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Cretaceous Ammonites from the Upper Chitina Valley, Alaska*

By

Tatsuro MATSUMOTO

Abstract

Recent collections from six localities near McCarthy, in the upper Chitina Valley, Alaska, contain seventeen species of ammonites that are described and illustrated in this paper. Four new species are established. The ammonites include interesting examples of Marshallitinae, one of which represents a new genus. The faunule represented at four of the localities has intimate relationships with Japanese Cenomanian ammonites that permit close correlations between Japan and the West Coast of America. It is suggested that the other two localities possibly include the Upper Albian.

The strata from which the described ammonites were obtained represent only a fraction of the great thickness of the Cretaceous strata in the upper part of the Chitina Valley. General comments on the Cretaceous stratigraphy in the Chitina valley are given in the appendix.

Introduction

When I visited Washington, D. C., in 1957, Dr. R. W. IMLAY kindly showed me some ammonites which had been collected recently by Messrs. C. E. KIRSCHNER and J. E. HEPPERT from the Cretaceous of the Nizina-McCarthy basin, source area of the tributaries of the upper part of the Chitina Valley, southeastern Alaska. At first glance I recognized the importance of the faunule represented by these specimens. The importance of the faunule is primarily that it indicates the presence of the Cenomanian, which has not been hitherto clearly demonstrated in this area; secondly, that it has intimate relations with both the Japanese Cretaceous fauna and the Cretaceous faunas of the West Coast of America from British Columbia to California; and finally, that it contains interesting members of the subfamily Marshallitinae, some of which are entirely new.

Although I am not acquainted with the area, Dr. IMLAY has kindly provided me with necessary information for preparing notes and comments on the stratigraphy. It is, of course, desirable that the paleontologist himself should go to the field and make observations and collections. However, the area is at present not easily accessible and I shall have no opportunity of doing field work there in the near

* Received October 20, 1958

future. In view of the importance of the faunule, I think it better to report the result of my study of the specimens now at my disposal than to wait for further acquisitions.

The following symbols are used for the institutions to which the specimens belong or at which the localities are registered:

CAS California Academy of Sciences, San Francisco, California
GSC Geological Survey of Canada, Ottawa, Canada
GT Geological Institute, University of Tokyo, Tokyo, Japan
UC University of California, Berkeley, California
USGS United States Geological Survey, Washington, D. C.
USNM United States National Museum, Washington, D. C.

Most of the described specimens are preserved in the last institution and are from U. S. Geological Survey Mesozoic localities.

The terminology used in description of the suture-line is that proposed by WEDEKIND (1916, p. 185–195) and elaborated by SPATH (1923, p. 10).

Acknowledgements

I am deeply indebted to the late Dr. John B. REESIDE, Jr. and Dr. Ralph W. IMLAY, of the U. S. Geological Survey, who helped me in various ways to complete the study. Especially Dr. IMLAY has provided me every available information about the stratigraphy of the area. Mr. C. W. WRIGHT has kindly read the first draft of the paleontologic descriptions and offered good advice. Dr. J. A. JELETZKY of Geological Survey of Canada arranged to send me pertinent plastotypes of some of WHITEAVES' species. Mr. Nelson W. SHUPE, of the U. S. Geological Survey, photographed the specimens. Sutures were drawn by myself.

The paper is a result of research work during my visit in 1957–58 to the United States under the auspices of the Conference Board of the Associated Research Councils. Thanks are due to Dr. G. Arthur COOPER, Head Curator, Department of Geology, U. S. National Museum; Dean Charles F. PARK, Jr., of the School of Mineral Sciences, Stanford University; Professor Hubert G. SCHENCK and Dr. Earl L. PACKARD, of the same university; Dr. G. D. HANNA and Dr. L. G. HERTLEIN of the California Academy of Sciences; Professor R. C. MOORE of the University of Kansas; and Professor J. Wyatt DURHAM, Chairman of the Department of Paleontology, University of California at Berkeley, who have rendered available facilities in those institutions. Finally my thanks are extended to Professor Toru TOMITA and Professor Ryuzo TORIYAMA for their help in arrangements of publishing this paper from the Faculty of Science, Kyushu University.

Notes on Stratigraphy

Many Cretaceous ammonites have already been listed in previous papers dealing with the Mesozoic stratigraphy of the upper Chitina Valley, southeast Alaska. This

paper, however, does not include their description, but principally is concerned with the collections made by Messrs. C. E. KIRSCHNER and J. E. HEPPERT during the summer of 1954. All known stratigraphic and geographic information concerning the Cretaceous ammonites described herein is shown in Text-fig. 1 and Table 1 below. This information has been kindly provided by the above-mentioned geologists through Dr. IMLAY.

The six localities described in the table are grouped into two areas (A and B on Fig. 1): one at the altitude of 3,300 feet on the first creek south of Moonshine Creek, near the head of the Nizina River, and the other on a bluff on the northwest side of the Chitistone River.

The stratigraphic positions of the two localities, USGS Mes. locs. 25441 and 25442, near Nizina Glacier are not recorded closer than the lower 1,000 feet of 3,000 feet of shale and sandstone. The four localities, USGS Mes. locs. 25443–25446, near the Chitistone River, are well located in stratigraphic order within the upper 500 feet of a shale and sandstone unit 3,000 feet thick. The stratigraphic relationship between the former two and the latter four localities is not exactly known. Evidently the ammonite faunule described in this paper is derived from only a fraction of the great thickness of Cretaceous strata in the Chitina Valley.

General comments on the Cretaceous stratigraphy in the upper Chitina Valley are given in the appendix, following the paleontologic descriptions.

Table 1.—Localities in the Nizina-McCarthy area, upper Chitina Valley, Alaska, at which the described ammonites were collected

Indication on fig. 1	U.S. Geological Survey Mesozoic locality	Collector's field number	Collection, year of collection, and description of locality
A	25441	CEK 428	C.E. KIRSCHNER, 1954. At altitude of 3,300 feet on first creek south of Moonshine Creek, 1.25 miles east of Nizina River Valley and 19.6 miles N.57°E. of town of McCarthy. Lower 1,000 feet of a formation of shale and sandstone, about 3,000 feet thick.
A	25442	CEK 428 B	C.E. KIRSCHNER, 1954. Some locality as described under locality 25441, but apparently from a different bed, within the same lower 1,000 feet of shale and sandstone formation.
B	25443	JEH 219	J.E. HEPPERT, 1954. Upper 125 feet, of 3,000 feet of shale and sandstone underlying Tertiary volcanics on bluff on northwest side of Chitistone River at approximate altitude of 5,700 feet, 21 miles N.73°E. of town of McCarthy.

B	25444	JEH 220	J.E. HEPPERT, 1954. From 125 to 200 feet below top of sequence described under locality 25443.
B	25445	JEH 221	J.E. HEPPERT, 1954. From 225 to 325 feet below top of sequence described under locality 25443.
B	25446	JEH 222	J.E. HEPPERT, 1954. From 400 to 435 feet below top of sequence described under locality 25443. Coordinates 14.08, 9.31.

Paleontologic Descriptions

Order Ammonoidea

Family Phylloceratidae

Genus *Partschiceras* FUCINI, 1920

Type-species.—Partschiceras partschi (STUR).

Partschiceras? japonicum (MATSUMOTO)

Pl. 12, figs. 1 a–c, 2 a, b, 3 a–c; Pl. 28, fig. 2 a–d;
Pl. 29, fig. 1 a, b; Text-fig. 2

1942. *Phylloceras japonicum* MATSUMOTO (1942 e), p. 674.
1953. *Phylloceras japonicum* MATSUMOTO, p. 144, text-fig. 10.

Material.—Three plesiotypes, USNM 129260 (Pl. 12, fig. 3 a–c; Text-fig. 2) and 129288 a, b (unfigured) at USGS Mes. loc. 25445. Two plesiotypes, USNM 129261 (Pl. 12, fig. 1 a–c) and 129262 (Pl. 12, fig. 2 a, b) from USGS Mes. loc. 25443. Total: five specimens of different sizes from Alaska.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus
USNM 129288 a	*c.* 73.0	45.0	32.3	(0.72)	4.2
USNM 129260	36.4	21.8	16.0	(0.73)	2.5
USNM 129261	38.3	23.2	17.8	(0.76)	2.8
USNM 129262	29.6	17.0	12.2	(0.71)	2.0
GT I-3251 (lectotype)	34.5	20.0	14.8	(0.74)	2.2

Descriptive remarks.—The largest specimen listed above has a partly preserved body whorl, the last septum being at the whorl-height of 32 mm. The other specimens of smaller dimensions unquestionably belong to the same species as the largest one, because of their great resemblance at corresponding growth-stages.

The Alaskan specimens represented by the above specimens are referred to "*Phylloceras*" *japonicum* MATSUMOTO because of their elliptical whorl-section, very

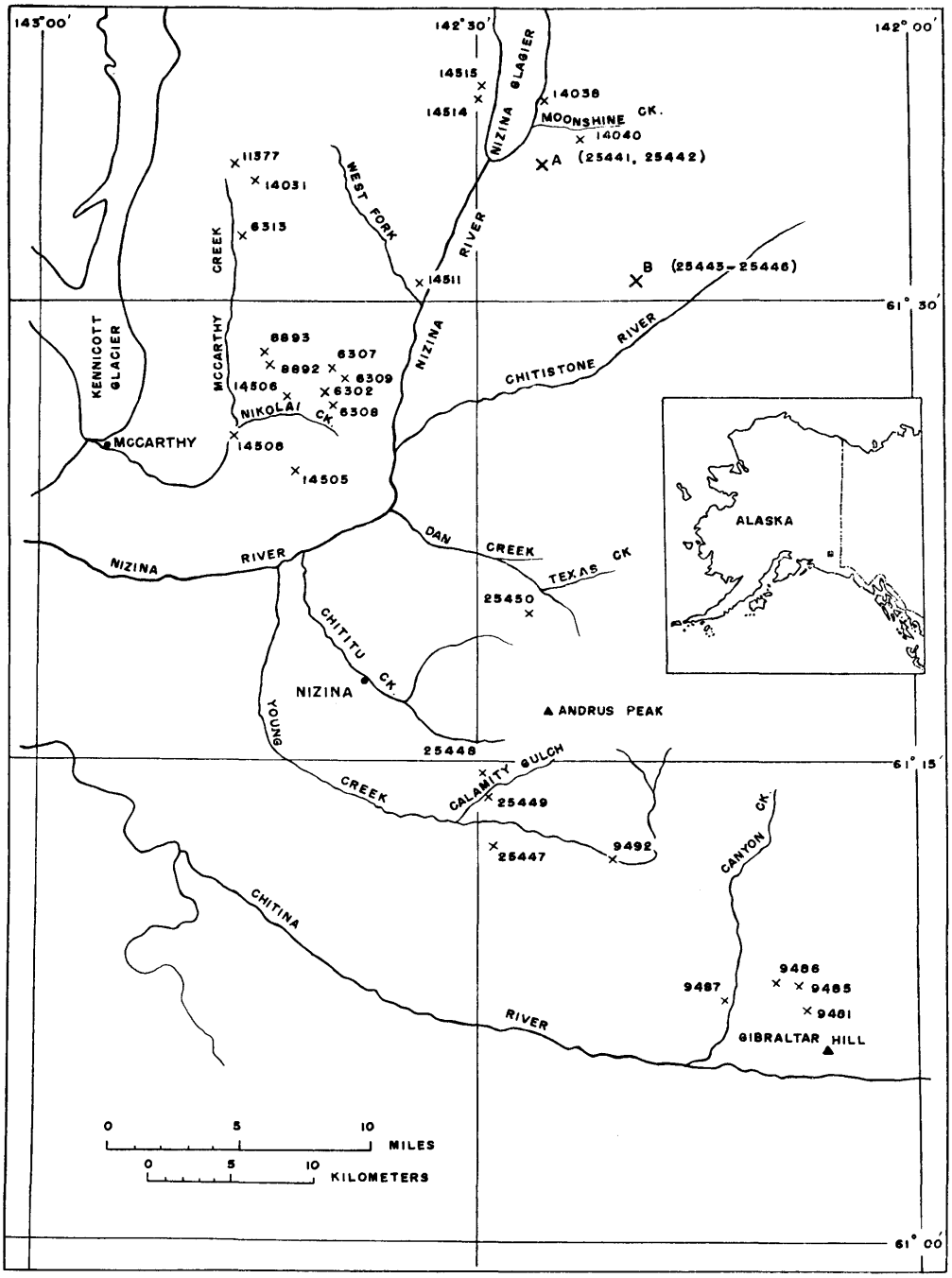


Fig. 1. Index map showing localities of collections from the Cretaceous of the upper Chitina Valley, southeastern Alaska. Letters (A, B) and numbers refer to Table 1 and also to descriptions in the appendix.

weak and broad major undulations and numerous fine riblets or lirae that are separated by interspaces somewhat wider than or almost as wide as the riblets.

"*Phylloceras*" *japonicum* MATSUMOTO (1942 e, p. 674), from the Cenomanian of Japan, is nomenclatorially valid since 1942, because it was defined with clear distinctions from the allied species *Phylloceras ellipticum* KOSSMAT (1895, p. 107 [11], pl. 15 (1), fig. 2 a, b; pl. 20 (6), fig. 1 a, b) [=*Ammonites subalpinus*, STOLICZKA, 1865 (*non* D'ORBIGNY), p. 114, pl. 58, fig. 3, 3 a, 3b], from the basal part of the Ootatoor group

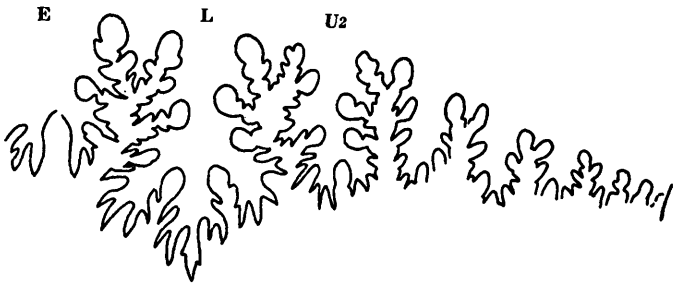


Fig. 2. *Partschiceras*? *japonicum* (MATSUMOTO). External suture of an Alaskan specimen, USNM 129260, from USGS Mes. loc. 25445, at whorl-height of 14.0 mm., shell-diameter of 23.5 mm.

of India. Unfortunately the types (syntypes) of *P. japonicum* were not illustrated in 1942 and only the sutures and whorl sections were drawn later (MATSUMOTO, 1953, text-fig. 10). The situation, although unfortunate, does not invalidate the specific name. In order to avoid further misunderstanding and to show the identity of the Japanese and Alaskan forms, I designate and illustrate herein the lectotype of "*Phylloceras*" *japonicum* MATSUMOTO, GT I-3251 (Pl. 28, fig. 2 a-d), from loc. T591 d, bed "II b" of Middle Yezo group, Abeshinai Valley, Teshio Province, Hokkaido.

This species is similar to *Phylloceras ellipticum* KOSSMAT but its riblets are not so fine and not so crowded as in that species, and show only slight flexuosity; they are obscure near the umbilical margin, but distinct on the outer half of the whorl. A constriction is not clearly shown on the shell of the present species, but is infrequently developed in the Indian species.

The suture of the present species has diphyllitic terminals to the saddles and evidently is less complicated than that of *Phyllopachyceras*, and much less so than that of *Hypophylloceras*. Both of the latter genera have tetraphyllic saddles between E, L, and U_2. In other words, this species has the suture characteristics of *Partschiceras*. The illustrated suture of *Phylloceras ellipticum* KOSSMAT is similar to, but different in detail from, that of the present species.

In many respects this species is better referred to *Partschiceras* than to any other genus. However, that genus has hitherto been found only in the Jurassic and

in the Neocomian stage of the Lower Cretaceous. As the phylloceratid genera are long ranging, it would not be surprising to find that *Partschiceras* ranges up to the Cenomanian. As it has not been recorded from the Aptian and Albian, I refer the present species to *Partschiceras* with a query.

Occurrence.—USGS Mes. locs. 25443 and 25445.

The Japanese representatives were obtained from beds II b and uppermost part of II a, the Abeshinai-Saku area, Teshio Province, Hokkaido, Cenomanian (See Chapter II in MATSUMOTO, 1942 b).

Genus *Neophylloceras* SHIMIZU, 1934

Type-species.—*Neophylloceras ramosum* (MEEK).

Synonym.—*Hyporbulites* BREISTROFFER, 1947.

Neophylloceras seresitense (PERVINQUIÈRE)

Pl. 12, figs. 4 a, b, 5 a–d; Text-fig. 3

1865. *Ammonites velledae*, STOLICZKA (*non* MICHELIN), p. 116, pl. 59, figs. 1–3.
1895. *Phylloceras velledae*, KOSSMAT, p. 108 [12], pl. 15 [1], fig. 3.
1907. *Phylloceras velledae* (MICHELIN) var. *seresitense* PERVINQUIÈRE, p. 52.
1907. *Phylloceras velledae*, CRICK, p. 166, pl. 10, fig. 11.
1910. *Phylloceras velledae* (MICHELIN) var. *seresitense* PERVINQUIÈRE, p. 9, text-fig. 2.
1923. *Phylloceras seresitense*, SPATH, p. 18, pl. 1, fig. 3 a, b; pl. 2, fig. 1.
1942. *Phylloceras velledae*, MATSUMOTO (1942 e), p. 193, 194 (listed).
1947. *Hyporbulites seresitensis*, BREISTROFFER, p. 82.
1951. *Phylloceras* cf. *seresitense*, WRIGHT & WRIGHT, p. 12.
1956. *Hyporbulites seresitensis*, COLLIGNON, p. 16, pl. 4, fig. 1, 1 a.
1958. *Phylloceras velledae*, ANDERSON, p. 180, pl. 16, fig. 4, 4 a.

Material.—A specimen of moderate size, USNM 129253 (Pl. 12, fig. 4 a, b), from USGS Mes. loc. 25442 and another smaller fragmentary one, USNM 129254 (Pl. 12, figs. 5 a–d; Text-fig. 3), from USGS Mes. loc. 25445.

Descriptive remarks.—The whorl is compressed, with a narrow venter and rather flat flanks. It resembles the shell of *Hypophylloceras velledae* (MICHELIN) (D'ORBIGNY, 1841, p. 280, pl. 82), from the Albian of Europe, but is more compressed and its subcostae are less flexuous than in that species. In all the observable characters the Alaskan specimens before me are best referable to "*Phylloceras*" *seresitense* PERVINQUIÈRE as redefined by SPATH (1923, p. 18). There are representatives of this species in the Japanese and the Californian Cenomanian, with which the Alaskan forms are specifically identical.

