

THE MARINE LOWER CRETACEOUS DEPOSITS OF JAPAN, WITH SPECIAL REFERENCE TO THE AMMONITES-BEARING ZONES

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THE MARINE LOWER CRETACEOUS DEPOSITS OF JAPAN, WITH SPECIAL REFERENCE TO THE AMMONITES-BEARING ZONES

BY

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With Four Plates and One Text-Figure

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I. INTRODUCTION*

The stratigraphical study of the Cretaceous deposits of Japan was first touched upon by the late B. S. LYMAN in 1877 in connection with the geological survey of the Ishikari coal-field (Hokkaidô) made under his direction. Subsequently, Cretaceous deposits, partly marine and partly terrestrial in origin, were found to occur in various parts of Japan, not only in Hokkaidô, but also in Honshû (the main island), Kiushû, Shikoku and in some of the smaller dependent islands, and during the

* The Parts I—VI were written in 1926 and presented to the Tôkyô Meeting of the Third Pan-Pacific Science Congress, while the final, descriptive part (VII) was brought to completion early in 1931. Meanwhile a comprehensive stratigraphical and palaeontological summary of the Japanese Cretaceous deposits has been given by Professor H. YABE in the Science Reports, Second Series (Geology), Vol. XI, 1927, in which essential points of my study are also incorporated.

years our knowledge of the order of succession of these deposits and of the fossils contained in them has gradually been extended. This study has become more intensive in the past few years, and a number of important papers have been issued recently on the Cretaceous stratigraphy and palaeontology, of which the following two are specially worthy of mention in connection with the present consideration; they are:—

H. YABE: Geological Age of the Cretaceous *Trigonia*-Sandstone of Japan. Proc. Imp. Acad., Vol. II, No. 1, 1926, p. 20.

H. YABE: A New Scheme of Stratigraphical Subdivision of the Cretaceous Deposits of Hokkaidô. Ibid., Vol. II, No. 5, 1926, p. 214.

S. YEHARA also is working on a similar study and one of his papers (Cretaceous *Trigoniae* from Southwestern Japan, Jap. Jour. Geol. and Geogr., Vol. II, No. 3, 1923, p. 59) contains many things worthy of attention; but on the whole, we do not agree with his plan of subdivision of the Cretaceous deposits of Japan.

Ammonites are rich in our Upper Cretaceous, but rather rare in the Lower, which often contains numerous remains of plants or of bivalves and univalves. However, we have now in the collection of the Institute of Geology and Palaeontology, Sendai, a set of ammonites derived from various parts of Japan, which, though not all in a good state of preservation, has been found to serve for the age-determination and correlation of the respective fossiliferous deposits. As is well known, the correlation of a Mesozoic stratum is carried out by means of ammonites more effectively than by means of any other groups of organisms.

In the present paper, we confine our attention to the Lower Cretaceous deposits with ammonites.

The unsparing counsel of Prof. H. YABE has been invaluable in the preparation of this paper, and I desire to express my deep obligation to him.

II. DISTRIBUTION OF THE AMMONITES-BEARING LOWER CRETACEOUS DEPOSITS

Lower Cretaceous ammonites have not yet been reported as occurring in Corea, Kiushû, Formosa or Saghalin¹. From adjacent lands, we have at present only a report by A. W. GRABAU² in which he announces the occurrence of the Lowest Cretaceous formation with *Blanfordia walkichi* (GRAY) var. *hongkongensis* GRABAU in the vicinity of Hongkong. There is no trace of marine Cretaceous rocks along the Pacific sea-board of Asia, north of this point. The ammonites³ from Hongkong assigned by GRABAU to *Blanfordia* do not belong, in my opinion, to the species characterizing the Lowest Valanginian of the Himalayas, New Guinea and Sulu Archipelago⁴.

So far as we know at present, ammonites-bearing Lower Cretaceous rocks are distributed in the following districts of Japan (Fig. 1):

¹ Recently I have published my studies of the Cretaceous deposits of South Saghalin (Cretaceous Deposits of North and South Saghalin; a Comparison, Ann. Rep. Work of Saitô Ho-on-kai, Sendai, No. 5, 1929) and have announced the existence of marine Lower Cretaceous there. I find the following succession in descending order, along the mid valley of the Naibuchi, South Saghalin:

1. The Ishikari coal-field, province of Ishikari, Hokkaidô.
2. Miyako district, province of Rikuchû, northeastern Honshû.

Formation		Rocks	Approximate thickness in meters	Fossil Zones	Age
No. V Group		Black shale with marly nodules	150		Senonian
No. IV Group		Glauconite sandstone with greenish gray sandy shale beds	550	Zone of <i>Phylloceras nera</i> FORBES Zone of <i>Baculites saghalinensis</i> SHIMIZU	
No. II Group	Up.	Glauconite sandstone	150	Zone of <i>Inoceramus schmidti</i> MICHAEL	
	Mid.	Greenish or blackish shale with nodules frequently traversed by sandstone dykes	800	Zone of <i>Mortoniceras fukazawai</i> YABE and SHIMIZU Zone of <i>Scaphites (Yezoites) planus</i> YABE	
	Low.	Greenish or blackish shale with marly nodules; traversed by sandstone dykes	400	Zone of <i>Pseudoaspidoceras</i> sp.	Turonian
No. II Group	Up.	Greenish or blackish shale with marly nodules	440	Zone of <i>Gaudryceras</i> cfr. <i>sacya</i> FORBES Zone of <i>Latidorsella pseudoimais</i> SHIMIZU	Cenomanian
	Mid.	Conglomerate and light greenish sandstone with sandstone nodules	300	Zone of <i>Puzosia tenuis</i> SHIMIZU	
	Low.	Sandstone and shale in alternate layers	100		
No. I Group	Up.	Blackish shale with marly layers	150	Zone of <i>Scaphites kanoi</i> SHIMIZU Zone of <i>Gaudryceras compressum</i> SHIMIZU	Gault
	Low.	Sandstone and shale in thin layered alternation	70		

Among the above mentioned subdivision of the formation only the No. 1 Group belongs to the Lower Cretaceous. By means of ammonites, the following zones are distinguished within the No. 1 Group:

1. The Zone of *Gaudryceras compressum* SHIMIZU nov. sp.

The Zone of *Gaudryceras compressum* SHIMIZU lies near the base of the upper division of the No. I Group: From this zone three species of ammonites are known, namely:

- Gaudryceras compressum* SHIMIZU
Tetragonites aff. *duvalianus* D'ORB.
Latidorsella aff. *latidorsata* MICHELLIN

Gaudryceras compressum nov. sp. belongs to the group of *G. aeolus* D'ORB. from the Albian of France.

Tetragonites aff. *duvalianus* is an ally of *T. duvalianus* D'ORB. from the Albian of France.

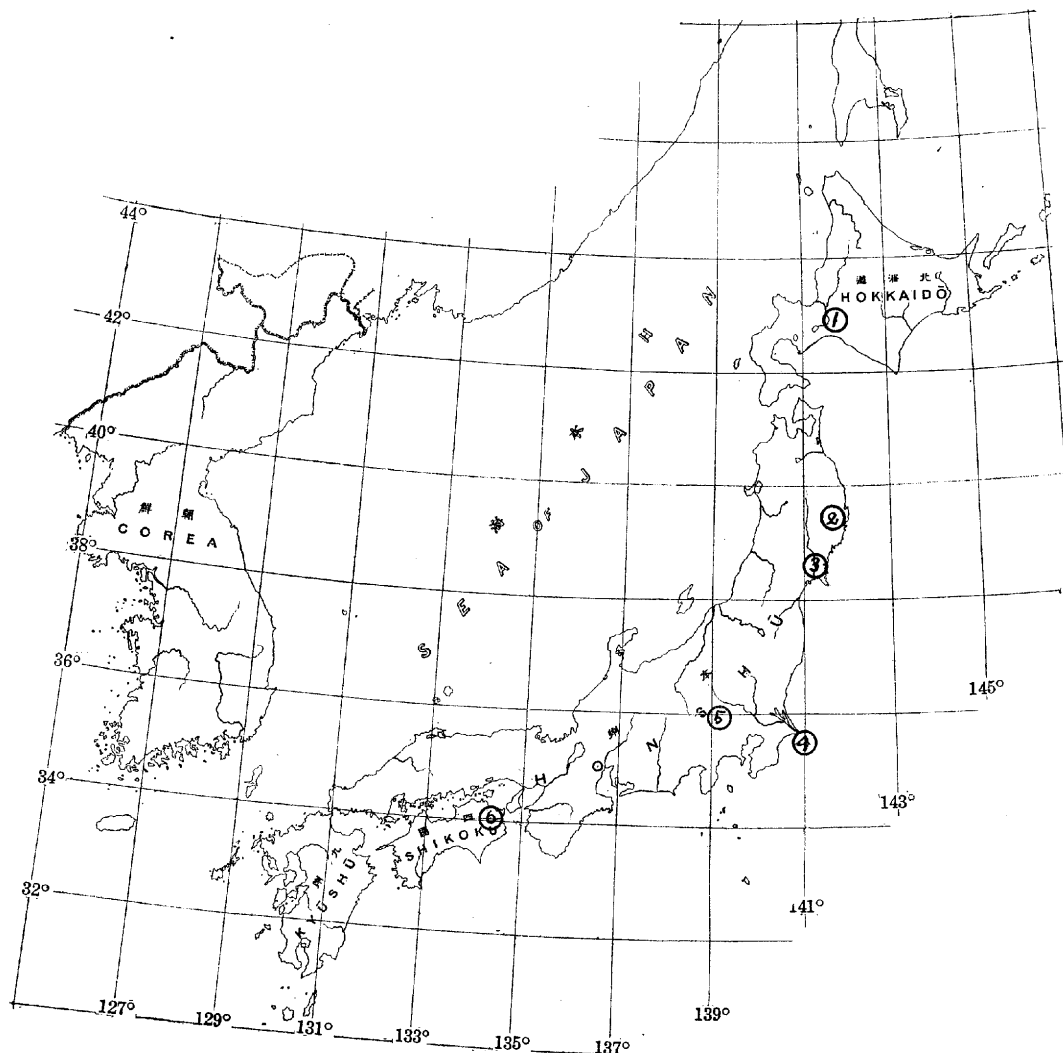
Latidorsella aff. *latidorsata* is an ally of *L. latidorsata* from the Albian of Switzerland, Albian and Cenomanian of France and Algeria, the Vraconian of Mozambique and the Utatur Group of South India.

2. The Zone of *Scaphites kanoi* SHIMIZU nov. sp.

This zone lies about 75m. above the Zone of *Gaudryceras compressum* and in the No. I Group. *Scaphites kanoi* nov. sp. is closely allied to *Scaphites aequalis* SOW., from the Vraconian of Algeria, the Cenomanian of Europe and Madagascar, and the Utatur Group of South India.

It is rather difficult to decide the precise age of the Zone of *Scaphites kanoi*; it may be either the Vraconian or the Cenomanian.

For the time being, I consider the Zone of *Scaphites kanoi* and *Gaudryceras compressum* altogether to be Gault in age. The No. I Group is probably an equivalent of the upper part of the Lower Ammonites Beds of Hokkaidô.



Text-Fig. 1.

Outline map of the Japanese Islands, showing distribution of ammonite-bearing Lower Cretaceous deposits.

1. The Ishikari coal-field, province of Ishikari, Hokkaidô.
2. Miyako district, province of Rikuchû.
3. Ôshima, opposite Kesenuma, province of Rikuzen.
4. Chôshi Peninsula, province of Shimôsa.
5. Sanchû Graben in the Kwantô, Mountainland.
6. The valley of the Katsura-gawa, province of Awa in Shikoku.

² A. W. GRABAU: A Lower Cretaceous Ammonite from Hongkong, Bull. Geol. Surv. China, No. 5, Pt. 2, 1923, p. 199.

³ After the completion of the present manuscript, I read A. W. GRABAU's "Stratigraphy of China, Pt. 2, Mesozoic, Geol. Surv. China, 1928", in which *Blanfordia wallichi* var. *hongkongensis* GRABAU is referred by S. S. BUCKMAN to Liassic Schlotheimids and revised as *Hongkongites hongkongensis* (GRABAU) (p. 774, Pl. IX, figs. 1-3).

Consequently, the formation yielding the ammonites is Liassic.

⁴ G. BOEHM: Beiträge zur Geologie von Niederländisch-Indien, Palaeontographica, Supplement IV, 1904; V. UHLIG: The Fauna of the Spiti Shale, Palaeontologia Indica, Ser. XV, Vol. IV, Fasc. 2, 1910.

3. Ōshima, a small islet opposite Kesenuma, province of Rikuzen, on the northeast coast of Honshū.
4. Chōshi Peninsula, province of Shimōsa, northeastern Honshū.
5. Sanchū Graben in the Kwantō Mountainland, extending over a part of the provinces of Shinano, Kōzuke and Musashi, Honshū.
6. The valley of the Katsura-gawa in the province of Awa in Shikoku. The marine Lower Cretaceous deposits are developed in Kiushū, but we have not yet found any remains of ammonites in them. On the other hand, there is no previous record of discovery of marine Lower Cretaceous deposits in the Inner Zone of Southwest Japan¹.

Brief accounts of the Lower Cretaceous ammonites-bearing deposits of these districts are given in the next chapter.

III. BRIEF ACCOUNTS OF THE AMMONITES AND THE AMMONITES-BEARING DEPOSITES

Researches along this line are now in their beginning; but I shall give below a summary of the result obtained by my recent studies.

1. The Ishikari Coal-Field, Hokkaido

The Lower Ammonites Beds 900 m. or more thick, of the Ishikari Coal-Field, are now assigned to the Lower Cretaceous. At this place, it is sufficient to quote the following lines from one of YABE's papers:

"A thick complex of shale of sandy shale of dark gray or blackish colour, sometimes with intercalation of thin layers of dark gray sandstone and marl; marl nodules of moderate size are common in the shale at different places. Along the lower course of the Sorachi-gawa, province of Ishikari, small lenses of limestone gray to white in colour and containing abundant *Orbitolina discoidea-conoidea* var. *ezoensis* YABE and HANZAWA and corals are intercalated in shale; the shale underlying a limestone lense contains another species of *Orbitolina*, *O. japonica* YABE and HANZAWA. The limestone is also noteworthy as containing *Praecaprotina yaegashii* (YEHARA). The uppermost part of the Lower Ammonites Beds is thin-bedded shale and sandstone in alternation and is distinguished as the Zone of *Lytoceras ezonense*² YABE. *Inflatoceras imaii* YABE and SHIMIZU and *Oxytropidoceras*³

¹ Very recently Mr. T. KOBAYASHI of the Geological Institute of the Tôkyô Imperial University found marine mollusca in a lower Cretaceous deposits exposed along the coast of Yoshimohama, province of Nagato, which resemble closely *Gervillia shinanoensis* YABE and NAGAO, *Corbicula (Veloritina?) sanchuensis* YABE and NAGAO, *Cyrena shiroiensis* YABE and NAGAO from the Shiroi Group of the Sanchu Graben (T. KOBAYASHI: On the Ryôseki Fauna in the Inner Zone of Japan, Jour. Geol. Soc. Tôkyô, Vol. XXXVII, No. 454, 1931) (note added during the press).

² This species seems to belong to the genus *Ammonoceras* LAMARCK.

³ This species is now placed in the genus *Prohysteroceras* SPATH.

sp. are obtained in the Lower Ammonites Beds of the Ponhorokabets near the Yûbari colliery (province of Ishikari); the fossiliferous bed is believed also to belong to the Zone of *Lytoceras ezoense* On the fossil evidence, the Lower Ammonities Beds have been found to be Aptian-Albian (Gault) in age."¹

Zone of *Ammonoceras ezoense* (YABE)

Ammonoceras ezoense (YABE)

Loc.: The mid-course of the Ikushunbets, Mikasayama-mura, Sorachi-gun, province of Ishikari, Hokkaidô. The species certainly belongs to the group of *A. mahadeva* (STOLICZKA) from the Utatur Group of South India.

Inflatoceras imaii YABE and SHIMIZU

Loc.: Ponhorokabets, Yûbari-machi, Yûbari-gun, province of Ishikari, Hokkaidô. *I. imaii* is closely related to *I. africanum* SPATH from the Upper Albian of Portuguese East Africa.

Prohysteroceeras sp. indet.

Loc.: Ponhorokabets, Yûbari-machi, Yûbari-gun, province of Ishikari, Hokkaidô. *P.* sp. indet. resembles somewhat *P. condolianum* (PICTET) figured by STOLICZKA from the Utatur Group of South India.

2. Miyako District, Province of Rikuchu

The stratigraphy of the Cretaceous deposits developed in this district has been studied in detail by YABE and YEHARA;² according to them, we see there the following succession of Cretaceous rocks, in descending order:

7. Hideshima Sandstone and Shale.
6. Akito Sandstone.
5. *Orbitolina* Sandstone.
4. Hiraiga Sandstone.
3. Tanohata Sandy Shale.
2. Moshi Sandstone.
1. Raga Conglomerate.

