov.

Pl. VIII, figs. 1a, b, 2; Text figs. 1, 2.

Maorites compressus (nom. nud.) MATSUMOTO MS, 1942, p. 193 and elsewhere, listed only.

Material.—Several well preserved specimens from the Paleogyliakian of the Abeshinai Valley, Teshio Province, Holotype, GK. H 2751, from locality T608, bed IIb. Paratypes, Nos. GT. I-3233, I-3234 a, b and I-3236 from locality T608, bed IIb; GK. H 2753, loc. T608, bed IIb; all T.M. Coll.

Specific diagnosis.—Shell fairly small and flatly discoidal with a moderate involution of whorls; umbilicus fairly narrow and shallow, being surrounded by a low and perpendicular wall with subrounded margin; whorls compressed with narrowly arched periphery and flattened flanks. The shell in the late growth stage is ornamented with numerous ribs, narrow and sharp-headed and separated by slightly wider interspaces. Every two or three ribs are united near the umbilical margin, forming a blunt elevation, but not a distinct tubercle. Ribs are flexiradiate, showing a considerable forward bend at the ventrolateral edge. The ornamentation in the immature shell is very weak and comprises fine striae discernible on the ventral part, very faint subcostae of unequal strength and low but elevations at the umbilical edge of the longer subcostae. Periodic constrictions are well marked, somewhat oblique and gently flexuous, showing a marked peripheral projection. The aperture is provided with a pair of ventrolateral sinuses and lower lateral lappets. Suture consists of E, L U2, U3 (=S), U1, I and corresponding saddles, being similar to that of *Desmoceras* in general pattern, but with descending lobules of the subdivided U3 as in *Puzosia*; in the adult finely incised with L nearly symmetrically trifold and somewhat deeper than E.

Measurements.—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus (%)	Involution
GK. H 2751	48.0	21.0	14.3	(0.67)	12.5 (26)	3/5
	34.7	16.3	10.6	(0.65)	9.2 (26)	
	30.3	13.5	9.9	(0.73)	7.4 (24)	
GT. I-3234a	Ca 40.					
	28.5	12.0	8.8	(0.73)	7.7 (27)	
GT. I-3234b	23.4	10.0	9.2	(0.92)	6.5 (28)	

Ontogeny.—The specimens at my disposal are so well preserved that they are available for tracing the ontogenetic development. One of them, GK. H 2753, has been examined down to its initial volution and protoconch. The observed facts are illustrated in text fig. 1.

There is a considerable change in shell-form with growth, the whorl-height in particular increasing more rapidly than the whorl-breadth. The whorl is at first highly depressed and laterally inflated, as is usually the case in the Desmocerataceae; in the third volution subcircular in cross-section but still broader than high; at a point in the fourth volution as high as broad with gently convex flanks. In these earlier stages the shell is fairly evolute and fairly widely umbilicate, with rounded umbilical margin; constrictions are very rare in the first three whorls and become frequent, well-marked and oblique in the fourth whorl; surface is nearly smooth.

In the fifth volution the shell is compressed (e.g. height 7.8 mm: breadth 6.2 mm) with subparallel and only slightly convex flanks, moderately involute and also moderately umbilicate, with a subrounded and then subangular umbilical shoulder; the faint subcostae are discernible besides the very fine striae; some of the subcostae reach the umbilical margin and some others are confined on the peripheral part; the elevation at the umbilical edge of the longer costae is scarcely discernible; constrictions run somewhat obliquely and show a strong forward bend on the periphery; suture-lines consist of E, L, U2, U3 (=S), U1, I and corresponding saddles, *Desmoceras*-like in general pattern, but much incised in this stage and already with strong tendency to the descending arrangement of the lobules derived from the subdivision of U3. Thus all the characters in this stage show a strong affinity with the general characters of the immature Puzosiids.

In the earlier part of the sixth volution the ornamentation is still weak but a faint elevation begins to appear at the umbilical edge of some of the longer subcostae. Most of the characters described in the specific diagnosis are observed after that stage.

The holotype exhibits the last septum slightly behind the preserved last part, so that the characters in the main part of the adult living chamber should be sought in further collection.

Variation.—Examining a number of specimens I have found that the present species shows some variation especially in shell-form. For example, the specimen GT. I-3234b (Pl. VIII, fig. 2), which is an immature shell, has a whorl somewhat less compressed and laterally more convex than the immature of the holotype. However other characters are common to both specimens and, furthermore, the intermediate feature is shown in another specimen, GT. I-3234a. (The three specimens were derived from one and the same nodule.)

On the other hand there are much compressed specimens which should be regarded as a subspecies.

Marshallites compressus puzosioides, subsp. nov.

Pl. VIII, figs. 3, 4a, b.

Material.—Three well preserved specimens: Holotype, GT. I-3240; paratypes, GT. I-3239a, b; those three and other comparable specimens are from locality T863, bed IIa (uppermost part), a little below the horizon of the normal form.

Measurements.—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus	(%) Involution
GT. I-3239	28.5	13.2	9.5	(0.72)	6.9 (24)	Ca 3/5
GT. I-3240	36.8	18.3	11.5	(0.63)	8.7 (24)	Ca 2/3

Diagnosis.—Allied to the typical form of the species but differs in its much flattened flanks and very fine subcostation.

Remarks.—As the largest one among the three specimens is still septate rear its anterior end, the character of the living chamber has not yet been completely observed. However the fine subcostation occupies a distinctly wider area than that in the normal form. Whether the ribs, which are as strong as those of the adult shell of the normal form, appear in the unpreserved later part or the fine subcostae continue further on is, of course, uncertain. But the character seems fairly constant and, moreover, the shell is much compressed, has the characteristically flattened flanks and its lateral lobe is far longer than the external lobe. Accordingly at least the subspecific separation is, in my opinion, natural and reasonable.

It is interesting that this subspecies shows a resemblance to some species of *Puzosia*, e.g. *P. subcorbarica* (YABE MS) MATSUMOTO from the Albian equivalent of Hokkaido and South Saghalien, although it is more narrowly umbilicate and has the oblique constrictions and longer subcostae many of which reach the umbilical margin, forming the umbilical elevations. Presumably it does not attain a large size as the Puzosiids do.

Among the species of *Hulenites* discussed above *H. ononus* (ANDERSON) from the uppermost part of the Horesetown group is closely allied to the typical form of *Marshallites compressus*. The latter has clearer umbilical elevations and more distinct cutting of ribs by constrictions than the former. *M. compressus puzosioides* has some affinity with *Hulenites veesidei* (ANDERSON) from the upper part of the Horesetown group.

Occurrence.—Paleogyliakin of Hokkaido. Fairly common in the Abeshinai-Saku area in Teshio Province and to be expected also in other areas. Comparable specimens are found in Kyushu (Tomochi formation in Kumamoto Prefecture).

So far as the available material before me is concerned, the subsp. *puzosioides* occurs a little below the horizon where the typical form is common. However whether this is constant or not has still to be determined.

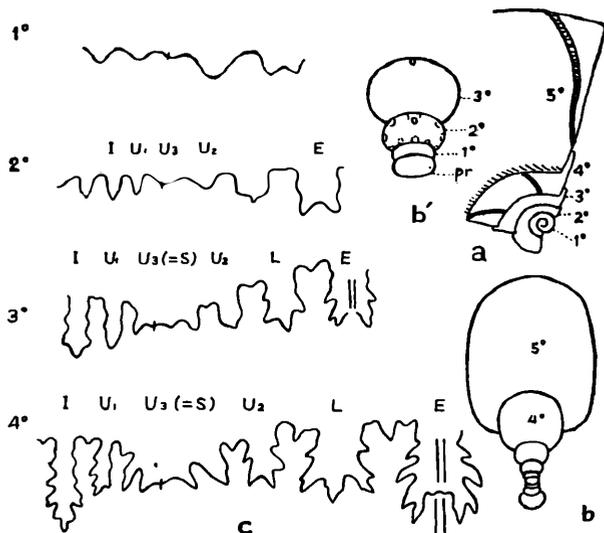


Fig. 1. Ontogenetic development of *Marshallites compressus*, sp. nov. GK. H 2753 from locality T608, bed IIb of the Abeshinai-Saku area, Teshio Province, Hokkaido. pr, 1°, 2°,.....: protoconch, first, second and.....volutions. a: lateral view, b, b': whorl sections, c: suture-lines. (Del. & coll. T.M.)

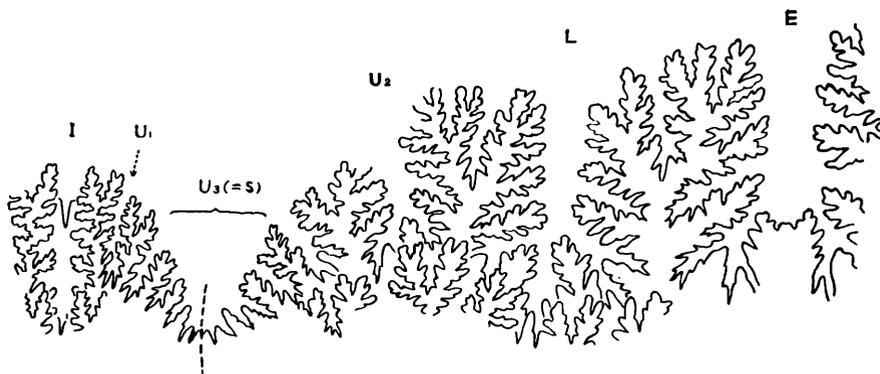


Fig. 2. *Marshallites compressus*, sp. nov. Suture-line in the adult stage (diameter = 47 mm., whorl-height = 21 mm.). Holotype, GK. H 2751 from locality T608, bed IIb of the Abeshinai-Saku area, Teshio Province, Hokkaido. (Coll. & del. T.M.)

Marshallites sp. aff. *M. compressus*, sp. nov.

Text fig. 3.

Material.—GT. I-3232a, loc. T608, the Sakugawa, bed IIb, the Abeshinai area, Teshio Province, Hokkaido. A small specimen; the unseptate a quater of the outer whorl is deformed.

Measurements of the septate part in mm.

Diameter	Height	Breadth	(B/H)	Umbilicus	(%)
18.3	7.2	6.9	Ca 0.9	5.8	(31.5)

Description.—In shell-form the specimen is just like the relatively less compressed form of *Marshallites compressus* described above (see 'variation' in the description). The inner whorl has fairly convex sides but the outer whorl has rather flattened ones. The change of shell-form in the ontogenetic development is so well exhibited in this specimen that it is illustrated here.

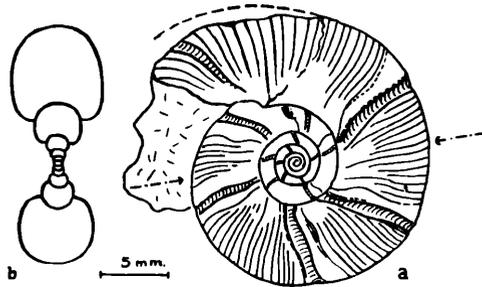


Fig. 3. *Marshallites* aff. *compressus* sp. nov. Lateral view (a) and whorl-section (b). GT. I-3232a from locality T608, bed IIb of the Abeshinai-Saku area, Teshio Province, Hokkaido (Coll. & del. T.M)

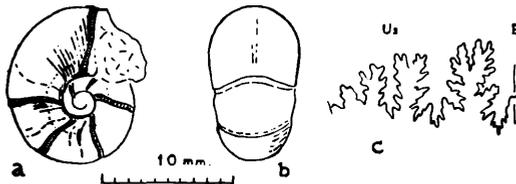


Fig. 4. *Marshallites olcostephanoides*, sp. nov. Immature; Lateral (a) and ventral (b) views and external suture-line (c). GT. I-3232b from locality T608, bed IIb, Abeshinai-Saku area, Teshio Province, Hokkaido. (Coll. & del. T.M.)

The figure demonstrates that a striking similarity is found between the present form and the immature shell of *Puzosia* or *Melchiorites*. As the speci-

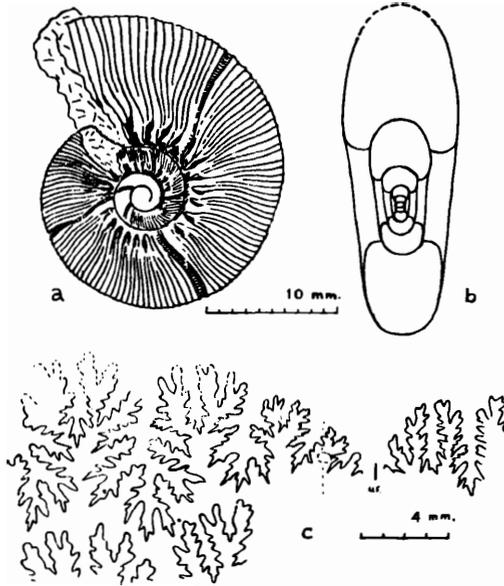


Fig. 5. An example of the young stage in *Maorites*. *M. suturalis* MARSHALL from the Upper Cretaceous of New Zealand (C.W. WRIGHT'S Coll.). Diameter = 22.0, height = 10.0, breadth = 8.4, umbilicus = 6.6 mm. (T. M. del.)