BREISTROFFER (1947) established the genus *Hyporbulites* for "*Phylloceras*" *seresitense*, because of the polyphylloid character of the suture. COLLIGNON (1957) continued to use BREISTROFFER's generic name and described seven species, including *seresitense* itself, from the Upper Cretaceous of Madagascar. From his descriptions and illustrations I cannot find any significant difference between *Hyporbulites*

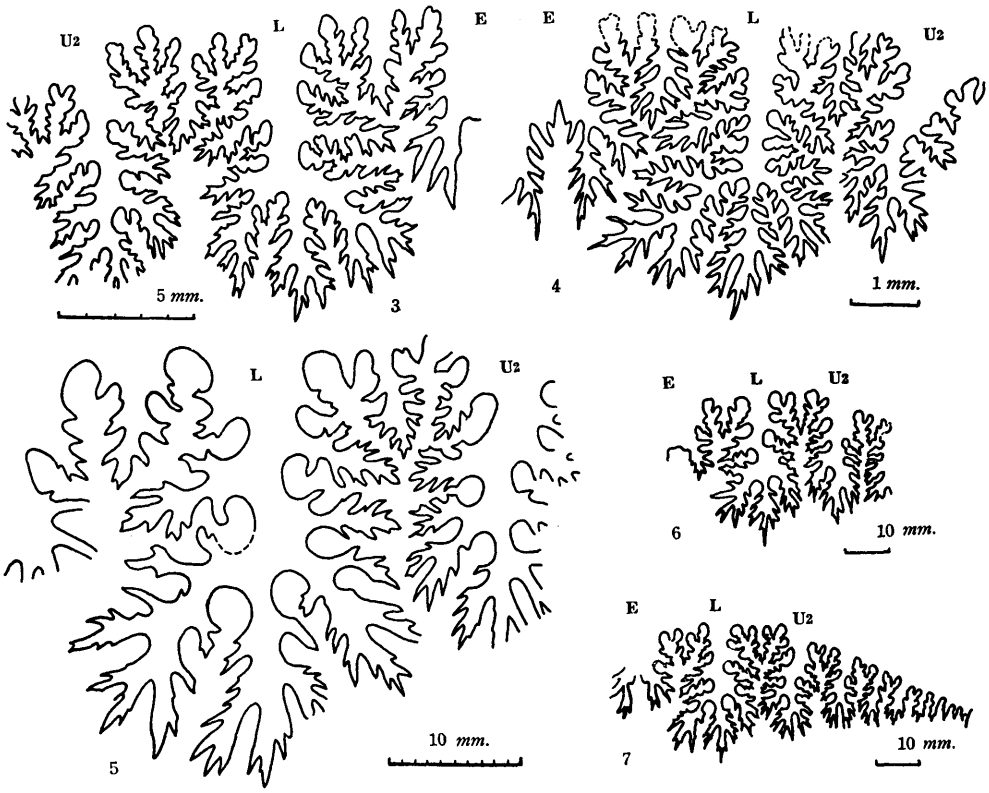
BREISTROFFER, 1947 and *Neophylloceras* SHIMIZU, 1934, the latter of which has been redefined by WRIGHT and MATSUMOTO (1954, p. 109). WRIGHT (1957 *in* MOORE [Editor], p. L189) included *Neophylloceras* within *Hypophylloceras* SALFELD, 1924.

There is some confusion about the type specimens of the type species of *Hypophylloceras*, *Phylloceras onoense* STANTON 1896 [1895] [=*Ammonites ramosus*, GABB (1864, p. 65, pl. 11, fig. 12) (*non* MEEK)]. GABB's specimens [=STANTON's syntypes] were considered by ANDERSON as lost, but are actually preserved in the Museum of Invertebrate Paleontology, University of California. E. L. PACKARD (Manuscript, May 1958) intends to designate a lectotype for *Hypophylloceras onoense* (STANTON). Fortunately, ANDERSON's interpretation of the species is in harmony with PACKARD's definition, although ANDERSON incorrectly retouched the details of the suture (Compare Text-fig. 6 with ANDERSON, 1938, pl. 11, fig. 1).

Now *Neophylloceras ramosum* (MEEK) (1857, p. 45; 1876, p. 371, pl. 5, fig. 1, 1 a, 1 b) is fairly similar to *Hypophylloceras onoense* (STANTON) in many features, except for the suture. Even in the small, probably immature, shell, as represented by the holotype, USNM 12451 (this paper, Text-fig. 4), *N. ramosum* (MEEK) already has a very complex suture, in which the elements are multipartite, deeply and finely incised, and the phylloid outlines to the terminals of the saddles tend to be lost. In *Hypophylloceras onoense* (STANTON), even on the large outer whorl, the suture is not so complicated as that of *N. ramosum* (MEEK), and the phylloid outline is distinctly shown to the terminals of the minor saddles (Text-figs. 5–7). The sutures in some of the Jurassic and Cretaceous ammonites vary considerably, but in the persistent stocks such as the Phylloceratidae and Lytoceratidae, the sutures are as reliable as those of many Paleozoic ammonoids for distinguishing the genera. As there are a number of species which are grouped near *N. ramosum* (MEEK), it is taxonomically necessary to separate *Neophylloceras* from *Hypophylloceras*. Someone might propose to put the former under the latter as a subgenus, because the general pattern of the suture is rather similar and because the difference is only the degree of multipartition. We distinguish, however, *Romaniceras* from *Calycoceras* because of greater multituberculation. Similarly the great increase in the number of indentations of suture may well be a criterion for distinguishing genera, so far as it is well shown on a group of species.

Neophylloceras of the Upper Cretaceous, however, is so closely related to *Hypophylloceras* of the Lower Cretaceous that the former is certainly a derivative of the latter. "*Phylloceras*" *seresitense* PERVINQUIÈRE of uppermost Albian and Cenomanian possibly represents an intermediate stage between *Hypophylloceras* and *Noephylloceras*. Unfortunately, the sutures of this species illustrated by the previous authors (PERVINQUIÈRE, 1910, text-fig. 2; SPATH, 1923, pl. 1, fig. 3 a, b; pl. 2, fig. 1; COLLIGNON, 1957, text-fig. 1) are all of an immature stage and are not very useful

for determining this particular point. I illustrate herein (Text-fig. 3) the suture of the Alaskan specimen which is evidently larger than any previously illustrated. This shows an intermediate state in complexity and multipartition, but is rather closer to the sutures of *Neophylloceras ramosum* (MEEK), whereas the suture of *Ammonites velledae* MICHELIN, as illustrated by D'ORBIGNY (1841, pl. 82, fig. 4), is obviously closer to that of *Hypophylloceras onoense* (STANTON). Therefore, I refer "*Phylloceras*" *seresitense* PERVINQUIÈRE to *Neophylloceras* and "*Phylloceras*"



Figs. 3–7. Sutures of *Neophylloceras* and *Hypophylloceras*.

3. *Neophylloceras seresitense* (PERVINQUIÈRE). A part of the external suture of the specimen USNM 129254, from USGS Mes. loc. 25445, at whorl-height of 27.5 mm.
4. *Neophylloceras ramosum* (MEEK). A part of the external lobe of the holotype, USNM 12451, from "Komooks," Vancouver Island, at whorl-height of 12.5 mm. (immature).
5. *Hypophylloceras onoense* (STANTON). A syntype [hypotype of GABB's *Ammonites ramosus*], UC 12110, from "Cottonwood", Shasta Co., California, at whorl-height of 60 mm.
6. *Hypophylloceras onoense* (STANTON). A specimen of CAS 7736, from loc. CAS 153, illustrated by ANDERSON (1938, p. 142, pl. 11, fig. 1), showing correction for ANDERSON's misretouching.
7. *Hypophylloceras onoense* (STANTON). A specimen of Acad. Nat. Sci., Philadelphia, 12885, "Cottonwood", Shasta Co., California, at whorl-height of about 57 mm.

velledae MICHELIN to *Hypophylloceras*. Thus *Hyporbulites* becomes a synonym of *Neophylloceras*.

Occurrence.—The Alaskan examples came from USGS Mes. locs. 25442 and 25445.

In Japan the specimens referable to this species were found at locs. T591 (bed II b) and T596 (bed II a), Cenomanian (MATSUMOTO, 1942 b, p. 193, 194, 211). In California ANDERSON's example came from loc. CAS 2233, where the unmistakable Cenomanian ammonite, *Calycoceras* cf. *C. newboldi* (KOSSMAT), was also obtained. In the other parts of the world, including Tunisia, Algeria, Madagascar, India and Europe, the species has been reported from Cenomanian and uppermost Albian.

Family Desmoceratidae

Genus *Desmoceras* ZITTEL, 1884

Subgenus *Pseudouhligella* MATSUMOTO, 1938

Type-species.—*Desmoceras* (*Pseudouhligella*) *japonicum* YABE.

Desmoceras (*Pseudouhligella*) *japonicum* YABE

Pl. 13, figs. 1 a–c, 2 a–c, 3 a–c, 4 a–c; Pl. 14, fig. 1 a, b

1904. *Desmoceras dawsoni* WHITEAVES var. *japonica* YABE, p. 35, pl. 5, figs. 3, 4.
1938. *Desmoceras* (*Pseudouhligella*) *japonica*, MATSUMOTO (1938 a), p. 23, text-fig. 27.
1942. *Desmoceras* (*Pseudouhligella*) *japonica*, MATSUMOTO (1942 a), p. 26, text-fig. 1 c.
1954. *Desmoceras* (*Pseudouhligella*) *japonicum*, MATSUMOTO (1954 a), p. 252, pl. 2 [18], fig. 1 a, b; pl. 1 [17], fig. 7 a, b; text-figs. 2-6 [48-52].
1954. *Desmoceras* (*Pseudouhligella*) *japonicum mediocompressa* MATSUMOTO (1954 a), p. 257, pl. 2 [18], figs. 2 a, b, 3 a, b.
1954. *Desmoceras* (*Pseudouhligella*) *japonicum compressior* MATSUMOTO (1954 a), p. 258, pl. 2 [18], fig. 4 a-c.

Material.—A large number of specimens, mostly immature, but partly mature, from USGS Mes. locs. 25443, 25445, and 25446. The illustrated specimens are USNM 129263 (Pl. 13, fig. 4 a–c), 129264 (Pl. 13, fig. 2 a–c), and 129265 (Pl. 13, fig. 1 a–c) from USGS Mes. loc. 25443; and USNM 129266 (Pl. 14, fig. 1 a, b) and 129267 (Pl. 13, fig. 3 a–c) from USGS Mes. loc. 25445; other relatively well preserved specimens are USNM 129285 (a–k) and 129291 (a–j). There are still more specimens of less perfect preservation.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus	(%)
USNM 129263	53.5	29.0	24.7	(0.85)	7.8	(14)
USNM 129264	52.0	27.3	22.2	(0.81)	7.9	(15)
USNM 129265	40.4	22.2	20.5	(0.98)	6.1	(15)
USNM 129266	62.5	34.2	29.3	(0.85)	9.3	(15)
USNM 129267	44.2	23.5	20.7	(0.87)	7.0	(16)
USNM 129291 a	49.5	27.5	22.1	(0.80)	6.9	(14)
USNM 129291 b	57.7	31.0	27.9	(0.90)	9.4	(16)
USNM 129291 c	30.2	16.3	12.2	(0.75)	4.5	(15)
USNM 129291 d	42.6	22.5	22.6	(1.00)	5.8	(14)

Remarks.—The specimens before me show diagnostic features of the species as redescribed by myself (1954 a), and have a range of variation similar to that of the Japanese representatives. I am now inclined to suppress the "subspecies" *mediocompressa* and *compressior*, since they are merely variants of one and the same species, occurring in the same locality and showing gradations between the compressed and less compressed forms. Fortunately, the holotype (the illustrated specimen of YABE, 1904, by original designation) is situated at the middle of the range of variation. The Alaskan specimens support this view.

Occurrence.—The large number of specimens in the collection indicates that the species is abundant at USGS Mes. locs. 25443, 25445 and 25446.

In Japan the species is common through the Lower Gyliakian, the approximate equivalent of the main part of the Cenomanian.

Desmoceras (*Pseudouhligella*) *dawsoni* WHITEAVES

Pl. 14, fig. 2 a, b; Pl. 15, figs. 1 a–c, 2; Pl. 16, fig. 1 a–c; Text-fig. 8

1884. *Haploceras beudanti*, WHITEAVES (*non* BRONGNIART), p. 205, pl. 26, fig. 1, 1 a.
1900. *Desmoceras dawsoni* WHITEAVES, p. 286, pl. 37, fig. 3.
1958. *Beudanticeras alamoensis* ANDERSON, p. 213, pl. 5, fig. 2, 2 a.
1958. *Beudanticeras argonauticum* ANDERSON, p. 213, pl. 9, figs. 1, 2.

Material.—A considerable number of well preserved specimens from USGS Mes. locs. 25441 and 25442. The illustrated ones are USNM 129250 (Pl. 14, fig. 2 a, b) from USGS Mes. loc. 25441 and USNM 129251 (Pl. 15, fig. 2; Pl. 16, fig. 1 a–c) and USNM 129252 (Pl. 15, fig. 1 a–c; Text-fig. 8) from USGS Mes. loc. 25442.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus	(%)
GSC 4992 (on the plastotype)	*c.* 110	(deformed body whorl)				
	92.5	47.2	28.5	(0.61)	13.7	(15)
USNM 129250 (slightly deformed)	137.0	67.0	39.9	(0.59)	21.2	(15)
USNM 129251 (body whorl)	125.0	62.5	—	(deformed)	19.3	(15)
" (at the last septum)	83.0	43.0	26.3	(0.61)	12.0	(14)
USNM 129252	70.0	37.5	22.5	(0.60)	11.0	(16)
	58.7	32.6	19.9	(0.61)	8.8	(15)

Diagnosis.—The shell is of moderate size at its full-grown stage and relatively involute. The whorl is compressed, with the average proportion of height: breadth 10: 6; narrowly arched on the siphonal side, slightly convex and convergent instead of flat and parallel on the flanks, being broadest in the lower part between the mid-flank and the umbilical shoulder. The umbilicus is narrow, about 15 per cent. of the shell-diameter; the umbilical shoulder is subrounded and not angulate.

The surface of the shell is nearly smooth, except for weak lirae or subcostae,

which are best discernible on the ventral part. The constrictions are well-marked, numerous on the adult whorl but not necessarily so on the immature whorls. They are flexuous on the sides and strongly projected on the venter.

The suture is of the *Desmoceras* type, consisting of numerous elements which uniformly decrease their size towards the umbilical seam, but L is as deep as or slightly deeper than E. The lobes on the sides are tripartite; saddles bipartite in the

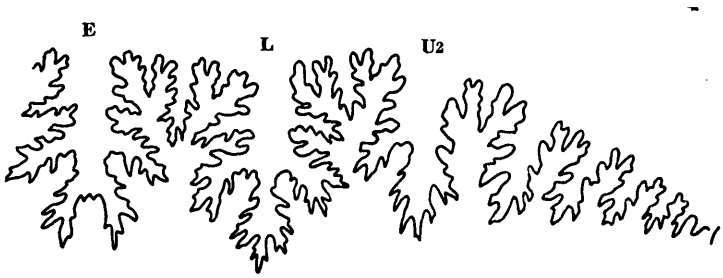


Fig. 8. *Desmoceras* (*Pseudouhligella*) *dawsoni* WHITEAVES. External suture of an Alaskan specimen, USNM 129252, from USGS Mes. loc. 25442, at whorl-height of 15.0 mm.

second order of subdivision. The indentation is deep and fine; the stems of the lobes are relatively narrow.

Remarks.—Since WHITEAVES (1884, p. 205, pl. 26, fig. 1, 1 a; 1900, p. 286, pl. 37, fig. 3) described and illustrated this species, it has not been discussed in any detail by paleontologists.

By courtesy of Dr. J. A. JELETZKY, of the Geological Survey of Canada, I have received two plaster casts (one for Stanford University, the other for Kyushu University) of the holotype of *Desmoceras dawsoni* WHITEAVES, 1900 [=*Haploceras beudanti* WHITEAVES, 1884, *non* BRONGNIART], from the Haida formation on the north shore of Cumshewa Islet, Queen Charlotte Islands, British Columbia, Canada. The plastotype was so nicely prepared that even the sutures can be seen. By comparison with it, the specimens from Alaska are undoubtedly referable to this species.

This species is so closely allied to *Desmoceras* (*Pseudouhligella*) *japonicum* YABE (see above), the type species of the subgenus *Pseudouhligella*, that it is clearly referable to the same subgenus. The specific distinctions are as follows. *D.* (*P.*) *dawsoni* WHITEAVES has in general a more compressed whorl than *D.* (*P.*) *japonicum* YABE. Its flanks are gently convex and rather convergent, whereas in *D. japonicum* they are nearly flat and parallel. *D. dawsoni* has a subrounded umbilical shoulder and a steeply inclined umbilical wall; *D. japonicum* has an angulate shoulder and a perpendicular wall. The suture is more deeply incised and the stems of its elements are narrower in *D. dawsoni* than in *D. japonicum*.

In many of these points, *D.* (*P.*) *dawsoni* WHITEAVES is rather closer to *D.* (*P.*) *ezoanum* MATSUMOTO (1942 a, p. 26, text-fig. 1 b; 1954 a, p. 260, pl. 3 [19], figs. 1 a–c,

2 a, b, 3 a, b, 4 a, b, 5 a, b, and 6), from the Cenomanian of Japan, but is still distinguished by the less angulate umbilical shoulder. In *D.* (*P.*) *ezoanum* MATSUMOTO, which is represented by relatively small specimens, the constrictions are less distinct and much less numerous on its supposed body whorl. In the immature whorls of *D.* (*P.*) *dawsoni* WHITEAVES, which are as large as the normal examples of *D.* (*P.*) *ezoanum*, the constrictions seem to be variable in frequency and distinctness. The feature can be seen, however, in the Californian specimens, rather than in the Alaskan specimens before me.

Some of the Californian examples have received unnecessary new specific names under the inadequate generic assignment by ANDERSON (*Beudanticeras alamoensis* ANDERSON, 1958, p. 213, pl. 5, fig. 2, 2 a; *Beudanticeras argonauticum* ANDERSON, 1958, p. 213, pl. 9, fig. 1, 1 a). There are fairly large number of specimens of this species occurring in the Upper Albian (*Mortoniceras*-bearing beds) of California, which prove that the minor differences in broadness of the whorl, or of the venter, and in curvature of constrictions are within the range of variation of a single species.

Occurrence.—The Alaskan examples are from USGS Mes. locs. 25441 and 25442, which are separated geographically and presumably represent different levels from the localities where *D.* (*P.*) *japonicum* YABE was obtained.

In California the species is common in the Upper Albian (*Mortoniceras*-bearing beds). I have seen, also, several examples of this species in the collections of E. L. PACKARD from central Oregon. An unmistakable example of this species has not yet been found in the Cretaceous of Japan and adjacent areas.

Genus *Pachydesmoceras* SPATH, 1922

Type-species.—*Pachydesmoceras denisonianum* (STOLICZKA).

Pachydesmoceras sp. indet.

Pl. 26, fig. 1; Pl. 27, fig. 1 a, b; Text-fig. 9

Material.—A single large specimen, USNM. 129296, from USGS Mes. loc. 25441. It is still septate at the adoral end. The venter of its outer whorl is partly eroded.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus	(%)
USNM 129296	363.5	160.5	*c.* 150	(0.93)	98.5	(27)
„ (1/2 whorl earlier)	—	*c.* 104.5	87.0	(0.83)	—	

Description.—The visible part of the inner whorl is more compressed and has a narrower venter than the outer whorl. The shell is ornamented with well-marked periodic constrictions, seven per whorl, and numerous minor ribs of unequal length, which are not discernible near the umbilical margin. The constrictions and ribs

are prorsiradiate, arcuate, concave on their anterior side, and bend gently forward on the venter.