Most of these divisions are very fossiliferous, fossils being commonly neritic molluscs, large foraminifera (*Orbitolina*), corals and calcareous algae; ammonites, on the other hand, are of very rare occurrence in this district.

In 1925, I succeeded, with the cooperation of a party of students of our Institute of Geology and Palaeontology, in getting a number of ammonites from the Hiraiga Sandstone of Hideshima and Matsushima; these are

¹ H. YABE: Cretaceous *Trigonia*-Sandstone, loc. cit.

² H. YABE and S. YEHARA: The Cretaceous Deposits of Miyako. Sci. Rep. Tôhoku Imp. Univ., II Ser., Vol. I, No. 2, 1913.

Parahoplites yaegashii nov. sp.

Loc.: Hideshima. A species closely related to *P. uhligi* ANTHULA from the Aptian of the Caucasus and *P. weisi* NEUMAYR and UHLIG from the Bedoulian of North Germany.

Acanthoplites subcornuerianus SHIMIZU nov. sp.

Loc.: Hideshima: obtained from a layer lying scores of meters below that containing the preceding ammonites. A species, analogous to *A. multispinatus* ANTHULA from the Aptian of the Caucasus and *A. bigoreti* SUENES from the Aptian of Europe.

Saynella matsushimaensis SHIMIZU nov. sp.

Loc.: Matsushima. A species belonging to the group of *S. paranderi* D'ORB. from the Gargasian of Europe.

Salfeldiella caucasica (SAYN)

Loc.: Matsushima; found two meters above the horizon of the preceding species. *S. caucasica* is a zone-indicator of the European Gargasian; it also occurs in a contemporaneous deposit of the Caucasus.

Pseudohaploceras nipponicum SHIMIZU nov. sp.

Loc.: Matsushima; found together with the two foregoing species. It resembles *A. falcistriatum* ANTHULA from the Aptian of the Caucasus and belongs to the group of *A. liptoviensis* ZEUSCHNER of the European Aptian.

Puzosia? yabei SHIMIZU nov. sp.

Loc.: Matsushima; found together with the three foregoing species. *P? yabei* is closely allied to *P? ibrahim* COQUAND ranging from the Upper Barremian to the Aptian of Tunis.

Douvilleiceras nodosocostatiforme SHIMIZU nov. sp.

Loc.: Matsushima; found two meters above the horizon of *Salfeldiella caucasica*, *Pseudohaploceras nipponicum* and *Puzosia? yabei*. It certainly belongs to the group of *D. nodosocostatum* D'ORB. from the Lower Albian of Europe.

Besides, *Cymatoceras pseudoneokomiense* SHIMIZU nov. sp. was found at Hideshima in association of *Pseudohaploceras subcornuerianum* and *Parahoplites yaegashii*

The Akito Sandstone.

Hoplites aff. dentatus (Sow.)

Loc.: Akito. The species seems to be close to *H. dentatus* (Sow.) from the Middle Albian of England.

The Hiraiga Sandstone, therefore, ranges from the Lower Aptian to the Lower Albian, and we can distinguish five ammonites zones within it.

The Akito Sandstone contains one ammonites zone which seems to suggest the Middle Albian.

These zones are as follows :

Akito Sandstone	Zone of <i>Hoplites</i> aff. <i>dentatus</i> (SOW.)	Middle Albian
<i>Orbitolina</i> Sandstone	?	?
Hiraiga Sandstone	Zone of <i>Dowvilleiceras nodosocostati</i> - <i>forme</i> SHIMIZU	Lower Albian
	Zone of <i>Salfeldiella caucasica</i> (SAYN) Zone of <i>Saynella matsushimaensis</i> SHIMIZU	Gargasian
	Zone of <i>Parahoplites yaegashii</i> SHIMIZU Zone of <i>Acanthoplites subcornuerianus</i> SHIMIZU ¹	Bedoulian
		Aptian

3. Ôshima, opposite Kesenuma, Province of Rikuzen.

The Cretaceous rocks of the small islet Ôshima, opposite Kesenuma in the province of Rikuzen constitute two different formations; those exposed along the northern coast are mostly dark coloured shales, more or less cleavable and containing a fossil flora approximately of Wealden age, while those of the southern part of the islet are shale and sandstone in alternation and contain marine molluscan remains at several horizons, such as *Trigonia hokkaidoana* YEHARA and *Gervilleia haradae* (YOKOYAMA). The two areas of Cretaceous rocks are separated by andesite of Kameyama, and the two formations, one with plant remains and the other with fossil molluscs, are nowhere exposed in contact.

A shale of the marine formation, exposed along the coast of Shiraitohama contains ammonites, and a much deformed but important specimen of ammonites obtained there many years ago by Y. ISHIHARA belongs to the group of *Crioceras duvali* which is known to range from the Upper Hauterivian to the Barremian.² This was described under the name of *C. ishiharai*³ YABE and SHIMIZU; it suggests the Upper Hauterivian-Barremian age of the ammonite bed of Shiraitohama.

4. Chôshi Peninsula, Province of Shimôsa.

S. YAMANE stated in his recently published "Explanatory Text of the Geological Map of Japan, Section Chôshi" (in Japanese, 1924), that the Cretaceous deposits of Chôshi peninsula consist of, in descending order,

- No. 4. Shale and sandstone,
- No. 3. Sandstone.
- No. 2. Shale.
- No. 1. Conglomerate

¹ According to the recent field observation of T. NAGAO and S. ÔISHI and also to my laboratory work *Acanthoplites subcornuerianus* SHIMIZU seems to possess a range extending from the Zone of *A. subcornuerianus* to the Zone of *Parahoplites yaegashii* SHIMIZU in the Hiraiga Sandstone of Hiraiga. However, this species is abundant especially a few decimeters below the latter zone, that is the Zone of *Acanthoplites subcornuerianus*.

² W. KILIAN: *Lethaea Geognostica*, Das Mesozoicum, Bd. III, Kreide, Fasc. 2, 1910, p. 224; Fasc. 3, p. 350.

³ H. YABE and S. SHIMIZU: A New Cretaceous Ammonite, *Crinoceras ishiharai* from Ôshima, Province of Rikuzen, Japan. Jour. Geol. & Geogr., Vol. IV, Nos. 3-4, 1925, p. 85, Pl. IV, Text-figs. 1-2.

The No. 3 Sandstone seldom contains ammonites, but four different species derived from this sandstone are now at my disposal¹; they are:

Colombiceras satowi SHIMIZU nov. sp. belonging to the group of *C. crassicostratum* D'ORB. from the Gargasian of Europe.

Hypophylloceras aff. *onoense* (STANTON), closely allied to *H. onoense* from the Lower Horsetown of California.

Ancyloceras chôshiense SHIMIZU, nov. sp., resembling *A. nicoleti* PICTET and CAMPICHE from the Gault of Switzerland on one side and *A. brevispina* KOENEN from the Upper Barremian and Lower Aptian of North Germany on the other.

Crioceras? sp. indet., resembling *C. aegoceras* KOENEN from the Lower Aptian or the Uppermost Barremian of North Germany and *C. percostatum* GABB from the Lower Horsetown of California.

At present it is not yet settled how many ammonites-zones are represented by these species; however, the occurrence of a characteristic zone of Gargasian age within the No. 3 Sandstone Complex, Zone of *Colombiceras satowi*, is indisputable.

5. The Sanchû Graben in the Kwantô Mountainland.

The stratigraphical study of the Cretaceous occupying the Sanchû Graben in the Kwantô Mountainland is now being carried on in our Institute, and according to the observation of S. ÔISHI and myself, the Cretaceous strata seem to be divided as follows:²

In descending order

3. Kawarazawa Group	Sandstone and shale
	Grayish green hard sandstone
2. Ishidô Group	Grayish black sandy shale
1. Shiroy Group	Dark grayish shale and sandstone

While the Shiroy Group intercalates plant beds with the Ryôseki (Wealden) flora and *Cyrena naumanni* bed of brackish water origin, the two other groups contain at places numerous molluscan remains; these mostly belong to Lamellibranchiata and Gastropoda. But there are a few ammonites obtained in the Ishidô and Kawarazawa Groups and by means of these ammonites we are now in a position to establish four ammonites-zones in them.

The Ishidô Group:

1. Zone of *Simbiriskites kochibei* YABE and SHIMIZU, with *Simbiriskites kochibei* YABE and SHIMIZU,³ resembling *S. mutabilis* (STANTON) from the Upper Knoxville of California and belonging to the group of *S. decheni*, to which L. F. SPATH recently has expressed his

¹ S. SHIMIZU: The Geological Age of the Cretaceous of Chôshi (in Japanese). Jour. Geogr., Tôkyô, Vol. XXXVIII, No. 446, 1926, p. 176.

² H. YABE, T. NAGAO and S. SHIMIZU: Cretaceous Mollusca from the Sanchû Graben in the Kwantô Mountainland, Japan. Sci. Rep. Tôhoku Imp. Univ., Ser., II (Geology), Vol. IX, No. 2, 1926.

³ H. YABE, T. NAGAO and S. SHIMIZU: Loc. cit., (1926), p. 69, (37), Pl. XV (IV), figs. 9, 10.

intention of confining the genus *Simbiriskites*. In his sense, *Simbiriskites* is characteristic of the Upper Hauterivian.

Crioceras yagii YABE and SHIMIZU, belonging to the group of *C. duwali*.

2. Zone of *Pulchellia ishidoensis* YABE and SHIMIZU, with *Pulchellia ishidoensis* YABE and SHIMIZU¹, belonging to the group of *P. provincialis* D'ORB. from the Barremian of Europe, and being a species of *Pulchellia* s. s. of M. GIGNOUX.

Desmoceras? pseudodifficile YABE and SHIMIZU², belonging to the group of *Desmoceras difficile* of the European Barremian.

Leptoceras cfr. *pumilum* UHLIG³, closely allied to *L. pumilum* from the Wernsdorf Bed of Moravia.

Leptoceras asiaticum YABE and SHIMIZU⁴, closely allied to *L. beyrichi* Karsten from the Wernsdorf Bed of Moravia.

Ancyloceras? sp⁵, allied to *A. obovatum* KOENEN and *A. brevispina* KOENEN from the Barremian of North Germany.

The Kawarazawa Group:

3. Zone of *Pseudosaynella otsukai* YABE and SHIMIZU, with *Pseudosaynella otsukai* YABE and SHIMIZU⁶, closely resembling *P. bicurvata* (MICH.) and *P. heimi* (SARASIN) from the Aptian of France.

Toxoceras? sp⁷, a form near *T. requienianum* D'ORB. from the Aptian and Barremian of France.

Hamites sp⁸, somewhat reminding us of *H. decurrens* RÖMER from the Aptian and *H. rotundatus* SOW. from the Gault of Europe.

4. Zone of *Lytoceras* sp. The specimen⁹ is too imperfect for detailed study, and it is premature to accept this as a distinct ammonites-zone, although it is assumed for the time being as such.

In short, as is shown in the annexed table, the Zone of *Simbiriskites kochibei* is the Upper Hauterivian, that of *Pulchellia ishidoensis* is the Barremian, and that of *Pseudosaynella otsukai* is the Bedoulian in age.

Kawarazawa Group	Zone of <i>Pseudosaynella otsukai</i>	Bedoulian
Ishidô Group	Zone of <i>Pulchellia ishidoensis</i>	Barremian
	Zone of <i>Simbiriskites kochibei</i>	Upper Hauterivian

¹ YABE, NAGAO and SHIMIZU: Loc. cit. (1926), p. 74 (42), Pl. XV (IV), figs. 22-24.

² Ibid., p. 70 (38), Pl. XV (IV), fig. 11.

³ Ibid., p. 73 (41), Pl. XV (IV), fig. 20.

⁴ Ibid., p. 73 (41), Pl. XV (IV), fig. 21.

⁵ Ibid., p. 73 (41), Pl. XV (IV), figs. 12, 13.

⁶ Ibid., p. 68 (36), Pl. XV (IV), figs. 5-8.

⁷ Ibid., p. 71 (39), Pl. XV (IV), figs. 14-15.

⁸ Ibid., p. 68 (36), Pl. XV (IV), fig. 4.

⁹ Ibid., p. 67 (35), Pl. XV (IV), figs. 1-3.

6. The Valley of the Katsura-gawa in the Province of Awa in Shikoku.

The Cretaceous rocks have been recently studied by S. YEHARA¹; but there are many doubtful points in his report. According to YABE, NAGAO and T. OBATA the Cretaceous deposits of the present district, in descending sequence, are as follows:

6. Fujikawa Shale (in the sense of YEHARA)
5. Hôji Sandstone.
4. Furuke Beds.
3. Mochii Sandstone.
2. Hanoura shale.
1. Tachikawa Conglomerate.

The Tachikawa Conglomerate intercalates plant beds with Ryôseki (Wealden) flora and *Cyrena naumanni* beds of brackish water origin and the Furuke Beds also intercalates plant beds. The other three groups contain in certain places numerous molluscan remains; these mostly belong to Lamellibranchiata. On the other hand, we can establish four ammonites zones in these three groups, two zones in the Hanoura Shale, one in the Mochii Sandstone and one in the Fujikawa Shale respectively.

The Hanoura Shale:

1. Zone of *Pseudothurmannia hanouraensis* YABE and SHIMIZU.

Pseudothurmannia hanouraensis YABE and SHIMIZU.

Loc.: Ushiotoshiyama, Hanoura-machi; found above the horizon with *Orbitolina shikokuensis* YABE and HANZAWA. *P. hanouraensis* is an ammonite belonging to the group of *P. angulaticostatus* D'ORB., an indicator of the Upper Hauterivian of Europe.

2. Zone of *Pulchellia* cfr. *ishidoensis* YABE and SHIMIZU.

Pulchellia cfr. *ishidoensis* YABE and SHIMIZU.

Loc.: Ushiotoshiyama, Hanoura-machi; found somewhat above the horizon of the preceding species. *P.* cfr. *ishidoensis* is almost indistinguishable from *P. ishidoensis* from the Ishidô Group of the Sanchû Graben.

Hamulina? sp. indet.

Loc.: Ushiotoshiyama, Hanoura-machi. This species has some affinity with *H.?* sp. indet. figured by UHLIG from the Wernsdorf Bed of Moravia.

¹S. YEHARA: On the *Trigonia*-Sandstone Group in the Katsura-gawa Basin containing Ryôseki Plants. Jap. Jour. Geol. & Geogr., Vol. II, Nos. 3, 4, 1924, p. 79.

The Mochii Sandstone :

3. Zone of *Ancyloceras giganteum* YABE and SHIMIZU.

Ancyloceras giganteum YABE and SHIMIZU.

Loc. : Komô, Hanoura-machi. This species closely resembles *A. urbani* NEUMAYR and UHLIG from the Lower Aptian of Europe and also *A. (Crioceras?) abichi* ANTHULA from the Lower Aptian of Caucasus.

Cheloniceras sp. indet.

Loc. : Komô, Hanoura-machi ; found together with the foregoing species. It resembles *C. cornuerianum* D'ORB. from the Aptian of Europe.

The Fujikawa Shale :

4. Zone of *Beudanticeras shikokuense* YABE and SHIMIZU.

Beudanticeras shikokuense YABE and SHIMIZU.

Loc. : Sakamoto, Tanano-mura. *B. shikokuense* belongs to the group of *B. beudanti* (BRONGN.) characteristic of the Middle Albian of Europe.

The ammonites zones stated above may be summarised in tabular form as follows :

Fujikawa Shale	Zone of <i>Beudanticeras shikokuense</i>	Middle Albian
Hôji Sandstone		
Furuke Beds		
Mochii Sandstone	Zone of <i>Ancyloceras giganteum</i>	Aptian
Hanoura Shale	Zone of <i>Patchellia</i> cfr. <i>ishidoensis</i>	Barremian
	Zone of <i>Pseudothurmannia hanouraensis</i>	Upper Hauterivian

IV. CORRELATION OF THE LOWER CRETACEOUS AMMONITES ZONES RECOGNIZED IN VARIOUS PARTS OF JAPAN

The correlation of the Lower Cretaceous ammonites zones thus recognized in the Ishikari Coal-field (Hokkaidô), the Miyako district (Rikuchû), Ôshima (Rikuzen), Chôshi Peninsula (Shimôsa), the Sanchû Graben (Kwantô Mountainland) and the valley of the Katsura-gawa (Shikoku) is given in the annexed Table I.

TABLE I. Correlation Table of the Lower Cretaceous Ammonites Zones in Japan.