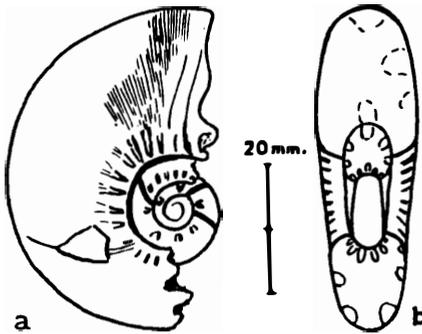


Fig. 6. An example of the young stage in *Maorites*. *M. cf. tenuicostatus* MARSHALL, or possibly an extremely densicostate form of *M. densicostatus* (KILIAN & REBOUL) from the Upper Cretaceous of New Zealand (A.P. MASON'S Coll.) (T. M. del.)

men is evidently immature, it must exhibit more involution and a narrower umbilicus as the shell grows.

In spite of its small size it is distinctly ornamented with fine subcostae in its outer whorl. The subcostae are gently sigmoidal and obsolete on the umbilical margin. The feature is again quite similar to the ornamentation of *Hulenites* and *Melchiorites*. However in the preserved last part (on the opposite side to that figured) weak umbilical lamellae begin to appear and the ribs become more distinct, showing a prominent peripheral projection. This feature presumably continued in the missing later whorls. The well-marked constrictions cut obliquely several ribs and are slightly flexuous, bordered behind by a narrow raised rib-like ornament and provided with a trace of lower lateral lappets, upper lateral sinus and a rostrum in front of them.

From all the characters described above the specimen is without doubt closely allied to *Madrasites compressus* but differs in that its ribbing appears earlier than in the typical form of that species. The interesting point is the following. When the specimen is compared with the immature shell of *Maorites* at the same size, a marked difference is found. The distinct umbilical tubercles in the latter are lacking in the former, while even the ribs are weakened on the umbilical margin of the latter. On the other hand the specimen resembles *Melchiorites* and *Hulenites* to a considerable extent. Even in the suture-line it does not differ much from *Melchiorites*. Furthermore the closest alliance is found between the present form and *Hulenites jimboi* (ANDERSON) from the uppermost bed of the Horsetown group. In the Californian species ribs are slightly coarser, whorls are slightly broader and the umbilical elevations are not well developed. Thus we can understand well the distinction between *Marshallites* and *Maorites*.

Marshallites olcostephanoides, sp. nov.

Pl. VIII, figs. 5a, b, 6, and 7a, b; Text fig. 4

Maorites olcostephanoides MATSUMOTO MS. *nom. nud.*, 1942, p. 194 and elsewhere, listed only.

Holcodiscoides aff. *papillatus* STOLICZKA, MATSUMOTO, 1942, p. 153 and elsewhere, listed only.

Material.—Fifteen specimens are at my disposal. Many of them are small and immature but can be connected with a few specimens of moderate size. Holotype: GK. H 1552, loc. Y 140d, bed II_m, the Shiyubari Valley, Ishikari Province, Hokkaido. Paratype: GK. H 1553, loc. Y235, bed II_j in the same valley; GT. I-3710 a, b from loc. N 44d, zone Kz-Mh in the Naibuchi

Valley, South Saghalien. Other referable specimens: GK. H 1554, loc. Y 144, bed IIj in the Shiyubari Valley; GT. I-3232b, loc. T608, bed IIB; GT. I-3237, loc. T225, bed IIB; GT. I-3241, loc. T711b, bed IIB; GT. I-3242, loc. T27, bed IIB-c (β); GT. I-3244, loc. T229p, bed IIB; GT. I-3305, loc. T846b, bed III-c (β), these six from the Abeshinai-Saku area, Teshio Province, Hokkaido; two other comparable specimens from loc. I35 e and I 55 a, zone Mho in the Aikawa Valley, South Saghalien. All collected by T. MATSUMOTO.

Measurements.—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus (%)
GK. H1552	50.9	23.0	19.5	(0.85)	13.2 (26—)
GT. I-3710a	25.0	11.0	10.0	(0.9)	7.0 (28)
GT. I-3232b	12.0	5.5	7.0	(1.2)	3.0 (25)

Specific diagnosis.—Shell of moderate size, discoidal, moderately involute and fairly narrowly umbilicate. Whorls compressed, somewhat convergent and broadest near the umbilical margin, with gently inflated flanks and narrowly arched venter. Surface of shell ornamented with numerous closelyset fine ribs, which are nearly straight or gently flexuous, branched at the umbilical margin and again, a little below the mid-flank; at or near the latter point shorter ribs are inserted. The united ribs at the umbilical edge are elevated in bundle-form without showing a distinct tubercle. Constrictions well marked, nearly straight in adult but with a slight flexuosity in the immature stage and strongly prorsiradiate, cutting several ribs behind them. Suture-line similar to that of *Marshallites compressus* described just above.

Description of the immature stages.—At diameters below 8 mm, as shown in GT. I-3232b and the inner whorl of GT. I-3720a, b, the whorl is rounded, somewhat broader than high, fairly involute, narrowly umbilicate and rather globose; surface is nearly smooth but frequently constricted (6-8 in one volution). Thus the shell is fairly similar to the young *Desmoceras*. The constrictions are distinct and bordered behind by a rib-like elevation. The weak striae in front of the constrictions show the trace of lateral lappets. Between the constrictions one or two very faint radial elevations are discernible on the lower-lateral part (see text figs. 4 a-c).

At a diameter of 10 mm or a little more fine ribs appear and the whorl is nearly or not quite as high as broad. At a diameter of about 20 mm the whorl is slightly higher than broad with its maximum breadth a little below mid-height, with gently convex flanks and arched venter. The ribbing becomes very distinct at this stage and almost similar to that of later stages; the ribs are numerous, close-set and somewhat flexuous, branching usually near the umbilical margin and sometimes at mid-flank, also with some inserted

ones; the bundled ribs near the umbilical margin are elevated and thickened but not form a distinct tubercle. On the periphery the ribs are regular, almost of equal strength and separated by interspaces as narrow as the ribs themselves, showing a gentle forward curvature. There is no peripheral tubercle at all. Constrictions are six or seven per whorl in this stage, well marked, slightly flexuous, bordered in front by a raised rim and prorsiradiate, cutting a few ribs behind them. A faint line in front of the constriction indicates an apertural margin which has a pair of moderately projected lower lateral lappets.

Remarks.—At first sight the present species is very similar to *Maorites densicostatus* (KILIAN & REHOUL) from the Campanian of Antarctica and New Zealand, so that I once referred it to that genus, regarding merely as specific a minor difference in the whorl-shape (convergent and gently convex whorls in the former, nearly parallel and compressed ones in the latter). Another more important criterion is in the umbilical tubercles: indistinct blunt elevations at the umbilical edge of the bundled ribs in the former as in the preceding species, while distinct tubercles occur in most growth stages in the latter, as in all other species of *Maorites*. Geological occurrence also supports the reference to *Marshallites* and it is very interesting to find such a striking resemblance between the two stratigraphically separated species.

Marshallites compressus and *M. ocostephanoides* are fairly dissimilar and subgeneric separation may be possible. However the available material is not sufficient to make a clear definition.

Holcodiscus cf. *theobaldianus* (STOLICZKA) in ANDERSON (1902, p. 101, pl. v, figs. 126, 127: pl. x, fig. 197), a probable Chico species, is not, in my opinion, a true *Kossmaticeras theobaldianum* (STOLICZKA), but is probably a species of *Marshallites* which is fairly akin to the present species. Our form has more strongly oblique constrictions cutting more ribs than the Californian one.

The immature shell of the present species is somewhat allied to *Ammonites papillatus* STOLICZKA (1865, p. 159, pl. lxxvii, figs. 7, 8) from the lower Ootatoor group of South India. In that species constrictions are more frequent and ribs are somewhat coarser and less flexuous than in our specimens of the corresponding size. The small specimens which I once listed as *Holcodiscoides* aff. *papillatus* should be included in the present species. Anyhow the Indian species is probably a *Marshallites*, because it has no peripheral tubercles and its umbilical tubercles are small and blunt.

The specific name of the present species indicates the superficial similarity to the lower Neocomian *Holcostephanus astieri* (D'ORBIGNY).

Occurrence.—Paleogyliakian (Cenomanian) of Hokkaido and Saghalien.

I know another species which may be referable to *Marshallites*. It was collected by Dr. R. SAITO from the middle member of Mikasa formation (the so-called *Trigonia* Sandstone) in the Ikushumbets Valley when he was a student of Hokkaido University. As it is still doubtful and as I intend to make a joint work with him, it is not described here.

Genus *Eomadrasites*, nov.

Type species: Eomadrasites nipponicus, sp. nov.

Generic diagnosis.—Small, fairly involute and fairly narrowly umbilicate shell, with inner whorls wider than broad and the outer whorl as high as broad or a little higher than broad; umbilical margin rounded. Outer whorl provided with definite tubercles on the inner part of the sides, at the peripheral edge and on the median line. Numerous fine ribs start from the umbilical suture, run nearly radially or somewhat irregularly on the flanks and cross the periphery without showing prominent forward bend; some of them being united at the large tubercles and others passing between them. Constrictions well marked, each of them cutting obliquely several ribs. Suture-line similar to that of *Kossmaticeras* and finely incised; E as deep as L, the external saddle fairly large and bifid, L subsymmetrically trifold and U2, U4 and lobules of U5 (=S) gradually descending.

Remarks.—The genus includes two new species to be described below. In my previous stratigraphical paper (1942-43) I assigned them to *Neomadrasites* MARSHALL, depending on his brief generic diagnosis: "Tubercles on shoulder and on median line. Suture-line resembles that of "*Madrasites*" (MARSHALL, 1926, p. 171). However from careful comparison with *N. nodulosus* MARSHALL*, the type species of *Neomadrasites*, I have recognized ample differences to distinguish *Eomadrasites* from *Neomadrasites*.

In *Neomadrasites* whorls are depressed throughout life and somewhat evolute, while in *Eomadrasites* the whorls increase rapidly in height and are fairly involute. On the periphery the ribs show a considerable forward curve in *Neomadrasites* but they are nearly straight in *Eomadrasites*, only the constrictions and a few adjacent ribs showing a gentle forward bend. The most definite difference is found in the tubercles. In *Neomadrasites* the umbilical tubercles begin to develop early in the inner whorl, while in *Eomadrasites* they are limited to the outer whorl and are situated on the lower part of the side. The tubercles at the ventrolateral edges are not essentially different

* Owing to the kindness of Mr. C.W. WRIGHT and Mr. MASON I have fortunately examined the holotype and other specimens.

between the two genera. On the median line of the venter almost all the ribs have a small projection or tubercle in *Neomadrasites*, whereas in *Eomadrasites* large tubercles are periodically distributed, approximately corresponding in number to those at the ventrolateral edges: some of the ribs are united at those tubercles and others cross the median line without a tubercle.

The morphological resemblance between the two genera in question is undeniable. If they occurred in the same formation or in beds of successive ages we would regard them as intimately related. However they are of widely separated ages between which no allied form has been reported. Probably

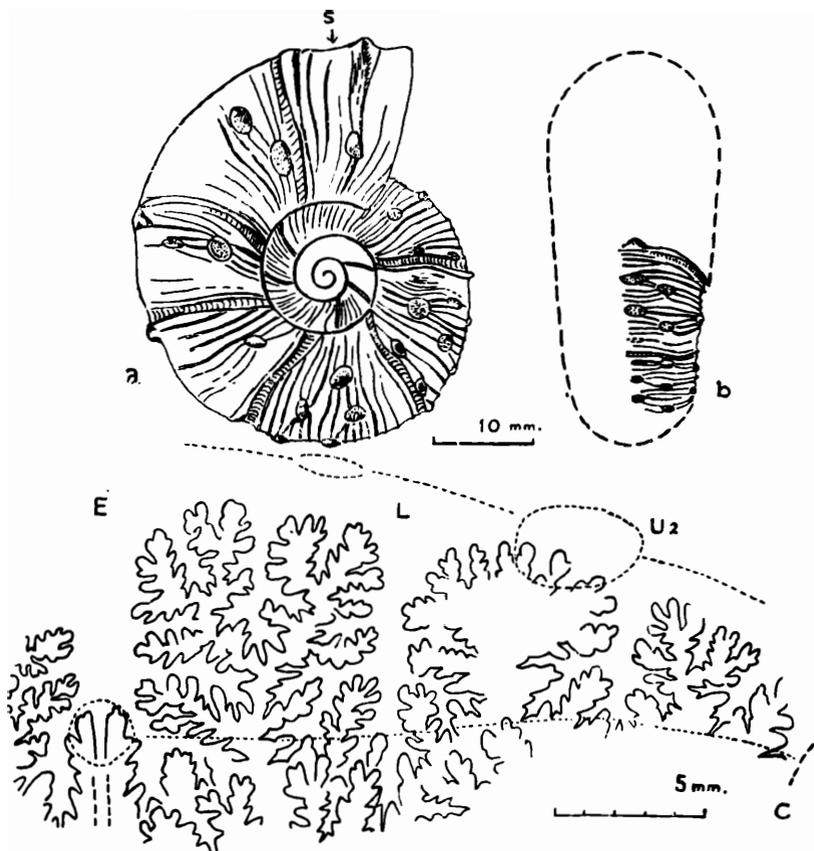


Fig. 7. *Eomadrasites nipponicus*, sp. nov. Restored from the deformed specimen, holotype, GK. H 1559 from locality T238 p, Led IIb, Abeshinai-Saku area, Teshio Province, Hokkaido, (T.M. Coll.). a: lateral view; b: ventral view; c: sutire-line (at a in fig. a) with the position of ribs and tubercles. (T. M. del.)