The last part of the preserved whorl is inflated on the sides and roundish in cross section. The major ribs become more frequent and coarser than in the preceding part, although the minor ribs still persist.

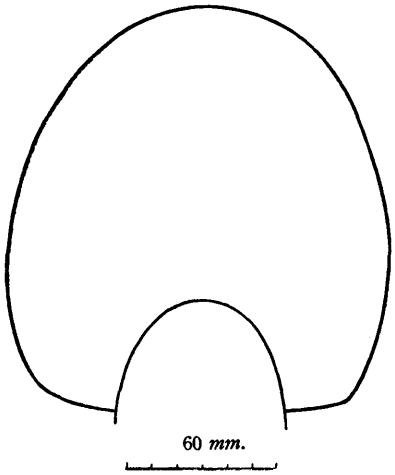


Fig. 9. *Pachydesmoceras* sp. Diagram of the outer whorl in cross section, USNM 129296, from USGS Mes. loc. 25441.

The suture is like that of *Puzosia*, having a large, asymmetrically trifid L and markedly descending auxiliaries. All the elements of the suture are deeply and finely incised.

Remarks.—From these observable characters, this specimen is best referable to *Pachydesmoceras*. The coarse ribs, which are usually developed on the adult whorl of the described species of that genus, are not very well shown on the specimen on hand, probably because it is not yet full-grown. Only a tendency to acquire this character is found on the last part of the preserved whorl. Until a better preserved adult whorl is obtained, accurate identification of the species is impossible.

Pachydesmoceras denisonianum (STOLICZKA) (emended by KOSSMAT, 1898, p. 121, pl. 14 [20], figs. 5 a, b, 6; pl. 15 [21], fig. 5 a, b; STOLICZKA, 1865, p. 133, pl. 66, fig. 2, pl. 66 a), from the Ootatoor group of India, already has coarse ribs at a stage earlier than the outer whorl of this Alaskan specimen. The whorl-section, however, as figured by KOSSMAT, closely resembles that of the present specimen. So the retarded development of the coarse ribs might be merely variation within the same species. The Japanese examples of *Pachydesmoceras* cf. *P. denisonianum* (STOLICZKA) reach a large size. A portion of a huge adult whorl, as illustrated by YABE (1914, p. 72 [2], pl. 12 [1]), could be ragarded as representing the stage which just succeeds the preserved last stage of the Alaskan specimen. I still hesitate, however, to conclude that this Alaskan example is specifically identical with the Indo-Japanese species.

A number of specimens, including the original type, of *Desmoceras colusaense* ANDERSON (1902, p. 96, pl. 5, figs. 128, 129; pl. 10, fig. 200) [=*Puzosia* (*Parapuzosia*) *colusaensis* (ANDERSON) (1958, p. 236, pl. 10, fig. 11)] from the Upper Albian (*Mortoniceras*-bearing beds) of California, are referred to *Pachydesmoceras*, because some of the larger examples show diagnostic features of that genus. The inner whorl of *Pachydesmoceras colusaensis* (ANDERSON) is relatively compressed and

ornamented with minor ribs, being apparently similar to certain species of *Mesopuzosia*. On the visible part of the single Alaskan specimen, which is somewhat weathered on the surface, the ribs are not so distinct as those of the Californian species. This might be, however, due to the condition of preservation. For accurate identification of the species more specimens are needed.

Occurrence.—USGS Mes. loc. 25441.

Family Kossmaticeratidae

The species from the Cretaceous of the McCarthy basin belong to the subfamily Marshallitinae MATSUMOTO, 1955 (see also 1956). In addition to the representatives of *Marshallites* and *Eogunnarites*, there is an interesting form which requires a new generic name, for which *Mccarthyites* is proposed on a later page.

Genus *Marshallites* MATSUMOTO, 1955

Type-species.—*M. compressus* MATSUMOTO

Marshallites cumshewaensis (WHITEAVES)

Pl. 17, figs. 1 a–d, 2 a, b, 3 a, b, 4; Pl. 19, fig. 2 a–c; Pl. 20, fig. 2; Text-fig. 10

1884. *Haploceras cumshewaensis* WHITEAVES, p. 208, pl. 24, fig. 1.
1954. *Holcodiscoides cumshewaensis*, IMLAY and REESIDE, p. 230 (without description and illustration).

Material.—Seventeen specimens from USGS Mes. loc. 25446; a few other comparable specimens from USGS Mes. locs. 25442 and 25443. The illustrated specimens are USNM 129277 (Pl. 17, fig. 4), 129278 (Pl. 17, fig. 1 a–d), 129279 (Pl. 19, fig. 2 a–c; Pl. 20, fig. 2), 129280 (Pl. 17, fig. 3 a, b; Text-fig. 10), and 129281 (Pl. 17, fig. 2 a, b), all of which came from USGS Mes. loc. 25446.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus	(%)
USNM 129279	41.0	18.0	11.5	(0.64)	10.5	(25)
USNM 129280	36.7	16.2	11.5	(0.70)	9.5	(26)
USNM 129281	26.5	12.3	9.3	(0.75)	7.0	(27)

Diagnosis.—The shell is relatively small or of moderate size, fairly narrowly umbilicate and moderately involute. The whorl is high, compressed, with slightly convex flanks, a narrowly arched venter and low, but perpendicular umbilical wall. It is ornamented with numerous, flexuous, narrow and distinct ribs, which are mostly bipartite near the bend slightly below or above the mid-flank and separated by interspaces broader than the ribs themselves; some of the ribs, especially those behind the constriction, show a branching near the umbilical margin and also another bifurcation near the ventrolateral part, resulting in rather irregular aspect

of ribbing in the whole view; the elevations at the umbilical end of the ribs are very faint and not high enough to be called tubercles. The constrictions are prorsiradiate, slightly flexuous, oblique to the ribs behind them and relatively frequent on the outer whorl. The suture is similar to that of *Marshallites compressus* MATSUMOTO (1955, text-fig. 2).

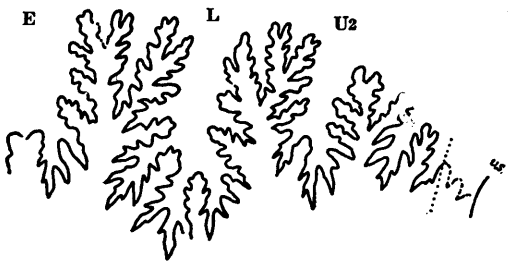


Fig. 10. *Marshallites cumshewaensis* (WHITEAVES). External suture of an Alaskan specimen, USNM 129280, from USGS Mes. loc. 25446, at whorl-height of 11.5 mm. (middle growth-stage).

Remarks.—WHITEAVES' original type (holotype of the species) is so fragmentary that I did not recognize it as an example of *Marshallites* when I established the genus. The specimens from southeast Alaska show, however, enough characters to indicate that the outer whorl matches well with WHITEAVES' description and also that the species is an example of *Marshallites*. The revised diagnosis here described depends much on Alaskan material, as well as on the plaster casts of the holotype donated by the Geological Survey of Canada to Stanford University and to Kyushu University. It would be desirable to get a sufficient number of well preserved specimens from the type locality for a better understanding of the species.

M. cumshewaensis (WHITEAVES) is allied to *M. olcostephanoides* MATSUMOTO (1955, p. 129, pl. 8, figs. 5 a, b, 6, 7 a, b; text-fig. 4), from the Cenomanian of Japan, but has more compressed whorls, a more narrowly arched venter and more frequent constrictions than that species; the ribs in *M. olcostephanoides* are finer and more closely set, with less prominent forward bend near the umbilical margin than in *M. cumshewaensis*.

Compared with *Marshallites compressus* MATSUMOTO (1955, p. 123, pl. 8, figs. 1 a, b, 2; text-figs. 1, 2), from the Cenomanian of Japan, *M. cumshewaensis* (WHITEAVES) has more flexuous ribs which are distinct even on the inner whorls and show clearer bifurcation.

Occurrence.—USGS Mes. loc. 25446.

The holotype is from the north shore of the Cumshewa Islet, Queen Charlotte Island, British Columbia, Canada. The stratigraphical range of the species in that area has not yet been accurately determined.

Marshallites aff. *M. olcostephanoides* MATSUMOTO

Pl. 17, figs. 5 a–c, 6 a, b

Compare:

? 1902. *Holcodiscus theobaldianus* ANDERSON (*non* STOLICZKA), p. 101, pl. 5, figs. 126, 127; pl. 10, fig. 197.

1955. *Marshallites olcostephanoides* MATSUMOTO, p. 129, pl. 8, figs. 5 a, b, 6, and 7 a, b; text-fig. 4.

? 1958. *Kossmaticeras* (*Madrasites*) *voyanum* ANDERSON, p. 241, pl. 37, fig. 5, 5 a, 5 b.

Material.—Two specimens, USNM 129273 (Pl. 17, fig. 5 a–c) and 129274 (Pl. 17, fig. 6 a, b), from USGS Mes. loc. 25443. Two unfigured specimens from USGS Mes. loc. 25442.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus (%)	
USNM 129274	61.5	27.8	20.0	(0.72)	16.0	(26)
USNM 129273	57.0	26.5	19.2	(0.72)	14.2	(25)
Japanese specimens:						
GK H1552 (holotype)	50.9	23.0	19.5	(0.85)	13.2	(26)
GT I-3710 a	25.0	11.0	10.0	(0.91)	7.0	(28)
GT I-3232 b	12.0	5.5	7.0	(1.2)	3.0	(25)
Californian specimen:						
UC 12115	61.2	27.5	22.3	(0.81)	15.6	(25)
„ (1/2 vol. earlier)	40.5	18.0	16.1	(0.88)	10.3	(25)

Descriptive remarks.—The four specimens from Alaska show some variation. Some of them are close to the original Japanese types and others are nearer to the Californian specimen (UC 12115) figured by ANDERSON [*Holcoldiscus theobaldianus*, ANDERSON, 1902, p. 101, pl. 5, figs. 126, 127; pl. 10, fig. 197 (*non* STOLICZKA)= *Kossmaticeras* (*Madrasites*) *voyanum* ANDERSON, 1958, p. 241, pl. 37, fig. 5, 5 a, 5 b]. The Californian specimen has the maximum whorl breadth at mid-flank, whereas the Japanese holotype is broadest near the umbilical margin and has more numerous and finer ribs and more strongly oblique constrictions. The differences are however, slight and could prove to be within the extent of variation of a single species. Although the Alaskan material strongly suggests this, until more specimens are obtained from both California and Japan, I shall call the Alaskan form *Marshallites* aff. *M. olcostephanoides* MATSUMOTO.

Occurrence.—The Alaskan examples here described are from USGS Mes. locs. 25443 and 25442. The types of the species occur in the Cenomanian of Hokkaido (Japan) and South Sakhalin. The stratigraphic position of the Californian specimen is uncertain.

Genus *Eogunnarites* WRIGHT and MATSUMOTO, 1954

Type-species.—*Eogunnarites unicus* (YABE)

Eogunnarites alaskaensis sp. nov.

Pl. 18, fig. 1 a–c; Pl. 19, fig. 1 a, b; Pl. 20, fig. 1 a, b

Types.—Holotype is USNM 129257 (Pl. 19, fig. 1 a, b; Pl. 20, fig. 1 a, b) from USGS Mes. loc. 25444. Paratype is USNM 129258 (Pl. 18, fig. 1 a–c), from the same locality. They are internal molds. Two other deformed specimens from the same locality are referable to this species.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus	(%)
USNM 129257	122.5	47.0	53.0	(1.1)	44.5	(36)
„ (inner whorl)	69.0	29.0	36.0	(1.2)	22.0	(32)
USNM 129258	117.0*	47.0	53.5	(1.1)	36.4	(31)

* There is an impression of at least another whorl, so the shell must originally have been fairly large.

Diagnosis.—The shell is of moderate size to fairly large. It is rather evolute in the early growth-stages but moderately involute in the late growth-stages. The whorls are rounded, broader than high, showing an increase in height as the shell develops first a broadly rounded and then a semicircular venter. During this change the flanks become convex, the umbilical shoulders rounded, and the umbilical walls steep.

The shell is ornamented with numerous, narrow subcostae, which are prorsiradiate and slightly flexuous near the umbilical margin and nearly rectiradiate on the outer half of the whorl, crossing the venter without interruption. The subcostae arise in bundles of three or four from the umbilical shoulder, but there are no prominent tubercles. The periodic constrictions are slightly prorsiradiate, slightly oblique to the subcostae behind them, weak on the septate whorls but strong on the body whorl.

The pattern of the suture is similar to that of *Kossmaticeras*. It is as much incised as that of *Eogunnarites unicus* (YABE).

Remarks.—This species is closely allied to *Eogunnarites unicus* (YABE) (1904, p. 28, pl. 6, fig. 5 a, b; emended by WRIGHT and MATSUMOTO, 1954, p. 126, pl. 8, figs. 2 a–c, 3 a, b, 4 a–c, 5 a, b; text-figs. 14–20) from the Cenomanian of Japan, but has not such prominent umbilical tubercles as in *E. unicus*, and is distinctly more evolute, especially in the early growth-stages. In shell form the present species resembles *Gaudryceras* but the similarity is evidently homeomorphic, considering that it has sutures and constrictions of kossmaticeratid type.

In the generic diagnosis of *Eogunnarites*, WRIGHT and MATSUMOTO (1954, p. 126) referred to the umbilical tubercles. In fact the genus typically should have umbilical tubercles, from which subcostae arise in bundles, but the tubercles in some

species may be weak or not well developed, as in the present species. This is not unreasonable, considering that many species of the Marshallitinae have less developed umbilical tubercles than those of Kossmaticeratinae, (*e.g.* MATSUMOTO, 1955, p. 120). Thus, *Ammonites moraviatoorensis* STOLICZKA (1865, p. 158, pl. 77, fig. 4), from the Ootatoor and Trichinopoly groups of India, which I previously left unassigned (MATSUMOTO, 1955, p. 121), may be included in *Eogunnarites*, although it has small umbilical tubercles only on its inner whorls.

Occurrence.—USGS Mes. loc. 25444.

Genus *Maccarthyites* nov.

Type-species.—*Maccarthyites gracilis* sp. nov. (described below).

Diagnosis.—The shell is small, compressed, fairly involute and fairly narrowly umbilicate. The venter is fastigate and ornamented with tubercles, from which short ribs run radially toward the umbilicus. Small umbilical tubercles may develop on the outer whorl, but are not found on the inner whorl. The periodic constrictions are prorsiradiate on the inner part of the flanks and tend to be radial on the outer part. The suture is of kossmaticeratid type.

Remarks.—The new genus is allied to *Hulenites* MATSUMOTO, 1955 and *Marshallites* MATSUMOTO, 1955, but is clearly distinguished from them by the tubercles at the top of the fastigate venter. In this characteristic feature of the venter the present genus is similar to *Mikasaites* MATSUMOTO, 1956, from the Lower Cenomanian of Japan, but *Mikasaites* has intimate connection with *Eogunnarites* WRIGHT and MATSUMOTO, 1954, in its much inflated and thick whorls. *Maccarthyites* is probably derived from *Hulenites* and is parallel to *Mikasaites*. Thus *Maccarthyites* is an interesting example of the group of genera in the Cenomanian into which the Marshallitinae differentiate.

The similarity of *Maccarthyites* to *Tragodesmoceras* and *Muniericeras* (both of which belong, in my opinion, to the Desmoceratidae) of later geological age and to *Neophlycticeras* (Lyelliceratidae) of earlier age is evidently homeomorphic.

Maccarthyites gracilis sp. nov.

Pl. 23, fig. 6 a–d

Holotype.—USNM 129286 from USGS Mes. loc. 25445.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus (%)	
USNM 129286	21.4	10.7	6.9	(0.6)	5.0	(23)

Diagnosis.—The shell is small, moderately involute and flatly discoidal. The

umbilicus is fairly narrow and shallow. The whorl is compressed, with a narrow, fastigate venter, flattened flanks, subangular umbilical shoulders, and low but steep (nearly perpendicular) umbilical wall. Periodic constrictions are well marked, prorsiradiate and slightly sinuous on the umbilical half of the flanks and then radiate on the outer half of the whorl.

Small bullate tubercles are developed on the top of venter. From them extend short ribs perpendicular to the siphonal line. These ribs are mostly short, especially in the early growth-stages, but later some of them nearly reach the umbilical margin and show a slight flexuousity. The ribs are narrow, separated by wider interspaces, and may be slightly elevated at their umbilical ends behind constrictions. The constrictions are bordered by narrow ribs.

The suture, so far as observable, is of the kossmaticeratid type, resembling that of *Marshallites compressus* MATSUMOTO.

Remarks.—Only a single specimen is at my disposal. However the specimen is so characteristic that establishment of a new genus and a new species is justified.

The species is allied to the immature forms of *Hulenites reesidei* (ANDERSON) (1938, p. 187, pl. 38, figs. 2, 3), from the Albian of California, and also of *Marshallites compressus* MATSUMOTO (1955, p. 123, pl. 8, figs. 1 a, b, 2; text-figs. 1, 2), from the Cenomanian of Japan, but is characterized by its tuberculate, fastigate venter and shorter and less closely spaced ribs.

Occurrence.—USGS Mes. loc. 25445.

Family Placenticeratidae

Genus *Proplacenticeras* SPATH, 1926

Type-species.—*Proplacenticeras fritschi* (DE GROSSOUVRE).

Proplacenticeras sp. indet.

Pl. 24, fig. 2 a, b; Pl. 25, fig. 1

Material.—A single large specimen, USNM 129297, from USGS Mes. loc. 25441.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus (%)	
USNM 129297	*c.* 380 (restored)	220	80.5	(0.36)	19.5	(5)
	321.5	182.0	80.5	(0.44)	—	
	—	120.0	43.0	(0.36)	—	

Descriptive remarks.—As the large outer whorl is almost wholly septate, and only a small fraction of the body whorl is preserved at its adoral end, the full-grown shell must have reached nearly 500 mm. in diameter.

The shell is discoidal, much involute, and narrowly umbilicate. The whorl is much higher than broad; the flanks are only slightly convex, with the maximum whorl-breadth near the middle, from which the whorl narrows fairly rapidly towards

the venter but very slowly towards the umbilicus. The venter is very narrow, but rounded, without ventrolateral keels on the observable part of the outer whorl. The umbilical shoulder is subangular, and the umbilical wall slopes down steeply.

The surface of the exposed part of the shell is nearly smooth, only a short, crescentic riblet being discernible near the body whorl. No umbilical tubercles are discernible.

The external suture is well exposed. It is much complicated and incised, showing a pattern similar to that on the larger outer whorl of *Proplacenticeras bolli* (HYATT) (1903, pl. 42, fig. 2). It is evidently much more complicated than the suture of *Hypengonoceras warthi* (KOSSMAT) (1897, pl. 20 [6], fig. 8), but the major branching follows the pattern of *Hypengonoceras*, showing deep bipartition of the saddles. The "pincer-like bifid folioles", as adequately expressed by WRIGHT (*in* MOORE [Editor], 1957, p. L390), of *Hypengonoceras* are furthermore finely subdivided in this specimen.

