DISCOVERY OF CRETACEOUS AMMONITES FROM THE UNDIVIDED MESOZOIC COMPLEX OF SHIKOKU, JAPAN

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DISCOVERY OF CRETACEOUS AMMONITES FROM THE UNDIVIDED MESOZOIC COMPLEX OF SHIKOKU, JAPAN

By

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Introduction

The southern subzone of the Outer Zone of Southwest Japan is occupied mainly by a thick series of sedimentary rocks called the Shimantogawa complex, or, by some authors, simply the Shimanto complex. Owing to the scarcity of fossils, the relatively monotonous rock-facies of alternating sandstone and shale, and the predominance of minor isoclinal folding, the precise stratigraphic classification of this complex is very difficult, although a division on lithologic grounds has been proposed locally.

From the general aspects of lithology, the complex is usually presumed to belong to the Mesozoic. When S. YEHARA (1926) introduced the "Shimantogawa series" in the geological literature, he intended to place it below his "Monobegawa series", which, in turn, is the Lower Cretaceous of the Outer Zone. This interpretation seemed to be supported by the occurrence of the so-called Torinosu type fossils in the lenticles of limestone (YABE 1927, YABE and SUGIYAMA 1931, 1942) and by the general character of the radiolarian remains in some siliceous rocks (S. YEHARA 1927, etc.) and the Jurassic theory was once generally accepted.

These fossils, however, are not favorable for identification of precise age, but indicate a particular facies. In fact, the subse-

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quent researches in the adjoining northern subzone have afforded us the evidence that the Torinosu type organic limestone is not confined to the upper Jurassic series. Furthermore, the stratigraphic value of the radiolarian rocks was discussed comprehensively by T. KOBAYASHI and T. KIMURA (1944), who threw doubt on the Jurassic theory. In the mean while, many authors sought in vain the more valuable index-fossils from this thick complex of extensive distribution*.

During the course of the field work in the research on the undifferentiated Mesozoic complex of southern Shikoku, T. KIMURA and J. KATTO obtained independently fossil ammonites at two localities in Takaoku-gun, Kochi Prefecture. After a preliminary identification, the fossils were sent to T. MATSUMOTO, who engaged in the paleontological work and made it clear that the upper series

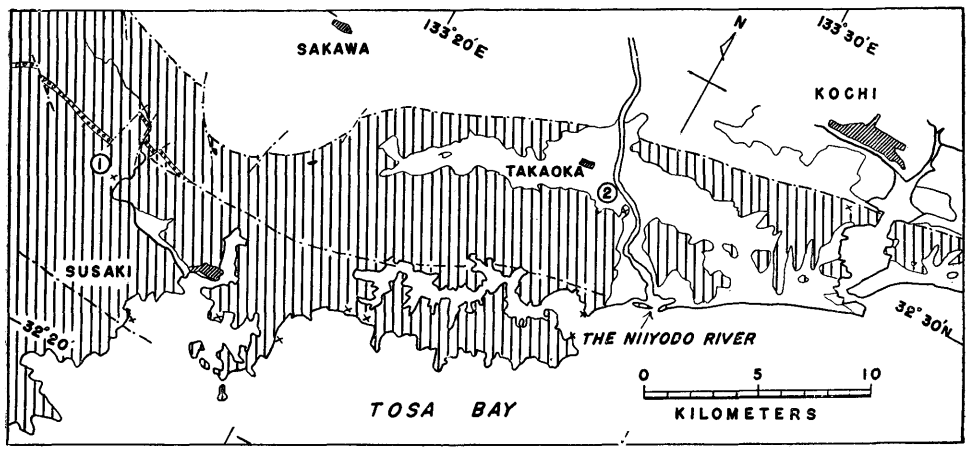

Fig. 1. Index map of Susaki-Takaoka area, Kochi Prefecture. Hatched area: Shimantogawa complex, o o o Sasano conglomerate at the base of the Susaki formation, × fossil localities in the Shimantogawa complex, ① Taru, Kamibun-mura, Takaoka-gun, ② Kitayama Hill, Takaoka-mura, Takaoka-gun. — Limestone in the Shimantogawa complex.