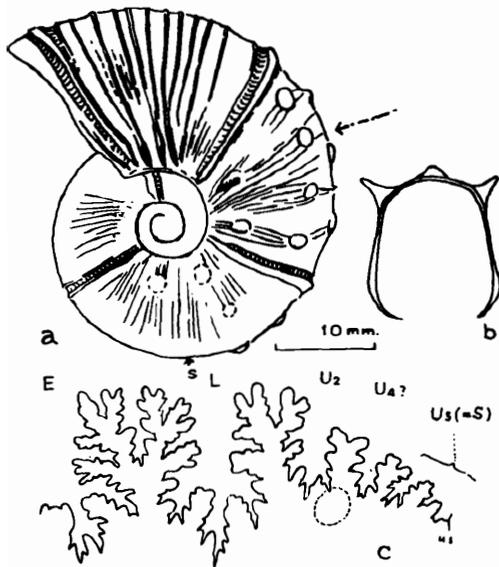


Fig. 8. *Eomadrasites subnipponicus*, sp. nov. Restored mainly from the holotype (GT. I-3235a) and partly from the paratype (GT. I-3235b) from locality T863, bed IIa, Abeshinai Valley, Teshio Province, Hokkaido. Lateral view (a), whorl-section (b) and external suture-line (c). (T.M. del.)

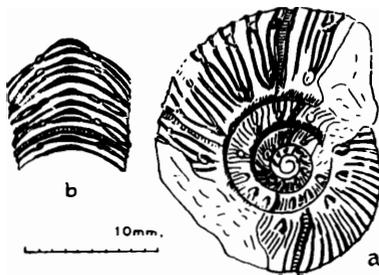


Fig. 9. The immature shell of *Neomadrasites nodulosus* MARSHALL. An example from the Upper Cretaceous of Bull Pt., Kaipara, New Zealand (C.W. WRIGHT no. 42, A.P. MASON coll.). Lateral (a) and part of ventral (b) views. (T.M. del.)

Neomadrasites is allied to *Jacobites* and intimately related to the group of "*Madrassites*" *multicostatus* MARSHALL, which is to be transferred to a new genus (see below). On the other hand *Eomadrasites* has certainly some connexion with the nearly contemporary *Marshallites* and also probably with *Eogunnarites* WRIGHT & MATSUMOTO. Thus *Eomadrasites* and *Neomadrasites* are again rather homoeomorphic.

The trituberculate character is also shown in the rare genus *Pseudojacobites*. Examining the type specimen of "*Pachydiscus*"

farmeri CRICK (BM. C. 12220) I have noticed that the three rows of peripheral tubercles are confined to the anterior one third of the preserved last whorl and the finely ribbed preceding part is free from the median tubercle. Furthermore, poorly preserved constrictions are discernible in the finely ribbed part and its fine ribs show diverging character. Indeed it may be a trituberculate derivative of *Lewesiceras*, as WRIGHT & MATSUMOTO discussed (1954), but a possibility of its belonging to Marshallitinae and its relation to *Eomadrasites* should also be considered. The problem must be examined, of course, by further study on better material.

Occurrence.—Paleogyliakian in the Japanese Cretaceous Province, approximately equivalent to the Cenomanian; rather rare.

Eomadrasites nipponicus, sp. nov.

Pl. X, fig. 3; Text-fig. 7 a-c

Neomadrasites (?) *nipponicus* MATSUMOTO MS. *nom. nud.*, 1942, p. 193 and elsewhere, listed only.

Material.—One small but interesting specimen collected from the zone of *Desmoceras* (*Pseudouhligella*) *japonica* (bed IIb) at locality T233p in the Abeshinai Valley, Teshio Province, Hokkaido: holotype GT. I-1559 (T. MATSUMOTO Coll.). The outer half whorl is somewhat deformed and the living chamber is mostly missing. The inner layer of the test is preserved.

Measurements.—

	Diameter	Height	Breadth	(B/H)	Umbilicus (%)
Preserved last part	Ca 40.				
‡ vol. earlier	26.0	12.0	16.0	(1.3)	6.5 (25)

Diagnosis.—Shell rather small, considerably involute and fairly narrowly umbilicate, with a rapid increase of whorls. Whorls in young stages depressed and nearly as high as broad in adult (just behind the living chamber), with a subrounded cross-section. Constrictions frequent throughout life. The ornamentation of the outer whorl consists of numerous, fine but sharp ribs, a pair of lower lateral tubercles, another pair of ventrolateral tubercles and a row of median ventral tubercles. Fine ribs are somewhat oblique on the inner whorls and nearly radial on the outer whorl. Three or four of the fine ribs, which start at the umbilical suture, are united at the inner lateral tubercle, from which again three to five fine ribs run outward. There are intervening free ribs besides the tied ones. Some of the ribs running from the inner lateral tubercles and a few of the intervening ones are united at the ventrolateral tubercle but some others run through the interspace of the

ventrolateral tubercles. A similar feature is found in the ribs and the median tubercles. Thus the inner lateral, ventrolateral and median tubercles are not always in regular arrangement but generally one inner lateral tubercle corresponds to two peripheral ones on the interspace of the constrictions and one by one correspondance is found just behind the constriction. The inner lateral tubercle just behind the constriction is sometimes narrow and elongated radially, sometimes obsolete and sometimes tends to be united with the adjacent large tubercle on the interspace. The constrictions are subradial in the late stage but slightly flexuous in the middle stage, showing a gentle forward bend at the umbilical margin and at the ventrolateral edge and cut obliquely several fine ribs behind each of them. A few ribs near the constriction are also flexuous. The growth-striae in front of each constriction indicate the trace of the apertural margin provided with the lower lateral lappets, shallow ventrolateral sinuses and very gentle peripheral projection. The constriction of the preserved last part becomes obsolete on the peripheral area.

The exposed part of the inner whorls ornamented with numerous fine ribs, which are bifurcated at the umbilical margin and sometimes bifurcated again near the mid-flank; no distinct umbilical tubercle; constrictions frequent and oblique forward.

Suture-lines finely and deeply incised in the adult, similar to those of *Kossmaticeras* in general pattern, with broad external saddle, fairly deep external and lateral lobes, relatively small U2 and gradually descending U4 and lobules of the subdivided U5.*

Remarks.—Although there is only a single specimen, it is so peculiar that I establish here a new species for it. The analogy to *Neomadrasites nodulosus* MARSHALLI has been mentioned just above. Besides the fundamental difference which I remarked, the ribs in the present species are distinctly finer than the New Zealand species. Taking into consideration the characters in the inner whorls this species seems to have an intimate connexion with some species of *Marshallites* or *Eogunnarites*.

Occurrence.—Zone of *Desmoceras japonicum* of the Middle Yezo group in the Abeshinai Valley, Teshio Province, Hokkaido. Paleogyliakian, approximately equivalent to Cenomanian; rare.

* As I have only a single specimen of delicate ornamentation, I still hesitate to examine the internal suture. Therefore whether this is U5 or U3 is not certain.

Eomadrasites subnipponicus, sp. nov.

Pl. X, fig. 2a, a', b; Text fig. 9 a-c

Material.—Two specimens in my collection; the living chamber somewhat deformed; test partly preserved. Holotype, GT. I-3235a, locality T863, horizon top of bed IIa, in the Abeshinai-Saku area, Teshio Province, Hokkaido. Paratype, GT. I-3235b collected from the same nodule in which the holotype was preserved.

Measurements.—(on undeformed septate part of the holotype)

Diameter	Height	Breadth	(B/H)	Umbilicus (%)
22.2	10.0	10.8	(1.08)	5.2 (26.4)

Diagnosis.—Small, moderately involute and fairly narrowly umbilicate shell. Adult whorl nearly as high as broad, with a subrounded cross-section in the septate part and subtrapezoidal one in the well-ornamented living chamber, which is broadest near the umbilical shoulder, somewhat flattened on flanks and broadly arched on the venter.

Constrictions well marked, not very frequent, four per whorl, slightly oblique, cutting a few ribs or subcostae behind each of them, bordered on both sides by raised rib-like elevations and accompanied anteriorly with a trace of the short lower-lateral lappets. Septate part of the outer whorl ornamented with numerous faint dense subcostae, with branching and intercalation near the umbilical margin. On the last portion of the septate part a blunt node appears at the umbilical shoulder, at which the subcostae which come from the umbilical suture are united once and then branch away towards the periphery. The living chamber, which occupies a little more than a half volution, has a special ornamentation. Its posterior half is characterized by multituberculation: three pairs of inner lateral (or 'umbilical'?), six pairs of ventrolateral and six median tubercles, a blunt one of the first row corresponding to the distinct and relatively large twos of the second and third rows. The peripheral tubercles are sometimes spinose as partly exhibited by the paratype. Numerous fine ribs start at the umbilical suture, run subradially and are often united at and branch away from the tubercles. They are much weakened on the venter. The anterior half of the living chamber has no peripheral tubercles and is ornamented with narrow subradial (sometimes slightly sigmoidal) ribs of unequal length, separated by broader interspaces. The shorter ribs are united with or sometimes inserted between the longer ones near the umbilical margin, where the longer ones form narrow, radially elongated tubercles or elevations. On the living chamber the raised ribs

behind the constrictions are prominent and show a projection outward and forward on the siphonal line.

The suture-line is similar to that of *Kossmaticeras* in general pattern, with a presumed formula of I, U1, U3, U5 (=S), U4, U2, L, E; L nearly as deep as E and subsymmetrically trifold.

Remarks.—The present species is another interesting representative of *Eomadrasites*. It is distinguished from the preceding species by its finer subcostation on the septate part, more limited development of multituberculation, weaker inner lateral nodes, somewhat compressed shell-form and its less finely incised sutura. Probably it is more intimately connected with *Marshallites*.

On the other hand the species resembles in general aspect *Holcodiscoides cliveanus* (STOLICZKA), from which it is distinguished by its involution, narrow umbilicus and the presence of distinct median tubercles.

Occurrence.—Zone of *Desmoceras japonicum* of the Middle Yezo group in the Abeshinai-Saku area, Teshio Province, Hokkaido; Paleogyliakian, approximately Cenomanian; rare. So far as can be seen from the available material this species occurs somewhat below the preceding species. In highly specialized forms like these two we can expect limited stratigraphic occurrence.

Eogunnarites WRIGHT & MATSUMOTO, 1954

This genus has already been defined and discussed by WRIGHT and MATSUMOTO (1954). The only thing to add here is that it is most probably referred to subfamily Marshallitinae. It is probably a relatively inflated and depressed form which has developed in parallel with compressed *Marshallites*.

A revised description of a single species, *Eogunnarites unicus* (YABE) has also been given in the previous paper and nothing is to be added here.

Incertum Sedes

Gen. et sp. indet., nov.?

Pl. X, fig. 4; Text figs. 10 a, b

Jacobites sp. nov. (?) MATSUMOTO, 1942, p. 196 and elsewhere listed.

Material.—Several rather poorly preserved specimens in my collection. GT. I-3248, loc. T912, bed 11c (δ), Abeshinai-Saku area, Teshio Province, Hokkaido, inner whorls not well exhibited. Besides this specimen there are a small specimen from the same area and two fragmentary specimens (GT. I-3712, loc. I 35e, zone Mho, the Aikawa and GT. I-3713 from the Imanosawa, a tributary of the Naibuchi, bed Kz or Kx) from South Saghalien;

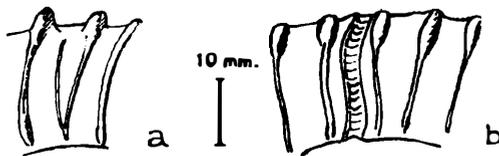


Fig. 10. Gen. et sp. indet. (new genus? apparently resembling *Jacobites*) Fragmentary whorls, GT. I-3712 (a) and GT. I-3713 (b) from locality I 35c and N 502, Aikawa-Naibuchi area, South Saghalien (T.M. coll. and del.)

they are assumed to be middle aged shells of the same species.

Description.—The adult shell, represented by GT. I-3248, seems to have a fairly wide umbilicus and a rounded outer whorl. That whorl is provided with periodic, strong, flared ribs which are fairly frequent, subradial and highly elevated on flanks, spinose at the ventrolateral edges and somewhat depressed on the venter. There are minor ribs between the periodic ribs, usually four or five at each interval, distinct on the flanks and at the umbilical margin but obsolete on the venter, as narrow as or slightly narrower than the interspace between them. Constrictions and umbilical tubercles are absent on this living chamber. Minute crenulation or longitudinal striae are partly discernible on some of the fine ribs.