As many placenticeratids have smooth outer whorls, regardless of differences in ornamentation on the inner whorls, it is difficult to determine the specific name, without seeing the inner whorls. Unfortunately only a single specimen is available and the sandy rock matrix of the specimen is so well cemented that the inner whorl cannot be inspected.

It is interesting to note, however, that this smoothish outer whorl resembles the large outer whorl of *Proplacenticeras bolli* (HYATT) (1903, p. 214, pl. 42, fig. 2), from the lowest Turonian (or possibly uppermost Cenomanian), lower part of the Eagle Ford shale near Dallas, Texas.

Occurrence.—USGS Mes. loc. 25441.

This may be the first record of the occurrence of *Proplacenticeras* in the Northern Pacific region. Such a record would not be unlikely, considering the *Hypengonoceras*, the earliest member of the Placenticeratidae, occurs in the Lower Ootatoor group of India and also an allied ammonite in the probable Upper Albian of Sakhalin (MATSUMOTO, 1942, p. 144).

Family Tetragonitidae

Subfamily Gaudryceratinae

Whether this group is ranked as a family or as a subfamily under Tetragonitidae is still debatable. As this is not the place to discuss the problem, I follow the recent scheme of WRIGHT (*in* MOORE [Editor], 1957, p. L200).

Genus *Parajaubertella* MATSUMOTO, 1942

Type-species.—*Parajaubertella kawakitana* MATSUMOTO.

Parajaubertella kawakitana MATSUMOTO

Pl. 23, fig. 1 a–d; Text-fig. 11

1942. *Parajaubertella kawakitana* MATSUMOTO (1942 c), p. 667, text-fig. 2 a–d.

Material.—A single small, probably immature, shell, USNM 129282, from USGS Mes. loc. 25446.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus (%)	
USNM 129282	29.0	13.0	20.4	(1.6)	8.7	(30)
GT I-3717 (paratype)	28.5	11.8	20.3	(1.7)	8.3	(29)

Descriptive remarks.—The specimen is indistinguishable from the inner whorl of the holotype and of other small, probably immature specimens of *Parajaubertella kawakitana* from the Infragyliakian (primarily Lower Cenomanian) of South Sakhalin and Hokkaido in its depressed whorl, the broadly arched venter, the angulate umbilical shoulder, and the deep umbilicus. For accurate identification the inner and outer whorls in association are desirable. However, the diagnostic features are so well shown that the Alaskan specimen is regarded as an immature example of that species.

Occurrence.—The Alaskan example here described is from USGS Mes. loc. 25446. The holotype of the species is from loc. N94 b, bed Kx or Ky, upper part of the

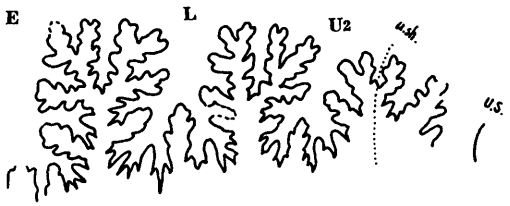


Fig. 11. *Parajaubertella kawakitana* MATSUMOTO. External suture of an Alaskan specimen, USNM 129282, from USGS Mes. loc. 25446, at whorl-height of 8.0 mm. (immature). Dotted line, position of the umbilical shoulder.

Kawakita group in the Naibuchi valley, South Sakhalin. This part is referred to the zone of *Desmoceras kossmati* (Infragyliakian), which corresponds primarily to Lower Cenomanian, but could include also the uppermost Albian. Other examples are from the same bed in the same area, also bed IIa of the Abeshinai-Saku area, Hokkaido and beds IIb 2, IId, IIe, lower IIf of the Shiyubari valley, Hokkaido, indicating that the species is not uncommon in the Lower Cenomanian, but that it may range down to the Upper Albian in Japan and Sakhalin.

Parajaubertella imlayi sp. nov.

Pl. 21, figs. 1 a–d, 2; Text-figs. 12, 13

Material.—Two specimens of dissimilar size from USGS Mes. loc. 25445. Holotype: USNM 129259 (Pl. 21, fig. 1 a–d; Text-fig. 13); paratype: USNM 129284 (Pl. 21, fig. 2; Text-fig. 12).

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus (%)	
USNM 129259	*c.* 95	44.0	*c.* 47	(1.07)	26.0	(27)
„ (1/4 whorl earlier)	75.5	35.0	37.6	(1.07)	20.2	(27 –)
„ (3/4 „ „)	—	19.7	22.7	(1.15)	12.0	
„ (1+3/4 „ „)	—	6.8	11.5	(1.69)	5.5	
USNM 129284 (inner whorl)	30.5	13.0	18.2	(1.4)	—	

Diagnosis.—The shell is of moderate size. The inner whorl is much depressed, with a broadly rounded venter and inflated flanks. As the shell grows, the whorl height increases, so the outer whorl is only slightly broader than high, with a

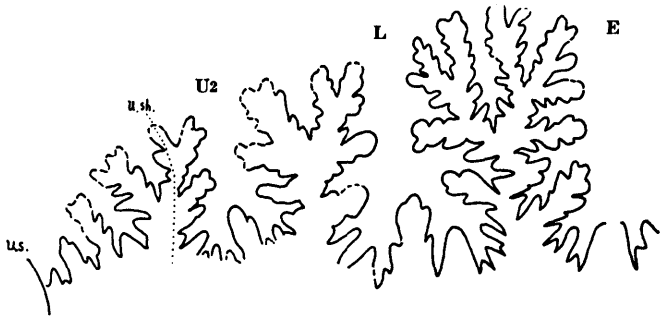


Fig. 12. *Parajaubertella imlayi* sp. nov. External suture of a paratype, USNM 129284, from USGS Mes. loc. 25445, at whorl-height of 7.0mm. Dotted line, position of the umbilical shoulder.

rounded venter and slightly convex flanks. The umbilical shoulder is subangular; the umbilical wall is high and nearly perpendicular to the plane of coiling.

A set of two or three constrictions are periodically developed on the relatively outer whorl. The body whorl itself is ornamented with low and broad ribs separated by narrow interspaces.

The suture is of the *Gaudryceras* pattern, being much incised. The internal lobe is of the characteristic type seen in *Gaudryceras* and allied genera.

Remarks.—At first sight this species looks like *Anagaudryceras sacya* (FORBES) [=*Ammonites buddha* FORBES], especially in its adult whorl, but *A. sacya* (FORBES) has more rounded whorls and a rounded umbilical wall. The subangular umbilical shoulder and depressed inner whorl indicate closer affinity to *Parajaubertella kawakitana* MATSUMOTO, although the present species has not so angular an umbilical shoulder as has the inner whorl of that species. The adult whorl of *P. kawakitana*

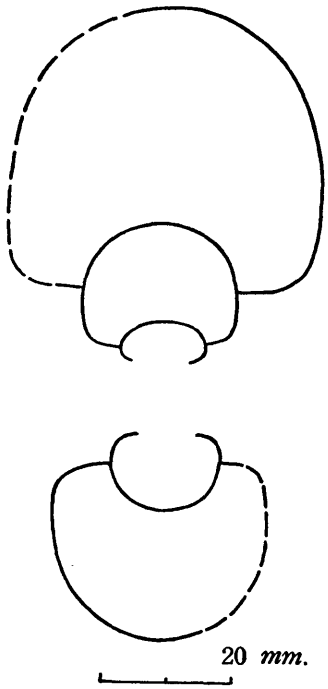


Fig. 13. *Parajaubertella imlayi* sp. nov. Diagram of cross section of the holotype, USNM 129259, from USGS Mes. loc. 25445.

is, also, apparently similar to that of *Anagaudryceras sacya*, as is exemplified by the holotype (see MATSUMOTO, 1942 c, text-figs. 2 a–d). Therefore, I regard the present species as another example of *Parajaubertella*.

In the cross section of the outer whorl, this species is similar to *Tetragonites glabrus* (JIMBO), but the resemblance is superficial. The latter species has a suture of *Tetragonites epigonus* type and shows a backward sinus in the growth-line on the venter.

Occurrence.—USGS Mes. loc. 25445. This is higher than USGS Mes. loc. 25446, where *Parajaubertella kawakitana* was obtained. In the recent collections from the Cretaceous of Hokkaido, Japan there are several examples which are referable to the present species.

Genus *Anagaudryceras* SHIMIZU, 1934

Type-species.—*Anagaudryceras sacya* (FORBES).

Anagaudryceras sacya (FORBES)

Pl. 22, figs. 4, 5 a–c

1846. *Ammonites sacya* FORBES, p. 113, pl. 14, fig. 10.
1846. *Ammonites buddha* FORBES, p. 112, pl. 14, fig. 9.
1865. *Ammonites sacya*, STOLICZKA, p. 154, pl. 75, figs. 5-7 (not pl. 76, figs. 2-3).
1884. *Lytoceras sacya*, WHITEAVES, p. 203, pl. 25.
1895. *Lytoceras (Gaudryceras) sacya*, KOSSMAT, p. 119.
? 1902. *Lytoceras (Gaudryceras) sacya*, ANDERSON, p. 82.
1903. *Gaudryceras sacya*, YABE, p. 17.
? 1917. *Gaudryceras sacya*, CRICK, p. 170, pl. 10, fig. 13, 13-A.
1934. *Anagaudryceras sacya*, SHIMIZU, p. 67.
1954. *Anagaudryceras sacya*, WRIGHT and MATSUMOTO, p. 112.

Material.—An adult specimen, USNM 129255 (Pl. 22, fig. 5 a–c), from USGS Mes. loc. 25442. Its body whorl is unfortunately half eroded away. Three immature specimens from USGS Mes. loc. 25443, one of which, USNM 129256, is illustrated (Pl. 22, fig. 4); others (USNM 129293 a, b) are still smaller.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus	(%)
USNM 129255	*c.* 51	23.0	24.0	(1.0)	18.3	(36)
USNM 129293 a	21.0	7.7	11.3	(1.4)	8.5	(40)

Descriptive remarks.—FORBES (1846) unfortunately established this species on a small, immature specimen, and gave another specific name, *Ammonites buddha,* for a fragment of a probable body whorl. The specific identity of the two could not be concluded from the insufficient number of specimens from India at FORBES' date. However, basing their views on the subsequent collections from India, STOLICZKA (1865) and then KOSSMAT (1895) have proved that identity and redefined the species *sacya.* The emended definition of "*Gaudryceras*" *sacya* has been confirmed by WHITEAVES, who has illustrated another good example of its adult shell. YABE (1903) also holds the same view as KOSSMAT. SHIMIZU (1934, not 1935) has established *Anagaudryceras* for YABE's (1903) "subgroup of *Gaudryceras sacya* (FORBES)". Shimizu (1935) may have been right in separating a part of STOLICZKA's *Ammonites sacya* (1865, pl. 76, figs. 2–3) from the true *sacya,* but his 1935 designation of *A. utaturensis* SHIMIZU as the type-species of *Anagaudryceras* is obviously illegal, even if *utaturensis* was considered valid. The inconsistency of his statements has led to confusion in the understanding of *A. sacya* and of the genus *Anagaudryceras.*

In Japan there are a number of specimens of *Anagaudryceras sacya* (FORBES), including both the immature shells, which are just like FORBES' smaller specimen (FORBES, 1846, pl. 14, fig. 10), and the adult shells, the body whorls of which show ornament just like FORBES' larger fragment (1846, pl. 14, fig. 9). Therefore I agree with KOSSMAT's (1895) redefinition of the species *sacya.*

The Alaskan specimens before me support this view, although they are not so numerous as the Japanese examples.

The whorl is somewhat broader than high in the immature stages, nearly as high as broad in the middle stage, and even higher than broad in the adult. In general the whorl is rounded and the umbilicus is moderately wide, although there are changes with growth and variation by individuals.

The inner whorls have periodic ribs (furrows on the mold) in addition to the very fine lirae on the surface of the shell. They run almost radially, except near the rounded umbilical shoulder, where they curve forward; they do not show the distinct biconcavity of the ribs of *Gaudryceras* (s. s.), the group of *G. mite* (HAUER).

The periodic furrows become more frequent adorally on the outer whorl, and finally the adult body whorl is ornamented with band-like, broad ribs which are separate by narrow furrows. The broad ribs are mostly rather flat on top, but occasionally somewhat rounded, foreshadowing the ribs of *Anagaudryceras limatum* (YABE). Even the relatively small number of specimens from Alaska show this feature. In Japan there is an intermediate form between the two species, and consequently I am not agreeable with the view of separating them into different genera, *Anagaudryceras* and *Paragaudryceras.*

Occurrence.—USGS Mes. loc. 25442, 25443, and 25445. MOFFIT (1938) already

reported this species from USGS Mes. loc. 9481, 9487, 9492, etc. On examining the specimens from these localities, I think them to be referable to, or at least comparable with, *Anagaudryceras sacya* (FORBES) in the revised definition. The one from USGS Mes. loc. 14514 is not *A. sacya*, but *Kossmatella* sp.

The species is widespread in the Albian and Cenomanian of the Indo-Pacific region.

Anagaudryceras madraspatanum (STOLICZKA)

Pl. 22, fig. 3 a, b

1865. *Ammonites madraspatanum*, STOLICZKA, p, 151, pl. 75, fig. 2, 2 a–c.
1895. *Lytoceras (Gaudryceras) madraspatanum*, KOSSMAT, p. 128.
? 1923. *Gaudryceras* aff. *madraspatanum*, SPATH, p. 22, pl. 1, fig. 4 a, b; text-fig. 5.
1942. *Anagaudryceras madraspatanum*, MATSUMOTO, p. 666.

Material.—A single specimen, USNM 129283, from USGS Mes. loc. 25442.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus	(%)
STOLICZKA's type	30.0	12.0	13.0	(1.08)	10.8	(36)
USNM 129283	—	13.5	14.0	(1.03)	—	

Descriptive remarks.—This single specimen is undoubtedly referable to *Anagaudryceras madraspatanum* (STOLICZKA) by the circular cross section of the whorl, little involution, fairly wide umbilicus, fine and dense striae and lirae on the surface of the shell that curve gently forward near the umbilical margin, but are nearly rectiradiate on the main part of the whorl, and the faint constrictions.

From the curvature of the shell, as well as other characters, this species is better assigned to *Anagaudryceras* than to *Gaudryceras*. The lirae are more distinct in this species than in *A. sacya* (FORBES), whereas the periodic ribs (or constrictions) are better developed in the latter species. No adult whorl of *A. madraspatanum* has been reported.

Occurrence.—The locality of the Alaskan example is USGS Mes. loc. 25442. The original type of the species came from the Lower Ootatoor group of India (*teste* KOSSMAT, 1895). The representative in the Japanese province is from the middle part of the Cenomanian.

Genus *Zelandites* Marshall, 1926

Type-species.—*Zelandites kaiparaensis* Marshall.

Zelandites inflatus sp. nov.

Pl. 23, figs. 2 a–d, 3 a–c, 4 a–c, 5 a–d;
Pl. 24, fig. 1 a–c; Text-fig. 14

Material.—Holotype is USNM 129268 (Pl. 23, fig. 5 a–d; Text-fig. 14) from USGS

Mes. loc. 25445; paratypes USNM 129269 (Pl. 24, fig. 1 a–c) from USGS Mes. loc. 25445, and also USNM 129270 (Pl. 23, fig. 4 a–c), 129271 (Pl. 23, fig. 3 a–c), and 129272 (Pl. 23, fig. 2 a–d) from USGS Mes. loc. 25443. In addition to them seven specimens, USNM 129292 a–g, from USGS Mes. loc. 25443; two, USNM 129290, from USGS Mes. loc. 25446; six, USNM 129287, from USGS Mes. loc. 25445; and one, USNM 129295, from USGS Mes. loc. 25444 are referable to the present species.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus	(%)
USNM 129268	34.4	16.3	—	—	8.4	(24)
„ (at the last septum)	31.4	14.1	9.3	(0.66)	7.9	(25)
USNM 129269	*c.* 51.5	22.2	14.9	(0.67)	12.9	(*c.* 25)
USNM 129271	28.3	13.0	8.9	(0.68)	6.3	(23)
USNM 129272	19.3	9.8	7.1	(0.72)	4.7	(25)

Diagnosis.—The shell is small, involute, and narrowly umbilicate, with fairly rapid increase of whorl-height. The whorl, except in the very early growth-stage, is higher than broad, and convergent in cross section, with a narrowly arched venter. In spite of the high whorl, the flanks are inflated, especially near the subrounded umbilical shoulder, from which the umbilical wall slopes down fairly steeply, forming a shallow, crater-like umbilicus.

The surface of the thin shell is nearly smooth or finely lirate, except for periodic constrictions. The constrictions are frequent on the adult whorl, and less so on the immature one. They are prorsiradiate and somewhat sigmoidal, with forward inclinations on the umbilical wall and on the ventral part. The flexuosity is more remarkable in the adult stage than in the immature. The growth-lines on the surface of the shell show curvature parallel to the constrictions.

The suture is of the *Zelandites* type, with numerous descending auxiliary elements. L is larger and deeper than E and somewhat asymmetrically bifid, with a larger outer branch. The external and lateral saddles adjacent to L are much asymmetrically bifid, with the smaller branches situated on both sides of L.

Remarks.—Among the hitherto described species of *Zelandites*, two should be brought into comparison with the present species. One is *Z. varuna* (FORBES) (1846, p. 107, pl. 8, fig. 5 a–c; KOSSMAT, 1895, p. 161 [65], pl. 16 [23], fig. 4 a–b; pl. 17 [3], fig. 8), from the Valudayur beds of India, and the other is *Z. odiensis* (KOSSMAT) (1895, p. 129 [23], pl. 18 [43], fig. 1 a–c; pl. 19 [5], fig. 5; also (?) CRICK 1907, p. 171, pl. 10, fig. 14, 14 a), from the Lower Ootatoor group of India and other Indo-Pacific areas, including Japan. The former has a convergent whorl, with the maximum breadth slightly above the umbilical margin, while the latter has the maximum breadth near the mid-flank, without noticeable umbilical shoulder. Therefore, in shell-form the present species is rather similar to *Z. veruna* (FORBES) of much later age than to the nearly contemporary *Z. odiensis* (KOSSMAT).

If we compare more carefully the present species with *Z. varuna* (FORBES), however, we can distinguish the two. As is shown in the figures of measurements, *Z. varuna* (FORBES) is more narrowly umbilicate and more compressed than the

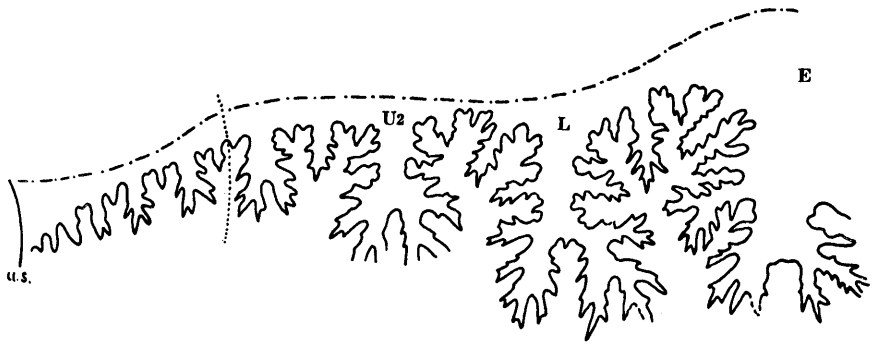


Fig. 14. *Zelandites inflatus* sp. nov. The external suture of the holotype, USNM 129268, from USGS Mes. loc. 25445, at whorl-height of 14.1 mm. (the last suture). Dotted line, position of the umbilical shoulder; Broken line, curvature of the constriction.

present species. The umbilical shoulder is better developed and the constrictions appear earlier and are better marked, generally more frequent, more flexuous, and more prorsiradiate in the present species than in *Z. varuna* (FORBES).