		Ishikari Coal-Field	Miyako	Ôshima	Chôshi	Sanchû Graben	Katsura-gawa
Albian	Upper (Upper Gault)	Zone of <i>Ammonoceras ezoense</i> (YABE)	—	—	—	—	—
	Middle (Lower Gault)	—	Zone of <i>Hoplites dentatus</i> (SOW.)	—	—	—	Zone of <i>Beudanticeras shikokuense</i> YABE and SHIMIZU
	Lower	—	Zone of <i>Douvilleceras nodosocostati-forme</i> SHIMIZU	—	—	—	—
Aptian	Upper (Gargasian)	—	Zone of <i>Salfeldiella caucasica</i> (SAYN) Zone of <i>Saynella matsushimaensis</i> SHIMIZU	—	Zone of <i>Colombiceras satowi</i> SHIMIZU	—	—
	Lower (Bedoulian)	—	Zone of <i>Parahoplites yaegashii</i> SHIMIZU Zone of <i>Acantholites subcornuerianus</i> SHIMIZU	—	—	Zone of <i>Pseudosaynella otsukai</i> YABE and SHIMIZU	Zone of <i>Ancyloceras giganteum</i> YABE and SHIMIZU
Barremian		—	—	—	—	Zone of <i>Pulchellia ishidoensis</i> YABE and SHIMIZU	Zone of <i>Pulchellia</i> cf. <i>ishidoensis</i> YABE and SHIMIZU
Haute-rivian	Upper	—	—	Zone of <i>Crioceras ishiharai</i> YABE and SHIMIZU	—	Zone of <i>Simbirskites kochibei</i> YABE and SHIMIZU	Zone of <i>Pseudothurmannia hanouraensis</i> YABE and SHIMIZU
	Lower	—	—	—	—	—	—

The local development of ammonites zones has been combined and brought into harmony with the European ones as much as possible, and as a result the foregoing scheme is here set forth as a provisional standard of the ammonites zones of our Lower Cretaceous. This, being my first trial, will of course require further modification. Such an approximation, though it may appear premature, will perhaps be serviceable for a further advance in the knowledge of our Cretaceous stratigraphy and palaeontology.

V. PROVISIONAL STANDARD LOWER CRETACEOUS
AMMONITES ZONES OF JAPAN

Upper Albian (Upper Gault) Zone of *Ammonoceras ezoense* (YABE)

Middle Albian (Lower Gault) { Zone of *Beudanticeras shikokuense* YABE and SHIMIZU
 { Zone of *Hoplites* aff. *dentatus* (SOW.)

Lower Albian	Zone of <i>Douvilleiceras nodosocostatiforme</i> SHIMIZU
Upper Aptian (Gargasian) . . .	{ Zone of <i>Salfeldiella caucasica</i> (SAYN) Zone of <i>Saynella matsushimaensis</i> SHIMIZU
Lower Aptian (Bedoulian) . . .	{ Zone of <i>Parahoplites yaegashii</i> SHIMIZU Zone of <i>Acanthoplites subcornuerianus</i> SHIMIZU
Barremian.	Zone of <i>Pulchellia ishidoensis</i> YABE and SHIMIZU
Upper Hauterivian.	Zone of <i>Pseudothurmannia hanouraensis</i> YABE and SHIMIZU

VI. CORRELATION OF THE MARINE LOWER CRETACEOUS OF JAPAN AND OF CALIFORNIA BY MEANS OF AMMONITES ZONES

If we follow the statement given by T. W. STANTON¹ on the Knoxville Beds of California, they apparently intercalate two distinct ammonites zones, namely the lower, Zone of *Berriasella storrsi* (STANTON), and the upper, Zone of *Simbiriskites mutabilis* (STANTON).

The Zone of *Berriasella storrsi* lies 300 ft. below the top of the Knoxville Beds and contains.

Berriasella storrsi (STANTON),
Phylloceras knoxvillensis STANTON.

Of these two ammonites, the former belongs to the group of *B. callisto* D'ORB.² from the Middle Valanginian of France.

On the other hand, the Zone of *Simbiriskites mutabilis* (STANTON) occupies a position higher up, in the upper part of the Knoxville Beds and contains

Simbiriskites mutabilis (STANTON),
Neocomites angulatus STANTON.
Crioceras latus GABB.

Of these three species, the first one belongs to the group of *S. decheni* from the Upper Hauterivian.

The Knoxville Beds are, hence, to be regarded as intercalating an ammonites zone of Middle Valanginian age in their lower part and another of Upper Hauterivian age in their upper part.

The Knoxville Beds are followed upwards by Horsetown Beds. Consulting the stratigraphical and palaeontological papers by W. M. GABB,³ J. P. SMITH,⁴ J. S. DILLER and STANTON,⁵

¹T. W. STANTON: Contribution to the Cretaceous Palaeontology of the Pacific Coast: The Fauna of the Knoxville Beds. Bull. U. S. G. S. No. 133, 1895.

²A. D'ORBIGNY: Paléontologie Française, Terrain Crétacé, Céphalopodes, 1841, p. 551, Pl. CCXIII, figs. 1-2.

³W. M. GABB: Palaeontology of California, Vols. I and II.

⁴J. P. SMITH: Mesozoic Changes in the Faunal Geography of California. Jour. Geol., Vol. II, No. 4, 1894; Periodic Migration between the Asiatic and the American Coast of the Pacific Ocean. Amer. Jour. Sci., Vol. XVIII, 1904; Ancient Climates of the West Coast, Pop. Sci. Monthly, 1910; The Geologic Record of California. Jour. Geol., Vol. XVIII, No. 3, 1910; Salient Events in the Geologic History of California, Sci. N. S., Vol. XXX, No. 769, 1919.

⁵J. S. DILLER and STANTON: The Shasta-Chico Series. Bull. Geol. Soc. Amer., Vol. V, 1894.

F. M. ANDERSON¹ and R. W. GORANSON,² we can distinguish the following seven ammonites zones in this thick formation. Namely, in descending order:

7. Zone of *Inflatoceras inflatum* (SOW.).
6. Zone of *Beudanticeras* aff. *beudanti* BRONGN.
5. Zone of *Douvilleiceras* aff. *mammillatum* SCHLOTH.
4. Zone of *Tetragonites andersoni* SHIMIZU.
3. Zone of *Pseudohaploceras?* *dilleri* (ANDERSON.)
2. Zone of *Reimondiceras reimondi* (GABB).
1. Zone of *Californiceras traski* (GABB).

The Zone of *Californiceras traski* (GABB) seems to occupy a position near the base of the Horsetown Beds; this contains

- Californiceras traski* (GABB),
Diptyhoceras laevis (GABB).

The first species³ was previously assigned to the genus *Olcostephanus*; but it is evidently not a typical *Olcostephanus* and represents a special type, properly not to be included in any hitherto known genera of ammonites. Taking it as the genotype, a new genus, *Californiceras* is proposed at this place.

The Zone of *Reimondiceras reimondi*⁴ (GABB) lies some 150 m. higher up. *Reimondiceras*⁵ is a genus recently proposed by L. F. SPATH, taking this species as its genotype.

The third, fourth, fifth and sixth zones are set forth based simply on palaeontological ground, but whether such zones do actually exist as independent ones must be verified by field work.

The third zone, Zone of *Pseudohaploceras dilleri* (ANDERSON), is established on *Pseudohaploceras dilleri*⁶ (ANDERSON) which certainly belongs to the group of *Pseudohaploceras liptoviensis* ZEUSCHNER from the Aptian of Europe; it also closely resembles *P. nipponicum* SHIMIZU from Japan.

The fourth zone, Zone of *Tetragonites andersoni* SHIMIZU, is based on a species⁷ of *Tetragonites* which is considered by ANDERSON to be related to *T. duvalianus* D'ORB.⁸ from the Lower Albian of Europe. The Californian form is, however, easily distinguished from the typical *T. duvalianus* by its broader umbilicus and more numerous radial furrows; it thus deserves to bear a new specific name, for which *andersoni* is here proposed dedicating it to Dr. F. M. ANDERSON.

¹ F. M. ANDERSON: Cretaceous Deposits of the Pacific Coast, Proc. Calif. Acad. Sci., Vol. V, 1894.

² R. W. GORANSON: A Correlation of the Mesozoic Formations of the Pacific Coast of the North America. Amer. Jour. Sci., Ser. V, Vol. VIII, 1924.

³ W. M. GABB: Pal. Calif., Vol. I, 1864, p. 63, Pl. XI, fig. 10; Pl. XII, fig. 11.

⁴ GABB: Ibid., p. 66, Pl. XII, figs. 14, 15.

⁵ L. F. SPATH: On the Ammonites of the Speeton Clay and the Subdivisions of the Neocomian. Geol. Mag., Vol. LXI, 1924, p. 87.

⁶ F. M. ANDERSON: Cret. Dep. Pacific Coast, loc. cit., p. 97, Pl. IV, figs. 116-117; Pl. X, fig. 192.

⁷ ANDERSON: Ibid., p. 81, Pl. VI, figs. 140-143.

⁸ A. D'ORBIGNY: Pal. Française, loc. cit., (1841).

The fifth zone, Zone of *Douvilleiceras* aff. *mammillatum* (SCHLOTH.) is based on the occurrence of *D.* aff. *mammillatum*¹ and the typical *D. mammillatum* is everywhere characteristic of the Middle Albian.

The sixth zone, Zone of *Beudanticeras* aff. *beudanti* (BRONGN.) is likewise based on the occurrence of an ammonite with a close affinity to *B. beudanti*,² which is characteristic of the Middle Albian of Europe, and to *B. shikokuense*, a contemporaneous representative in Japan, as is stated in a foregoing paragraph.

The seventh zone, Zone of *Inflatoceras inflatum* (SOW.) is intercalated in the uppermost part of the Horsetown.³ This indicates the Upper Albian age at its highest horizon, which is thus almost contemporaneous with the Zone of *Inflatoceras imaii* of the Japanese Cretaceous.

At any rate, it seems to me almost certain that the Lower Cretaceous of California ranges from the Middle Valanginian to the Upper Albian, although there is no trustworthy evidence indicating the Lower Aptian and Barremian; possibly these two stages are represented approximately by the Zone of *Reimondiceras reimondi* and *Californiceras traski* respectively.

The Knoxville Beds and the Horsetown Beds have been hitherto variously correlated with the European standard divisions of the Lower Cretaceous, as is shown by Table II of which the last column is my own.

TABLE II. Correlation Table of the Lower Cretaceous of California.

Author Beds	T. W. STANTON ⁴ J. P. SMITH ⁵ R. W. GORANSON ⁶	F. M. ANDERSON ⁷ J. S. DILLER and STANTON ⁸	G. C. MARTIN ⁹	E. KAYSER ¹⁰	C. SCHUCHERT ¹¹	S. SHIMIZU
Horsetown Beds	Gault	Cenomanian Gault	Cenomanian Albian Gault Aptian	Albian Aptian (?)	Gault Albian Aptian	Up. Albian } Gault M. Albian } L. Albian } Aptian } Barremian (?) }
Knoxville Beds	Neocomian	Neocomian	Barremian Neocomian		Barremian Hauterivian Valanginian	Hauterivian

Although the above statements on the Lower Cretaceous deposits of Japan and of California include many factors still unsettled and data too arbitrarily interpreted, yet we can get in this way a means of correlating in rough approximation the Lower Cretaceous deposits of Japan and California, as will be seen from Table III.

¹ ANDERSON: Cret. Dep. Pacific Coast, loc. cit., 102, p. 1908.

² DILLER and STANTON: The Shasta-Chico Series, loc. cit., (1894), p. 445.

³ DILLER and STANTON: Ibid., p. 445.

⁴ STANTON: Cret. Pal. Pacific Coast, loc. cit., 1895, p. 29-31.

⁵ J. P. SMITH: The Geologic Record of California, Jour. Geol., Vol. XVIII, No. 3, 1910.

⁶ GORANSON: Correlation Mes. Form, Pacific Coast of America, loc. cit., 1924, p. 117.

⁷ ANDERSON: Cret. Dep. Pacific Coast, loc. cit., 1902, p. 62.

⁸ DILLER and STANTON: The Shasta-Chico Series, loc. cit., 1894, p. 459.

⁹ G. C. MARTIN: The Mesozoic Stratigraphy of Alaska, U. S. G. S. Bull., No. 776, 1926, p. 474.

¹⁰ E. KAYSER: Lehrbuch der Geologie, 1924, IV Band, p. 207.

¹¹ L. V. PIRSSON and C. SCHUCHERT: A Text-Book of Geology, 1915, p. 870.

TABLE III. Correlation Table of the Lower Cretaceous Ammonites Zones of Japan and California.

	Japan	California
Upper Albian (Upper Gault)	Zone of <i>Ammonoceras ezoense</i> (YABE)	Zone of <i>Inflatoceras inflatum</i> (Sow.)
Middle Albian (Lower Gault)	Zone of <i>Beudanticeras shikokuense</i> YABE and SHIMIZU Zone of <i>Hoplites</i> aff. <i>dentatus</i> (SOW.)	Zone of <i>Beudanticeras</i> aff. <i>beudanti</i> (BRONGN.) Zone of <i>Douvilleiceras</i> aff. <i>mammil-</i> <i>latum</i> (SCHLOTH.)
Lower Albian	Zone of <i>Douvilleiceras nodosocostati-</i> <i>forme</i> SHIMIZU	Zone of <i>Tetragonites andersoni</i> SHIMIZU
Upper Aptian	Zone of <i>Salfeldiella caucasica</i> (SAYN) Zone of <i>Saynella matsushimaensis</i> SHIMIZU	Zone of <i>Pseudohaploceras?</i> <i>dilleri</i> (ANDERSON)
Lower Aptian	Zone of <i>Parahoplites yaegashii</i> SHIMIZU Zone of <i>Acanthoplites subcornueri-</i> <i>cnus</i> SHIMIZU	Zone of <i>Reimondiceras reimondi</i> (GABB)
Barremian	Zone of <i>Pulchellia ishidoensis</i> YABE and SHIMIZU	Zone of <i>Californiceras traski</i> (GABB)
Upper Hauterivian	Zone of <i>Pseudothurmannia hanc-</i> <i>uraensis</i> YABE and SHIMIZU	Zone of <i>Simbirskites nutabilis</i> (STAN-
Lower Hauterivian	---	---
Upper Valanginian	---	---
Lower Valanginian	---	Zone of <i>Berriasella storrsi</i> (STANTON)

VII. DESCRIPTION OF SPECIES

The Cephalopoda dealt with in the succeeding pages are the following 23 species, comprising 22 species of Ammonites and one species of *Nautilus*. Of them all 8 species are not specifically determined:

Nautiloidea:

Cymatoceras pseudoneokomiense SHIMIZU nov. sp.

Ammonoidea:

Hypophylloceras aff. *onoense* (STANTON)

Salfeldiella caucasica (SAYN)

Ammonoceras ezoense (YABE)

Torneutoceras? aff. *intermedium* (SOW.)

Hamulina? sp. indet.

Puzosia? *yabei* SHIMIZU nov. sp.

Saynella matsushimaensis SHIMIZU nov. sp.

Beudanticeras shikokuense YABE and SHIMIZU (MS. nom.)

Pseudohaploceras nipponicum SHIMIZU nov. sp.

- Hoplites* aff. *dentatus* (Sow.)
Pseudothurmannia hanouraensis YABE and SHIMIZU (MS. nom.)
Parahoplites yaegashii SHIMIZU nov. sp.
Acanthoplites subcornuerianus SHIMIZU nov. sp.
Cheloniceras sp. indet.
Colombiceras satowi SHIMIZU nov. sp.
Douvilleiceras nodosocostatiforme SHIMIZU nov. sp.
Crioceras? sp. indet.
Ancyloceras choshiense SHIMIZU nov. sp.
Ancyloceras giganteum YABE and SHIMIZU (MS. nom.)
Pulchellia cfr. *ishidoensis* YABE and SHIMIZU.
Inflatoceras imaii YABE and SHIMIZU (MS. nom.)
Prohysteroceras sp. indet.

Cymatoceras HYATT.

Cymatoceras pseudoneokomiense SHIMIZU nov. sp.

Pl. I, Figs. 1, 2, 3, 4.

Two deformed internal moulds are at my disposal, of which the better one (figs. 1, 2) is chosen as the holotype.

Shell gibbous, with feebly convex flanks and more or less flattened venter. Whorls broader than high, somewhat truncated oval in cross-section and broadest near the umbilical margin. Umbilicus small in size, with steep walls and rounded margin. Siphuncle 4 mm. in diameter and placed below the center (centrodorsan). Surface of the shell ornamented with numerous prominent, flattened ribs; ribs radial near the umbilical margin, running straight forwards on two-thirds of the flanks, and later bending obliquely backwards and forming rather open V-shaped sinus on the venter. Ribs 3 mm. broad and 2 mm. distant on the venter of the shell where it is about 80 mm. in diameter; generally simple but occasionally bifurcated near the umbilical margin. Septa slightly curved on the flanks, and forming a very obscure sinus on the venter.

Remarks: These specimens seem to represent a new species belonging to the genus *Cymatoceras* HYATT and clearly allied to *C. neokomiense*¹ D'ORBIGNY of Europe which ranges from the Hauterivian to the Aptian; it resembles especially the specimens² figured by PICTET and CHAMPICHE from the Aptian of Switzerland, though distinguished by somewhat broader venter, less emarginate umbilical margin, broader interspaces of ribs, and siphuncle lying slightly closer to the dorsal.