Middle-aged shell, represented by GT. I-3712 and other comparable specimens, has a whorl nearly as high as broad (about 20 mm.) and is ornamented with strong periodic ribs, which are a little more frequent than on the adult whorl, large tubercles at the ventrolateral edges and a few weak interstitial ribs, which are sometimes bifurcated at the umbilical edge. The ventrolateral tubercles are usually developed on major ribs but sometimes on a minor ribs. Blunt tubercle-like elevations are found at the umbilical edge of the major rib. Constrictions well marked and slightly flexuous, showing peripheral projection. Suture not yet known.

Whorls of still younger stages not yet known.

Remarks.—This form is still very indefinite because it is represented by a few fragmentary specimens. At one time I referred them to *Jacobites*, which they resemble, but there are undeniable differences. The specimens fit into no known genera but are too poorly preserved to establish a new genus. (The generic and specific name, *Jacobitoides japonicus* MATSUMOTO MS. *nom. nud.*, provisionally listed in my recent paper (1954 in T.M. (Editor) p. 15) should be abandoned until we get more sufficient material.) The form looks like *Jacobites*, KILIAN & REBOUL, 1909, in the periodic strong ribs and the ventrolateral spinose elevations but differs in having no prominent umbilical

It is still questionable whether *Kossmaticeras* is a descendant from *Marshallites* or an offshoot from the Puzosiids through such a genus as *Jimboiceras*. In fact *Jimboiceras* (*planulatiforme-mihoensis* group) is fairly similar to *Kossmaticeras* (*theobaldianum* group) in middle-aged stage, but the oblique intersection of the ribs by the constrictions is not distinct and its adult shell has strong periodic straight ribs as in *Puzosia* (*Anapuzosia*), being fairly different from the adult of *Kossmaticeras*. On the other hand between *Marshallites* and *Kossmaticeras* there is a gap in the main part of the Turonian.

Madrasites is an objective synonym of *Kossmaticeras* (see HAAS, 1948), but several species of the so-called *Madrasites* should be removed from the true *Kossmaticeras* to *Maorites* or *Kaiparaites* (defined below). Reference of the Patagonian forms to *Kossmaticeras* is also incorrect, as will be explained below.

The genus, thus emended, seems to be characteristic of the Lower Senonian (i. e. Coniacian plus Santonian) of the Indo-Pacific region. The questionable exception was its occurrence in the "Upper Senonian" of Madagascar (BOULE, LEMOIN & THÉVENIN, 1907), but now Général M. COLLIGNON has kindly informed me the revised knowledge that the genus is also characteristic of the Coniacian in Madagascar (personal communication dated 12th December, 1953).

Another doubt is the age of '*Kossmaticeras* (*Madrasites*)' *haumuriensis* (HECTOR) (WOODS, 1917, p. 34, pl. xix, fig. 5a-c; pl. xx, fig. 1) in New Zealand. This species, though represented by small specimens, is probably referable to *Kossmaticeras* (s. s.) here defined rather than to any of the specialized genera of the Campanian. The 'Calcareous Conglomerate' of Amuri group, from which the specimens came, has been, and is still, regarded as Upper Senonian by the New Zealand geologists (kind personal communications from Dr. C. A. FLEMING and Mr. H. W. WELLMAN, April-May, 1954). However the evidence is, in my opinion, by no means convincing and a possibility of the Santonian or Coniacian age cannot be denied.

(2) *Maorites* MARSHALL, 1926

Type species: Maorites tenuicostatus MARSHALL, 1926.

Compressed, fairly involute and narrowly umbilicate shell, with flattened flanks and narrowly arched venter. Numerous, dense, fine ribs or subcostae, which are divergent and somewhat flexuous; distinct umbilical tubercles develop from an early stage but sometimes weakened later; highly oblique and gently flexuous constrictions cut numerous ribs. The suture is finely and deeply incised with a long and asymmetrically trifid L.

The genus includes, besides the type species, *M. densicostatus* (KILIAN & REBOUL), *M. suturalis* MARSHALL, *M. scymourianus* (KILIAN & REBOUL), *M.*

pseudobhavani SPATH, *M. madrasianus* (STOLICZKA), *M. kandi* (STOLICZKA), *M. (?) aemilanus* (STOLICZKA), *M. (?) madagascarensis* (BASSE) and *M. africanus* (VAN HOEPEN).

These species constitute a distinct group, but the nomenclatorial type species, *M. tenuicostatus* MARSHALL, is much specialized than others in its delicate fine ornamentation and extremely incised suture (even in the inner whorls) and thus by no means situated in the center of the group. Its umbilical tubercles in the immature shell are also not so strong as in other species but can be said relatively clear, if we consider the extreme fineness of the ribs.

The genus is Campanian in age and is said prominent in its upper part; it is mainly distributed in the Southern Pacific realm, including New Zealand, Antarctica and New Caledonia, also in India, Western Australia and South Africa (mainland and Madagascar).

The genus may be derived from the subgroup of *Kossmaticeras recurrens* mentioned above.

(3) *Kalparaites*, gen nov. *Em. Comp.* 161

Type species: *Madrasites multicosatus* MARSHALL, 1926.

Similar to *Kossmaticeras* (emended above) in shell-form and suture-line. Small but prominent tubercles at the umbilical edge; numerous, slightly flexuous or nearly straight ribs, diverging from and also inserted between the tubercles; constrictions well marked and prorsiradiate, cutting several ribs.

K. multicosatus (MARSHALL), *K. regularis* (MARSHALL), *K. sulcatus* (MARSHALL) from New Zealand, probably *K. buddhaicus* (KOSSMAT) from India, *K. natalensis* (CRICK MS) (SPATH), *K. acuticostatus* (CRICK MS) (SPATH) and (?) *K. faku* (VAN HOEPEN) from South Africa are referred to the genus. They have been assigned to *Kossmaticeras* or "*Madrasites*", but should be separated from *Kossmaticeras* (s. s.) because of their prominent umbilical tubercles. Mostly Campanian in age, but may appear a little earlier (e. g. *K. (?) buddhaicus* (KOSSMAT)).

The genus may have been derived directly from *Kossmaticeras* of Coniacian-Santonian age and be parallel to *Maorites*, from which it is distinguished by its wider umbilicus, lower whorls and coarser and less flexuous ribs.

Kossmaticeras sp. indet from the Campanian (main part of the Toyajo group) of Kii, Southwest Japan (YABE, 1915, p. 22, pl. i, fig. 8) is probably referable to this genus, because it resembles *K. regularis* (MARSHALL).

SHIMIZU's (1935, p. 209) assignment of this specimen to '*Kossmaticeras karapadensis* (KOSSMAT) is clearly incorrect, because it is much depressed, round whorled and has different type of ornamentation.

(4) *Gunnarites* KILIAN & REBOUL, 1909

Type species: *Gunnarites antarcticus* (STUART WELLER).

Resembles *Kaiparaites* but is characteristically provided with crenulation on the ribs, which are in some species nearly rectiradiate.

The genus comprises a number of species from the Upper Campanian of Anarctica and also some from the Campanian of New Zealand and South India. They are, besides the type species, *G. rotundus* (SPATH), *G. paucinodatus* SPATH, *G. pachys* SPATH, *G. flexuosus* SPATH, *G. gunnari* (KILIAN & REBOUL), *G. kalika* (STOLICZKA), *G. zelandicus* MARSHALL and *G. denticulatus* (MARSHALL). Some species have rather rounded whorls and relatively coarse ribs; the extreme representative is *G. pachys* SPATH. Others such as *G. bhavaniformis* SPATH and *G. kalika* (STOLICZKA) have rather compressed whorls and numerous, fine ribs.

The genus may be a derivative from the closely allied *Kaiparaites* or have a common ancestor with that genus.

(5) *Grossouvrites* KILIAN & REBOUL, 1909

Type species: *Holcodiscus gemmatus* HUPPÉ.

Shell reaches fairly large size in the adult. Slightly flexuous ribs, very fine and dense in the immature and strong but still numerous in the adult; several ribs are united at each umbilical tubercles, and some shorter ribs are also intercalated.

This is said to look like *Pachydiscus* (s.s.) in the adult but there is no smoothing of the ornamentation at the middle of the flanks, while the kossmaticeroid character is well exemplified in the immature stage. Actually the affinity with *Maorites* and also with some *Kaiparaites* cannot be overlooked.

Upper Senonian in Chile, Antarctica and New Zealand.

(6) *Karapadites*, gen. nov. *em. nyp. 161*

Type species: *Holcodiscus karapadensis* KOSSMAT, 1897.

Fairly small, compressed and laterally flattened Kossmaticeratid, in which ribs become obsolete on the middle part of the flanks, resulting in a differentiation of the ornament into umbilical tubercles and external ribs. Well marked oblique constrictions show a prominent forward projection on the venter, cutting several ribs behind each of them.

The designated species has been included in *Kossmaticeras* but is so much specialized as to be distinctly separated from that genus which has been re-defined just above. *Karapadites* in the Kossmaticeratidae is morphologically somewhat analogous to *Pachydiscus* (s.s.) (i.e. the *gollevillensis-neubergicus* group) of the Pachydiscidae and certain species of *Kitchiniles* of the Puzosiidae.

Monotypic at present. Arrialoor group in India, Upper Campanian(?)

(7) *Neograhamites* SPATH, 1953.

Type species : *Neograhamites kiliani* SPATH, 1953.

Besides the type species, *N. taylori* SPATH was described from the Upper Campanian of Antarctica. In my opinion '*Madrasites*' *similis* SPATH from the Senonian of Pondoland and "*Kossmaticeras theobaldianum*" of PAULCKE from the Upper Senonian of Patagonia are probably referable or at least closely allied to this genus. Mr. C. W. WRIGHT kindly showed me some specimens of the genus from New Zealand in his brother's collection.

From the species described by SPATH the generic diagnosis is interpreted as follows. Relatively small Kossmaticeratid with the outer whorl somewhat higher than broad or nearly as high as broad, provided with coarse, nearly rectiradiate ribs, at first bifurcating at the umbilical tubercles and finally breaking up into single ones. Immature shell is fairly similar to that of *Kaiparaites*. Oblique constrictions on the internal mould are bordered on both sides by blunt or raised ribs.

SPATH correctly remarked its relation to *Pseudokossmaticeras* and especially to *Brahmaïtes*. It is probably derived from *Kaiparaites* or *Kossmaticeras*.
(8) *Pseudokossmaticeras* SPATH, 1922

Type species : *Ammonites pacificus* STOLICZKA, 1865.

Evolute Kossmaticeratid with rectiradiate simple ribs in the adult ; small umbilical tubercles still persist.

Besides the Indian type species (which occurs also in Madagascar) five European species and one species from Asia Minor are referred to this genus: *P. dureri* (REDTENBACHER), *P. brandti* (REDTENBACHER), *P. galicianum* (FAVRE), *P.(?) aturicum* (SEUNES), *P.(?) koeneni* (GROSSOUVRE) and *P. tchihatcheffi* (BOEHM). The second species is fairly close to *Neograhamites*.

(9) *Brahmaïtes* KOSSMAT, 1897.

Type species : *Ammonites brahma* FORBES, 1846.

An evolute Kossmaticeratid, typically, but not necessarily, with radially elongated umbilical tubercles in the middle growth-stage and with rectiradiate ribs instead of obsolete tubercles in the late stage. Constrictions slightly oblique, frequent in the adult and bordered behind each of themselves by an elevated rib which is raised to a tubercle-like prominent elevation on crossing the median venter in the adult whorl.

The genus includes, besides the type species, *B. vishna* (FORBES), *B. haugii* (SEUNES) and *B. saghalinensis* YABE & SHIMIZU. As SPATH (1953) remarked YABE & SHIMIZU'S subdivision of this genus into three subgenera is based on insufficient evidence.

Maestrichtian (The Saghalien species is still uncertain in its occurrence).

(10) *Jacobites* KILIAN & REBOUL, 1909.

Type species: *Jacobites andersoni* KILIAN & REBOUL, 1909.

A specialized Kossmaticeratid, the outer whorl of which is ornamented with prominent, often irregularly flared lateral ribs, ventrolateral spinose tubercles, periodic median tubercles and typically an obtuse median keel, with obsoletion of constrictions. Inner whorls have numerous, fine, diverging ribs, umbilical tubercles and oblique constrictions like the common forms of the Kossmaticeratids.

The following Upper Campanian species from Antarctica and New Zealand are included: *J. andersoni* KILIAN & REBOUL, *J. crofti* SPATH, *J. angularis* MARSHALL, *J. minimus* MARSHALL, *J. (?) rotundus* (MARSHALL), *J. whangaroaensis* (MARSHALL) and *J. waitapuensis* MARSHALL.

From the resemblance of its inner whorls to those of *Kaiparaites Jacobites* is considered to have an intimate genetic connexion with that genus or to have a common ancestor in *Kossmaticeras*.

(11) *Neomadrassites* MARSHALL, 1926.

Type species: *Neomadrassites nodulosus* MARSHALL, 1926.