Z. varuna var. *japonica* MATSUMOTO (1938 b, p. 140, pl. 14, figs. 5–7, text-fig. 1 a–d), probably a geographical subspecies, from the Upper Hetonaian (Maestrichtian) of South Sakhalin, which is based on better material than the Indian form, is clearly distinguished from the present species by its more compressed and more involute shell-form and by the curvature of the ornamentation.

Z. odiensis (KOSSMAT) was established on a single, small, probably immature, shell. We do not know well what kind of characters this species shows in the adult stage. However, the immature example of the present species as small as the Indian type of *Z. odiensis*, shows such diagnostic features as the inflation of shell near the umbilical shoulder and the flexuous and prorsiradiate constrictions. Therefore, the two species are clearly distinguishable.

I have recognized Japanese examples of the present species in recent collections from the Cenomanian of Hokkaido, although they have not been illustrated.

Occurrence.—Fairly common at USGS Mes. loc. 25445; and also found at USGS Mes. locs. 25444, and 25446. In Japan it is common in the subzone of *Mantelliceras* n. sp. of Hokkaido, and ranges up slightly higher.

Subfamily Tetragonitinae

Genus *Tetragonites* KOSSMAT, 1895

Type-species.—*Tetragonites timotheanus* (PICTET).

Tetragonites sp. nov. (?)

Pl. 22, figs. 1 a–c, 2 a–c; Text-fig. 15

Material.—In the collection there are six specimens which are described under this heading. The illustrated specimens are USNM 129275 (Pl. 22, fig. 1 a–c), from USGS Mes. loc. 25443 and 129276 (Pl. 22, fig. 2 a–c; Text-fig. 15), from USGS Mes. loc. 25444.

Measurements (in mm.).—

Specimen	Diameter	Height	Breadth	(B/H)	Umbilicus	(%)
USNM 129276	36.0	14.7	18.2	(1.2)	9.0	(25)
USNM 129275	21.5	9.0	11.0	(1.2)	5.5	(25)
An adult shell from USGS Mes. loc. 9492	110.0	53.0	59.0	(1.1)	26.5	(24)

Description.—The notable features of this species are the tetragonal cross section of the whorl, nearly parallel and flattened flanks, the broadly arched venter, which is nearly flat on the immature whorl and broadly rounded on the adult body whorl, the vertical and high umbilical wall, the fairly narrow umbilicus, and the relatively infrequent constrictions, which run obliquely forward on the flank and show at first a slight, but later a considerable backward sinus on the venter.

Remarks.—From these characters, I am inclined to regard this as a new species and distinguishable from *Tetragonites timotheanus* (PICTET) (redefined by SPATH, 1923, p. 25, pl. 1, figs. 5, 6; text-fig. 6; with synonymy) by its parallel, instead of convergent, flanks. Only a crushed example in the Alaskan specimens happens to show a convergent cross section, which is obviously due to secondary deformation. The specimens in the older collections, which were listed by MOFFIT (1938, table facing p. 80) under the specific name *T. timotheanus*, such as from USGS Mes. locs. 9481, 9485, 9487, and 9492, are not typical *T. timotheanus*, but rather belong to the same species as described here.

One of the Japanese species, which was briefly mentioned in my preliminary note under the heading of *Tetragonites* sp. nov. (?) (MATSUMOTO, 1942 d, p. 671, without illustration), is identical with the Alaskan species.

Tetragonites kiliani JACOB (1908, p. 21, pl. 1, fig. 9 a, b; text-fig. 8), from the Albian of France, is allied to the present species in its parallel sides. However, that species is described as having a wide umbilicus and well-marked and numerous constrictions. Unfortunately, *T. kiliani* is based on a small, presumably immature, specimen, and its range of variation is not well known. Therefore I still hesitate to establish a new specific name for the present species.

Another point that should be remarked in connection with the present species is the character of the suture. In addition to the external sutures, which are well exposed on several specimens, I have examined the internal sutures of the two specimens, both of which have only one pair of internal lateral lobes. The elements

of the suture can be expressed with a formula [I, U_1, U_3 (=S), U_2, L, E], as in most of the Tetragonitinae (Text-fig. 15). SPATH (1925) separated *Epigoniceras* from *Tetragonites* on account of the difference in the character of the internal sutures. He depended, however, on the illustration of KOSSMAT (1895) of the Indian specimens. Drawings in KOSSMAT's monograph are in general very good, but in illustra-

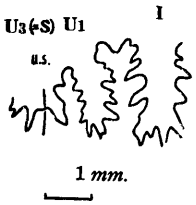


Fig. 15. *Tetragonites* sp. nov. (?). Internal suture of an Alaskan example, USNM 129276, from USGS Mes. loc. 25444.

tion of sutures it is often very difficult to show their actual state, as the pattern found on the curved plane has to be more or less modified in drawing on flat paper. I have examined the suture of a specimen from St. Croix, Switzerland (Text-fig. 16), which is referable to *Tetragonites timotheanus* (PICTET), in the collection of the Museum of Comparative Zoölogy at Harvard College. The suture is again [I, U_1, U_3 (=S), U_2, L, E], with only one pair of internal lateral lobes, and remarkably descending "auxiliaries" (i.e. subdivisions of U_3 on both internal and external sides of the umbilical line). The pattern of the lobes and saddles are of *Tetragonites* type in every detail. Although I have used the generic name *Epigoniceras* for the Senonian and Turonian species, I am now quite doubtful about the distinction of *Epigoniceras* from *Tetragonites*. In other words *Epigoniceras* SPATH, 1925, can be regarded as a synonym of *Tetragonites* KOSSMAT, 1895. In fact, the present species is fairly similar to "*Epigoniceras*" *glabrum* var. *problematica* MATSUMOTO (1942 d, p. 673, fig. 1 a, b), of Santonian-Campanian age, although it is distinguished from that species by its broader whorls and less rounded venter. HOWARTH (1958, p. 9) has independently reached a conclusion that the generic name

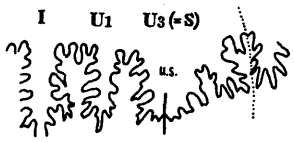


Fig. 16. *Tetragonites timotheanus* (PICTET). Internal suture and a portion of external suture at whorl-height of 14.5 mm. An example from St. Croix, Switzerland in the collection of the Museum of Comparative Zoölogy at Harvard College, drawn by kind permission of the Curator.

Epigoniceras is unnecessary. His conclusion is based on the observation quite similar to mine. Therefore I agree with HOWARTH's view.

Considering that *Anagaudryceras* and *Zelandites* range from Upper Albian to

Maestrichtian, and *Gaudryceras* ranges from Cenomanian to Campanian, it would not be surprising to find that *Tetragonites* has a long range from Albian to Upper Senonian.

Occurrence.—USGS Mes. locs. 25444, 25443, 25442, and 25446. Specimens are not numerous in the collection here dealt with, but there are some more localities in the upper Chitina Valley as mentioned above. The Japanese examples occur in the Cenomanian.

Family Anisoceratidae

Genus *Anisoceras* PICTET, 1854

Type-species.—*Anisoceras saussureanus* (PICTET).

Anisoceras sp. nov. (?)

Pl. 28, fig. 1; Pl. 29, fig. 2 a–c

Material.—A large, but imperfect, specimen, USNM 129298, from USGS Mes. loc. 25441. The body whorl and the earliest part are missing.

Measurements (in mm.).—

Specimen	Height	Breadth
USNM 129298		
Anterior end of the elongated part	85.0	82.3
Posterior end of the coiled part	44.5	48.0

Descriptive remarks.—The large size of the shell is remarkable. If the body whorl were preserved, the specimen would be very large. From the helicoid part extends the elongated arm, which is not strictly straight but rather arcuate, so far as the preserved part is concerned. The whorl is nearly circular in cross section, although it is slightly modified in the helicoid part.

The shell is ornamented with numerous, crowded, minor ribs, frequent major ribs, and four rows of tubercles developed on the major ribs. The major ribs are low and covered with two to four minor ribs, which join in loop or ribbon manner at the tubercles. The minor ribs number from three to five in each interspace between the major ribs. They are separated by minor interspaces, which are as narrow as or narrower than the minor ribs. The ventral paired tubercles are rounded at their bases; the lateral tubercles are small and tend to be weakened.

The sutures are not completely exposed, but, so far as the exposed part is concerned, they are very complex, and show the pattern of *Anisoceras* type.

In the crowded minor ribs and the frequent major ribs this species resembles *Anisoceras pseudoelegans* PICTET and CAMPICHE (1861, p. 69, pl. 1, fig. 5 a, b; see synonymy, SPATH 1939, p. 556, 557), but is distinguished from it by a circular cross section and still denser ribbing. In the tendency of the lateral tubercles to weaken, it is similar to *Anisoceras exoticum* SPATH (1939, p. 555, pl. 59, fig. 7; pl. 60, fig. 4;

pl. 63, fig. 2; text-fig. 115), but that species has more widely spaced major ribs, more numerous minor ribs on the major interspaces, and coarser minor ribs, which are weakened on the venter.

The present species seems to be different from the hitherto described species of the Indo-Pacific region, which are, however, based on imperfect specimens. Another possible example of this species is a highly crushed specimen from USGS Mes. loc. 14038, which specimen has crowded minor ribs, frequent major ribs, and four rows of tubercles. It is unfortunately too small and too poorly preserved for exact comparison with the specimen here described, although it might be the earlier portion of the same species.

It is highly possible that the described specimen represents a new species of *Anisoceras*. However, as only a single, imperfect specimen is at my disposal, I hesitate to propose a new name.

Occurrence.—The recorded locality number is USGS Mes. loc. 25441, but how many feet of beds this locality includes is not exactly known. In other words, it is not certain whether or not this species came from the same bed as, for instance, *Proplacenticeras* sp.

Concluding Remarks

Table 2 is a summarized list of the ammonites recently obtained from the Cretaceous strata of the upper Chitina Valley, southeastern Alaska, which are described in this paper.

Table 2.—List of ammonites and USGS Mesozoic localities in the Nizina-McCarthy area, upper Chitina Valley, Alaska

		Localities
(1)	*Partschiceras? japonicum* (MATSUMOTO)	25443, 25445
(2)	*Neophylloceras seresitense* (PERVINQUIÈRE)	25442, 25445
(3)	*Desmoceras* (*Pseudouhligella*) *japonicum* YABE	25443*, 25445, 25446
(4)	*Desmoceras* (*Pseudouhligella*) *dawsoni* WHITEAVES	25441*, 25442*
(5)	*Pachydesmoceras* sp. indet.	25441
(6)	*Marshallites cumshewaensis* (WHITEAVES)	25446*, 25442(?), 25443(?)
(7)	*Marshallites* aff. *M. olcostephanoides* MATSUMOTO	25442, 25443
(8)	*Eogunnarites alaskaensis* sp. nov.	25444
(9)	*Maccarthyites gracilis* gen., sp. nov.	25445
(10)	*Proplacenticeras* sp. indet.	25441
(11)	*Parajaubertella kawakitana* MATSUMOTO	25446
(12)	*Parajaubertella imlayi* sp. nov.	25445
(13)	*Anagaudryceras sacya* (FORBES)	25442, 25443, 25445 (cf.)
(14)	*Anagaudryceras madraspatanum* (STOLICZKA)	25442
(15)	*Zelandites inflatus* sp. nov.	25443, 25444, 25445*, 25446
(16)	*Tetragonites* sp. nov. (?)	25442, 25443, 25444, 25446
(17)	*Anisoceras* sp. nov. (?)	25441

* Indicates the locality where the species is represented by a relatively large number of specimens in the collection.

These ammonites belong to the families Phylloceratidae [(1) and (2)], Desmoceratidae (s. l.) [(3)—(5)], Kossmaticeratidae [(6)—(9)], Placenticeratidae [(10)], Tetragonitidae (s. l.) [(11)—(16)], and Anisoceratidae [(17)]. Of the 17 species, 10 known in Japan and Sakhalin are (1), (2), (3), (7), (11), (12), (13), (14), (15), and (16), and at least 6 found in the area including British Columbia, Oregon and California are (2), (4), (6), (7), (13), and (16). The species known only from the areas surrounding the northern Pacific Ocean (i.e. Japan, southern Alaska, British Columbia, Oregon, California, etc.) and not reported in other parts of the world are (1), (3), (4), (5?), (6), (7), (8), (9), (11), (12), (15) and (17?). These 12 species are about 70 per cent. of the whole faunule. At least two species restricted to Alaska, according to present knowledge, include *Eogunnarites alaskaensis* and *Maccarthyites gracilis*. No elements of the families Acanthocerataceae and Hoplitaceae are found in the collection, except for a species of *Proplacenticeras*.

The number of known species may change as our studies proceed. However, all of the facts indicate that the faunule is typical of the northern Pacific province and has intimate connections with Japan and Sakhalin on one hand and with the west coast of North America from British Columbia to California on the other.

As to age correlation, the species common with those of the Japanese province are reliable, since their ranges are relatively well established in Japan. All ten species found in common between Alaska and Sakhalin-Japan are known in the Cenomanian of the latter province, although the long ranged species, such as *Anagaudryceras sacya* (FORBES) and *Anagaudryceras madraspatanum* (STOLICZKA), range down into the Albian. Thus all the strata represented by localities USGS 25443–25446 are referable as a whole to the Cenomanian. The strata represented by localities USGS 25441 and 25442 can be either the Upper Albian or the Cenomanian, because none of the species from those localities are the restricted Cenomanian indices, but belong to long-ranged genera. In California *Desmoceras* (*Pseudouhligella*) *dawsoni* WHITEAVES occurs in the Upper Albian, often associated with species of *Mortoniceras*. Possibly the two localities (25441 and 25442) could represent about 1000 feet thickness of strata ranging from Upper Albian to Cenomanian.

Since the members of Acanthoceratidae, Hoplitidae, Hystatoceratidae and Schloenbachiidae are not found in the faunule, it is rather difficult to determine what parts of the Cenomanian the first four localities near the Chitistone River represent. However, it should be noted that the relatively lower part that is represented at USGS loc. 25446 contains *Parajaubertella kawakitana* MATSUMOTO. This species occurs in the zone of *Desmoceras kossmati* MATSUMOTO in Japan and Sakhalin. The zone defines the Infragyliakian substage in the Japanese scale. The Infragyliakian was once considered as in the intermediate position between Upper Albian and Lower Cenomanian. However, the zone has recently been found to contain in its upper part several species of *Mantelliceras* and, although in an

isolated area of Kyushu, such a characteristic form as *Graysonites* sp., which is referable to Lower Cenomanian *G. lozoi* YOUNG (1958, p. 172, pl. 1, figs. 1–11; text-fig. 1 b, c, d, f). The unmistakable Upper Albian species, such as *Mortoniceras imaii* (YABE) and *Mortoniceras* (*Deiradoceras*) sp. occur in the upper part of the Neomiyakoan (below the Infragyliakian) in Japan. Therefore it is preferable to refer the zone of *Desmoceras kossmati* (i.e. Infragyliakian) to the Lower Cenomanian rather than to the Upper Albian. Consequently the relatively lower part of the section near the Chitistone River as represented at USGS loc. 25446, may be referable to the Lower Cenomanian. It is, however, still difficult to fix the actual boundary of the Albian and Cenomanian in the Cretaceous succession of the circum-Pacific areas, since we have not yet been successful in obtaining good indices of the zones of *Stoliczkaia dispar* and *Mantelliceras martimpreyi*. The same problem applies to the Cretaceous of Alaska.

Another point which should be mentioned in this concluding chapter concerns the subfamily Marshallitinae. The subfamily is the earlier subgroup of the Kossmaticeratidae which show interesting homeomorphic similarity to the Senonian subfamily Kossmaticeratinae, as I mentioned previously (MATSUMOTO, 1955 and 1956). The principal members have been found in the Japanese Cenomanian and a few representatives are known in California, India, and also in New Zealand. The ancestral form of the subfamily is to be sought in the Albian *Hulenites reesidei* (ANDERSON) and allied species, from California.

Now, through the study of the material from the southeastern part of Alaska, it is evident that the representatives of the subfamily are fairly abundant on the Pacific side of Alaska. Moreover, an interesting new genus, *Maccarthyites*, has been added from the Alaskan material. This is a specialized genus which is parallel to *Mikasaites*, from the Lower Cenomanian of Japan. Thus the subfamily Marshallitinae characterizes the northern circum-Pacific region of the Cenomanian (plus the late Albian and the early Turonian), although a few elements, such as *Holcodiscoides* SPATH and *Wellmanites* WRIGHT (1957, p. 808) are known in India and New Zealand. This is a remarkable contrast to the occurrence of the various specialized forms of the Senonian subfamily Kossmaticeratinae, which are characteristic of the areas surrounding the Southern Pacific and the Indian Oceans, such as Antarctica, New Zealand, south western part of South America, South Africa, Madagascar and southern India, although several representatives are sometimes found in other areas, including Japan and California. This may be a case not of bipolar similarity in the true sense of the term, but of an analogous phenomenon, homeomorphic similarity in successive geological ages between the northern and southern provinces. Anyhow, as I previously mentioned, further research on the faunas of the unexplored parts of the world may furnish us better evidence to clarify the tangled but interesting history of evolution and distribution of the family Kossmaticeratidae.

Appendix

Comments on the Cretaceous Stratigraphy of the Upper Chitina Valley, Alaska

The stratigraphy and correlation of the Cretaceous outcrops near McCarthy and Nizina, in the upper Chitina Valley, have been discussed in several papers (MOFFIT and CAPPS, 1911, p. 31–38; MOFFIT, 1918, p. 29–45; MARTIN, 1926, p. 330–369; MOFFIT, 1938, p. 71–89; IMLAY and REESIDE, 1954, p. 229–231). Nevertheless the stratigraphic work that has been done is reconnaissance in character, and the fossils have not been studied systematically (MOFFIT, 1938, p. 4, 79).

In his latest studies of the Cretaceous of the eastern part of the Chitina Valley MOFFIT (1938, p. 71–80) republished measured sections, summarized the stratigraphy, and showed that the Cretaceous beds rest with angular unconformity on beds of Triassic to Mississippian age and are overlain unconformably by Tertiary volcanics and continental sediments. After considering the faunal, lithologic, and stratigraphic evidence he concluded that the Cretaceous fossils were probably all of Early Cretaceous age and that the Cretaceous sequences at different localities were probably deposited contemporaneously even though they showed marked lithologic differences. He suggested that the Cretaceous succession from top to bottom is as follows:

	feet
Conglomerate, sandstone and sandy shale	2500–3000
Black shale	3000
Sandstone and sandy shale, calcareous	300–500
Conglomerate or grit, locally absent	?
Total thickness	6000 ±

In his geological map MOFFIT indicated Cretaceous areas mostly under the name of Kennicott formation, and partly under "Mesozoic in part Upper (?) Cretaceous." The localities of ammonites described in this paper are within the area of his "Kennicott formation."