The present species resembles *C. bifurcatum*³ OOSTER figured by UHLIG from the Wernsdorf Beds of Moravia and also *C. neohipanicum*⁴ BURCKHARDT from the Upper Aptian of Mexico, but it differs from these foreign species in having almost simple and more distantly arranged ribs.

¹ D'ORBIGNY: Loc. cit., (1841), p. 74, Pl. XI.

² F. H. PICTET et G. CAMPICHE: Description des fossiles des environs de Saints-Croix, Paleontologie Suisse, Ser. II, pt. 1, livr. 7, p. 128, Pl. XV.

³ UHLIG: Loc. cit., (1883), p. 178, II, fig. 1.

⁴ C. BURCKHARDT: Faunas del Aptiano de Nazas (Durando), Inst. Geol. de Mexico, Boletin No. 45. 1925, p. 7, Pl. I, figs. 1-4.

Horizon: Zone of *Parahoplites yaegashii* SHIMIZU, the Hiraiga Sandstone.

Locality: Hideshima, Sakiyama-mura, Shimohei-gun, province of Rikuzen. Reg. No. 36520.

Hypophylloceras SALFELD

Hypophylloceras aff. *onoense* (STANTON)

Pl. I, Fig. 5; Pl. III, Fig. 29.

1864. *Phylloceras ramosum* GABB: Description of Cretaceous Fossils, Geol. Surv. Calif. Palaeontology, Vol. I, p. 65, Pl. XI, fig. 12; Pl. XII, fig. 12.
1895. *P. onoense* STANTON: Contribution to the Cretaceous Palaeontology of the Pacific Coast, the Fauna of the Knoxville Beds, U. S. G. Surv. Bull. No. 133, p. 74.
1898. *P. onoense* SMITH: The Development of *Lytoceras* and *Phylloceras*, Proceedings of the California Academy of Science, III series, Geology, Vol. I, No. 4, p. 147, Pl. XIX, XX.
1924. *Hypophylloceras onoense* SALFELD: Die Bedeutung der Konservativstämme für die Stammesentwicklung der Ammonoideen, p. 5, Pl. I.

This is a fragmental septated specimen, consisting of nearly one half a volution, about 50 mm. in diameter.

Shell discoidal, much compressed and almost flat; whorls highly involute, high and narrow, increasing rather rapidly in dorso-ventral diameter. Flanks flat and subparallel, but slightly converging toward the narrowly rounded venter and gradually passing to the umbilical wall.

Surface of the shell marked with fine crowded radial ribs, counting about 17 on a space of 10 mm. of venter, where the whorl is 23 mm. high. Ribs straight, prominent and narrower than their intervals on the venter and on the outer one-third of the flanks, rapidly becoming narrower toward, and being slightly flexuous near, the umbilical margin. Neither constriction nor interstitial striae visible.

Suture-lines: Very finely incised and composed of eight saddles and corresponding lobes. External lobe very short; external saddle oblique and overhanging the first lateral lobe; first lateral lobe twice as long as the siphonal, its outer branch being highly developed. First lateral saddle narrower and lower than the external saddle, nearly symmetrically bifid and narrower at the base. None the saddles typically phylliform.

Remarks: This species resembles *H. onoense* (STANTON) from the Horsetown Beds of California, but differs from it more or less in suture-lines. *H. onoense* was established by T. W. STANTON on that type of *Ammonites* once referred by W. M. GABB to *Ammonites ramosus* MEEK, from Cottonwood Creek, Shasta Country, California; according to STANTON, GABB's figures are not exactly drawn. STANTON¹ says that "the septum of *P. onoense* differs from that species (*P. ramosum*) in all its details, being much more like the septum of the type of *P. knoxvillense*² STANTON (from the Knoxville Beds of Tehama Country, California), though not quite so complex."

The present species differs from *P. (?) knoxvillense* not only by its finer and less prominent sculpture, but also by the entire absence of periodic constrictions.

Horizon: The No. 3 Sandstone.

Locality: Near Cape Inubô, Takagami-mura, Unakami-gun, province of Shimosu. Reg. No. 36820.

¹STANTON: Loc. cit., (1895), p. 74.

²STANTON: Loc. cit., (1895), p. 72, Pl. XIV, figs. 1-4.

Salfeldiella SPATH.*Salfeldiella caucasica* (SAYN)

Pl. III, Figs. 15, 16, 17, 28.

1900. *Phylloceras guetardi* ANTHULA, J.: Ueber die Kreidefossilien des Kaukasus mit einem allgemeinen über die Sedimentärbildungen des Kaukasus, Beiträge z. Pal. u. Geol. Osterr.-Ung. u. d. Orients, Bd. XII, p. 97 (43), Pl. V (IV), fig. 5 a-c.
1920. *P. guetardi* RASPAIL var. *caucasica* SAYN, M. G.: Les *Phylloceras* gargasiense du sud-est de la France, Mém. expl. carte geol. France, p. 190.

This species is represented by a nearly complete but slightly deformed specimen.

Dimensions:

	A		B	
Diameter	42 mm.	100	42 mm.	100
Height of the last whorl.	23	54	22	52
Breadth of the last whorl	17	40	18	43
Width of umbilicus	6	14	6	14

A = The Japanese specimen.

B = The Caucasian specimen figured by ANTHULA.

Shell discoidal, compressed and highly involute. Whorls thin and high, with greatest breadth lying at about one-third of the height of the whorl from the umbilicus. Flanks slightly convex and somewhat converging toward the convex venter. Umbilicus very small, exposing but a small portion of inner whorls. Last whorl elongate-oval in cross-section. Body-chamber occupying the last two-thirds volution and bearing the same ornamentation as the septated volutions.

Surface of the shell ornamented with five constrictions, parallel to fine lines of growth. Constrictions rather feeble on the surface of shell but distinct on the internal mould, impressed rather deep and broad. Lines of growth and constrictions arranged radially near the umbilicus, directed gently forwards on the flanks and forming rather broad projection on the venter.

Suture-lines phylloid, and not materially different from those of *S. caucasica* (SAYN) figured by ANTHULA, consisting of five saddles and corresponding lobes. Siphonal saddle narrow, elongate lanceolate and entire, never serrated along the margin; external saddle broadest and bifid inclining somewhat inward, and lower than the first lateral; first lateral saddle narrow, bifid and highest; all succeeding saddles lower, and gradually and uniformly decreasing in size towards the umbilicus; second lateral saddle as high as the external one; first lateral lobe longest and broadest, and rather asymmetrically tripartite.

Remarks: ANTHULA¹ once identified his Caucasian specimen with *P. guetardi* (RASP.) from the Gargasian of France. Later, however, SAYN² distinguished it as var. *caucasica*, because the typical *S. guetardi* shows much broader whorls, narrower umbilicus, more flexed constrictions and much stronger costation; the Japanese specimen agrees more with the varietal form than with *S. guetardi* itself.

¹ ANTHULA: Loc. cit., (1900), p. 97, Pl. V, fig. 5 a-c.

² M. G. SAYN: Les *Phylloceras* gargasiens du sud-est de la France, Mém. expl. carte geol. France, 1920, p. 197.

The Japanese specimen also resembles *S. guetardi* var. *victrica*¹ KILIAN (= *P. cfr. guetardi*² UHLIG) and *S. eresti*³ (UHLIG) from the Wernsdorf Beds of Moravia. However, the former differs from the first of the latter two in its much narrower whorls and slightly wider umbilicus and from the second in its narrower whorls, as well as in its narrower and fewer constrictions.

Horizon: Zone of *Salfeldiella caucasicca* (SAYN), the Hiraiga Sandstone.

Locality: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû. Reg. No. 36508.

Ammonoceras LAMARCK.

Ammonoceras ezoense (YABE)

Pl. IV, Figs. 1, 2, 3, 4.

1903. *Lytoceras ezoense* YABE: Cretaceous Cephalopoda from Hokkaidô, Jour. Coll. Sci. Imp. Univ. Tokyo, Vol. XVIII, Art. 2, p. 9, Pl. I, fig. 1; Pl. V, fig. 1.

Three specimens of this species are at my disposal, the best one of which is here measured and figured.

Dimensions:

	A		B	
Diameter	92 mm.	100	200 mm.	100
Height of the last whorl	40	43	80	40
Breadth of the last whorl	33.5	33	75	30
Width of umbilicus	31	32	70	35

A = The autotype of *A. ezoense*.

B = The holotype of *A. ezoense*.

Shell discoidal, very slightly involute, whorls rather rapidly enlarging, laterally compressed, higher than broad, nearly circular in cross-section and broadest at about one-third the height from the umbilical margin. Flanks rounded, somewhat converging from the broadest portion toward the venter. Venter rounded. Umbilicus very wide, with vertical walls and rounded margin.

Surface ornamented with a great number of fimbriate striae. Striae arising at the umbilical suture, bent forwards on the umbilical margin, arranged almost radially, with but a slight forward inclination, on the flanks, and forming a shallow and broad forward loop on the venter.

Ribs about 81 in number on the last volution, and separated by broader interspaces; intersected by numerous faint spiral striae on both the flanks and the venter, which are less prominent than the radial striae. Neither periodic ribs nor periodic constrictions visible.

Suture-lines consisting of four saddles and corresponding lobes. Siphonal lobe very short, and first lateral lobe with outer branch of a considerable size, and external saddle overhanging and inclined inwards. Siphonal saddle narrow, lanceolate, richly indented along the margin; external saddle deeply bifid and the highest of all the saddles, which diminish regularly in height towards the umbilical suture; second lateral saddle lying just on the umbilical margin; median secondary saddle in the first lateral lobe narrow and very high, being as high as the siphonal

¹ W. KILIAN: *Lethaea Mesozoica*, 1915, p. 332.

² UHLIG: *Loc. cit.*, (1883), p. 182, Pl. IV, fig. 9.

³ *Ibid.*, p. 183, Pl. IV, fig. 6.

saddle; a single auxiliary saddle very small. Internal portion of the suture-lines more or less similar to that of *Fimbytoceras fimbriatum*¹ (Sow.) from the Liassic of Europe figured by SALFELD, but very complicately ramified. Antisiphonal lobe narrow, bifid at the end, considerably longer than the siphonal, and provided with a long, rather narrow side-lobe at about the middle of the length on each side; side lobe very long, passing over the umbilical suture and extending to near the second lateral lobe; the outer branch of the first auxiliary saddle with its inner side lying nearly on the umbilical suture.

Remarks: The genus *Ammonoceras* was established by LAMARCK² in 1822, and recently SPATH³ says about it that "the genus is adopted for the group of *Ammonites mahadeva* STOLICZKA which is probably identical with the fragments originally described by LAMARCK as *Ammonites glossoidea*, certainly not a Jurassic form as has been held by BEYRICH."

Neither specimen nor figure of *Amm. glossoidea* being accessible and LAMARCK's description of this species being incomplete, I cannot come to any definite conclusions.

Accepting SPATH's opinion as most credible, there is no question about it that *Lytoceras ezoense* YABE also should be placed in the genus *Ammonoceras*, because this species evidently belongs to the group of *Amm. mahadeva*, as early pointed out by YABE.

The present specimens are exactly identical with the holotype of *Lyto. ezoense* described by YABE. They most closely resemble *A. mahadeva*⁴ (STOLICZKA) from the Utatur Group of South India, being distinguished from the latter by its whorls more gradually increasing in height and breadth. Another species which resembles ours is *Lytoceras argonautarum*⁵ ANDERSON from the Upper Horsetown Beds of California, which is probably likewise referable to the genus *Ammonoceras*; this species shows radial striae very similar to those of *A. ezoense*, and whorls rapidly enlarging, though it differs from the Japanese form by lacking spiral striae and by its much broader whorls, being broadest near the middle of the flanks, instead of at one-third of its height from the umbilical margin.

With respect to the ornamentation, the Japanese species is very similar to *Lytoceras batessi*⁶ MEEK figured by GABB from the Shasta Group of California and RICHARDSON's *C. horizon* of the Cretaceous of the Queen Charlotte Islands. The latter also may belong to the genus *Ammonoceras*; it has a wider umbilicus as well as less rapidly enlarging whorls.

Horizon: Zone of *Ammonoceras ezoense* (YABE), the Lower Ammonites Beds.

Locality: The mid-course of the Ikushumbets, Mikasayama-mura, Sorachi-gun, province of Ishikari, Hokkaidô. Reg. No. 35161.

¹ H. SALFELD: Über die Ausgestaltung der Lobenlinie bei Jura- und Kreide-Ammonoiden, K. Gesellschaft d. Wissenschaft. z. Göttingen, Math.-Phys. Klasse, 1919, p. 14, Pl. II, fig. 7; SALFELD: Die Bedeutung der Konservativstämme für die Stammesentwicklung der Ammonoideen, Leipzig, 1924, Pl. IX.

² LAMARCK: Histoire Naturelle de Animaux sans Vertèbres, Vol. XI, 1945, p. 340.

³ SPATH: Revision of the Jurassic Cephalopod Fauna of Kachh (Cutch), Pal. Indica, New Series, Vol. IX, No. 2, 1927, p. 5, 6.

⁴ STOLICZKA: Op. cit., (1866), p. 165, Pl. LXXX.

⁵ F. M. ANDERSON: Cretaceous Deposits of the Pacific Coast, Proceedings of the California Academy of Science, III ser., Geology, Vol. II, No. 1, 1902, p. 85, Pl. VII, figs. 154-155.

⁶ W. M. GABB: Palaeontology of California, Cret. Foss., Vol. I, 1864, p. 67, Pl. XIII, figs. 16 a-b; WHITEAVES: Op. cit., (1876), Vol. I, pt. 1, p. 45, Pl. IX, fig. 2; WHITEAVES: Ibid., (1884), Vol. I, pt. 3, p. 202, Pl. XXVII, fig. L; T. W. STANTON and DILLER: The Shasta Chico Series, Bull. Geol. Soc. America, 1894, Vol. V, p. 446; T. W. STANTON: Contribution to the Cretaceous Palaeontology of the Pacific Coast; the Fauna of the Knoxville Beds, Bull. U. S. Geol. Surv., 1895, No. 133, p. 75, Pl. XIII, figs. 9-11.

Torneutoeras HYATT.*Torneutoceras* ? aff. *intermedium* (SOWERBY)

Pl. III, Figs. 3, 4.

A small portion of a shell like *Hamites*, about 18 mm. in length, is believed to be best comparable with *T. intermedium* (SOWERBY)¹, from the Gault of France. The present example is somewhat deformed, so that the original outline of the whorl cannot accurately be determined; it lacks, moreover, suture-lines. Shell slightly curved, ornament consists of numerous, rounded, transverse ribs. Ribs are rather narrow, separated by somewhat broader and shallow interspaces, arranged more or less obliquely forwards except on the dorsal region, where they are indistinct. Our form more or less resembles *Torneutoceras intermedium* (SOW.), though different by having less oblique and narrower ribs. *T. aff. intermedium*² figured by E. BÖSE from the Vraconnian of Mexico likewise possesses stronger and more oblique ribs.

*T. attenuatum*³ (SOW.) figured by PICTET and CHAMPICHE from the Gault of Switzerland has much broader ribs and narrower interspaces. This species is the genotype of *Torneutoceras*.

Some confusion has arisen in regard to *T. intermedium* and *T. attenuatum*; while *Hamites intermedius* of RENEVIER and *H. attenuatus* of D'ORBIGNY are, according to BÖSE,⁴ *T. intermedium* (SOW.), *H. attenuatus* of D'ORBIGNY and *H. attenuatum* of PICTET and CAMPICHE are considered by SPATH⁵ to be specifically identical. I rather tend to accept BÖSE's view.

Horizon: Zone of *Douvilleiceras nodosocostatiforme* SHIMIZU, the Hiraiga Sandstone.

Locality: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû. Reg. No. 36859.

Hamulina D'ORBIGNY.*Hamulina* ? sp. indet

Pl. IV, Fig. 12.

An internal gypsum cast in a rather bad state of preservation was examined.

Shell tubular, V-shaped; broken at both ends. The prolonged and reflected portions slender, straight; about 70 mm. and 27 mm. long respectively; angle sustained between the dorsal and ventral lines of the prolonged portion about 7°; separated by a uniform space about 7 mm. broad; much compressed secondarily and the original section of the whorl hardly determinable.

Surface of the cast marked with prominent, narrow, usually simple and rarely bifurcating transverse ribs, in alternation of moderately broad and deep concave furrows. Ribs about 1 mm. apart on the prolonged portion and nearly 2 mm. apart on the reflected portion.

¹D'ORBIGNY: Loc. cit., (1841), p. 533, Pl. CXXXI, figs. 9-13.

²E. BÖSE: Algunas Faunas Cretácicas de Zacatecas, Durango y Guereeto, Instituto Geológico de Mexico, Bull. No. XLII, 1923, p. 132, Pl. IX, figs. 43-45.

³F. J. PICTET and G. CAMPICHE: Description des Fossiles du Terrain Crétacé des Environs de Sainte-Croix, Matériaux pour Paléontologie Suisse, Vol. III, 1861-1864, p. 88, Pl. LIV, figs. 1-3.

⁴E. BÖSE: Loc. cit., (1923), p. 132.