Fairly large tubercles on the umbilical margin and at the ventrolateral edges. Some of the numerous ribs are united at these tubercles and others are intercalated. Almost all the ribs have a small median tubercle and show a forward curve on crossing the venter. Whorls depressed and constricted throughout life.

This is probably a descendant from *Kaiparaites* and has no direct connexion with Cenomanian *Eomadrassites*.

Monotypic at present. Upper Senonian of New Zealand.

(12) *Aucklandites* MARSHALL, 1927.

Type species: *Acanthoceras ultimum* MARSHALL, 1926.

The outer whorl is provided with coarse nearly straight, prominent ribs and large umbilical, ventrolateral and median tubercles. Whorls are broader than high and inflated. Inner whorls as well as the suture-line show the general character of the family.

This is one of the most specialized Kossmaticeratids and only superficially resembles *Acanthoceras*.

Monotypic. Upper Senonian of New Zealand.

(13) *Tainuia* MARSHALL, 1926.

Type species: *Tainuia aucklandica* MARSHALL, 1926.

Coarse ribs provided with a number of rounded tubercles including umbilical and median ones. Whorls with inflated flanks and constrictions.

The genus is a specialized Kossmaticeratid with a *Romaniceras*-like aspect.

Monotypic. Upper Senonian of New Zealand.

(14) *Yokoyamaoceras* (ex. SHIMIZU, 1935, *nom. nud.*) WRIGHT & MATSUMOTO, 1954.

Type species: *Holcodiscus kotoi* JIMBO, 1894.

Small and compressed Kossmaticeratid with ventrolateral tubercles but obsolete umbilical ones. Numerous, rather flexuous ribs, quite obsolete on a limited space of the venter between the peripheral tubercles, but again becoming distinct on the body chamber with a median forward and outward projection. Constrictions are well marked, frequent and oblique forward, with a prominent ventral projection.

The genus may be derived from the compressed and finely ribbed subgroup of *Kossmaticeras* (see above) and have no direct connexion with *Holcodiscoides* of Cenomanian age nor with *Neomadrasites* of Campanian. It includes, besides the type species, two new species from the Urakawan series (approximately Coniacian-Santonian) in the Japanese province. *Ammonites paravati* STOLICZKA from India may be referable to this genus.

Finally I should like to add the definition and a remark of the following kossmaticeroid genus.

Kitchinites Spath, 1922.

Type species: *Holcodiscus pondicherryanus* KOSSMAT, 1897.

Discoidal, compressed and laterally rather flattened shell with nearly recirradiate or somewhat prorsiradiate ribs but without prominent umbilical tubercles. Constrictions oblique, cutting several ribs. Suture-line similar to that of *Puzosia*.

The genus has indeed a kossmaticeroid aspect especially in its oblique constrictions. However it is better attached to the closely allied *Neopuzosia* of the Santonian age than any other known genera, as I have discussed in detail in my previous paper (1954) on the Puzosiidae.

As one of the alternatives the genera of the Kossmaticeratidae might be considered as derivatives from Puzosiidae acquiring repeatedly the kossmaticeroid character. However I have failed to find a good evidence for such a conclusion. On the other hand they can mostly be well explained as specializations within family Kossmaticeratidae, if we exclude the fundamental forms like *Marshallites* and *Kossmaticeras* (s. s.). Among the specialized forms *Kitchinites* only is proved to belong to such a category. In other words it is a kossmaticeroid Puzosiidae.

I refer to this genus, besides the Indian type species, *K. brevicostatus* (MARSHALL), *K. (?) angustus* (MARSHALL) from New Zealand, *K. darwini* (PHILLIPI) from Chile and *K. sp.* from West Australia (SPATH, 1940, p. 45, pl. ii, fig. 2). Another allied species was listed by SPATH (1951, 1953) from Angola. Comparing the holotype of *Parapuzosia ordinaria* MARSHALL with the specimens of the above listed two New Zealand species, as well as with the Indian specimen, I am strongly inclined to regard it a *Kitchiniles*. It may be an immature of *Kitchiniles*, specifically different but fairly allied to the immature of *K. pondicherryanus* and *K. brevicostatus*, or, if it represents an adult whorl, it may be a special dwarf form of *Kitchiniles* (possibly a new subgenus) in which the weakening of the ribs takes place.

Thus *Kitchiniles* has its main distribution in the Upper Senonian of Southern Hemisphere.

Genus *Kossmaticeras* DE GROSSOUVRE, 1901

Kossmaticeras theobaldianum paucicostatum subsp. nov.

Pl. IX, figs. 1 and 2.

Ammonites theobaldianus STOLICZKA, 1865, p. 161, pl. lxxviii, fig. 3 only.

Holcodiscus theobaldianus KOSSMAT, 1897, p. 36 (143), "B, Grobberippte Varietät."

Material.—Two specimens from the Ikushumbets Valley, Ishikari Province, Hokkaido are before me. One is preserved in the Department of Geology & Mineralogy, Hokkaido University and was collected from the Bannosawa (loc. no. 62004), a tributary of the Ikushumbets, by Mr. SARAKI when he was a student. This was illustrated and listed as *Kossmaticeras cf. theobaldianum* by A. FUKADA and others (1953 a, p. 27; 1953 b, pl. 7, fig. 3) on the basis of my preliminary determination. The other is in the Department of Geology, Kyushu University and was collected by me from a cliff (loc. Ik. 931) along the main course of the Ikushumbets, just above the mouth of the Bannosawa. Several other comparable specimens were collected by Mr. N. KANBE and me from the Ashibets Valley, Ishikari Province, Hokkaido and have been deposited in the Geological Survey of Japan. All these specimens were found in the zone of *Inoceramus uwajimensis*. The first mentioned specimen is the holotype of the subspecies.

Measurements.—

Specimen	Diameter	Height (H/D)	Breadth (B/H)	Umbilicus(%)
Holotype	109.0	45.0 (0.41)	35.5 (0.8)	35.7 (33)
	73.4	29.0 (0.35)		26.5 (36)
GK. H 4101	94.0	40.0 (0.42)		29.8 (32)
STOLICZKA, 1865, pl. 78, fig. 3.	135.0	43.2 (0.32)	35.0 (0.81)	54.0 (40)
KOSSMAT, 1897, p. 36, B.	105.0	36.0 (0.34)	33.0 (0.9)	41.0 (39)

Subspecific diagnosis.—Very similar to the typical form of *Kossmaticeras theobaldianum* (STOLICZKA) in almost all characters, but for the frequency of ribs, which, in this subspecies, especially in its living chamber, are somewhat coarser and separated by wider interspaces than in the typical form.

Remarks.—KOSSMAT (1897) recognized the considerable variation in *Kossmaticeras theobaldianum* (STOLICZKA) and distinguished the three forms, calling them A, the typical form, B, the coarsely ribbed variety, and C, the variety with prorsiradate constrictions. On the basis of the Japanese material as well as the works of STOLICZKA and KOSSMAT the three forms seem to be fairly well distinguished. I accept KOSSMAT's form B as a subspecies and give it a new name on the grounds that it represents a stage from which *Kossmaticeras sparcicostatum* (KOSSMAT) (1897, p. 38 (145), pl. vi (xvii), fig. 5a-c) and *Kossmaticeras pachystoma* (KOSSMAT) (1897, p. 39 (146), pl. vii (xviii), fig. 1a-c) probably branch off. The first of those species has still coarser, stronger and more oblique ribs both on the outer and inner whorls but narrower constrictions than the present form. The second of them is also much more coarsely ribbed and has more inflated whorls.*

In addition there are a number of minor differences which are only a matter of individual variation. For example three of the measured Indian specimens (including those of the typical form) have broader umbilicus (39 or 40% of the diameter) than the two Japanese ones (whose umbilicus is 32% or 33-36% of the respective diameter). At the same time the whorl is relatively high in the Japanese form. However one of the STOLICZKA's specimens which was designated by KOSSMAT as a typical representative of the species (STOLICZKA, 1865, pl. lxxviii, fig. 2) shows dimensions fairly similar to ours. In fact the Japanese specimens seem to represent an adult stage in which the whorl increases rapidly, resulting in somewhat higher whorl and narrower umbilicus. The largest specimen of STOLICZKA (1865, pl. lxxviii, fig. 3) may represent the variation in size as well as in other characters.

At any rate the coarse ribbing is, as KOSSMAT rightly pointed out, of prime importance in distinguishing the subspecies. So far as this point is concerned the Japanese material seems more typical than the Indian. Therefore one of our specimens has been selected here as a holotype of the subspecies. In our form the coarse ribbing is best exemplified in the living chamber in which constrictions are also somewhat broader than in the septate part. The broaden-

* The specific name *K. pachystoma* is found in a list of ammonites from Hokkaido given by YABE (1909), but I have failed to find that species in the collections which I have ever examined.

ing of the constriction is well exhibited in the Indian *Kossmaticeras pachystoma* (KOSSMAT).

• *Kossmaticeras theobaldianum* (STOLICZKA) in PAULCKE (1907, p. 54, pl. 7 (xvi), fig. 1, 1a) from South Patagonia has the umbilicus nearly as wide as the three Indian specimens mentioned above and the ribs nearly as coarse as the subspecies here treated. However there are some difference which cannot be neglected. Its whorl is much rounded in cross-section with convex flanks and rounded umbilical margin and, furthermore, its ribs are nearly rectiradiate and show generally distinct branching, with a branching point usually near the umbilical margin. The typical form of *K. theobaldianum* and the subspecies *paucicostatum* have rather flattened or only slightly convex flanks, subangular umbilical shoulder and the perpendicular umbilical wall. Their ribs are gently flexuous or fairly oblique, branch near the midflank and frequently contain intercalated shorter ones instead of branching ones. Therefore I am inclined to regard the Patagonian form as a separate species, representing a somewhat evolved stage leading to the typical form of *Neograhamites*. I propose for it the name *Neograhamites* (?) *paulckei* nov.; its holotype is, of course, the specimen which was illustrated by PAULCKE (1907, p. 54, pl. 7 (xvi), fig. 1, 1a).

Occurrence.—*Kossmaticeras theobaldianum paucicostatum* characterizes the zone of *Inoceramus uwajimensis*, the Paleourakawan, approximately equivalent to the Coniacian, in Hokkaido. In India *K. theobaldianum* (STOLICZKA), including its "varieties," comes from the upper part of the Trichinopoly group. As I discussed on other occasion (1943) that part is approximately correlated with the Coniacian or possibly extends further up to at most lower Santonian and never to the Campanian. I do not accept the placing of a zone of *Kossmaticeras theobaldianum* in the Campanian as in the table of MULLER and SCHENCK (1937), who adopted SPATH's scheme of 1926. As Dr. SPATH clearly demonstrated true *Kossmaticeras* does not occur in Europe, where only *Pseudokossmaticeras* is found. The reason why the zone of *Kossmaticeras theobaldianum* was placed so high is, as Dr. Spath kindly told me and as he recently remarked in his paper (1953, p. 47), that the species was reported by PAULCKE to occur above the bed with prolific *Hopitoplacenticeras plasticum*. Now however the specimen from Cerro Cezador in South Patagonia has been shown not to be *K. theobaldianum*. We must therefore remove the zone of *Kossmaticeras theobaldianum* to the Paleourakawan of the Japanese province and probably to the Coniacian of the Pacific-Indo-Malgash realm where species of *Kossmaticeras* (s.s.) are fairly characteristic.

Kossmaticeras japonicum (ex. YABE MS.), sp. nov.

Pl. IX, fig. 3a, b

Holcodiscus japonicus (nom. nud.) YABE, 1909, p. 442, listed only.*Kossmaticeras japonicum* (nom. nud.) YABE, 1927, p. 45 (19), listed only.

Material.—Holotype, GT. I-353 from the Kikumezawa, a tributary of the Ikushumbets, *Anapachydiscus* zone (i.e. "*Parapachydiscus* beds" in YABE 1927), Ishikari Province, Hokkaido (Coll. H. YABE). Another specimen (GT. "Cr. 125") from the Kikumezawa and two other comparable ones from Ikushumbets in YABE'S collection. In my collection only one specimen from loc. N24p, zone Mh6, the Naibuchi Valley, South Saghalien.

Measurements.—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus (%)	Involution
GT. I-353	37.5	15.0	15.0	(1)	12.9 (34.4)	Ca $\frac{1}{2}$
	(max. 42)					

Diagnosis.—Shell small, moderately involute and moderately umbilicate; outer whorl nearly as high as broad, with an arched periphery, slightly convex flanks and a subrounded umbilical margin. Constrictions frequent (6-7 per whorl), well marked and nearly straight, running obliquely forward. Ribs very fine in the immature stage, of moderate strength and separated by interspaces as wide as themselves in the adult, flexuous, and diverging near the umbilical margin or sometimes with intercalated shorter ones. The oblique intersection of ribs and the constriction is not very marked, for the raised rib behind the constriction tends to be united near the umbilical margin with the flexuous rib behind it. Umbilical tubercles absent, but for a slight elevation at the umbilical edge of some ribs. Suture like that of *Kossmaticeras* with the symmetrically trifold L, a little longer than E.