An analysis made by MARTIN (1926, p. 330–369) of the stratigraphic and paleontologic studies published by MOFFIT and associates led to the conclusion that the Cretaceous deposits in the eastern part of the Chitina Valley are much thicker than indicated by MOFFIT, include thousands of feet of both Lower and Upper Cretaceous rocks, and that the sequences at separate localities represent different parts of the Cretaceous system. The problem of correlation was discussed in more detail by IMLAY and REESIDE (1954, p. 229, 231), who, however, did not furnish ample faunal evidence that permitted correlations of the Kennicott formation with any

particular stage of the Upper Cretaceous. The present study furnishes adequate evidence for the existence of rocks of the Cenomanian age in the Chitina Valley.

In addition to the Cenomanian and possible Upper Albian localities described herein, there are many localities in the Chitina Valley that have furnished Mesozoic fossils of other ages. Most of those localities were described by MOFFIT (1938, p. 80-88) and will not be redescribed. Others that have been found in recent years are described below under subheadings (7) and (8). The fossils from some of these localities, arranged by ages, are discussed briefly as follows:

(1) *Upper Jurassic.*—USGS Mes. locs. 11374, 11380, 14032, 14034, 14495 to 14497 contain *Buchia* of late Oxfordian to early Kimmeridgian age, including *Buchia concentrica* (SOWERBY), *B. concentrica leguminosa* (STOLICZKA), and *B. spitiensis* (HOLDHAUS); USGS Mes. locs. 14496 to 14497 contain *Amoeboceras* (*Prionodoceras*) spp.; USGS Mes. locs. 11376 and 14034 contain *Cylindroteuthis* spp. All identified by Dr. IMLAY. These collections are from black shale exposed at the head of McCarthy Creek.

(2) *Neocomian.*—USGS Mes. locs. 11377 and 14031 contain *Buchia crassicollis* (KEYSERLING), of Valanginian age; USGS Mes. loc. 14031 contains *Acroteuthis* sp., suggesting Valanginian to Barremian (identified by Dr. IMLAY). These are from dark sandstone at the head of McCarthy Creek.

(3) *Aptian.*—No fossils of Aptian age have been found anywhere in Alaska.

(4) *Albian.*—USGS Mes. loc. 6313 contains three poorly preserved specimens that are possibly comparable with *Anagaudryceras* sp. and *Beudanticeras haydeni* (GABB). This locality is reported to be at the base of the sandstone formation in McCarthy Creek, but its stratigraphic relation with the Upper Jurassic-Valanginian localities is not known.

The unmistakable Albian fossil localities, represented by USGS Mes. locs. 8872, 8873, 8878, and 9489, are located in the Kotsina-Kuskulana area, more than 25 miles west of the McCarthy area, and are not shown on the index map (Text-fig. 1). The principal species present have been listed by IMLAY and REESIDE (1954, p. 229) under the phrase "the first assemblage", but some of the species may properly be referred to recently defined genera. For convenience the assemblage will be called the *Leconteites* faunule of the Kotsina-Kuskulana area. The species are fairly well preserved and the faunule contains a few new species, awaiting full paleontological description.

Another Albian faunule is present at USGS Mes. loc. 9492, which is recorded as being on the bluffs of Young Creek, a southern branch of the Nizina River. This is about 25 miles south of the Cenomanian localities described in this paper, even farther removed from the Kotsina-Kuskulana area, and its stratigraphic relationship to the *Leconteites* faunule is unknown. The faunule represented by USGS Mes. loc. 9492 has been called by IMLAY and REESIDE (1954, p. 229) "the second assemblage."

It is characterized by *Brewericeras* aff. *B. breweri* (GABB) and *Beudanticeras haydeni* (GABB). It contains also, among other ammonites, several specimens which are referable to *Hulenites*, which genus, in my opinion (MATSUMOTO, 1955, p. 122), is a probable ancestor of *Marshallites*.

(5) *Upper Albian and possibly also part of Cenomanian.*—USGS Mes. locs. 14038, 14040, 14511, 14514, and 14515; also USGS Mes. locs. 9481, 9485, 9486, and 9487. The first five are in the valley of the Nizina Glacier, so that they are fairly close to the localities of the ammonites described in this paper. The last four are located north or northwest of Gibraltar Hill, not far from the contact (fault or unconformity uncertain) with the basement of Triassic and Paleozoic rocks. This area is 25 to 30 miles south-southeast of the localities of the Cenomanian ammonites described herein.

The species from all these localities have been grouped under the phrase "the third assemblage" by IMLAY and REESIDE (1954, p. 229, 230). However, the localities may represent slightly different levels, considering that the species at all localities are not the same. For instance, Mes. loc. 14514, which contains *Kossmatella* cf. *K. gainesi* ANDERSON and *Beudanticeras* sp. is doubtless Albian. However, Mes. loc. 9481 is probably Cenomanian, because it contains *Partschiceras* ? cf. *P. japonicum* (MATSUMOTO), *Neophylloceras* aff. *N. seresitense* (PERVINQUIÈRE), *Desmoceras* (*Pseudouhligella*) sp. juv. (resembling *D.* (*P.*) *ezoanum* MATSUMOTO), *Marshallites cumshewaensis* (WHITEAVES), *Marshallites olcostephanoides* MATSUMOTO (immature), *Wellmanites* sp., *Anagaudryceras sacya* (FORBES), *Zelandites* cf. *Z. inflatus* MATSUMOTO, *Sciponoceras* sp. (with a rounded cross section, smooth surface, and infrequent constrictions), and other species. Certain species mentioned above by comparison with their ranges in Japan are referred to the Cenomanian, although the possibility of the faunule being late Albian cannot be denied. This possibility is not only indicated by certain long-ranged species but also by the presence at Mes. loc. 14514 of *Inoceramus concentricus subsulcatus* WILTSHIRE. *I. concentricus* PARKINSON, *I. sulcatus* PARKINSON, and *I. concentricus subsulcatus* WILTSHIRE are characteristic of the Albian in Europe. In Japan, however, *I. concentricus nipponicus* NAGAO and MATSUMOTO is rather common in the Cenomanian, and *I. sulcatus* is occasionally found in beds of probable Cenomanian age. Therefore the existence of *I. concentricus subsulcatus* does not necessarily indicate Albian, especially in the northern Pacific region.

Other ammonites which should be recorded herein are *Desmoceras* (*Pseudouhligella*) cf. *D. japonicum* YABE (unfortunately represented by small, immature specimens) (locs. 14040 and 14511); *Eogunnarites* sp. [close to *E. unicus* (YABE)] (loc. 14038); and *Pseudohelicoceras* sp. (a fragment from loc. 14515).

I cannot now make conclusive age determinations for the fossils at these localities, but want to call attention to resemblances with the ammonite faunule

described in this paper, leaving their final determinations to future collecting and studies.

(6) *Upper Cenomanian-Turonian.*—Several localities south of Nikolai Creek, an eastern tributary of McCarthy Creek, about 15 miles southwest of the area of the described Cenomanian ammonites, are USGS Mes. locs. 6302, 6307, 6309, 8892, 8893, 14505, 14506, 14508, and others. MOFFIT (1938, p. 75) describes the stratigraphic sequence of this creek as follows (in descending order):

	feet
Greenish-gray sandy beds	50
Sandy beds with limy phases, weathering brown; fossils fairly numerous	50
Dark-gray shale, weathering brown and grading into shale below	50
Light-gray shale, weathering brown	50
Dark-gray grit or fine conglomerate of variable thickness, not exceeding 50 feet; contains beds of ground-up shells and is highly calcareous...	50
	250

Unconformity

Nikolai greenstone and Chitistone limestone

The fossils mostly have a sandy matrix and were probably obtained, therefore, from the second highest unit of the 250-foot sequence cited above. Although more or less crushed, they are most probably referable to *Inoceramus hobetsensis* NAGAO and MATSUMOTO and especially to its non-sulcate variety. There are a few specimens that are comparable with *Inoceramus pictus* SOWERBY. One ammonite from loc. 6307 is an impression on brownish shale that is presumably from the third unit. It belongs to a new species of *Marshallites* from the Upper Cenomanian of Japan, and is characterized by strong involution, a narrow umbilicus, and very fine ribbing.

In summation, the available material from the Nikolai Creek localities suggests the existence of Upper Cenomanian and Turonian in the upper part of the 250-foot sequence exposed there.

(7) *Lower Senonian.*—The best evidence is found in the recent collection by Mr. L. M. KUENZI, 1954. The localities are recorded, according to him, as follows:

USGS Mes. loc. 25448 [=LMK. 241]. Black shale 2,500 feet stratigraphically below base of upper sandy unit (2,000 feet thick) at altitude 4,000 feet on north side Calamity Gulch, a branch of Young Creek, 18.8 miles S.49°E. of town of McCarthy; coordinates 12.74, 4.64.

USGS Mes. loc. 25449 [=LMK. 243]. Black shale about 1,100 feet stratigraphically below base of upper sandy unit and 1,500 feet above lowest shale exposed at altitude 3,400 feet on southeast side, Calamity Gulch, 19.2 miles S.47°E. of town of McCarthy; coordinates 12.70, 4.42.

USGS Mes. loc. 25447 [=LMK. 239]. 500-foot shale unit at altitude 3,400 feet on

south side of Young Creek about 3,500 feet stratigraphically below crest of ridge and 1,300 feet below a conglomerate, 20.7 miles S.44°E. of town of McCarthy; coordinates 12.78, 3.97.

Following is the list of identified species:

Species	Localities
Phyllopachyceras cf. *P. ezoense* (YOKOYAMA)	25449
Damesites sp.	25449
Kossmaticeras aff. *K. japonicum* MATSUMOTO (the same species as the one described under *Kossmaticeras* sp. β aff. *K. japonicum* MATSUMOTO by MATSUMOTO, 1956, p. 180, pl. 14, fig. 2 a, b; pl. 15, fig. 1 a, b)	25448, 25449
Tetragonites glabrus (JIMBO)	25449
Baculites sp.	25448
Scaphites cf. *S. pseudoaequalis* YABE	25449
Otoscaphites sp. (fragmentary)	25449
Bostrychoceras sp. (with relatively dense ribbing and periodic constrictions)	25449
Hyphantoceras? sp. (fragmentary)	25449
Inoceramus yokoyamai NAGAO and MATSUMOTO	25447–25449
Inoceramus cf. *I. uwajimensis* YEHARA	25447–25449

The association of these species indicates, according to the Japanese scale, a Coniacian age, although some of them have longer ranges.

(8) *Upper Senonian.*—In the collections from the upper Chitina Valley that are now at my disposal there is no fossil evidence for the Campanian and Maestrichtian. If we consider the thickness of rocks above the preceding Lower Senonian beds, the possibility of the existence of Upper Senonian cannot be denied. The only information is a statement by MOFFIT and CAPPS (1911, p. 34) that ammonite shells 15 or 18 inches across occur in the shale high up on the slopes of the mountains at the headwaters of Chititu Creek north of Young Creek. These ammonites were not brought back to the museum. There is available, however, a specimen of *Inoceramus*, which has divergent ribs. Unfortunately its umbonal part is missing, so that we cannot tell whether it is *I. schmidti* MICHAEL (Campanian), *I. undulatoplicatus* ROEMER (Santonian, possibly highest Coniacian), or some other species. It was obtained in shale at USGS Mes. loc. 25450, altitude 4,300 feet on the south side of Cooper Creek, near mouth of Texas Creek, 17.4 miles S.69°E. of town of McCarthy; coordinates 13.19, 6.19. This belongs also to the collection made by L. M. KUENZI, 1954.

In the collections from the Upper Cretaceous of the Matanuska Valley, there are unmistakable specimens of *Inoceramus schmidti* MICHAEL, and in the beds still

higher than those containing *I. schmidti* MICHAEL, there are species of *Pachydiscus*, which are referable to *P. ootacodensis* (STOLICZKA), *P. suciaensis* (MEEK), and *P. subcompressus* MATSUMOTO. Therefore the Upper Senonian is doubtlessly represented in the Cretaceous succession of the Matanuska Valley. More collections are required for the correlation of the higher part of the succession in the Chitina Valley with the Upper Senonian in the Matunuska Valley.

Alaska is a rough country and the Mesozoic strata on the Pacific side are structurally complicated. However, through laborious efforts field geologists are obtaining increasing numbers of fossils that will result in a better understanding of correlations and other stratigraphic problems. The present paper is an evaluation of some of these collections and constitutes a distinct forward step in our knowledge of the Cretaceous of Alaska.

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Tatsuro MATSUMOTO

Cretaceous Ammonites from the Upper Chitina Valley, Alaska

Plates 12-29

Plate 12

Explanation of Plate 12

(All figures are of natural size.)

Figs. 1-3. *Partschiceras ? japonicum* (MATSUMOTO) . . . . . Page 52

1. Ventral (a), lateral (b), and frontal (c) views of an example, USNM 129261, from USGS Mes. loc. 25443.
2. Lateral (a) and ventral (b) views of another example, USNM 129262, from USGS Mes. loc. 25443.
3. Sectional (a), lateral (b), and ventral (c) views of an example, USNM 129260, from USGS Mes. loc. 25445.

Figs. 4, 5. *Neophylloceras seresitense* (PERVINQUIÈRE) . . . . . Page 55

4. Ventral (a) and lateral (b) views of an example, USNM 129253, from USGS Mes. loc. 25442.
5. Two lateral (a, b), sectional (c), and ventral (d) views of an example, USNM 129254, from USGS Mes. loc. 25445.

1a

1b

1c

2a

2b

3a

3b

3c

5a

5b

4a

4b

5c

5d

T. MATSUMOTO: Cretaceous Ammonites from Alaska

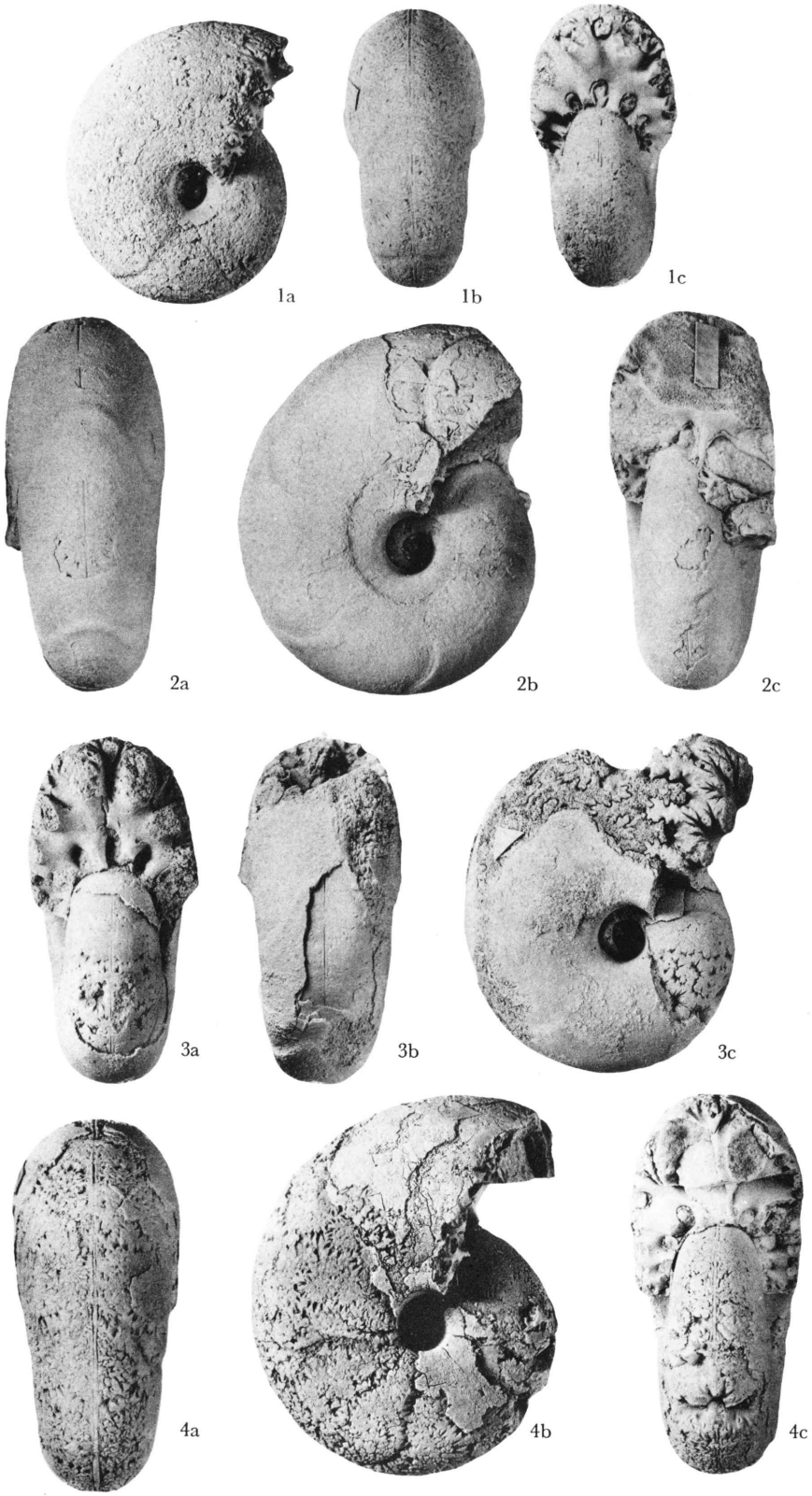
Plate 13

Explanation of Plate 13

(All figures are of natural size.)

Figs. 1–4. *Desmoceras* (*Pseudouhligella*) *japonicum* YABE . . . . . Page 58

1. Lateral (a), ventral (b), and frontal (c) views of a relatively thick-whorled example, USNM 129265, from USGS Mes. loc. 25443.
2. Ventral (a), lateral (b), and frontal (c) views of a relatively compressed example, USNM 129264, from USGS Mes. loc. 25443.
3. Frontal (a), ventral (b), and lateral (c) views of a moderate example, USNM 129267, from USGS Mes. loc. 25445.
4. Ventral (a), lateral (b), and frontal (c) views of a moderate example, USNM 129263, from USGS Mes. loc. 25443.



T. MATSUMOTO: Cretaceous Ammonites from Alaska

Plate 14

Explanation of Plate 14

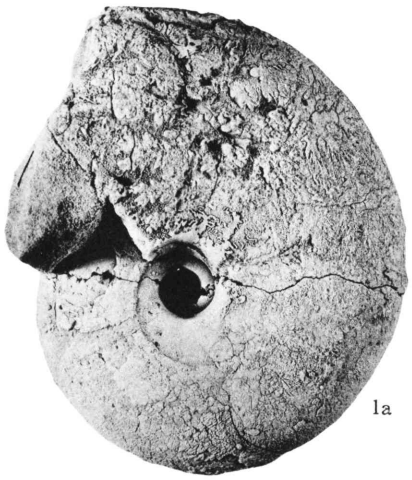
(All figures are of natural size.)

Fig. 1. *Desmoceras* (*Pseudouhligella*) *japonicum* YABE . . . . . Page 58

Lateral (a) and sectional (b) views of a typical example, USNM 129266, from USGS Mes. loc. 25445.