⁵SPATH: On Cretaceous Ammonoidea from Angola, collected by Prof. J. W. GREGORY, Transactions Royal Society Edinburgh, Vol. LIII, pt. 1 (No. 6), 1922, p. 148.

Remarks: Although not only imperfect, but also unknown as to its suture-lines, yet its resemblance to the genus *Hamulina* D'ORBIGNY and particularly to such a species as *Hamulina* sp. indet. figured by UHLIG¹ from the Wernsdorf Beds of Moravia is strong. Compared with the Moravian species it has the curvature between the prolonged and reflected portions more open, and coarser ribs on the reflected tube.

*H. davidsoni*² COQUAND (= *H. lorioli* UHLIG) from the Barremian of Switzerland is another allied form; it has much finer costae on the prolonged tube.

Horizon: Zone of *Pulchellia* cfr. *ishidoensis* YABE and SHIMIZU, the Hanoura Shale.

Locality: Ushiotoshiyama, Hanoura-machi, Naka-gun, province of Awa. Reg. No. 35299.

Puzosia BAYLE.

Puzosia? *yabei* SHIMIZU nov. sp.

Pl. III, Figs. 18, 19, 20, 27.

A single small pretty specimen (an internal mould) was examined.

Dimensions:

Diameter	18 mm.	100
Height of the last whorl	6	33
Breadth of the last whorl	7	38
Width of umbilicus	3.5	41

Shell discoidal, composed of several gradually enlarging whorls. Whorls flattened on the flanks, slightly broader than high, and showing the greatest breadth near the middle of the flanks. Aperture subquadrate in cross-section. Venter narrow, convex. Umbilicus wide and shallow, surrounded by vertical walls which are very low and pass into flanks with rounded margin. Involution about $\frac{1}{2}$. Body-chamber occupying two-thirds of the last volution.

Surface marked with numerous flexuous, rather fine radial ribs, and broad, deep periodic constrictions. Constrictions five in number on the outer volution, arising at the umbilical suture, passing over the flanks obliquely forwards, and forming an acute saddle directed forwards on the venter. Ribs five to nine in number, visible only on the body-chamber, generally commencing near the umbilical margin, and running most prominently on the ventro-lateral and weakly on the venter on the internal mould.

Suture-lines: Rather simple, sloping gradually backwards, though a little less than in *Puzosia mayoriana* D'ORBIGNY.

Remarks: The first species among the known ones, with which I should like to make comparison, is *P. ibrahim*³ COQUAND ranging from the Upper Barremian to the Aptian of Tunis, figured by PERVINQUIÈRE. Our form differs from this, not only by higher and narrower whorls with more flattened flanks, but also by a somewhat different type of suture-lines. In *P. yabei*, the first lateral saddle is nearly as broad and as high as the external, and the third lateral saddle lies on

¹ UHLIG: Cephalopoden d. Wernsdorferschiechten, loc. cit., (1883), p. 216, Pl. XIII, fig. 8.

² C. SARASIN and C. SCHÖNDELMAYER: Étude Monographique des Ammonites du Crétacique Inférieur de Chatel-Saint-Denis, Mém. Soc. Pal. Suisse, Vol. XXIX, 1902, p. 163, Pl. XXIII, figs. 1-3.

³ PERVINQUIÈRE: Loc. cit., (1907), p. 154, Pl. VI, figs. 23 a-c.

the umbilical margin, while in *P. ibrahim* the first lateral saddle is narrower and lower than the external one and the third lateral lobe lies on the umbilical margin.

On the other hand, the suture-lines of the Japanese species, as far as visible, nearly agree with those of *P. angladei*¹ SAYN, ranging from the Upper Barremian to the Aptian of Tunis, figured by PERVINQUIÈRE. In *P. angladei*, however, the saddles are generally much more elevated; moreover, it has more rounded whorls, and a narrower umbilicus.

In external appearance, this species resembles *Silesites seranois*² D'ORBIGNY (= *Amm. trajawi* TIETZE) from the Barremian of Europe and Tunis, figured by D'ORBIGNY, PERVINQUIÈRE and TIETZE. However, the Japanese form is easily distinguished from *Silesites* by the suture-lines sloping gradually backwards, instead of being horizontal or curving forwards as in the genus.

Furthermore, this species considerably resembles in many respects *Melchiorites melchioris*³ (TIETZE) from the Aptian of Europe and Tunis, and *M. emerci*⁴ (RASPAIL) from the Aptian of Europe, though distinguished from them by stronger costation, the longer siphonal lobe and more inclined auxiliaries.

P. ? yabei and its foreign allies, *P. ibrahim* and *P. angladei*, may possibly belong to *Melchiorites*; but I follow KILIAN⁵ and PERVINQUIÈRE⁶ provisionally in placing them in *Puzosia*.

Horizon: Zone of *Salfeldiella caucasica* (SAYN), the Hiraiga Sandstone.

Locality: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû. Reg. No. 36506.

Saynella KILIAN.

Saynella matsushimaensis SHIMIZU nov. sp.

Pl. I, Figs. 10, 11, 12, 13; Pl. III, Fig. 26.

Several small specimens were examined, of which the best preserved is chosen as the holotype; it is figured and measured.

Dimensions:

Diameter	20 mm.	100
Height of the last whorl	9	40
Breadth of the last whorl	7	31
Width of umbilicus	6	27

Shell discoidal, laterally compressed, composed of several rather rapidly enlarging whorls; whorls higher than broad, with greatest breadth near the umbilical margin. Flanks flattened,

¹ PERVINQUIÈRE: Loc. cit., p. 155, Pl. VI, figs. 21 a-b; 22 a-c.

² D'ORBIGNY: Loc. cit., (1841), p. 361, Pl. CIX, figs. 4-5; PERVINQUIÈRE: Loc. cit., p. 170, Pl. VI, fig. 24 a-b; E. TIETZE: Geologische und Palaeontologische Mitteilungen aus dem südlichen Theil des Banater Gebirgstockes, Jahrbuch d.k.k. geologischen Reichsanstalt, Wien, Vol. XXII, 1872, p. 140, Pl. IX, figs. 1-2; P. FALLOT: Remarques sur le Genre *Silesites*: Mém. p. Servir à l'Explication de la Carte Géologique Détaillée de la France, 1920, p. 215.

³ TIETZE: Loc. cit., p. 135, Pl. IX, figs. 9-10; UHLIG: Loc. cit., (1883), p. 232, Pl. XCII, figs. 5, 12; PERVINQUIÈRE: Loc. cit., p. 147, Pl. VI, figs. 15 a-c; FALLOT: Observations sur diverses especes du Gargasien bathyal Alpin et en particulier sur la Faune de Blieux, Mem. l'Expl. Carte Geol. Detaillée de la France, 1920, p. 254.

⁴ D'ORBIGNY: Loc. cit., (1841), p. 160, Pl. LI, figs. 1-3; UHLIG: Loc. cit., p. 224, Pl. XVII, fig. 13; Fallo: Loc. cit., p. 249.

⁵ W. KILIAN: Lethaea Geognostica, Das Mesozoicum, 3 Bd, Kreide, Erste Abteilung: Unterkreide (Palaeocretacium), Zweite Lieferung, 1910, p. 335.

⁶ PERVINQUIÈRE: Loc. cit., (1907), p. 154, 156.

and slightly converging towards the venter. Venter narrow and almost flat, being but slightly convex; ventral margin rounded. Umbilicus small and deep with nearly vertical walls and well defined rounded margin. Involution about 3/4.

Surface marked with slightly flexuous ribs, about 10 in number on the outer volution, which on the internal mould are bordered by a broad, rather deep constriction in front. Ribs commence near the umbilical margin, bend slightly forwards at a short distance from the umbilical margin, pass over the flanks nearly radially, and cross the venter in a gentle forward curve.

Surface of the shell between the ribs apparently smooth excepting numerous, very fine striations visible by a lense.

Suture-lines: Simply incised. Siphonal saddle small and short. External saddle asymmetrically bifid, with the inner branch much narrower than the outer. First lateral saddle also bifid, with a much smaller outer branch and a larger inner one, once more divided by a tertiary lobe which is nearly as long as the secondary lobe; thus appearing almost trifid as in D'ORBIGNY's figure of *S. parandeiri* D'ORBIGNY¹. First lateral lobe longer than the siphonal and somewhat asymmetrically tripartite. Auxiliary elements slightly inclined.

Remarks: It is to be kept apart from such genera as *Puzosia* and other allied genera by its asymmetrical first lateral lobe and slightly inclined auxiliaries; and these characters on the other hand suggest its reference to the genus *Saynella* KILIAN, with which it has also flexuous ribs in common.

This species is closely allied to *S. parandeiri* D'ORBIGNY from the Albian of France; but it is more involute and has less flexuous ribs.

It also resembles *Puzosia ligata* D'ORBIGNY² from the Hauterivian of France, from which it is distinguished by flexuous ribs and by certain details of suture-lines. The Japanese species is a form intermediate between *S. parandeiri* and *P. ligata*, and more nearly approaching the former of the two.

Horizon: Zone of *Saynella matsushimaensis*, the Hiraiga Sandstone.

Locality: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû. Reg. No. 36507.

Beudanticeras HITZEL.

Beudanticeras shikokuense YABE and SHIMIZU (MS. nom.)

Pl. IV, Figs. 5, 6.

An imperfect internal mould in a yellowish fine sandstone was examined; it consists of two-thirds of one volution.

Dimensions:

Diameter	56 mm.	100
Height of the last whorl	26	45
Breadth of the last whorl	18	32
Width of umbilicus	9	16

¹D'ORBIGNY: Loc. cit., (1841), p. 129, Pl. XXXVIII, figs. 7-9.

²Ibid., p. 126, Pl. XXXVIII, figs. 1-4.

Shell discoidal, highly compressed. Whorls considerably higher than broad, rapidly increasing in height, with flanks gradually converging toward the narrowly rounded venter; elongate elliptical in cross-section; broadest near one-third of the height from the umbilical margin. Flanks flattened, being very slightly convex. Umbilicus narrow with rather steep wall, which gradually passes into the flanks with a round margin. Body-chamber occupying slightly less than two-thirds of the last volution.

Surface of the internal mould marked with several distinct, very flexuous, oblique constrictions, and many feeble traces of fine falciform striae, which are quite parallel to the constrictions. Constrictions counting possibly six in number on the body-chamber; arise near the umbilical suture; curve slightly backwards immediately after passing over the umbilical margin, bend forwards near one-third of the height of the whorls from the umbilical margin, thence making a rather conspicuous backward curve near the ventral margin, and finally crossing the venter in a sharp forward loop.

Suture-lines, partly visible, much serrated; external saddle nearly symmetrically bifid; first lateral lobe somewhat asymmetrically tripartite and very much longer than the siphonal.

Remarks: In general character, this species seems to possess a very close specific relation to *B. ligatum*¹ (NEWTON and JUKES-BROWNE) from the *mammillatus* zone of the Folkestone of England as figured by SPATH. The Japanese species, however, differs from its European ally in being slightly narrower in umbilicus and broader in whorl.

Further, it is distinguished from *B. laevigatum*² (SOW.) from the *dentatus* zone of the Middle Albian of England, not only by its narrower whorls and umbilicus, but also by having periodic constrictions.

It differs from *B. beudanti*³ (BRONGN.) from the *cristatus* zone of the Middle Albian of England, in its more rounded venter.

Horizon: Zone of *Beudanticeras shikokuense* YABE and SHIMIZU, the Fujikawa Shale.

Locality: Sakamoto, Tana-mura, Katsura-gun, province of Awa. Reg. No. 35154.

Pseudohaploceras HYATT.

Pseudohaploceras nipponicum SHIMIZU nov. sp.

Pl. I, Figs. 17, 18, 19.

A single fragmental specimen (30 mm. in height, and 24 mm. in breadth) was examined.

Shell laterally compressed, with narrow and rounded venter and flattened nearly parallel flanks; whorls higher than broad, oblong-elliptical in cross-section, being broadest at a little below the middle of the flanks.

Surface marked with numerous falciform ribs and several stronger periodic ones. Periodic ribs appearing as somewhat deep and broad constrictions on the internal mould; beginning on the umbilical margin, without any tubercles or projections; directed slightly forwards near the umbilical margin, bent backwards near the middle of the flanks, and distinct and forming a rather acute

¹L. F. SPATH: A Monograph of the Ammonoidea of the Gault, Palaeontographical Society, 1921, p. 58, Pl. III, figs. 3 a-e.

²Ibid., Loc. cit., 1921, p. 55, Pl. III, figs. 2 a-d, Text-figs. 13.

³SPATH: Ibid., p. 49, Pl. II, figs. 4 a-d; Text-fig. 12.

forward loop on the venter; broad and rounded, about twice as broad as the interstitial ones on the venter, and counting four in number in half a volution; sometimes bounded on both sides by a rather deep constriction.

Suture-lines: Unknown.

Remarks: I was once inclined to think that this species might belong to the group of *Desmoceras emerici* which is now placed under the genus *Merchiorites* by SPATH.¹ Now, however, it appears to me more probable that it represents a new species of the genus *Pseudohaploceras* HYATT, much resembling *P. liptoviensis*² ZEUSCHNER from the Wernsdorf Beds of Moravia.

Ammonites liptoviensis was included at first in the genus *Haploceras* by UHLIG³ and subsequently taken by HYATT as the genotype of his new genus *Pseudohaploceras*.

Several authors, W. KILIAN,⁴ M. P. FALLOT⁵ and others, do not accept the genus *Pseudohaploceras*, but place *Ammonites liptoviensis* under the genus *Puzosia* BAYLE.

SPATH alone holds *Pseudohaploceras* distinct and in this respect, I follow him, especially on the following accounts. In *Pseudohaploceras*, (1) the shell is more involute; (2) the umbilicus is narrow; (3) the suture-lines exhibit peculiar features and the auxiliaries are less oblique, being more or less erect.

On the other hand, *Pseudohaploceras* is easily distinguished from *Latidorsella* by having narrower and less inflated whorls, more prominent costation, a peculiar front of suture-lines, a much longer first lateral lobe, and a little more oblique auxiliaries.

The present species is very closely allied to *P. falcistriatum*⁶ (ANTHULA) from the Aptian of Caucasus, which, ANTHULA considered to belong to the group of *Desmoceras emerici*; but the former differs from the latter in having narrower whorls, less convex flanks and more flexuous costae.

Compared with *P. liptoviensis*, the Japanese form has more flexuous and slightly weaker costae; it is easily distinguished from *P. dilleri*⁷ (ANDERSON) from the Horsetown Beds of California by its much narrower whorls and flexuous costae.

Horizon: Zone of *Salfeldiella caucasica* (SAYN), the Hiraiga Sandstone.

Locality: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû. Reg. No. 36514.

Hoplites NEUMAYR, emend SPATH.

Hoplites aff. *dentatus* (SOWERBY).

Pl. IV, Figs. 10, 11.

1925. *Hoplites dentatus* SPATH: A Monograph of the Ammonoidea of the Gault, Pal. Soc., London, Pt. II, p. 101, Pl. VII, figs. 5-10; text-figs. 23-24.

¹SPATH: The Gault Ammonoidea, loc. cit., (1921), p. 33, 35.

²UHLIG: Die Cephalopoden der Wernsdorferschichten, loc. cit., p. 229, Pl. XVI, figs. 9, 16-18; Pl. XVIII, 1, 3, 5, 6.

³Ibid., p. 229, Pl. XVII, figs. 9, 16-18; Pl. XVIII, figs. 1, 3, 5, 6.

⁴W. KILIAN: Lethaea Geognostica, II Theil, Das Mesozoicum, 3 Bd., Kreide, 1910, p. 335.

⁵P. FALLOT: Observations sur diverses especes der Gargasien bathyal Alpin et en particulier sur la Faune de Blicux. Mémoires pour servir à de la carte geologique détaillée de la France, 1920, p. 259.

⁶ANTHULA: Über die Kreidefossilien des Kaukasus, loc. cit., (1899), p. 103, Pl. VIII, figs. 2 a-c.

⁷ANDERSON: Cretaceous Deposits of the Pacific Coast, loc. cit., (1902), p. 97, Pl. IV, figs. 116-117; Pl. X, fig. 192.

A single deformed fragmental specimen was examined. This form resembles *H. dentatus* (Sow.), and especially *H. aff. Dentatus*¹ figured by SPATH from the Middle Albian of England, which is distinguished by compressed whorls with sulcated venter and bifurcating prorsiradiate ribs. In a diameter of about 10 mm., the shell possesses an umbilicus about 3 mm. wide. Whorl considerably higher than broad, and increasing somewhat more rapidly in height than in *H. dentatus*. Flanks flattened but slightly convex, and passing rather abruptly to the narrow, sulcated venter. Ventral sulcus somewhat broad and rather shallow.

Sculpture consists of numerous rounded ribs, bifurcating at the umbilical tubercles; 7 in number on half a volution. In approaching the venter, ribs become broader gradually, terminating in a tubercle more distinct than that of *H. dentatus*; marginal tubercles on two sides of a median ventral groove alternate as in *H. dentatus*. Ribs completely disappear without passing across the venter. Preservation being unfavourable, I could not succeed in tracing the suture-lines in this specimen.