Remarks.—The present species fairly closely resembles *Kossmaticeras theobaldianum* (STOJICZKA) and should be referred to the same genus. The specific difference is in its small size and in the flexuous and dense ribbing. The branching or intercalation of ribs takes place at the mid-flank in *K. theobaldianum*, but near the umbilical margin in this species. The so-called variety C of *K. theobaldianum* in KOSSMAT (1897, p. 38 (143), pl. vii (xviii), fig. 4a, b) is fairly similar to the present species in its prorsiradiate constrictions and dense ribbing, but the ribs are less flexuous and narrower, being separated by broader interspaces than in the present species. *K. recurrens* (KOSSMAT) (1897, p. 37 (144), pl. vii (xviii), fig. 2a, b) and *K. bhavani* (STOJICZKA) (1865, p. 138, pl. lxix, figs. 4-7) from the upper part of the Trichinopoly group in

India have more compressed and involute whorls, more numerous and finer ribs than ours and show a marked truncation of the ribs by constrictions. Their ribs are, however, somewhat sigmoidal and lack the distinct umbilical tubercles, as in our species. All these species probably form a subgroup intimately related with one another.

It should be noted here that the present species is fairly similar to immature *Jimboiceras mihoensis* MATSUMOTO which occurs a little earlier. There is corresponding resemblance between *K. theobaldianum* and immature *Jimboiceras planulatiforme*. Although the adult *Jimboiceras* is distinctly different from *Kossmaticeras*, the theory that the Kossmaticeratinae may be a derivative from the main stock of the Puzosidae seems to receive support.

Occurrence.—Neourakawan, approximately equivalent to Santonian, in Hokkaido and Saghalien.

Genus *Yokoyamaoceras* WRIGHT & MATSUMOTO, 1954

Yokoyamaoceras kotoi (JIMBO)

Text figs. 11a-c, 12a-c

Holcodiscus kotoi JIMBO, 1894, p. 33, pl. v (xxi), fig. 2, 2a, 2b.

Kossmaticeras kotoi (JIMBO), YABE, 1927, p. 45 (19).

Yokoyamaoceras kotoi (JIMBO), SHIMIZU, 1935, p. 198, without generic definition.

Yokoyamaoceras kotoi, (JIMBO), WRIGHT & MATSUMOTO, 1954, p. 128, pl. 8, fig. 1a-c.

Material.—Holotype, GT.I-107 from "Opirashibets river, 60km. from the mouth," Teshio Province, Hokkaido (JIMBO coll.). Other examples, GT.I-347 a, b, Kikumezawa, a tributary of the Ikushumbets, Ishikari Province, Hokkaido (H. YABE coll.); GK. H 1560 from locality Y 130 d, basal part of the zone of

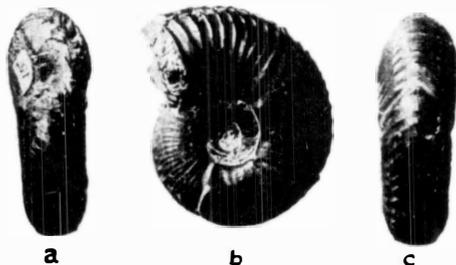


Fig. 11. *Yokoyamaoceras kotoi* (JIMBO). Apertural (a), lateral (b) and ventral (c) views, $\times 1$. Holotype, GT. I-107 from the Opirashibets Valley, Teshio Province, Hokkaido (K. JIMBO coll.). The same specimen as illustrated by K. JIMBO, 1894, pl. v. fig. 2, 2a, 2b and WRIGHT & MATSUMOTO, 1954, pl. 8, fig. 1a-c.

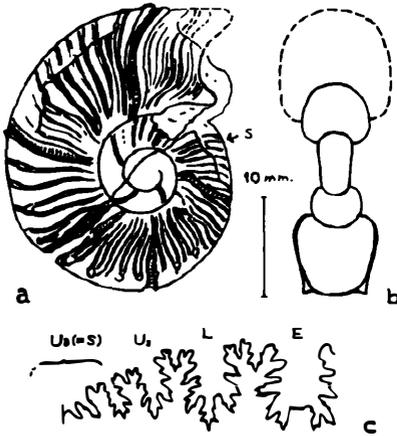


Fig. 12. *Yokoyamaoceras kotoi* (JIMBO). Lateral view (a), whorl-section (b) and suture-line at s in fig. a (c). GT. I-347 from Kikume-zawa, Ikushumbets, Ishikari Province, Hokkaido (H. YABE coll.). (T. M. del.)

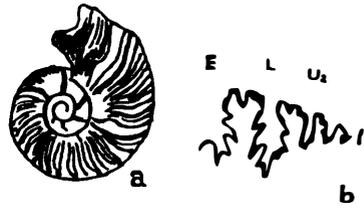


Fig. 13. *Yokoyamaoceras jimboi* (YABE MS.), sp. nov. Lateral view (a) and suture-line (b). Holotype, GT. I-349a, a branch of Saushisanushibe, Iburi Province, Hokkaido (H. YABE Coll.). (T.M. del.)

uwajimensis in the Shiyubari Valley, Ishikari Province, Hokkaido (T. MATSUMOTO coll.).

Measurements.—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus (%)	Involutions
GT. I-107*	35	14.5	13.0	(0.9)	11.5 (33)	3/5
GT. I-347a	27.5	10.5	10.8	(1.0)	9.4 (34)	1/2

(* The dimensions described by JIMBO are different from the actual ones.)

Diagnosis.—Shell small, fairly involute and moderately umbilicate. Whorls broader than high in the young and slightly higher than broad in the adult; umbilical margin subrounded; flanks gently convex; ventral area moderately arched in the latest part but somewhat flattened between the marginal tubercles in the middle-aged part. Inner whorls distinctly constricted and very faintly ornamented with subcostae or rather striae. The outer whorl is provided with five well marked constrictions, flexiradiate ribs and ventrolateral tubercles. In its posterior half ribs are relatively fine, being united in pairs at ventrolateral tubercles; the ventral area between the tubercles is nearly smooth, having only faint striae. On the anterior half of the outer whorl each rib has a small ventrolateral elevation and the rib crosses the ventral area

with a prominent forward projection. Sometimes the apex of the projected curve on the median line is also elevated, if not forming a distinct tubercle. As a rule longer and shorter ribs alternate. The shorter ones scarcely reach the umbilical margin and are mostly simple intercalatories; they may rarely be united with the longer one near the umbilical margin. The longer ones arrive at the umbilical margin with decreasing strength and without a tubercle. Only the long rib just adjacent to the constriction shows on the outer whorls a slight thickening. Apertural margin is provided with a pair of considerably projected lower lateral lappets and a peripheral rostrum. Suture-lines are similar to those of young *Kossmaticeras*.*

Remarks.—The present species apparently resembles *Holcodiscoides cliveanus* (STOLICZKA) (1865, p. 157, pl. lxxvii, fig. 3), but is clearly distinguished by the absence of the umbilical tubercles, by frequent ventrolateral tubercles, by more flexuous ribs and by greater involution. The Indian species was reported from the lower part of the Ootatoo group (approximately the lowest Cenomanian and uppermost Albian) but our species occurs in the Urakawan (Coniacian-Santonian). There is probably no direct connexion of lineage of the two species. *Y. kotoi* (JIMBO) resembles the nearly contemporary *Kossmaticeras japonicum* (YABE MS) (described above) in the essential characters except for the peripheral tuberculation. The two have presumably a common ancestor in the *Kossmaticeras theobaldianum* group.

It should be noted that the present species is fairly similar to the immature shell of *Neopuzosia japonica* (SPATH) in its general shell-form, flexuous ribs and frequent constrictions. However even in the immature stage the latter is distinguished from the former in its finer ribs, a more compressed whorl and absence of peripheral tubercles. The adult of *N. japonica* is, of course, entirely different.

Occurrence.—Urakawan, both in Paleourakawan (Coniacian) and in Neourakawan (Santonian).

Yokoyamaoceras jimboi (YABE MS), sp. nov.

Pl. IX, figs. 4a, b, 5a, b; Text-fig. 13a, b

Holcodiscus jimboi YABE, *nom. nud.*, 1909, p. 442, listed only.

? *Holcodiscus pusillus* YABE, *nom. nud.*, 1909, p. 442, listed only.

Yokoyamaoceras jimboi (YABE), MATSUMOTO, *nom. nud.*, 1938, p. 193, listed only.

Material.—Five specimens in H. YABE's collection from Hokkaido, GT. I-348 a, b, loc. Shisanushibe; GT. I-349 a, b, a branch of Saushisanushibe, Ibur

* The external saddle was shown as much too broad in JIMBO'S figure.

Province; GT. I-350 from the Ikushumbets Valley, Ishikari Province. The third of these (GT. I-349 a) is the best in preservation and is selected as the holotype. One specimen in M. KAWADA's collection, GT. "Cr. 598c" from the main course of the Naibuchi and several specimens in T. MATSUMOTO's collection from the same valley, South Saghalien and preserved in GT and GK from loc. N133 h, zone Mh6; loc. N 143 r, zone Mh 6 α ; loc. N 332 d, zone Mh 6 α ; loc. N164p, zone Mh6. Eight specimens in T. MATSUMOTO's collection from the Urakawa area, Hidaka Province, Hokkaido, GK. H3376 a-e, loc. U513; GK. H3377, loc. U512r; GK. H3378 a, b, loc. U513r, all from bed Ur2 β '.

Measurements.—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus (%)
GT. I-349a	30.2	12.7	10.3	(0.81)	9.0 (29)
GK. H 3378a	24.5	9.8	7.4	(0.75)	8.2 (29)

Diagnosis.—Shell very small, moderately involute and moderately umbilicate. Outer whorl compressed, with fairly flattened flanks and narrowly arched venter. The inner whorls nearly smooth, having only faint striae which are better discernible on the external part where they show a prominent forward bend. The outer whorl is ornamented with fine ribs or subcostae, which are flexuous on the flank and tend to be obsolete near the umbilical margin. The middle half or third of the outer whorl is provided with ventrolateral tubercles, at each of which usually two of the lateral subcostae are united, while the ribs are mostly obsolete on the external area between the tubercles, except the raised rib just behind the constriction. The latest part of the periphery is free from tubercles and crossed by the ribs with decreased intensity. There are intercalated ribs especially on the last portion of the tuberculated part, where the tubercles are sometimes infrequent. Constrictions are well marked throughout life, showing a prominent forward projection on crossing the venter and on the outer whorl cutting a few ribs behind them. Aperture with considerably projected lappets and rostrum. Aptychus present. Septal suture of typical *Kossmaticeras*-pattern. The last septum is found in the tuberculated part.

Remarks.—The present species resembles *Y. kotoi* (JIMBO) in general aspect but is distinguished by its smaller size, more compressed whorl, finer subcostae and the absence of the ventrolateral tubercles and median elevation on each rib on the main part of the body chamber.

Examining the ontogeny on one specimen (GK. H2462, loc. N143r. Mh6 α), the *Desmoceras*-like characters (i.e. the fairly involute, depressed, smooth and constricted whorls) are found in the earliest stage, which is succeeded by the

stage resembling immature *Puzosia*, with whorls as broad as high, a moderate umbilicus, strong constrictions and external striation. In the mature stage the characters are mostly kossmaticeroid rather than puzosoid. The lateral lobe of the last septum is not too large nor too asymmetrical. However certain Puzosiids show similar pattern of suture-line in their immature stage of the corresponding size. In practice when immature shells are compared it is very difficult to distinguish the present species from the nearly contemporary *Neopuzosia ishikawai* (JIMBO). The relation corresponds to that between *Y. kotoi* (JIMBO) and *Neopuzosia japonica* (SPATH), mentioned in the preceding species.

The specimen labelled by H. YABE as *Kossmaticeras pusillum* YABE (MS) (GT. I-350) seems to me an immature shell of the present species, although constrictions are less frequent than in the holotype.

Occurrence.—Fairly common in the Neourakawan (mostly equivalent to the Santonian) of Hokkaido and South Saghalien.

Yokoyamaoceras (?) *mysticum*, sp. nov.

Pl. X, fig. 1 a, b

Kossmaticeras (*Yokoyamaoceras*) aff. *paravati* (STOLICZKA), MATSUMOTO, 1942, p. 264.

Material.—A single specimen in which the test is preserved. Holotype, GK. H3379 from loc. U147 p₁, bed Ur2 β in the Urakawa area, Hidaka Province, Hokkaido (T.M. coll.).

Measurements.—

	Diameter	Height	Breadth	(B/H)	Umbilicus (%)
GK. H 3379	38.2	17.0	14.3	(0.84)	10.3 (27)

Diagnosis.—Small, fairly involute and fairly narrowly umbilicate. Outer whorl compressed, with flattened flanks and an arched venter; seven constrictions bordered anteriorly by a narrow raised ribs and posteriorly by a blunt rib, showing a forward projection on the periphery. Other ribs nearly straight on the sides, curved forward on the periphery, generally weak, narrow and separated by wider interspaces, but irregularly rather stronger; sometimes simple, sometimes bifurcated at the umbilical edge and sometimes short and intercalated without reaching the umbilical margin. A few, small, exceptional tubercles are found at the umbilical edge of some of the long ribs on the latest part of the outer whorl that is preserved. Periodic tubercles at the ventrolateral edges in the middle half of the preserved last whorl. In the

same stage the external area between the tubercles is free from ribs, except for those that accompany the constrictions, and crossed by the faint striae, some of which join the untuberculated ribs. Several lateral ribs are also united at the ventrolateral tubercles. On the untuberculated part ribs cross the venter with decreasing strength. The striae in front of the constriction do not show a trace of strongly projected lappets but suggest a gentle sinuosity of the apertural margin. The partly exposed suture-line shows a *Kossmaticeras*-like pattern.