Fig. 2. *Desmoceras* (*Pseudouhligella*) *dawsoni* WHITEAVES . . . . . Page 59

Ventral (a) and lateral (b) views of an example, USNM 129250, from USGS Mes. loc. 25441, showing a body chamber.



T. MATSUMOTO: Cretaceous Ammonites from Alaska

Plate 15

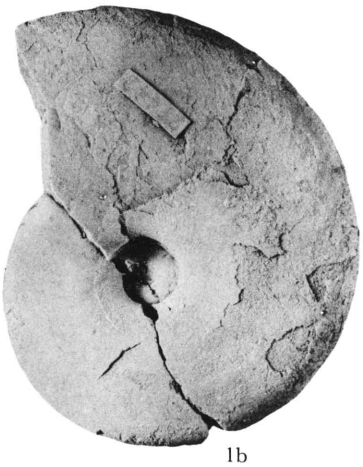
Explanation of Plate 15

(All figures are of natural size.)

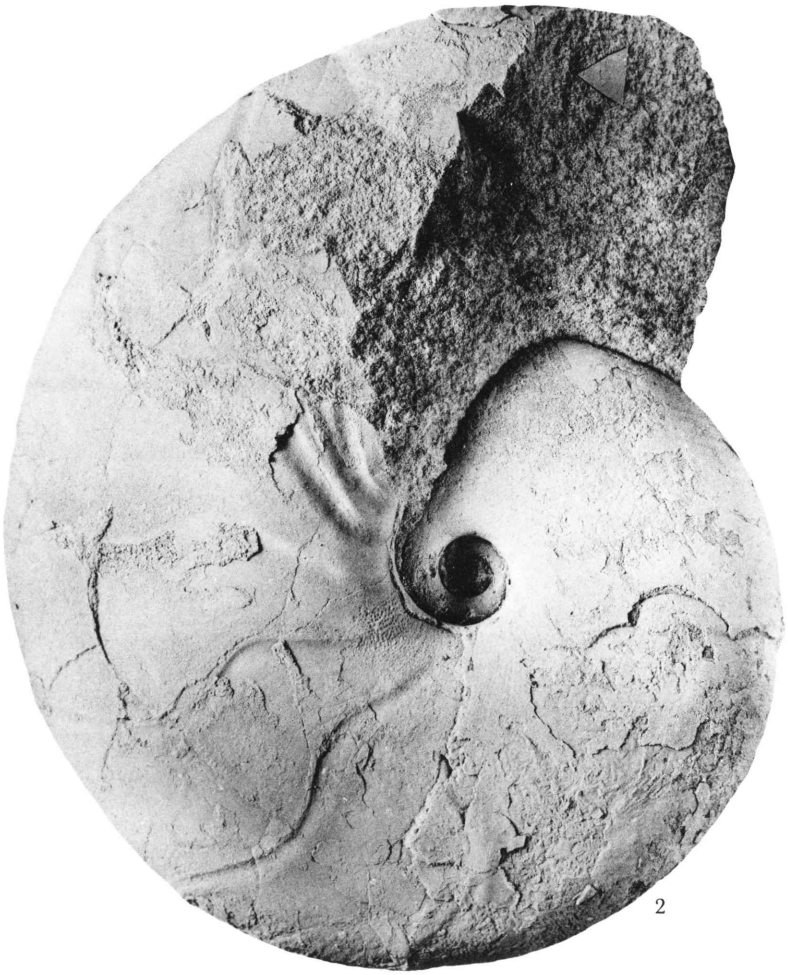
Figs. 1, 2. *Desmoceras (Pseudouhligella) dawsoni* WHITEAVES . . . . . Page 59

1. Lateral view (a) of the whole specimen, and lateral (b) and frontal (c) views of the inner whorl of the same specimen, USNM 129252, from USGS Mes. loc. 25442. See Text-fig. 8 for a suture.
2. Lateral view of an example, with a body chamber USNM 129251, from USGS Mes. loc. 25442. Other views of the same specimen are on Pl. 16, fig. 1 a–c.

1a



1b



2

1c

T. MATSUMOTO: Cretaceous Ammonites from Alaska

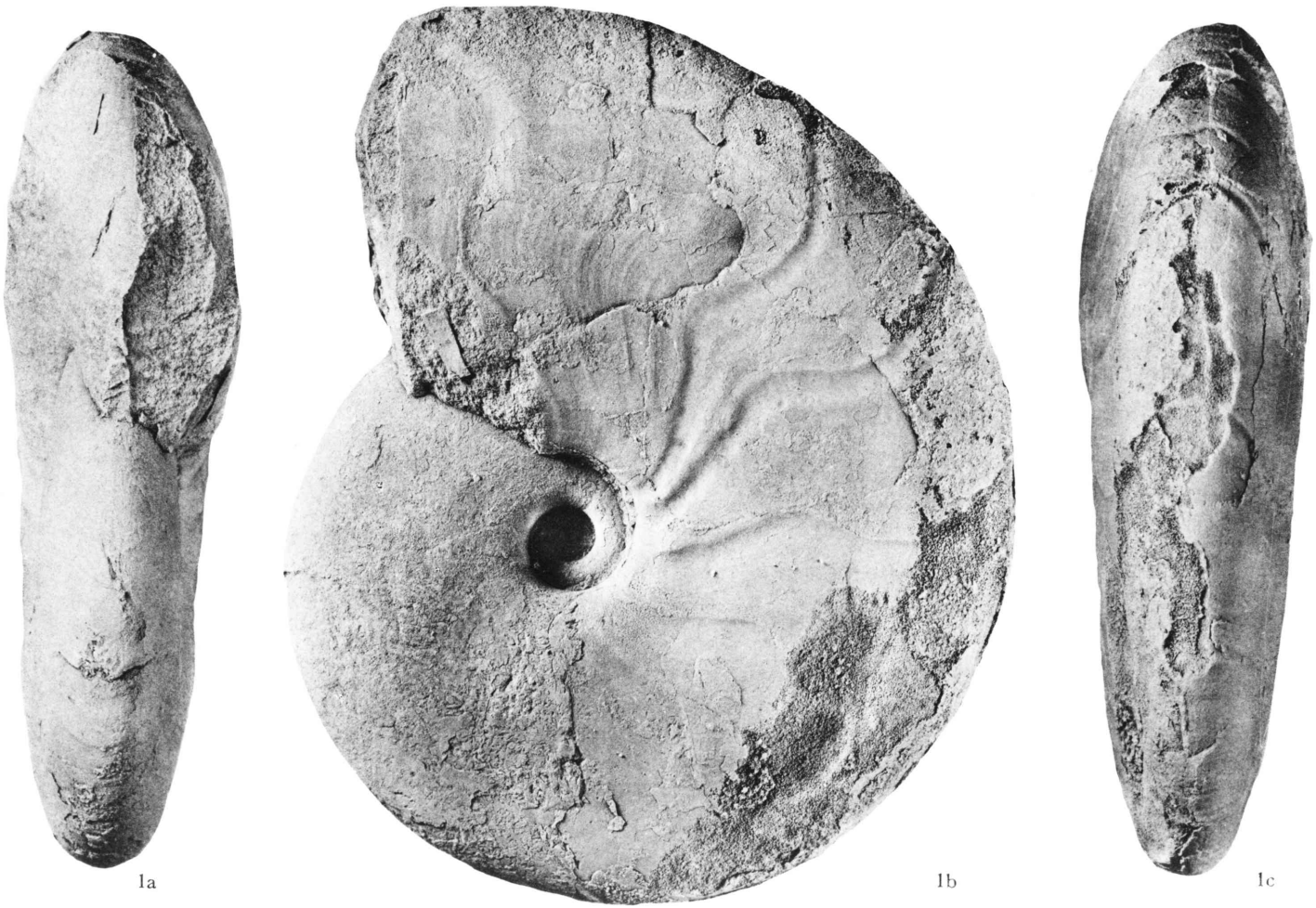
Plate 16

Explanation of Plate 16

(All figures are of natural size.)

Fig. 1. *Desmoceras* (*Pseudouhligella*) *dawsoni* WHITEAVES . . . . . Page 59

Frontal (a), lateral (b), and ventral (c) views of an example, with a body chamber, USNM 129251, from USGS Mes. loc. 25442. The other side view of the same specimen is on Pl. 15, fig. 2.



1a 1b 1c

T. MATSUMOTO : Cretaceous Ammonites from Alaska

Plate 17

Explanation of Plate 17

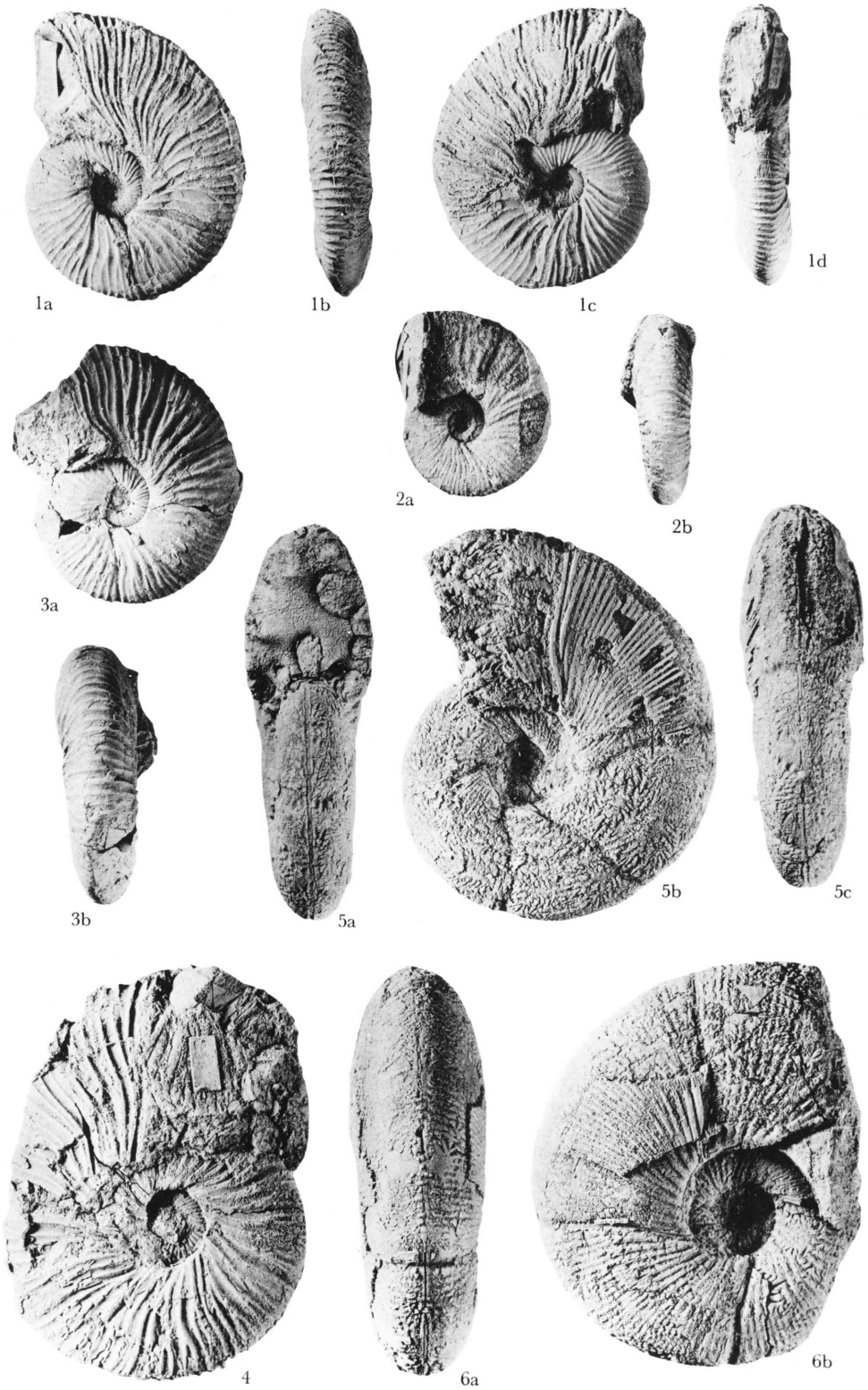
(All figures are of natural size.)

Figs. 1-4. *Marshallites cumshewaensis* (WHITEAVES) . . . . . Page 63

1. Two lateral (a, c), ventral (b), and frontal (d) views of an example, USNM 129278, from USGS Mes. loc. 25446.
2. Lateral (a) and ventral (b) views of a small, probably immature example, USNM 129281, from USGS Mes. loc. 25446.
3. Lateral (a) and ventral (b) views of an example, USNM 129280, from USGS Mes. loc. 25446. A suture of the same specimen is in Text-fig. 10.
4. Lateral view of an example, USNM 129277, from USGS Mes. loc. 25446, showing a crushed body whorl.

Figs. 5, 6. *Marshallites* aff. *M. olcostephanoides* MATSUMOTO . . . . . Page 65

5. Frontal (a), lateral (b), and ventral (c) views of an Alaskan example, USNM 129273, from USGS Mes. loc. 25443.
6. Ventral (a) and lateral (b) views of another Alaskan example, USNM 129274, from USGS Mes. loc. 25443.



T. MATSUMOTO: Cretaceous Ammonites from Alaska

Plate 18

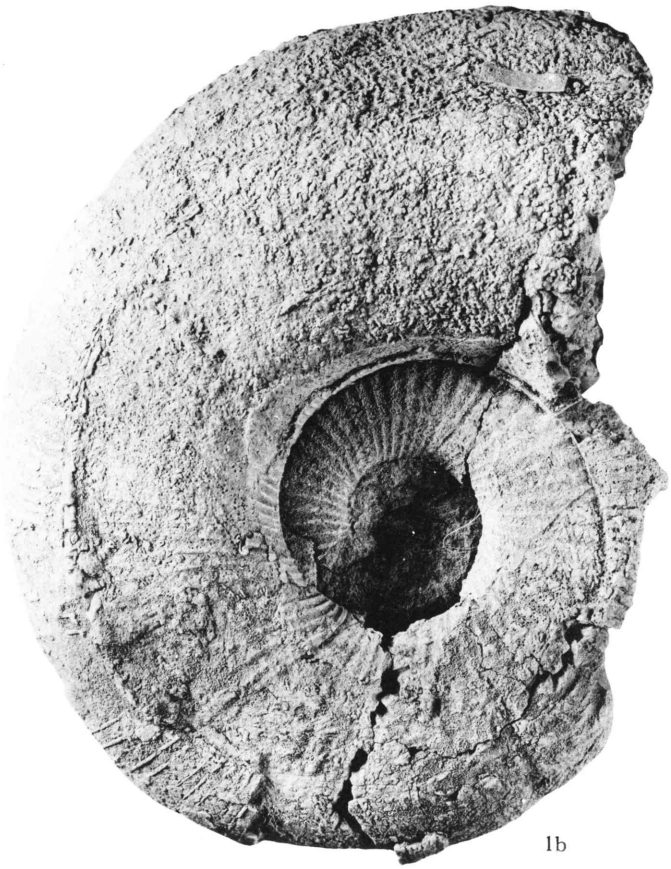
Explanation of Plate 18

(All figures are of natural size.)

Fig. 1. *Eogunnarites alaskaensis* sp. nov. . . . . Page 66

Ventral (a), lateral (b), and frontal (c) views of a paratype, USNM 129258, from loc. USGS Mes. loc. 25444. The specimen is partly eroded, as seen in front view.

1a



1b

1c

T. MATSUMOTO: Cretaceous Ammonites from Alaska

Plate 19

Explanation of Plate 19

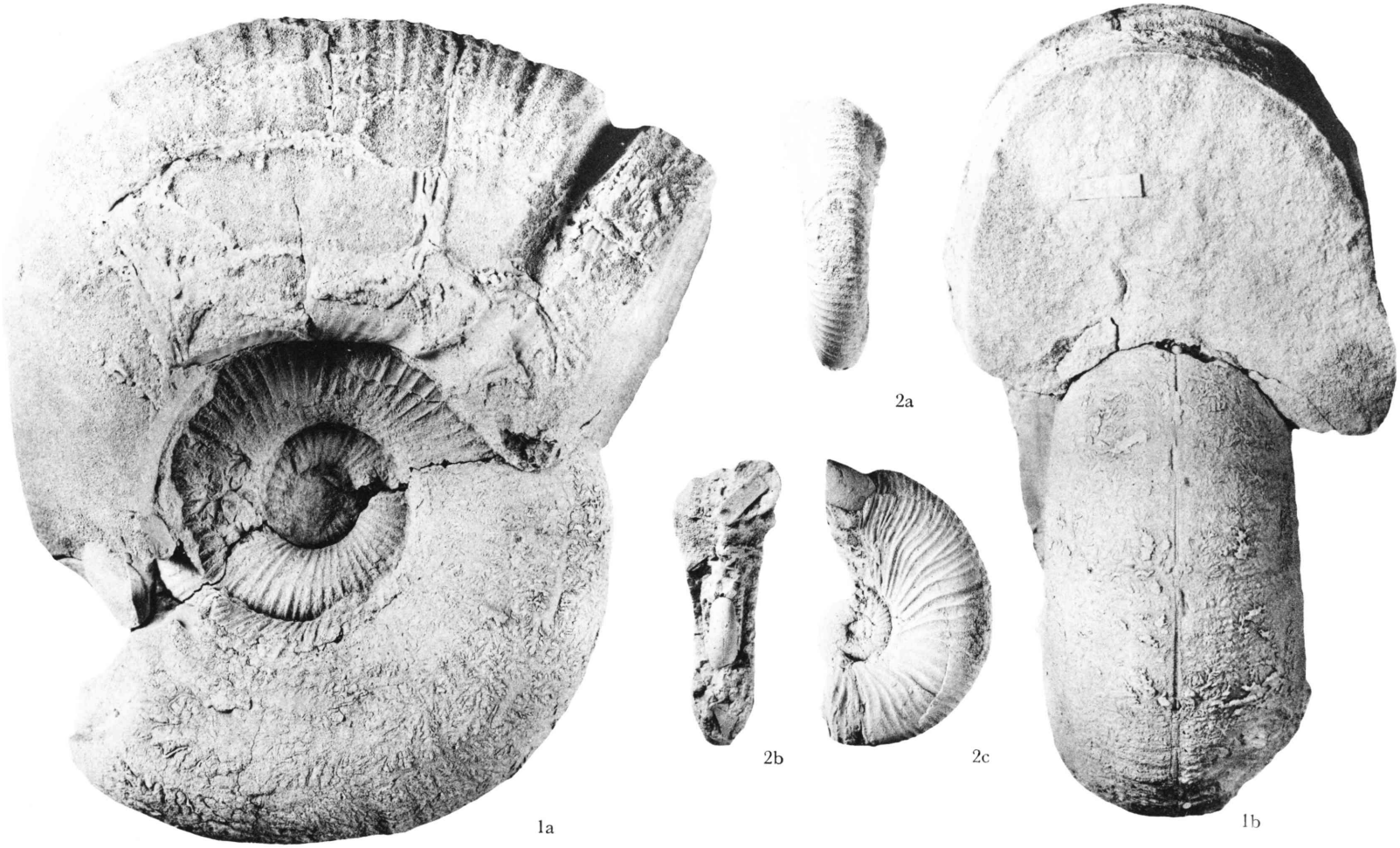
(All figures are of natural size.)