Horizon: Zone of *Hoplites aff. dentatus*, the Akito Sandstone.

Locality: Akito, Tanohata-mura, Shimohei-gun, province of Rikuchû. Reg. No. 36513.

Pseudothurmannia SPATH.

Pseudothurmannia hanouraensis YABE and SHIMIZU (MS. nom.)

Pl. I, Figs. 20, 21, 22, 23, 24; Pl. III, Fig. 11.

Several specimens of this species were examined; all are rather ill preserved in a yellowish sandy shale, being either external or internal moulds. The best preserved internal cast (fig. 20) taken as the holotype, has the following dimensions:

Diameter	34 mm.	100
Height of the last whorl	13	38
Breadth of the last whorl	—	—
Width of umbilicus	12	35

In the following description, the notes on the outline of whorls in cross-section and on the suture-lines are based on another small specimen, an internal mould (figs. 22, 23, 24).

Shell discoidal, consists of a few rather slowly enlarging whorls. Whorls considerably higher than broad, trapezoidal in cross-sections, being broadest near the umbilical margin. Flanks flattened, only slightly convex, and somewhat converging toward the narrowly arched venter, which unites with the flanks in rather distinct somewhat narrowly rounded margins. Umbilicus shallow and moderate in size, with steep rather low and slightly convex walls, which are separated from the flanks by a fairly distinct, rounded margin. Involution slightly less than 1/2.

Ornamentation consists of a number of longer ribs in alternation with one or two shorter ones; both ribs rounded on the flanks and rather flattened on the venter. Longer ribs arise near the umbilical suture, curve slightly backwards on the umbilical margin and pass over the flanks nearly radially, then cross straight over the venter. Shorter ribs variable in length, ranging between one-half to two-thirds of the longer ones; occasionally, but not always combined with the longer ones near the middle of the flanks.

¹SPATH: A Monograph of the Ammonoidea of the Gault, loc. cit., (1925), p. 103. Pl. VII, fig. 6.

Suture-lines: Partly visible; simply serrated. Siphonal saddle very short; external saddle bifid; first lateral lobe tripartite, slightly longer than the siphonal.

Remarks: Our species evidently belongs to the group of *Ammonites anglicostatus* D'ORBIGNY and represents a new species. In the past some controversy has prevailed as to the taxonomic position of *A. anglicostatus*; HYATT¹ considered it as belonging to the genus *Acanthoceras*, while afterwards STANTON² and J. FELIX³ placed it in the genus *Hoplites*. On the other hand, ANTHULA⁴ included it in the genus *Parahoplites*, KILIAN first placed it in *Hoplites (Neocomites)*⁵, then transferred it to *Parahoplites*⁶ and finally placed it in *Acanthoplites*.⁷ Recently, SPATH⁸ established the genus *Pseudothurmannia* with *A. anglicostatus* as its genotype.

The Japanese species differs from *Pseudothurmannia anglicostatus*⁹ D'ORBIGNY from the Hauterivian of Europe and Mexico, in its narrower venter and in its trapezoidal whorl in cross-section.

*P. storsi*¹⁰ (STANTON) from the Knoxville Beds of California has rather finer ribbing and longer first lateral lobe.

Compared with *Hoplites tenochi*¹¹ described by I. FELIX from the Neocomian in Mexico, the Japanese species is a more involute form.

*Hoplites tlachiacensis*¹² FELIX from the Neocomian of Mexico has more rapidly enlarging whorls and narrower umbilicus.

Horizon: Zone of *Pseudothurmannia hanouraensis* YABE and SHIMIZU, the Hanoura Shale.

Locality: Ushiotoshiyama, Hanoura-machi, Naka-gun, province of Awa. Reg. Nos. 35304, 36516 and 36860.

Parahoplites (s. st.) ANTHULA emend KILIAN.

Parahoplites yaegashii SHIMIZU, nov. sp.

Pl. II, Figs. 1, 2, 3; Pl. III, Figs. 1, 2.

A single specimen was examined. The following table shows the dimensions of *P. yaegashii* and of its near allies:

	A		B		C		D		E	
	mm.		mm.		mm.		mm.		mm.	
Diameter	200	100	120	100	157	100	270	100	150	100
Height of the last whorl	78	39	50	41	71	45	106	39	68	45
Breadth of the last whorl	50	25	37	31	40	25	73	27	39	26
Width of umbilicus	70	35	36	30	38	24	80	29	35	23

¹ STANTON: The Colorado Formation and Its Evertbrate Fauna, Bull. U. S. Geol. Surv. No. 106, 1893, p. 176.

² STANTON: The Fauna of the Knoxville Beds, loc. cit. (1895), p. 80.

³ FELIX: Versteinerungen aus der Jura-und Kreide-Formation, Palaeontographica, Vol. XXXVII, 1891, p. 185.

⁴ ANTHULA: Über die Kreidefossilien des Kaukasus, loc. cit. (1899), p. 114.

⁵ KILIAN: Das Mesozoicum, 3 Bd., Kreide, loc. cit. (1910), p. 268.

⁶ Ibid., p. 343, 345.

⁷ Ibid., p. 349.

⁸ SPATH: The Gault Ammonoidea, loc. cit. (1921), p. 66.

⁹ D'ORBIGNY: Pal. Française, loc. cit. (1841), p. 146, Pl. XLVI, figs. 3-4.

¹⁰ STANTON: The Fauna of the Knoxville Beds, loc. cit. (1895), p. 79, Pl. XVII, figs. 1-2; Pl. XVIII, fig. 5.

¹¹ FELIX: Versteinerungen aus der Jura-und Kreide-Formation, loc. cit. (1891), p. 186, Pl. XVIII, figs. 1-3.

¹² Ibid., p. 184, Pl. XXVIII, fig. 5.

- A = *P. yaegashii*.
 B = *P. uhligi* ANTHULA.
 C = *P. weissii* UHLIG and NEUMAYR.
 D = *P. germanicus* nom. nov.
 E = *P. weissii* KOENEN.

Shell discoidal, more or less compressed, with a few rather rapidly expanding whorls; whorls higher than broad, ovate-elliptical in cross-section, being broadest somewhat below the middle of the flanks (at nearly one-third of the height of the whorl from the umbilical margin). Flanks feebly convex or nearly flat, very gradually converging towards and insensibly passing into the rather narrowly convexed venter. Umbilicus moderate in size and rather shallow, with rounded margin, and somewhat steep inner walls. Involution about 1/3.

Surface of the shell marked with numerous, rounded, gently flexuous, radial ribs. Ribs about 18 in number on the last one-half volution near the umbilical margin, usually bifurcating near the middle of the flanks, and slightly broader than their interspaces which are shallow and concave; straight and radial on the umbilical wall, slightly swollen on the umbilical margin, then somewhat bent forward near the umbilical margin on the flanks, but soon straightening up and passing over the venter without any change. On the venter of the last one-half volution, the ribs regularly arranged, average from 4 to 5 mm. in breadth, and from 3 to 4 mm. apart.

Suture-lines: Relatively simple, arms of the saddle being not deeply incised. External saddle large, broad, and bifid symmetrically; first lateral saddle just as high as the external one, and half as broad; second lateral saddle with its inner margin nearly coinciding with the umbilical margin, nearly as broad as the first lateral one. First lateral lobe the longest and much broader than the second lateral one; tripartite asymmetrically, the outer branch being more prominent, and longer than the inner one.

Remarks: Without doubt this species belongs to the genus *Parahoplites* (s. st.) ANTHULA emend KILIAN,¹ and especially to the group of *P. weissii* UHLIG and NEUMAYR in the sense of W. KILIAN¹. V. UHLIG and M. NEUMAYR³ figured two specimens of *P. weissii* from the Lower Aptian of Germany, of which the larger one⁴ somewhat differs from the smaller⁵ (holotype), in having slightly wider umbilicus, much more rounded whorls, less involute form (the former nearly 1/3, while the latter 1/2), and ribs branching much more outwards.

Hence, I propose a new specific name *P. germanicus* for the larger specimen as an independent species. *P. weissii*⁶ figured by KILIAN from the Bedoulian of France seems to be referable to *P. germanicus*, since his figures show a wider umbilicus and less involution than the typical *P. weissii*.

The dimensions given above show that the Japanese species has the widest umbilicus among these related forms.

¹ W. KILIAN: La Fauna de l'Aptien Inférieur des Environs de Montélimar (Drome), Mém. l'Expl. Carte Géol. France 1915, p. 36.

² Ibid., p. 38.

³ M. NEUMAYR and V. UHLIG: Über Ammonitiden aus den Hilsbildungen Norddeutschland, Palaeontographica, Vol. XXVII, 1881, p. 179, Pl. XLVII, fig. 1 a; Pl. XLVI, fig. 1 a.

⁴ Ibid., Pl. XLVII, fig. 1 a.

⁵ Ibid., Pl. XLVI, fig. 1 a.

⁶ KILIAN: Loc. cit. (1915), p. 42, Pl. III, fig. 3; Pl. IV, fig. 4.

This species, moreover, differs from *P. weissi*, in the lower whorls, much less involute form, and the characteristic straight ventral costation, and from *P. germanicus* in the ribs branching more innerwards and straightening on the venter.

When compared with the Caucasian species it is found that the shape of the whorl distinguishes it from *P. uhligi*¹ ANTHULA (non. *A. uhligi*² WEERTH) from the Lower Aptian. The Japanese form shows a rounded ventral margin, while the Caucasian form is more or less subangular, and has a rather wider umbilicus.

Suture-lines show more incision than those of *P. weissi* figured by NEUMAYR and UHLIG,³ and nearly equal degrees of incision to that of *P. consobrinoides* SINZOW from the Aptian of North Germany figured by NEUMAYR and UHLIG,⁴ a species that has a narrower umbilicus (25%) and higher whorls (45%), as far as can be seen from his figures.

P. yaegashii, however, has a broader and more asymmetrical first lateral lobe than that of *P. consobrinoides*.

The marked straight ventral costation, wider umbilicus, and broader first lateral lobe, seem to me, to distinguish it from all others. The specific name is dedicated to Mr. S. YAEGASHI who discovered the holotype.

Horizon: Zone of *P. yaegashii* SHIMIZU, the Hiraiga Sandstone.

Locality: Hideshima, Sakiyama-mura, Shimohei-gun, province of Rikuchû. Reg. No. 36509.

Acanthoplites SINZOW.

Acanthoplites subcornuerianus SHIMIZU nov. sp.

Pl. I, Figs. 8, 9.

Several imperfect specimens were examined. The holotype is a somewhat obliterated internal mould; it differs considerably from any other species belonging to *Acanthoplites* in ornamentation, so that it is considered advisable to distinguish it by a new specific name.

Shell about 25 mm. in diameter. Umbilicus 14 mm. in width, rather shallow, surrounded by more or less steep walls which round off into the flattened flanks. Whorls higher than broad, subquadrate in cross-section. Involution about 1/3.

Ornamentation consists of numerous, somewhat flexuous ribs of two kinds. Principal ribs arise on the umbilical suture, pass over the flanks in a slightly forward curve, and then cross the venter without any change; tuberculated on the umbilical and ventral margins, as well as little above the middle between them. Secondary ribs generally less prominent, narrower, shorter and not tuberculated. All the ribs differing with age; on the inner half of the last volution, the principal ribs regularly bifurcate at the lateral tubercles, and there are two or three secondary ones usually arising near the umbilical margin and inserted between a pair of the principal ones;

¹J. ANTHULA: Über die Kreidefossilien des Kaukasus, Beiträge z. Paläontologie u. Geologie Osterreich-Ungarns u. d. Orients, Vol. XII, 1900, p. 115 (60), Pl. X (IX), figs. 1 a-b. L. PERVINQUIÈRE: Études de Paléontologie Tunisienne, I, Céphalopodes des Terrain Secondaires, 1907, p. 190; he identified *P. uhligi* ANTHULA with *P. weissi* U. and N., though these are quite different species.

²O. WEERTH: Die Fauna des Neocomsandsteins im Teutoburger Wald. Palaeontologische Abhandlungen, Vol. II, 1885, p. 22, fig. 1. *P. uhligi* WEERTH is now revised as *P. weerthi* SIMIONESCU.

³A. KOENEN: Die Ammonitiden des Norddeutschen Neocom., Abhandlungen der königlich preussischen geologischen Landesanstalt u. Bergakademie, Neue Folge, No. XXIV, p. 207, Pl. XLV, fig. 1.

⁴NEUMAYR and UHLIG: Loc. cit. (1881), p. 177, Pl. XLV, fig. 1 a, b.

on the outer half of the last volution, the principal ribs are simple, and alternate regularly with a secondary one which commences near the middle of the flanks.

Suture-lines: Unknown.

Remarks: This species was first compared with *Cheloniceras cornuerianum*¹ D'ORBIGNY from the Aptian of France, and placed it in the genus *Cheloniceras* HYATT. But the ribs being narrower, somewhat weaker and flexuous, the former is at once separated from the latter genus.

This species now appears to me rather to belong to the genus *Acanthoplites* SINZOW and to be closely allied to *A. multispinatus*² ANTHULA from the Aptian of Caucasus, which has, however, a more or less narrower umbilicus and shows somewhat different costae.

*A. abichi*³ ANTHULA and *A. ashiltanensis*⁴ ANTHULA from the Aptian of the Caucasus likewise differs from our species in costation.

The nearest European relative of this fossil is *A. bigoreti*⁵ SEUNES from the Albian, from which it is distinguished by having less prominent and much weaker ribs.

On external appearance, this species resembles *Cheloniceras cornuerianum* D'ORBIGNY and *C. martini*⁶ D'ORBIGNY from the Aptian of France, but it differs from the two European species by its less prominent, much weaker costae and much narrower whorls.

Horizon: Zone of *Acanthoplites subcornuerianus* SHIMIZU, the Hiraiga Sandstone.

Locality: Hideshima, Sakiyama-mura, Shimohei-gun, province of Rikuchû. Reg. No. 36512.

Cheloniceras HYATT.

Cheloniceras sp. indet.

Pl. III, Figs. 12, 13, 14.

A fragmental whorl in an internal mould was examined.

Whorls slightly broader (65 mm. broad) than high (60 mm. high), subcircular in cross-section; broadest near the umbilical margin. Flanks rounded, slightly converging towards the rounded venter.

There is no distinct boundary between the venter and the flanks. The umbilical wall is nearly vertical and of moderate height; it passes gradually into the flanks, through a rounded umbilical margin. Indentation about $\frac{1}{4}$ of the height.

Surface ornamented with strong, rounded radial ribs which start from small rounded tubercles on the umbilical margin, and bifurcate at prominent, somewhat radially elongated

¹ D'ORBIGNY: Pal. Française, loc. cit., 1841, p. 364, Pl. XCII, figs. 1-2.

² J. ANTHULA: Kreidefossilien etc., loc. cit., 1900, p. 119, Pl. X (IX), fig. 2 a-c.

³ Ibid., p. 118, Pl. IX (VIII), figs. 2 a-c.

⁴ Ibid., p. 117, Pl. X (IX), figs. 2 a-b, 3 a-c, 4; Pl. XI (X), fig. 1.

⁵ J. SEUNES: Ammonites du Gault, Bull. Soc. Géol. de France, III, XV, p. 566, Pl. XIV, figs. 3, 4 a-b.

⁶ D'ORBIGNY: Pal. Française, loc. cit. (1841), p. 193, Pl. VI, figs. 4-7. *Amm. martini* D'ORB. was placed in different genera by several European authors: in *Douvilleiceras* by GROSSOUVRE (Les Ammonites de la Craie Supérieure, loc. cit. (1894), p. 29). PERVINQUIÈRE (Études de Pal. Tunisiene, loc. cit. (1907), p. 196) and KILIAN (Das Mesozoicum, 3 Bd., Kreide, loc. cit. (1910), p. 340; La Faune de l'Aptien Inférieur, loc. cit. (1915), p. 48). However, I am of the same opinion as SPATH (the Gault Ammonoidea, loc. cit. (1921), p. 64, 68) and E. KAYSER (Lehrbuch der Geologie: Formationskunde, Vol. II, 1924, p. 149, Pl. XIX, fig. 3), and have placed *Amm. martini* D'ORB. in *Cheloniceras*, I believe that *Douvilleiceras* should be restricted to the group of *Amm. mammillatus* D'ORB. from the Albian of Europe.

tubercles at about two-thirds of the height of the whorls from the umbilical margin. Besides, there is a single slightly weaker, intercalary rib between each pair of the principal ones; it commences near the umbilical margin and bears no tubercles on it. All the ribs pass over the venter without any change.

Suture-lines: Unknown.

Remarks: The specimen is not good in preservation, yet its close relation to *C. cornuerianum*¹ D'ORBIGNY from the Aptian of France is almost indisputable, and hence it is now provisionally referred to *Chelonicerias*. The two forms are considered at least to be specifically distinct, as the Japanese form is easily distinguished from the European by its narrower whorl and by one intercalary rib.