Remarks.—The specimen in question shows some affinity to *Ammonites paravati* (STOLICZKA) (1865, p. 158, pl. lxxvii, figs. 5, 6), to which I once referred it. However the Japanese form is more involute, more narrowly umbilicate and somewhat more compressed than the Indian species. Furthermore, the latter has distinctly coarser ribs and one of the STOLICZKA'S specimens, which is of similar size to ours, show a stronger forward bend of the ribs on the side. The umbilical tubercle seems to be absent in the Indian species. Thus our specimen must be separated from the Indian species.

Ammonites paravati STOLICZKA has closer affinity with *Yokoyamaoceras kotoi* (JIMBO) than with *Holcodiscoides cleveanus* (STOLICZKA) in that it has no umbilical tubercle and has curved ribs. However in its general shell-form it resembles rather *H. cleveanus*. As the species are described as internal moulds, absence of the umbilical tubercle should be confirmed in specimens of better preservation. They can only provisionally be called *Yokoyamaoceras* (?) *paravati*. The horizon of this species seems somewhat questionable, in view of STOLICZKA'S record of it as from the Trichinopoly group, KOSSMAT'S (1897, p. 35 (142)) as Lower Trichinopoly group and SPATH'S (1953, p. 23) as a "Santonian species." The lower part of the Trichinopoly group is clearly older than the Urakawan, in which *Yokoyamaoceras* occurs frequently.

Meanwhile the present species is very mysterious in that it is provided with the umbilical tubercles, though they are small and few in number. Both the umbilical and ventrolateral tubercles are found typically in *Holcodiscoides* from the Ootator group.

The present species is nearly contemporary with *Yokoyamaoceras jimboi* from which it is clearly distinguished. Its distinction from *Y. kotoi* is also considerable, for it has less frequent ventrolateral tubercles and less flexuous and weaker ribs. *Y. kotoi* itself shows a blunt elevation or thickening at the umbilical edge of some of the long ribs just behind the constrictions. Therefore it is not unnatural that *Yokoyamaoceras* can include a species which has a few discernible umbilical tubercles in a limited portion. The smoothing of the ventral area and some angulation at the ventrolateral edge in the tuber-

culated stage are commonly found in the three Japanese species in question. I am therefore inclined to refer the present species to *Yokoyamaoceras* with a query. It probably has no direct connexion with *Holcodiscooides* but may be an offshoot from *Kossmaticeras*.

It is interesting to find an analogy between the present species and *Kitchiniles pondicherryanus* (KOSSMAT) in the general aspect, especially the rectiradiate ribbing, although in the peripheral ornamentation they are quite different. This may correspond with the resemblance between immature specimens of the other two species of *Yokoyamaoceras* and certain *Neopuzosia*.

Occurrence.—Neourakawan (approximately Santonian) in Hokkaido, very rare.

Conclusion

(A concise history of the Kossmaticeratidae)

The main purpose of this paper has been, of course, to describe the Kossmaticeratids from Hokkaido and Saghalien. In connexion with that I have endeavoured as far as possible to sort the hitherto known forms of the Kossmaticeratids from various parts of the world. Our present knowledge is by no means perfect, but I hope this paper might serve for a step forward to the better understanding of the group. As a conclusion I summarize here concisely the history of the family Kossmaticeratidae (see Table 1).

Kossmaticeratidae has been regarded as a Senonian family specializing in a relatively short epoch. However it now becomes evident that the family has a fairly long history of evolution.

The family appeared in the Albian of the circum Pacific region, being represented by *Hulenites* that branched out perhaps from Aptian *Melchiorites* fairly close to the course along which Puzosiidae (s.s.) developed. *Marshallites*, which is rather common in the Cenomanian and Lower Turonian of Japan and adjacent areas, was most probably evolved from *Hulenites*, becoming more kossmaticeroid in aspect. In contrast to the compressed *Marshallites* there is in the Upper Albian and Cenomanian depressed or round-whorled *Eogumari-tes*. The origin of that genus is still uncertain but can be expected in the thick subgroup of *Melchiorites* or *Puzosia* (*Anapuzosia*). In the Cenomanian more specialized genera are found too. The bituberculated and flat-sided *Holcodiscooides* and trituberculated *Eomadrasites* are the examples.* Even a

* In a recent collection of New Zealand, several specimens of which have been sent from Dr. FLEMING to London for us on loan, Mr. WRIGHT and I have recognized another interesting bituberculate but inflated form, perhaps a new genus, of the probable Cenomanian Kossmaticeratid. We are looking for better material of it.

peculiarly ornamented, flared and spinose form seems to have existed, although the available stuff is not yet sufficient enough for establishing a distinct genus.

The above mentioned genera are grouped in this paper into subfamily Marshallitinae. So far as our present knowledge is concerned, there is a gap within the Turonian between Marshallitinae and Kossmaticeratinae (s.s.). True *Kossmaticeras*, revised in this paper, is characteristic to the lower half of Senonian (i.e. Coniacian-Santonian) of the Indo-Pacific realm. Whether it was derived straight from *Marshallites* or offshooted from a certain Turonian-Coniacian Puzosiid is not yet certain. Anyhow it is an earlier and relatively simple representative of Kossmaticeratinae without notable umbilical tubercles. *Yokoyamaoceras* is almost contemporary with *Kossmaticeras* but morphologically somewhat advanced. The genus, however, might again be a kossmaticeroid derivative from a certain Puzosiid, say *Neopuzosia*, but can be regarded as an offshoot from *Kossmaticeras*.

The subfamily Kossmaticeratinae was specialized rather in the Upper Senonian. Although there is no complete record of zonal collection in the Senonian of New Zealand and other areas of Southern Pacific, various specialized forms are mostly nearly contemporary with one another, being mainly Campanian, and some of them seem to have persisted or to have newly appeared in the Maestrichtian. Exactly speaking, to correlate precisely the strata of the Pacific-Indian region with the Campanian and Maestrichtian of the international scale, the standard of which is in Europe, is rather difficult in our present knowledge, especially the Kossmaticeratids are concerned. Only *Pseudokossmaticeras* and a few *Brahmaites* are known in the Upper Senonian of Europe. Thus we are still far from leading a confirmative conclusion on the evolutionary course of each of the Upper Senonian genera. The presumed lines of descent are drawn preliminarily in Table 1 from what I have remarked in the descriptive chapter.

The number of the Upper Senonian genera of Kossmaticeratids is rather great, being much larger than that of the Cenomanian genera of the Marshallitinae. However some of them may be better treated as subgenera, as in the case of the closely allied *Jacobites*, *Neomadrasites*, *Aucklandites* and *Tainuia* or *Grossouvrites* and *Maorites*. There is an interesting analogy or small-scale homoeomorphy between Marshallitinae and Kossmaticeratinae. The examples have been already demonstrated in detail. Thus *Holcodisoides* corresponds to *Yokoyamaoceras*, *Eomadrasites* to *Neomadrasites* and *Marshallites* to *Maorites*, but there is no direct connexion between the analogous genera.

The main distributional area of Kossmaticeratidae was obviously in the Pacific-Indian realm. Although the members of Marshallitinae have hitherto

occurred rather sporadically, we can expect increasing number of specimens in further collections. The main province of the subfamily seems in the Northern Pacific.

The specialized forms of *Kossmaticeratinae* are characteristic to the Southern Pacific but the family has a wider distribution in the Indo-Pacific realm. Europe is evidently a margin of the distributional area and only a few particular genera are found in a limited age. In close connexion with the Indian realm, Madagascar-South Africa and West Australia have more *Kossmaticeratids* than Europe, North Africa and North America. The distribution of the family has not yet been confirmed in Gulf Coast and Interior of America.

Finally I must add to remark that more collections and further studies are wanted to clarify the true history of *Kossmaticeratidae*.

Acknowledgements

To the friends whose names were gratefully mentioned in my previous number of the serial papers (1954 in T.M. [Editor], Appendix) I wish here again to express my sincere thanks for their kind helps to my works on ammonites. But I should like to mention here Mr. C. W. WRIGHT of London who has shared me in good many opportunities for fruitful discussions, allowed me the free use of his private collections (part of which were provided by his brother, Mr. E.V. WRIGHT) and kindly read through the typescript; Mr. W.N. EDWARDS, Keeper of Geology, British Museum (Natural History), who has rendered me facilities in that Museum, where I have been able to study through a British Council Scholarship in 1953-54; Dr. L.F. SPATH of the same Museum who has advised me from his profound experience; Général M. COLLIGNON of Isère, France, who has kindly given me very useful information about the *Kossmaticeratids* from Madagascar; Dr. C.A. FLEMING, Mr. A.P. MASON and Mr. H.W. WELLMAN of New Zealand Geological Survey who have sent frequently for Mr. WRIGHT and me on loan a number of precious specimens including the types of Dr. P. MARSHALL and Dr. H. WOODS; Dr. L.G. HERTLEIN of the California Academy of Science who has kindly supplied me with the plaster casts of certain type specimens of Dr. F.M. ANDERSON; Professor Emeritus H. YABE and Professor T. KOBAYASHI who have enabled me to study the collections in the University of Tokyo with encouragements; Dr. R. SAITO and Messrs. K. KANMERA, K. FUJII, N. KANBE and A. FUKADA who have allowed me use of several specimens and given me necessary informations; Mr. C. UENI who kindly photographed for me the majority of the specimens figured in the plates.

Postscript.—I had submitted the manuscript of the present paper to the Publication Committee, before I received a new paper of the *Kossmaticeratidae* of Madagascar by M. COLLIGNON, 1954, entitled: *Ammonites Néocrétacées du Menabe [Madagascar] III.—Les Kossmaticeratidae (Travaux du Bureau Géologique Madagascar, No. 62, 59 pp., 12 pls.)*. The results of Général COLLIGNON'S magnificent work are essentially in harmony with those of the present paper. Therefore there needs no great alteration to the writing of this paper, except for the following nomenclatorial notes, which are added here concisely by kind permission of the Editor. For further discussion in detail I should wait another occasion.

(1) *Kaiparites* gen. nov. in the above description (p. 48) should be synonymized with *Natalites* COLLIGNON, 1954 (p. 6), since the definition of the genus is essentially the same between the two authors. The type species of *Kaiparites*, *Madrasites muticostatus* MARSHALL 1926, designated by myself, has been included by COLLIGNON (1954, p. 46) in his *Natalites*, while that of *Natalites*, *Madrasites natalensis* (CRICK MS) SPATH 1922, designated by COLLIGNON has been listed in this paper as a member of *Kaiparites* based on my examination of the original specimen (BM. C. 19432). Among several other species *Holcodiscus africanus* HOEPFEN, 1920 alone has been assigned to the different genera by the two authors; namely it has been referred to *Natalites* by COLLIGNON but to *Maorites* by me.

(2) *Karapadites* gen. nov. in the present paper' (p. 49) is the same as *Karapadites* COLLIGNON, 1954 (p. 6). Incidentally the same name has been proposed and the same species, *Holcodiscus karapadensis* KOSSMAT, 1897, has been designated as type by the two independent authors. The author name and the date of the genus are of course COLLIGNON, 1954 (evidently misprinted as 1953 in COLLIGNON, p. 27). Apart from the Indian species several forms have been described from the Lower Campanian of Menabe. The genus, thus, becomes more comprehensive and is better defined than has been explained above (p. 49 of this paper).

(3) *Kossmaticeras theobaldianum paucicostatum* subsp. nov. in this paper (p. 53, pl. x, figs. 1, 2) may be identical with *Kossmaticeras theobaldi* (STOJICZKA) var. *crassicostata* COLLIGNON 1954 (p. 17, pl. i, fig. 3a, b, c; pl. ii, fig. 1a, b, c), since the two authors have included the "coarse ribbed variety" of KOSSMAT (1897) in the respective forms. However our specimens from Hokkaido are still somewhat different from the illustrated ones from Menabe in their more widely separated ribs, broader constrictions in the adult and their coarser ribs even in the inner whorls. Without examining more carefully the Indian and Malgash specimens in comparison with ours, I cannot give

here a final conclusion. The subspecific name *paucicostatum* can remain at least for the time being, since a Japanese specimen has been designated as its holotype. Anyhow the occurrence of *Kossmaticeras theobaldianum* (STOLICZKA) and its allies in the Coniacian has been confirmed from both the Japanese and Malgash sides.

(Jan. 1955. T. M.)