Fig. 1. *Eogunnarites alaskaensis* sp. nov. . . . . Page 66

Lateral (a) and frontal (b) views of the holotype, USNM 129257, from USGS Mes. loc. 25444. Two other views are on Pl. 20, fig. 1 a, b.

Fig. 2. *Marshallites cumshewaensis* (WHITEAVES) . . . . . Page 63

Dorsal (a), frontal (b), and lateral (c) views of an example, USNM 129279, from USGS Mes. loc. 25446. See another view on Pl. 20, fig. 2.



T. MATSUMOTO: Cretaceous Ammonites from Alaska

Plate 20

Explanation of Plate 20

(All figures are of natural size.)

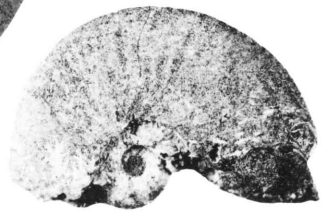
Fig. 1. *Eogunnarites alaskaensis* sp. nov. . . . . Page 66

Lateral (a) and sectional (b) views of the holotype, USNM 129257, from USGS Mes. loc. 25444. The natural section of the last whorl is oblique. Two other views of the same specimen are shown on Pl. 19, fig. 1 a, b.

Fig. 2. *Marshallites cumshewaensis* (WHITEAVES). . . . . Page 63

Lateral view, without white coating, of an example, USNM 129279, from USGS Mes. loc. 25446, showing sutures. Other views, with white coating, are on Pl. 19, fig. 2 a–c.

1a



2

1b

T. MATSUMOTO: Cretaceous Ammonites from Alaska

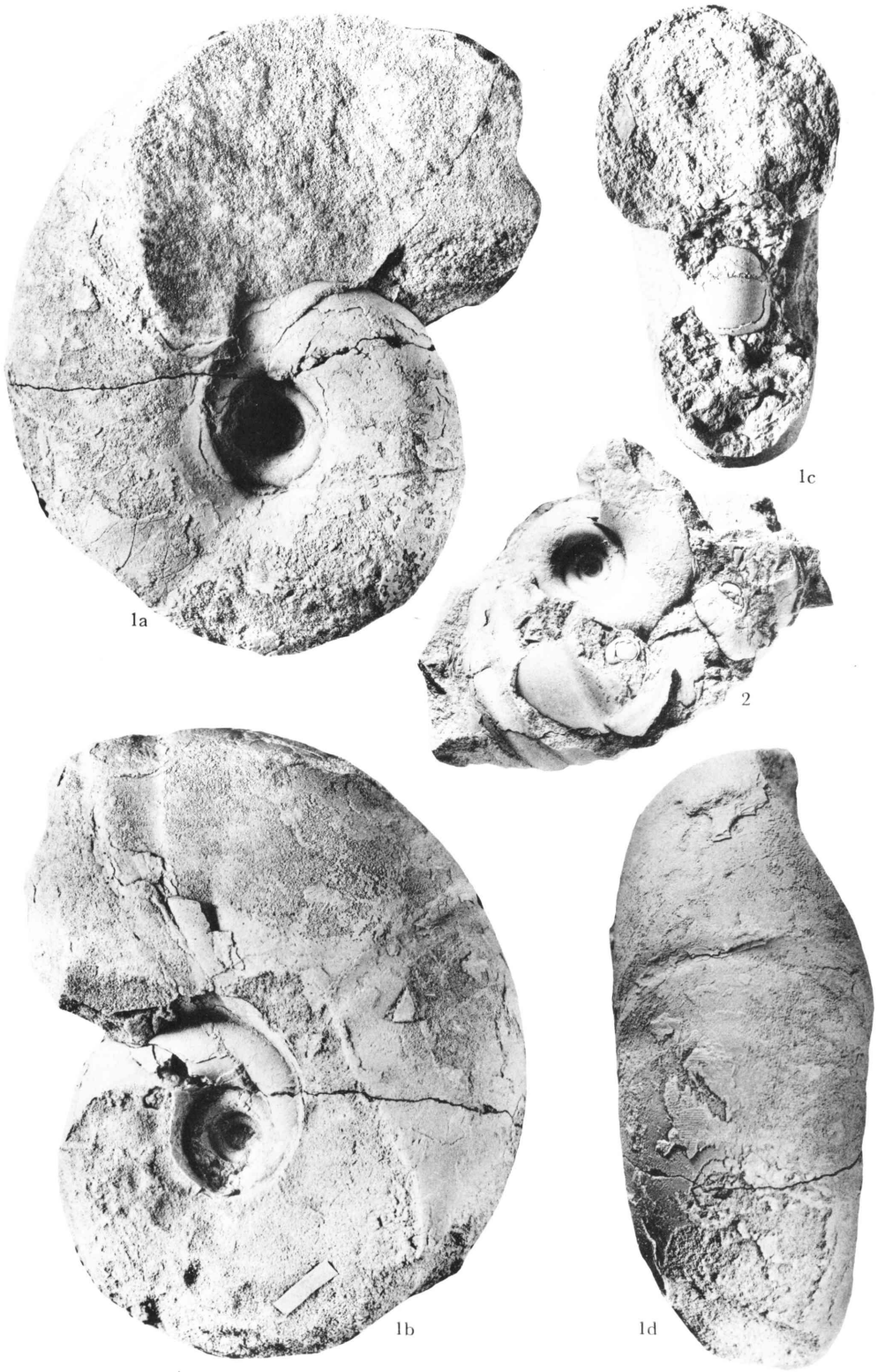
Plate 21

Explanation of Plate 21

(All figures are of natural size.)

Figs. 1, 2. *Parajaubertella imlayi* sp. nov. . . . . Page 71

1. Two lateral (a, b), sectional (c), and ventral (d) views of the holotype, USNM 129259, from USGS Mes. loc. 25445.
2. Lateral view of an inner whorl, surrounded by rock matrix, in which a portion of a crushed body whorl and an aptychus are preserved. A paratype, USNM 129284, from USGS Mes. loc. 25445. The suture of the inner whorl is illustrated in Text-fig. 12.



T. MATSUMOTO : Cretaceous Ammonites from Alaska

Plate 22

Explanation of Plate 22

(All figures are of natural size.)

Figs. 1, 2. *Tetragonites* sp. nov. (?) . . . . . Page 77

1. Frontal (a), lateral (b), and ventral (c) views of an Alaskan example, USNM 129275, from USGS Mes. loc. 25443.
2. Lateral (a), sectional (b), and ventral (c) views of another example, USNM 129276, from USGS Mes. loc. 25444.

Fig. 3. *Anagaudryceras madraspatanum* (Stoliczka) . . . . . Page 74

Lateral (a) and sectional (b) views of an example, USNM 129283, from USGS Mes. loc. 25442.

Figs. 4, 5. *Anagaudryceras sacya* (Forbes) . . . . . Page 72

4. Lateral view of a small, probably immature example, USNM 129256, from USGS Mes. loc. 25443.
5. Back (a), side (b), and front (c) views of an example, USNM 129255, from USGS Mes. loc. 25442. Fig. 5 a shows a truncated, eroded surface.

T. MATSUMOTO : Cretaceous Ammonites from Alaska

Plate 23

Explanation of Plate 23

(Figures are of natural size, unless otherwise stated.)

Fig. 1. *Parajaubertella kawakitana* MATSUMOTO . . . . . Page 70

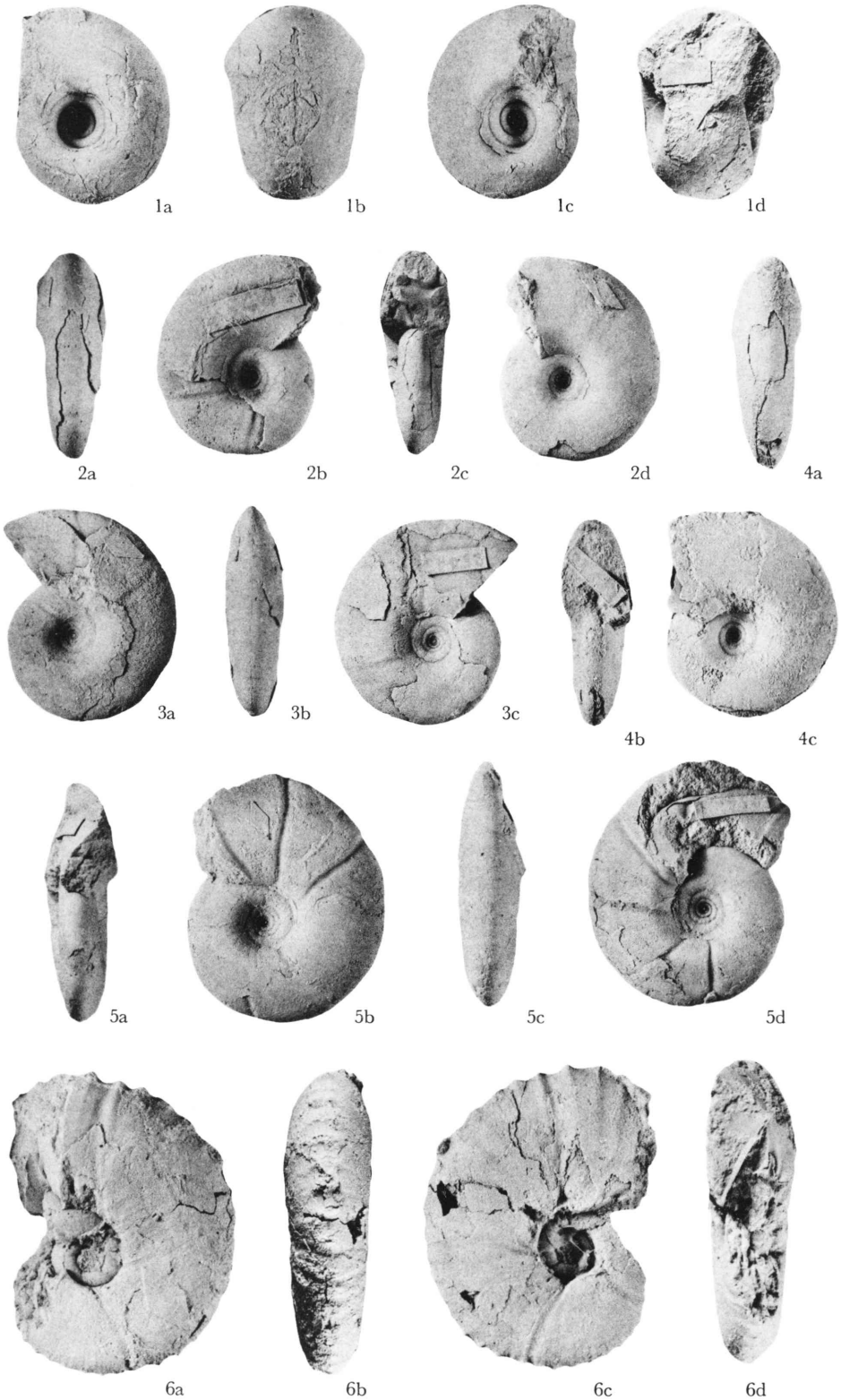
Two lateral (a, c), ventral (b), and frontal (d) views of an immature example, USNM 129282, from USGS Mes. loc. 25446.

Figs. 2–5. *Zelandites inflatus* sp. nov.. . . . . Page 74

2. Ventral (a), two lateral (b, d), and frontal (c) views (×3/2) of a paratype, USNM 129272, from USGS Mes. loc. 25443.
3. Two lateral (a, c) and ventral (b) views of a paratype, USNM 129271, from USGS Mes. loc. 25443.
4. Ventral (a), frontal (b), and lateral (c) views of a paratype, USNM 129270, from USGS Mes. loc. 25443.
5. Frontal (a), two lateral (b, d), and ventral (c) views of the holotype, USNM 129268, from USGS Mes. loc. 25445.

Fig. 6. *Maccarthyites gracilis* sp. nov.. . . . . Page 67

Two lateral (a, c), ventral (b), and frontal (d) views (×2) of the holotype, USNM 129286, from USGS Mes. loc. 25445.



T. MATSUMOTO: Cretaceous Ammonites from Alaska

Plate 24

Explanation of Plate 24

Fig. 1. *Zelandites inflatus* sp. nov. . . . . Page 74

Ventral (a), lateral (b), and frontal (c) views (×1) of a paratype, USNM 129269, from USGS Mes. loc. 25445. Probably adult example.

Fig. 2. *Proplacenticeras* sp. . . . . Page 68

Frontal view (a) (×1/2) and a portion of the flank (b) (×1) on which sutures are exposed. USNM 129297, from USGS Mes. loc. 25441. See Pl. 25, fig. 1 for the lateral view (×1/2) of the same specimen.

1a

1b

1c

2a

2b

T. MATSUMOTO: Cretaceous Ammonites from Alaska

Plate 25

Explanation of Plate 25

Fig. 1. *Proplacenticeras* sp.. . . . . Page 68

Lateral view (×1/2) of a large specimen, USNM 129297, from USGS Mes. loc. 25441. See Pl. 24, fig. 2 a, b.

T. MATSUMOTO: Cretaceous Ammonites from Alaska

Plate 26

Explanation of Plate 26

Fig. 1. *Pachydesmoceras* sp. . . . . Page 61

Lateral view (×1/2) of a large specimen, USNM 129296, from USGS Mes. loc. 25441. Other views of the same specimen are on Pl. 27.

T. MATSUMOTO: Cretaceous Ammonites from Alaska

Plate 27

Explanation of Plate 27

Fig. 1. *Pachydesmoceras* sp. . . . . Page 61

Frontal (a) and ventral (b) views (×1/2) of a large specimen, USNM 129296, from USGS Mes. loc. 25441. See Pl. 26, fig. 1 for the lateral view of the same specimen.

T. MATSUMOTO: Cretaceous Ammonites from Alaska

Plate 28

Explanation of Plate 28

Fig. 1. *Anisoceras* sp. nov. (?) . . . . . Page 79

General view (×1/2) of the whole specimen, USNM 129298, from USGS Mes. loc. 25441. See also Pl. 29, fig. 2 a–c.

Fig. 2. *Partschiceras* ? *japonicum* (MATSUMOTO) . . . . . Page 52

Lateral view (a) (×1) of the whole specimen, and two lateral (b, c) and frontal (d) views (×1) of the inner whorl of the same specimen, lectotype, GT I-3251, from loc. T591d, bed IIb, Abeshinai Valley, Teshio Province, Hokkaido, Japan (Coll. T. MATSUMOTO; photos by C. UEKI).

T. MATSUMOTO: Cretaceous Ammonites from Alaska

Plate 29

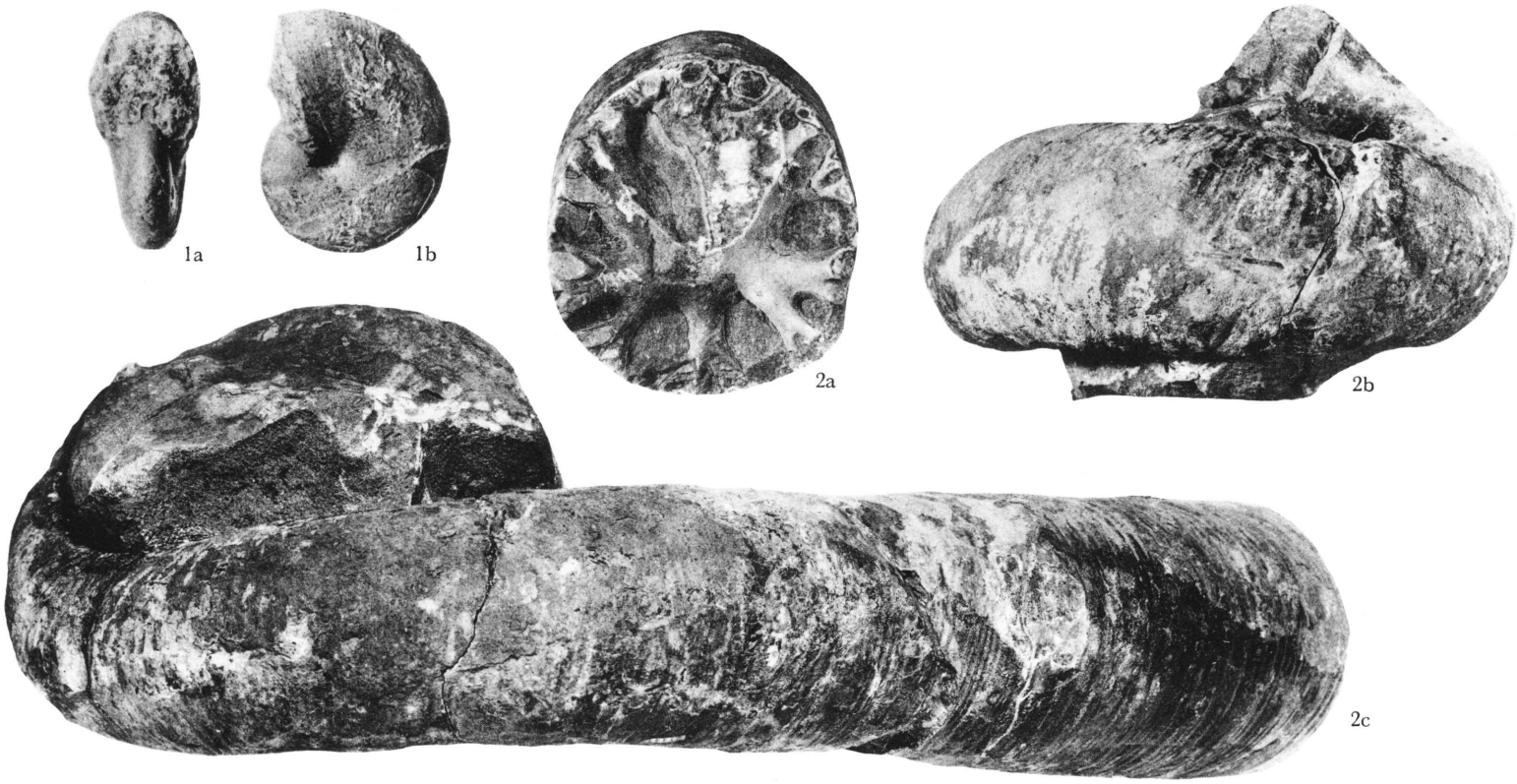
Explanation of Plate 29

Fig. 1. *Partschiceras* ? *japonicum* (MATSUMOTO) . . . . . Page 52

Frontal (a) and lateral (b) views (×1) of a syntype, GT I-3255 a, from loc. T 863, top of bed IIa, Abeshinai Valley, Teshio Province, Hokkaido, Japan (Coll. T. MATSUMOTO; photos by C. UEKI).

Fig. 2. *Anisoceras* sp. nov. (?) . . . . . Page 79

Section (a) at the anterior end of the elongated part, back view (b) of the helical part, and back view (c) of the elongated part (all ×1/2), of the same specimen as illustrated on Pl. 28, fig. 1, USNM 129298, from USGS Mes. loc. 25441.



T. MATSUMOTO: Cretaceous Ammonites from Alaska