Horizon: Zone of *Ancyloceras gigantiforme* YABE and SHIMIZU, the Mochii Sandstone.

Locality: Komô, Hanoura-machi, Naka-gun, province of Awa. Reg. No. 36856.

Colombiceras SPATH.

Colombiceras satowi SHIMIZU nov. sp.

Pl. III, Figs. 5, 6, 7, 8, 9, 10.

A small internal mould was examined, the dimensions of which are as follows:

Diameter	17 mm.	100
Height of the last whorl	6	35
Breadth of the last whorl	7	41
Width of umbilicus	6	35

Shell discoidal, consisting of two or three gradually enlarging whorls. Whorls subquadrate in cross-section, slightly broader than high, but the height increasing somewhat more rapidly than the breadth, and the greatest breadth of the last volution lying near the umbilical margin. Flanks more or less convex, but subparallel, rounded off evenly into the venter and also into the umbilical walls. Venter somewhat narrow and flat. Umbilicus moderately wide and shallow. Involution about 1/3.

Shell ornamented with rather strong radial ribs, about 33 in number on the last volution. These start from a tubercle on the umbilical margin, and pass straight over the flanks and venter. The surface of the shell in its greater part is slightly weathered, so that a detailed account of the ribs can not be made out with certainty. There are, however, indications that these ribs become slightly weaker near the umbilicus but stronger and somewhat flattened on the venter. Some of the ribs bifurcate at the lateral tubercles lying near one-third of the height of the whorls from the umbilical margin; lateral tubercles larger and more prominent than those of the umbilical margin, and carried only by the dichotomous ribs. All the tubercles entirely disappear after the shell reaches 13 mm. in diameter.

Suture-lines: Simply serrated. External saddle highest and broadest of all; first lateral saddle considerably narrower and shorter than the external one; first lateral lobe narrow, short and nearly as long as the siphonal one; second lateral lobe lying just on the umbilical margin.

¹D'ORBIGNY: Pal. Française, loc. cit. (1841), p. 365, Pl. XCIII, figs. 1, 2.

Remarks: This species shows a great resemblance to *Colombiceras crassicoatum*¹ (D'ORBIGNY) from the Aptian of France and of Tunis, as well as to *Cheloniceras (Acanthoplites) delagoense*² KRENKEL from the Bedoulian of South Africa. In fact, I was at first inclined to regard our specimen as belonging to *Cheloniceras*.

However, our specimen has slightly narrower whorls, and more flattened ribs on the venter than *Cheloniceras*, and these are features apparently sufficient to cause us to regard the present specimen as belonging to *Colombiceras*. It is distinguished from *C. crassicoatum* by its more rounded venter, and finer weaker costae.

Horizon: Zone of *Colombiceras satowi* SHIMIZU, the No. 3 Sandstone.

Locality: Near Cape Inubô, Takagami-mura, Unakami-gun, province of Shimôsa.

Reg. No. 35387.

Douvilleiceras GROSSOUVRE.

Douvilleiceras nodosocostatiforme SHIMIZU nov. sp.

Pl. I, Figs. 6, 7.

Several specimens were examined, the best preserved being taken as the holotype. This is figured and measured.

Dimensions:

		A		B	
Diameter	26 mm.	100	35 mm.	100	
Height of the last whorl	10	38	13	37	
Breadth of the last whorl	13	50	16	45	
Width of umbilicus	11	42	13.6	49	

A = The holotype of this species.

B = *D. nodosocostatum* D'ORBIGNY.

Shell discoidal, composed of several gradually enlarging whorls. Whorls broader than high, subcircular in cross-section, and broadest near umbilical margin. Flanks convex, gradually passing into the convex venter. Umbilicus moderate in size and rather deep, surrounded by high walls which are slightly convex, as a whole practically vertical. Umbilical margin not distinctly marked, being very broadly convex. Body-chamber occupying two-thirds of the outer volution. Involution about 1/2.

Surface of the shell covered by numerous radial ribs 13 in number on the outer volution, and one to three feeble intermediate striae or costae. Ribs comparatively prominent and rounded from the umbilical suture to near the middle of the flanks, then becoming broader, flatter and less prominent on the outer half and finally passing straight over the venter.

Interspaces between the ribs very broad and shallow. Intermediate striae or costae as prominent and strong as ribs in earlier volutions (up to about 5 mm. in diameter), but gradually losing their prominence and strength on the outer volutions. Ribs tuberculated; tubercles in three rows on the flanks of the shell. Tubercles of the first row situated on the umbilical margin, small and radially elongated. Those of the second row situated slightly above the middle of the flanks,

¹D'ORBIGNY: Pal. Française, loc. cit. (1841), p. 197, Pl. LIX, figs. 1-4.

²E. KRENKEL: Die Aptfossilien der Delagoa-Bai, N. Jahrb. Min. Geol. u. Pal., 1910, Bd. I, p. 147, Pl. XVII, figs. 6-7; SPATH: On Cretaceous Cephalopoda from Zululand, loc. cit., (1921), p. 316, Pl. XXVI, figs. 2 a-d.

and those of the third row lying on the ventral margin, and being most prominent, largest of all, and spirally elongated.

Remarks: Although, unfortunately, the suture-lines of this species are unknown, this species belongs to the genus *Douvilleiceras* GROSSOUVRE. The dimensions and ornamentation of this species are very like those of *D. nodosocostatum*¹ D'ORBIGNY from the Lower Albian of France. However, the present species differs from *D. nodosocostatum* in having less prominent intermediate striae or costae, the tubercles of the second row a little nearer the venter, and much larger tubercles on the third row. There is some resemblance to *D. pretiosum*² D'ORBIGNY from the Aptian of France, which has much broader whorls, a wider umbilicus, and much stronger tubercles, and is free from ribs and striae. *D. subnodosocostatum*³ SINZ. figured by J. NIKCHITCH from the Aptian of the Caucasus has much broader whorls and much stronger costation.

*Chelonicerias martinii*⁴ D'ORBIGNY from the Aptian of France has much broader whorls, a narrower umbilicus, and different sculpture. At any rate, there is no doubt that this species belongs to the group of *D. nodosocostatum*⁵ in the sense of W. KILIAN, and that it is probably derived from the group of *D. pretiosum* of the Aptian.

Horizon: Zone of *Douvilleiceras nodosocostatifforme* SHIMIZU, the Hiraiga Sandstone.

Locality: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû. Reg. No. 35152.

Crioceras LEVEILLE.

Crioceras ? sp. indet.

Pl. III, Fig. 25.

A single large internal mould, half a volution (about 255 mm. long) belonging to the body-chamber, was examined, but no detailed account of it can be made out.

Shell gently curved, gradually enlarging, being 83 mm. high at the posterior end and 72 mm. high at the anterior end. Flanks flattened and marked with simple, rounded, forwardly inclined and rather widely spaced ribs which are separated by intervals much wider than the breadth of the ribs. Ribs do not appear anywhere to have grown into a distinct tubercle.

The fragmental state of the specimen renders any reliable identification of it rather impossible. However, the general appearance, so far as it can be made out, suggest its reference probably to the genus *Crioceras* LEVEILLE.

The present species bears a certain resemblance to *C. aegoceras*⁶ KOENEN ranging from the Uppermost Barremian to the Lowest Aptian of North Germany and *C. percostatum*⁷ (GABB) from the Lower Horsetown Beds of California.

Horizon: The No. 3 Sandstone.

Locality: Near Cape Inubô, Takagami-mura, Unakami-gun, province of Shimôsa. Reg. No. 22350.

¹ D'ORBIGNY: Loc. cit. (1841), p. 258, Pl. LXXV, figs. 1-4.

² Ibid., p. 194, Pl. LVIII, figs. 7, 8, 9, 10.

³ J. NIKCHITCH: Representante du Genre *Douvilleiceras* de l'Aptien du versant septentrional du Caucase, Mém. Com. Géol., Nouvelle série, Liv. 120, 1915, p. 58, Pl. VI, figs. 4-7.

⁴ D'ORBIGNY: Loc. cit. (1841), p. 193, Pl. LVIII, figs. 4, 5, 6.

⁵ KILIAN: Loc. cit. (1915), p. 49.

⁶ A. V. KOENEN: Die Ammonitiden des Norddeutschen Neokom., Abh. d. k. preuss. geol. Landesanst. u. Bergakad., Neue Folge, Heft 24, 1902, p. 328, Pl. XXXVI, figs. 1 a-c, 2, 3.

⁷ W. M. GABB: Palaeontology of California, Vol. I, 1846, p. 77, Pl. XVI, fig. 26.

Ancyloceras D'ORBIGNY.*Ancyloceras chôshiense* SHIMIZU nov. sp.

Pl. III, Figs. 22, 23, 24.

The holotype is a small internal mould in a yellowish sandstone having the following dimensions :

Length of whorl	ca. 13 mm.
Height of whorl at the posterior end.	5 mm.
Breadth of whorl at the anterior end.	3 mm.

Shell compressed, gradually enlarging and slightly curved; whorl subquadrate in cross-section, higher than broad; flanks broader than the other sides and subparallel; venter nearly flat and slightly broader than rounded dorsal, and with a narrow and shallow sulcus.

Surface of the shell ornamented with prominent, rather rounded ribs, which are oblique on the flanks, and completely encircle the volution. Ribs simple, never coalescing, and becoming slightly weaker near the dorsal; provided with tubercles in two rows, of which one is on the ventral margin and the other is at one-third of the height of the whorl from the ventral margin. Tubercles on the ventral margin more prominent and larger than those on the flanks. Intervals between the ribs nearly twice as broad as their breadth.

Suture-lines: Unknown.

Remarks: In ornamentation, ventral sulcus and shape of whorl, this species recalls *Ancyloceras brevispina*¹ KOENEN from the Zone of *A. trispinosum* KOENEN (Upper Barremian) of North Germany, but the former is easily distinguished from the latter by its more rounded whorl.

The present species also shows some resemblance to *A. nicoleti*² PICTET and CAMPICHE from the Gault of Switzerland, but differs in its narrower ribs and their extension to the dorsal side.

Horizon: The No. 3 Sandstone.

Locality: A little north of Cape Inubô, Takagami-mura, Unakami-gun, province of Shimôsa. Reg. No. 36332.

Ancyloceras giganteum YABE and SHIMIZU (MS. nom.)

Pl. IV, Fig. 7.

An internal gypsum cast, taken from a large fragmental external mould, consisting of half a volution, was examined.

The only specimen which is now at my disposal is gently curved; about 300 mm. long, slowly enlarging, being about 60 mm. high near the posterior end, and 50 mm. high at the anterior end. Compressed on the flanks, probably broadly oval or almost circular in cross-section.

¹ KOENEN: Die Ammonitiden des Norddeutschen Neokom, loc. cit. (1902), p. 363, Pl. XXXV, fig. 1; Pl. XXXIX, figs. 1, 2.

² F. J. PICTET and G. CAMPICHE: Descriptions des Fossiles du Terrain Crétacé des Environs de Sainte Croix. Mat. Pal. Suisse, 3 ser. 1861-1864, p. 33, Pl. XLVI, figs. 5-9.

Ribs numerous, regularly disposed; nearly radial, but slightly oblique; rounded, and broader than the shallow, concave interspaces between them. Ribs of two kinds, 4 or 5 rather weaker ribs without tubercles being inserted between a pair of broader ribs which bear somewhat rounded tubercles in three spiral rows, one on the ventral margin and other two on the flanks.

Suture-lines: Unknown.

Remarks: Although the suture-lines are unknown, this fossil closely resembles *A. urbanii*¹ NEUMAYR and UHLIG from the Lower Aptian of Europe from which it differs in its much broader ribs and slightly more numerous interstitial ribs. It also resembles *A. (Crioceras?) abichi*² ANTHULA from the Lower Aptian of the Caucasus, though easily distinguished by having much broader and less flexuous ribs.

Horizon: Zone of *Ancyloceras giganteum* YABE and SHIMIZU, the Mochii Sandstone.

Locality: A little north of Komô, Hanoura-machi, Naka-gun, province of Awa.
Reg. No. 35297.

Pulchellia UHLIG emend. GIGNOUX.

Pulchellia cfr. *ishidoensis* YABE and SHIMIZU.

Pl. I, Figs. 14, 15, 16.

1926. *Pulchellia ishidoensis* YABE and SHIMIZU: Cretaceous Mollusca from the Sanchû Graben in the Kwantô Mountainland, Japan. Sci. Rep. Tôhoku Imp. Univ., Second Ser. (Geology), Vol. IX, No. 2, p. 74 (42), Pl. XV (IV), figs. 22-24.

This form is represented by two fragmental moulds and one internal gypsum cast. Because of the bad state of preservation, comparison of it with hitherto known species is difficult; but the characters, exhibited by this poor material, indicate that it is almost indistinguishable from *P. ishidoensis* YABE and SHIMIZU from the Ishidô Group of the Sanchû Graben.

The following is a description of the present specimens.

Shell compressed, slightly umbilicated. Whorls highly involute, high and narrow, with greatest breadth near the umbilical margin, trapezoidal in cross-section. Venter narrow, somewhat deeply depressed, and bordered on each side by a row of sharply defined clavates.

Ornamentation consists of flexuous, somewhat flattened, radial ribs. Ribs broader than the rather shallow concave interspaces between them; gradually thickening towards the venter where they are not interrupted: tuberculated along the ventral margin and ventro-lateral part. Tubercles along the ventro-lateral part very faint.

Suture-lines: Unknown.

Remarks: This form differs slightly from *P. ishidoensis* in its less prominent ventro-lateral tubercles. In this respect it approaches somewhat *P. veleziensis*³ HYATT from the Bar-

¹M. NEUMAYR and V. UHLIG: Über Ammonitiden aus den Hilsbildungen Norddeutschland, Palaeontographica, Bd. XXVII, 1881, p. 190, Pl. XLIX, figs. 3 a, b; Pl. L, fig. 1.

²ANTHULA: Über die Kreidefossilien des Kaukasus, loc. cit. (1899), p. 124, Pl. XII, fig. 1.

³L. W. COLLET: Sur quelques Ammonites du Barrémien de Colombie. Eclogae Geologicae Helvetiae, Vol. XVIII, No. 4, 1924, p. 490, Pl. XV, figs. 11, 11 a.

remian of Europe figured by L. W. COLLET, though this species is distinguished by its finer and closer ribs.

Horizon: Zone of *Pulchellia* cfr. *ishidoensis* YABE and SHIMIZU, the Hanoura Shale.

Locality: Ushiotoshiyama, Hanoura-machi, Naka-gun, province of Awa. Reg. No. 35300.

Inflatoceras STIELER.

Inflatoceras imaii YABE and SHIMIZU nov. sp.

Pl. IV, Fig. 8.

This species is based on a somewhat deformed specimen, with the following dimensions:

Diameter	34 mm.	100
Height of the last whorl	12	34
Breadth of the last whorl	—	—
Width of umbilicus	14	41

Owing to a secondary deformation which the specimen suffered, the breadth of its whorls is not accurately measurable, but there is almost no doubt that the shell was primarily quadrate in cross-section of whorls and that it was provided with flanks nearly flat.

Shell slightly involute, leaving a wide umbilicus which is surrounded by steep walls. Whorls broadest near the umbilical margin; venter flat, bearing a median keel which is slightly elevated, and a shallow, rather narrow groove on either side of it.

Flanks crossed by rounded, slightly flexuous, radial ribs, counting 37 on the last volution. Ribs of two kinds, longer ones, in alternation with shorter, extending to the umbilical margin and sometimes coalescing near the umbilical margin with an adjacent longer one to form an umbilical tubercle; shorter one generally appearing at about one-fourths of the height of the whorl from the umbilical margin and extending to the venter. All the ribs curving abruptly forwards near the ventral margin where they are swollen to small tubercles.

The suture-lines could not be seen.

Remarks: Although the suture-lines are unknown, yet the resemblance of the present form to certain species of *Inflatoceras* in outline and ornamentation is so great that I feel warranted in assigning it to this genus. For instance *I. africanum*¹ SPATH from the Upper Albian of Portuguese East Africa is closely related to the Japanese species, though with much wider umbilicus and less involute whorls.

Besides, the present fossil is very similar to *I. haughtoni*² SPATH from the Upper Albian of Portuguese East Africa, but the latter has more numerous ribs and a wider umbilicus.

The specific name is given in honour of the discoverer of the species, Mr. H. IMAI, a geologist of the Mitsubishi Mining Company.

Horizon: Zone of *Ammonoceras ezoense* (YABE), the Lower Ammonites Beds.

Locality: Ponhorokabets, Yūbari-machi, Yūbari-gun, province of Ishikari, Hokkaidō. Reg. No. 36857.

¹ SPATH: On Upper Cretaceous Ammonoidea from Portuguese East Africa, with an Appendix on Upper Cretaceous Ammonites from Maputoland, Ann. Transvaal Museum, Vol. XI, pt. 3, 1924, p. 183, Pl. XXIX, figs. 2 a, b.

² Ibid., p. 148, Pl. XXIX, fig. 1 a, b.