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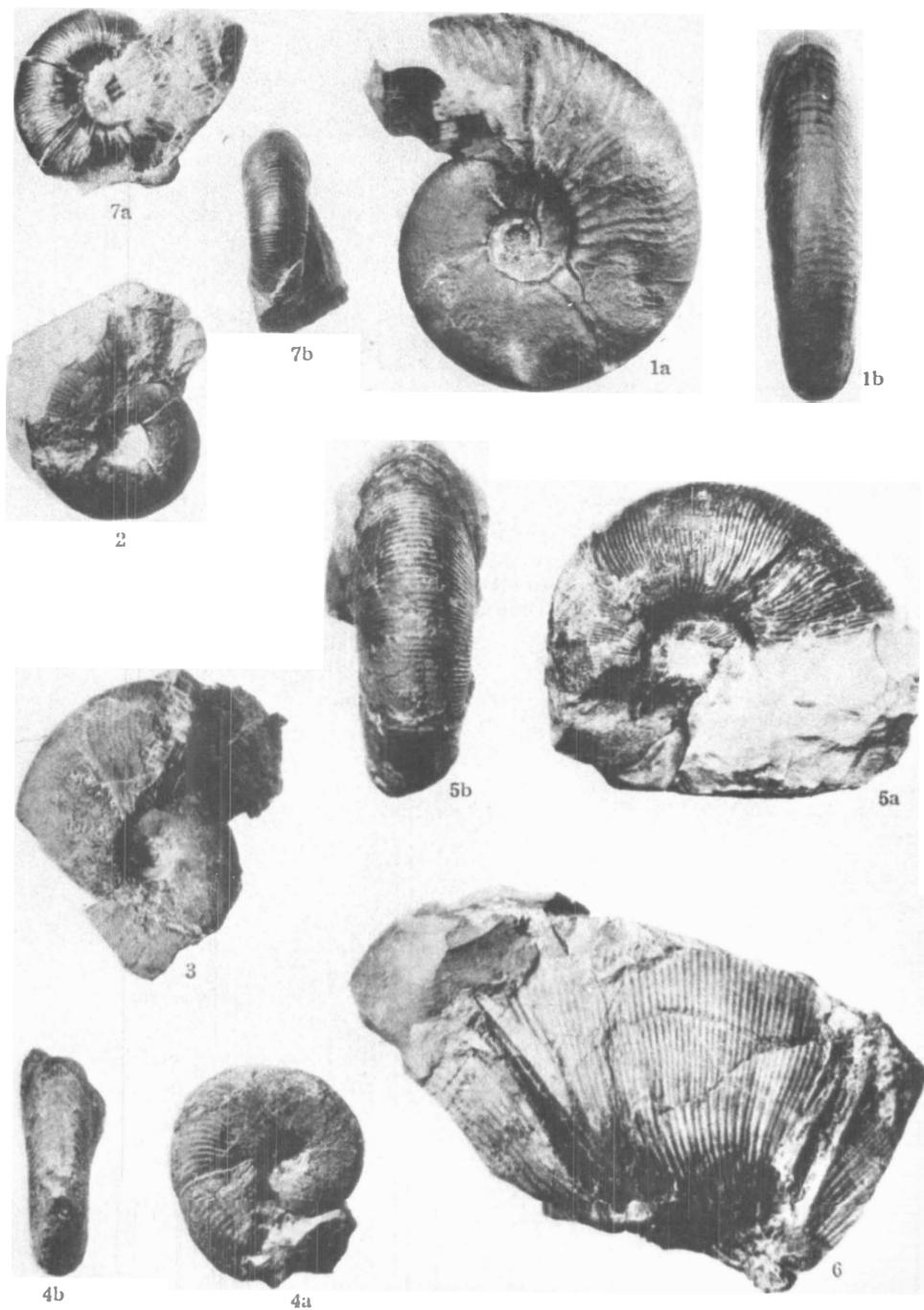
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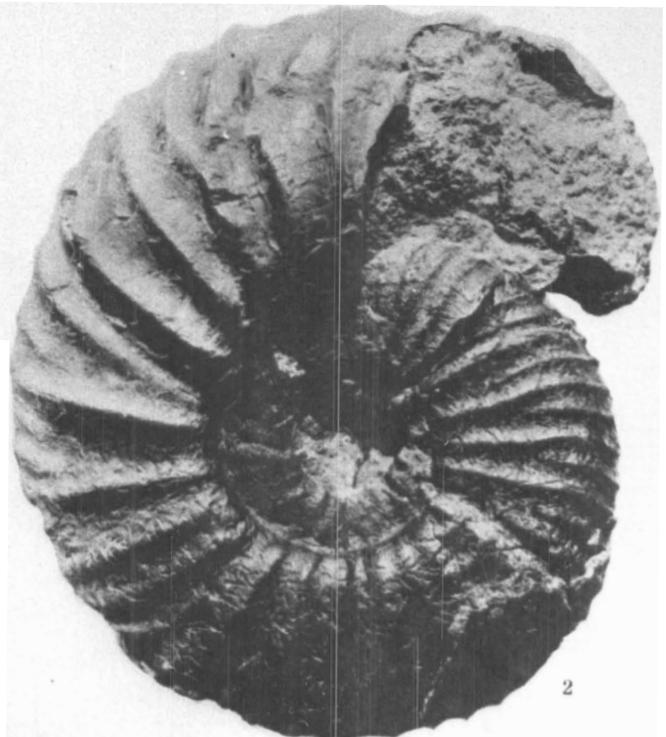
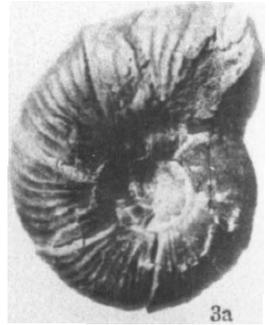
Explanation of Plate VIII

- Marshallites compressus*, gen. et sp. nov.p. 123
Fig. 1 a, b. Lateral and ventral views, x1. Holotype, GT. I-3231, from locality T 608, bed II b, Saka-gawa, Abeshinai-Saku area, Teshio Province, Hokkaido (Coll. T. MATSUMOTO).
Fig. 2. Lateral view of an immature, x1. GT. I-3234 b, loc. T 608, bed II b of Abeshinai-Saku area, Teshio Province, Hokkaido (Coll. T.M.)
- Marshallites compressus puzosoides*, subsp. nov.p. 125
Fig. 3. Lateral view, x1. Holotype of the subspecies, G.T. I-3240, from locality T 863, bed II a, Abeshinai Valley, Teshio Province, Hokkaido (Coll. T. MATSUMOTO).
Fig. 4 a, b. Lateral and ventral views, x1. GT. I-3239, Loc. T 863, bed II a, Abeshinai Valley, Teshio Province, Hokkaido (Coll. T.M.).
- Marshallites olcostephanoides* gen. et. sp. nov. p. 129
Fig. 5 a, b. Lateral and ventral views, x1. Holotype, GT. H 1552, from locality Y 140 d, bed IIm Shiyubari Valley, Ishikari Province, Hokkaido (Coll. T. MATSUMOTO).
Fig. 6. Lateral view of a fragmentary adult whorl, x1. Paratype, GK. H1553, loc. Y 235, bed IIj, Shiyubari Valley, Ishikari Province, Hokkaido (Coll. T.M.).
Fig. 7 a, b. Lateral and ventral views, x1. Paratype, GT. I-2710, loc. N 44d, zone Kz-Mh, Naibuchi Valley, South Saghalien (Coll. T. MATSUMOTO).
Photos by K. KANMERA, K. FUJII & T. MATSUMOTO.



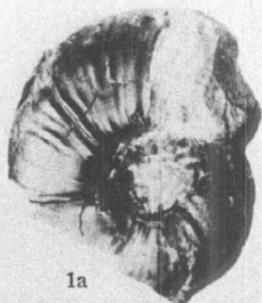
Explanation of Plate IX

- Kosmaticeras theobaldianum paucicostatum*, subsp. nov.p. 147
- Fig. 1. Lateral view, x1. Paratype of the subspecies, GK. H 4101, loc. Ik. 931, zone of *Inoceramus ussajimensis*, main course of the Ikushumbets, near the mouth of a tributary, Bannosawa, Ishikari Province, Hokkaido (Coll. T. MATSUMOTO).
- Fig. 2. Lateral view, x1. Holotype of the subspecies preserved in Hokkaido University, Bannosawa, a tributary of the Ikushumbets, Ishikari Province, Hokkaido (Coll. SARAKI).
- Kosmaticeras japonicum* (YABE MS), sp. nov.p. 150
- Fig. 3 a, b. Lateral and ventral views, x1. Holotype, GT. I-353, from the Kikume-zawa, a tributary of the Ikushumbets (Coll. H. YABE).
- Yokoyamaaceras jimboi* (YABE MS), sp. nov.p. 153
- Fig. 4 a, b. Lateral and ventral views, x3/2, Holotype, GT. I-349 a, from a branch of the Saushi-sanushibe, *Anapachydiscus* zone, Iburi Province, Hokkaido (Coll. H. YABE).
- Fig. 5 a, b. Lateral view and sections, x3/2. Paratype, GT. I-349 b, the same locality and horizon as the holotype (Coll. H. YABE).
- Photos by C. UEKI (3, 4, 5), KUMANO (2) and K. KANMERA & T. MATSUMOTO (1).



Explanation of Plate X

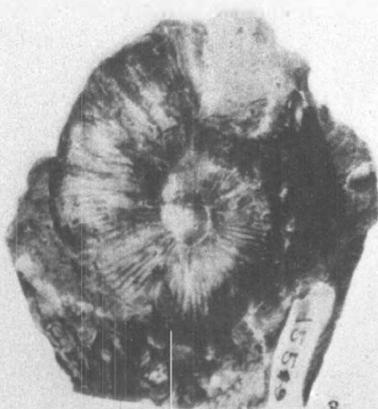
- Yokoyamaoceras* (?) *mysticum*, sp. nov.p. 155
Fig. 1 a, b. Lateral and peripheral views, $\times 1$. Holotype, GK. H3379, from locality U147p, bed Ur2 β , Urakawa area, Hidaka Province, Hokkaido (Coll. T. MATSUMOTO).
- Eomadrasites subnipponicus*, gen. et sp. nov.p. 137
Fig. 2a, a', b. Lateral and peripheral views, $\times 1$. Holotype, GT. I-3235, from locality T863, bed IIa, Abeshinai Valley, Teshio Province, Hokkaido (Coll. T. MATSUMOTO).
- Eomadrasites nipponicus*, gen. et sp. nov.p. 135
Fig. 3. Lateral view, $\times 1$. Holotype, GK. H 1559, from locality T233p, Shibunai-toge-no-sawa, bed IIb, Abeshinai Valley, Teshio Province, Hokkaido (Coll. T. MATSUMOTO).
- Gen. et sp. indet.p. 138
Fig. 4. A form with flared ribs, lateral view, $\times 4/5$, GT. I-3248 from locality T912, bed IIc (δ), Abeshinai Valley, Teshio Province, Hokkaido (Coll. T. MATSUMOTO).
- Photos by C. UEKI (1) and K. KASUMERA, K. FUJII & T.M. (2-4).



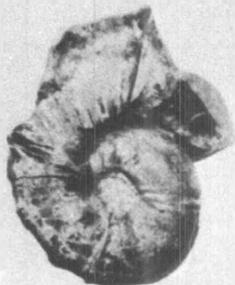
1a



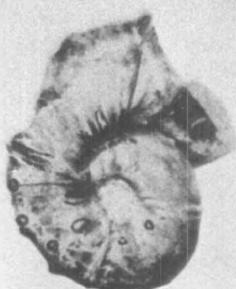
1b



3



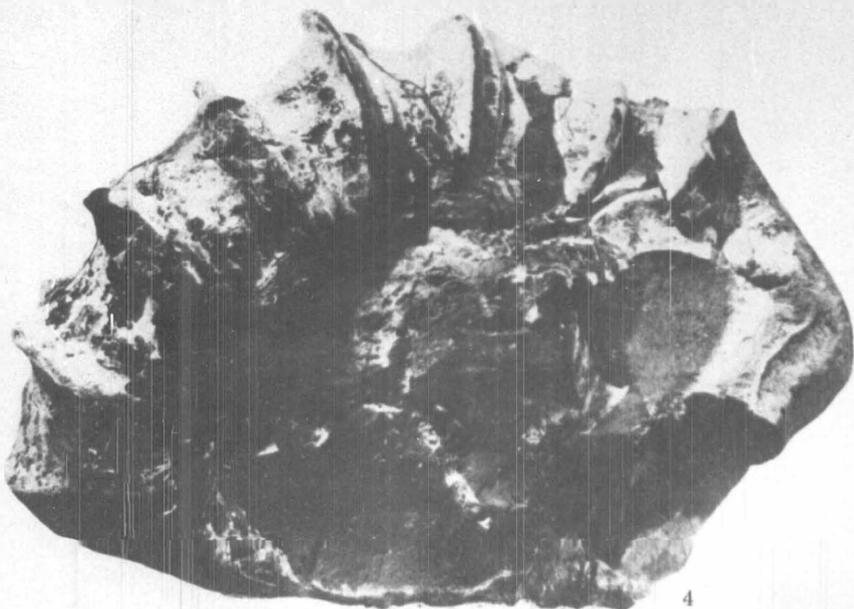
2a



2a'



2b



4