Prohysterocheras* SPATH.**Prohysterocheras* sp. indet.**

Pl. IV, Fig. 9.

A small fragmental, deformed specimen consisting of nearly half a revolution in an internal mould.

Fragmental as the specimen is, there are some characteristics which attract our attention.

It is so deformed that it does not show the original shape of the whorl, but the whorl appears to have been higher than broad.

The mould is marked with numerous very faint tubercles along the umbilical margin. From each of the tubercles there arise usually two radial ribs; the ribs curve forward slightly near the umbilical margin and turn rather strongly forward on the ventral margin, then are interrupted on the venter by a rather sharp, elevated median keel. The ribs gradually widen toward the venter and are separated by interspaces narrower than the ribs themselves.

The suture-lines are not visible.

On account of its general form and ornamentation, this specimen¹ is thought to be assignable to the genus *Prohysterocheras* although the suture-lines are unknown. Externally this species resembles somewhat *P. candollianum*² PICTET figured by STOLICZKA from the Utatur Group of South India, though finer in costation.

As regards the sculpture, this species reminds us strongly of such a type as *P. wordiei* SPATH var. *compressa*³ SPATH, though the ribs are more flexuous and the keel is higher.

Horizon: Zone of *Ammonoceras ezoense* (YABE), the Lower Ammonites Beds.

Locality: Ponhorokabets, Yûbari-machi, Yûbari-gun, province of Ishikari, Hokkaidô.
Reg. No. 36858.

¹ This was formerly assigned to the genus *Oxytropidoceras* STIELER and thus cited by YABE in his "Cretaceous Stratigraphy of the Japanese Islands," Sci. Rep. Tôhoku Imp. Univ., Sendai, 2 ser. (Geology), Vol. XI, No. 1, 1927, p. 39 (13), as *Oxytropidoceras* sp.

² F. STOLICZKA: The Fossil Cephalopoda of the Cretaceous Rocks of Southern India, Ammonoidea, Pal. Indica, Ser. 1, Vol. I, 1865, p. 51, Pl. XXX, fig. 4.

³ SPATH: Loc. cit. (1922), p. 144, Pl. III, figs. 5, 6a, 6b.

PLATE I

(Figures natural size)

- Figs. 1, 2, 3. *Cymatoceras pseudoneokomiense* SHIMIZU. Loc.: Hideshima, Sakiyama-mura, Shimohei-gun, province of Rikuchû; Zone of *Parahoplites yaegashii* SHIMIZU, the Hiraiga Sandstone. An internal mould (holotype), left side (1), ventral (2), and posterior (3) views. Reg. No. 36520.
- Fig. 4. *Cymatoceras pseudoneokomiense* SHIMIZU. Loc.: Hideshima, Sakiyama-mura, Shimohei-gun, province of Rikuchû; Zone of *Parahoplites yaegashii* SHIMIZU, the Hiraiga Sandstone. An internal mould (paratype), left side view. Reg. No. 36519.
- Fig. 5. *Hypophylloceras* aff. *onoense* (STANTON). Loc.: Near Cape Inubô, Takagami-mura, Unakami-gun, province of Shimôsa; the No. 3 Sandstone. Right side view. Reg. No. 36530.
- Figs. 6, 7. *Douvilleiceras nodosocostatiforme* SHIMIZU. Loc.: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû; Zone of *Douvilleiceras nodosocostatiforme* SHIMIZU, the Hiraiga Sandstone. An internal mould (holotype), left side (6), and apertural (7) views. Reg. No. 35152.
- Figs. 8, 9. *Acanthoplites subcornuerianus* SHIMIZU. Loc.: Hideshima, Sakiyama-mura, Shimohei-gun, province of Rikuchû; Zone of *Saynella matsushimaensis* SHIMIZU, the Hiraiga Sandstone. An internal mould (holotype), left side (8), and right side views (9). Reg. No. 36512.
- Figs. 10, 11, 12, 13. *Saynella matsushimaensis* SHIMIZU. Loc.: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû; Zone of *Saynella matsushimaensis* SHIMIZU, the Hiraiga Sandstone. The holotype, right side (10), left side (11), apertural (12), and ventral (13) views. Reg. No. 36507.
- Fig. 14. *Pulchellia* cfr. *ishidoensis* YABE and SHIMIZU. Loc.: Ushiotoshiyama, Hanoura-machi, Naka-gun, province of Awa; Zone of *Pulchellia* cfr. *ishidoensis* YABE and SHIMIZU, the Hanoura Shale. An internal gypsum cast, left side view. Reg. No. 35300.
- Figs. 15, 16. *Pulchellia* cfr. *ishidoensis* YABE and SHIMIZU. Loc.: Ushiotoshiyama, Hanoura-machi, Naka-gun, province of Awa; Zone of *Pulchellia* cfr. *ishidoensis* YABE and SHIMIZU, the Hanoura Shale. An internal mould, right side (15), and ventral (16) views. Reg. No. 36855.
- Figs. 17, 18, 19. *Pseudohaploceras nipponicum* SHIMIZU. Loc.: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû; Zone of *Salfeldiella caucasica* (SAYN), the Hiraiga Sandstone. An internal mould (holotype), right side (17), ventral (18), and apertural (19) views. Reg. No. 36514.
- Fig. 20. *Pseudothurmannia hanouraensis* YABE and SHIMIZU. Loc.: Ushiotoshiyama, Hanoura-machi, Naka-gun, province of Awa; Zone of *Pseudothurmannia hanouraensis* YABE and SHIMIZU, the Hanoura Shale. An internal gypsum cast (holotype), left side view. Reg. No. 35304.
- Fig. 21. *Pseudothurmannia hanouraensis* YABE and SHIMIZU. Loc.: Ushiotoshiyama, Hanoura-machi, Naka-gun, province of Awa; Zone of *Pseudothurmannia hanouraensis* YABE and SHIMIZU, the Hanoura Shale. An internal mould (paratype), left side view. Reg. No. 36516.
- Figs. 22, 23, 24. *Pseudothurmannia hanouraensis* YABE and SHIMIZU, Loc.: Ushiotoshiyama, Hanoura-machi, Naka-gun, province of Awa; Zone of *Pseudothurmannia hanouraensis* YABE and SHIMIZU, the Hanoura Shale. An internal mould (paratype), right side (22), apertural (23), and ventral (24) views. Reg. No. 36860.



PLATE II

(Figures natural size)

Figs. 1, 2, 3. *Parahoplites yaegashii* SHIMIZU. Loc.: Hideshima, Sakiyama-mura, Shimohei-gun, province of Rikuchû; Zone of *Parahoplites yaegashii* SHIMIZU, the Hiraiga Sandstone. The holotype, left side (1), apertural (2), and ventral (3) views. Reg. No. 36509.

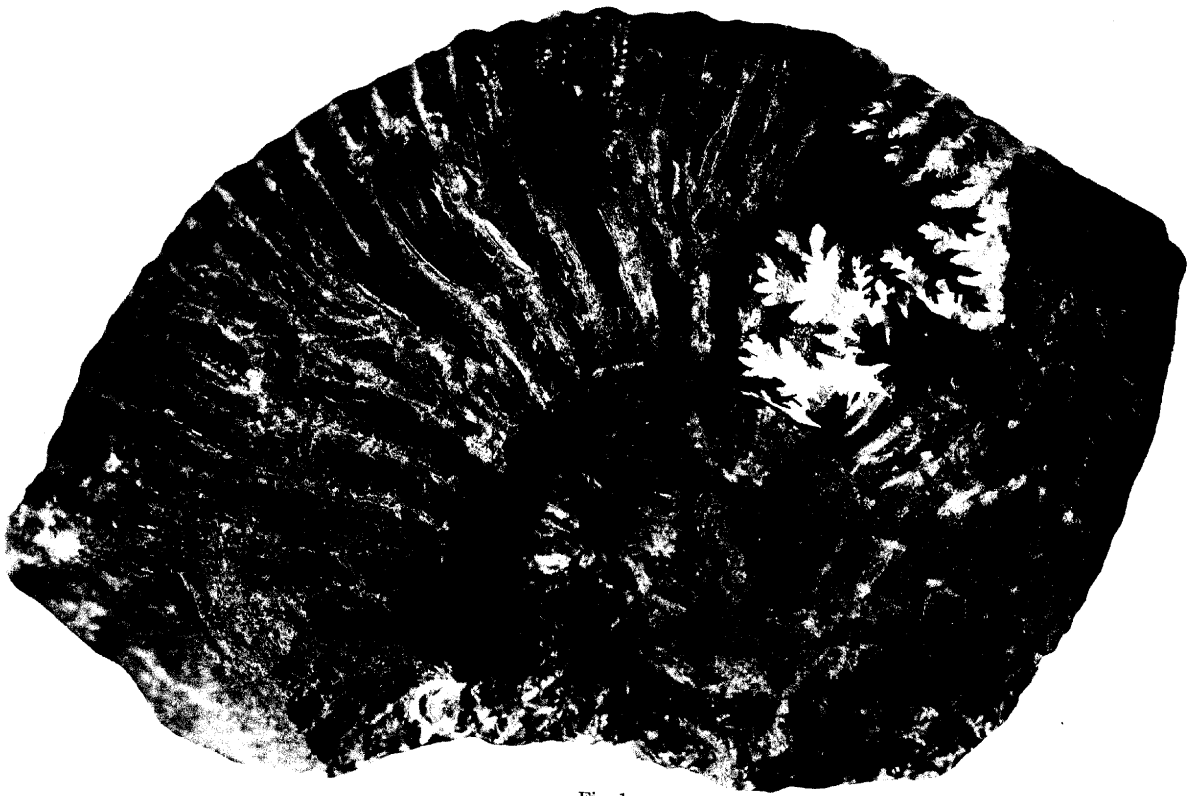


Fig. 1.



Fig. 2.



Fig. 3.

PLATE III

(Figures natural size, unless otherwise stated)

- Fig. 1, 2. *Parahoplites yaegashii* SHIMIZU. Loc.: Hideshima, Sakiyama-mura, Shimohei-gun, province of Rikuchû; Zone of *Parahoplites yaegashii* SHIMIZU, the Hiraiga Sandstone. Suture-lines of the holotype.
- Figs. 3, 4. *Torneutoceras* ? aff. *intermedium* (SOW.). Loc.: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû; Zone of *Douvilleiceras nodosocostatiforme* SHIMIZU, the Hiraiga Sandstone. Right side (3), and ventral (4) views. Reg. No. 36859.
- Figs. 5, 6, 7, 8. *Colombiceras satowi* SHIMIZU. Loc.: Near Cape Inubô, Takagami-mura, Unakami-gun, province of Shimôsa; Zone of *Colombiceras satowi* SHIMIZU, the No. 3 Sandstone. An internal mould (holotype), right side (5), left side (6), and apertural (7) views. A suture-line of the holotype (8). Reg. No. 35387.
- Figs. 9, 10. *Colombiceras satowi* SHIMIZU. Loc.: Near Cape Inubô, Takagami-mura, Unakami-gun, province of Shimôsa; Zone of *Colombiceras satowi* SHIMIZU, the No. 3 Sandstone. An internal mould (holotype), left side (9), and diagramatic left side view (10), $\times 2$.
- Fig. 11. *Pseudothurmannia hanouraensis* YABE and SHIMIZU. Loc.: Ushiotoshiyama, Hanouramachi, Naka-gun, province of Awa; Zone of *Pseudothurmannia hanouraensis* YABE and SHIMIZU, the Hanoura Shale. A suture-line of the paratype (Reg. No. 36860), $\times 4$.
- Figs. 12, 13, 14. *Chelonicerias* sp. indet. Loc.: Komô, Hanoura-machi, Naka-gun, province of Awa; Zone of *Ancyloceras gigantiforme* YABE and SHIMIZU, the Mochii Sandstone. An internal mould, left side (12), ventral (13), and apertural (14) views. Reg. No. 36856.
- Figs. 15, 16, 17, 28. *Salfeldiella caucasica* (SAYN). Loc.: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû; Zone of *Salfeldiella caucasica* (SAYN), the Hiraiga Sandstone. The holotype, left side (15), ventral (16), and right side (17) views. A suture-line of the holotype (28). Reg. No. 36508.
- Figs. 18, 19, 20, 21, 27. *Puzosia* (?) *yabei* SHIMIZU. Loc.: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû; Zone of *Salfeldiella caucasica* (SAYN), the Hiraiga Sandstone. The holotype, left side (18), right side (19), ventral (20), and apertural (21) views. A suture-line of the holotype (27), $\times 4$. Reg. No. 36506.
- Figs. 22, 23, 24. *Ancyloceras choshiense* SHIMIZU. Loc.: A little north of Cape Inubô, Takagami-mura, Unakami-gun, province of Shimôsa; the No. 3 Sandstone. An internal mould (holotype), left side (22), ventral (23), and apertural (24) views. Reg. No. 36823.
- Fig. 25. *Crioceras* (?) sp. indet. Loc.: Near Cape Inubô, Takagami-mura, Unakami-gun, province of Shimôsa; the No. 3 Sandstone. An internal mould, right side view. $\times 2/3$. Reg. No. 22350.
- Fig. 26. *Saynella matsushimaensis* SHIMIZU. Loc.: Matsushima, Tarô-mura, Shimohei-gun, province of Rikuchû; Zone of *Saynella matsushimaensis* SHIMIZU, the Hiraiga Sandstone. A suture-line of the holotype, $\times 4$.
- Fig. 29. *Hypophylloceras* aff. *onoense* (STANTON). Loc.: Near Cape Inubô, Takagami-mura, Unakami-gun, province of Shimôsa; the No. 3 Sandstone. Suture-lines.



PLATE IV

(Figures natural size, unless otherwise stated)

- Figs. 1, 2, 3, 4. *Ammonoceras ezoense* (YABE). Loc.: The mid-course of the Ikushunbets, Mikasayama-mura, Sorachi-gun, province of Ishikari, Hokkaidô; Zone of *Ammonoceras ezoense* (YABE), the Lower Ammonites Beds. The autotype, right side (1), and ventral (2) views. A portion of the side view, near the end of the last volution, to show the spiral striae (3), $\times 3$. A suture-line of the autotype (4), $\times 2$. Reg. No. 35161.
- Figs. 5, 6. *Beudanticeras shikokuense* YABE and SHIMIZU. Loc.: Sakamoto, Tanano-mura, Katsuragun, province of Awa; Zone of *Beudanticeras shikokuense* YABE and SHIMIZU, the Fujikawa Shale. An internal mould (holotype), left side (5), and ventral view (6). Reg. No. 35154.
- Fig. 7. *Ancycloceras giganteum* YABE and SHIMIZU. Loc.: A little north of Komô, Hanouramachi, Naka-gun, province of Awa; Zone of *Ancycloceras giganteum* YABE and SHIMIZU, the Mochii Sandstone. An internal gypsum cast (holotype), left side view, $\times \frac{1}{2}$. Reg. No. 35297.
- Fig. 8. *Inflatoceras imaii* YABE and SHIMIZU. Loc.: Ponhorokabets, Yûbari-machi, Yûbari-gun, province of Ishikari, Hokkaidô; Zone of *Ammonoceras ezoense* (YABE), the Lower Ammonites Beds. An internal mould (holotype), left side view. Reg. No. 36857.
- Fig. 9. *Prohystoceras* sp. indet. Loc.: Ponhorokabets, Yûbari-machi, Yûbari-gun, province of Ishikari, Hokkaidô; Zone of *Ammonoceras ezoense* (YABE), the Lower Ammonites Beds. An internal mould, left side view. Reg. No. 36858.
- Figs. 10, 11. *Hoplites* aff. *dentatus* (Sow.) Loc.: Akito, Tanohata-mura, Shimohei-gun, province of Rikuchû; Zone of *Hoplites* aff. *dentatus* (Sow.), the Akito Sandstone. An internal mould, left side (10), and ventral (11) views. Reg. No. 36513.
- Fig. 12. *Hamulina* (?) sp. indet. Loc.: Ushiotoshiyama, Hanoura-machi, Naka-gun, province of Awa; Zone of *Pulchellia* cfr. *ishidoensis* YABE and SHIMIZU, the Hanoura Shale. An internal gypsum cast, right side view. Reg. No. 35299.

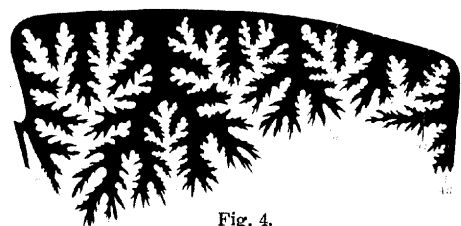


Fig. 4.



Fig. 2.



Fig. 12.



Fig. 1.



Fig. 11.



Fig. 6.



Fig. 10.

Fig. 7.



Fig. 8.



Fig. 3.

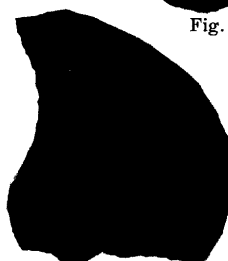


Fig. 9.



Fig. 5.