* The upper Cretaceous molluscan fossils were formerly discovered from the Uwajima district and the Kunimi district of Ehime and Kochi Prefectures, southwestern Shikoku. Furthermore, the lower Tertiary formations were recently identified in southeastern Kyushu, Kii peninsula, and southwestern corner of Shikoku. These upper Cretaceous and lower Tertiary parts have been separated from the Shimanto complex by some authors, although the remaining Shimanto group may still include the unrecognized upper Cretaceous and Tertiary parts.

of the Lower Cretaceous is demonstrated by these fossils. As the stratigraphy is to be described in other occasion, the paleontological note will be presented here.

Before proceeding we wish to acknowledge here the gift of the specimens from Mr. Osamu HASHIMOTO, Mr. Keizo KAWAZAWA, and Mr. Naokichi HORIUCHI, all in Takaoka-gun, Kochi Prefecture. We are indepted to Prof. Emeritus H. YABE and Prof. K. HATAI of Tohoku University and Prof. T. KOBAYASHI of Tokyo University for their kind suggestion of our cooperative work. Thanks are due to Mr. C. W. WRIGHT in London who kindly read the typescript and gave us a good criticism. The photographs were taken by Mr. Chuzo UEKI. The illustrated specimens have been deposited at the Department of Geology, Kyushu University.

Paleontological note

1. *Dipoloceras* aff. *fredericksburgense* SCOTT

(Pl. XIII fig. 1 a, b)

Material: Specimen rg. no. GK. H-4021. A fragment of an internal mould of a living chamber, somewhat deformed. The specimen was collected by Mr. Osamu HASHIMOTO in June 1949 and sent to T. KIMURA from Mr. Keizo KAWAZAWA.

Locality: The specimen was collected from a detrital block at the foot of a small hill called Kita-yama,* 62 m. high, in Takaishimura, Takaoka-gun, Kochi Prefecture (Lat. 33°29′ N, Long. 133° 27′ E). (fig. 1)

The same locality was visited again by T. KIMURA, who sought in vain any other specimens.

Description: Whorl-section not much depressed, and subquadrate, although the exact measurement is difficult owing to secondary deformation. Shell with strong median keel on ventral side and prominent flexuous, flared ribs, somewhat irregular in size and flexuosity. Height of the preserved whorl 30–34 mm.

Remarks: As this is only a fragment, the exact identification is difficult. Nevertheless the characteristic properties remind us

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at once the living chamber of the genus *Dipoloceras*, HYATT.

Among the hitherto described species of *Dipoloceras*, the world-wide *D. cristatum* (DELUC), the genotype, is provided with very strong flared ribs, and depressed whorl and is probably specifically different from the present form. *D. fredericksburgense* SCOTT (1928) from the Fredericksburg group of the Comanche Series in Texas has less depressed, subquadrate whorls and prominent ribs which is less regular in size and sometimes flared. Accordingly the present form is fairly similar to this species, and especially resembles the specimen which was described by SPATH (1931) as *D.* aff. *fredericksburgense* SCOTT (SPATH 1931 Pl. XXXIV figs. 9, 10) from the Lower Gault of England. This is said to be a transition to *D. cristatum* (DELUC) in that it has more conspicuous flares than in the normal form of *D. fredericksburgense* SCOTT (SCOTT 1928, Pl. XV, figs. 1, 2, SPATH 1931, Pl. XXXIV, fig. 8).

SPATH pointed out that the fragments of body-chamber are difficult to identify precisely, because *D. bouchardianum* (D'ORBIGNY), for instance, has similarity in ornamentation of later stage to *D. fredericksburgense* SCOTT. Therefore a decision should be reserved until a more sufficient material is obtained. Yet the presence of flared ribs suggests strongly the variety of *D. fredericksburgense* SCOTT under consideration.

Horizon: A shale-member in the Shimantogawa complex. According to the hitherto published geological map the locality Kitayama was included in the "Nishigawa formation" of T. KOBAYASHI, i. e. his "middle division" of the Shimanto complex in the southern part of Kochi Prefecture. This was tentatively correlated with the Jurassic.

The Albian age, and probably the top of the Middle Albian age, of the Cretaceous is indicated by the occurrence of the present specimen.

2. *Kazanskyella* (?) *japonica* MATSUMOTO, sp. nov.

(Pl. XIII fig. 2 a, b)

Material: Sp. rg. no. GK. H-4022, an internal mould preserved in a dark grey shale, secondarily compressed and somewhat sheared;

probably a full-grown shell.

The specimen was collected by Mr. N. HORIUCHI in September 1949 and sent to J. KATTO.

Locality: Taru,* Kamibun-mura, Takaoka-gun, Kochi Prefecture. (Lat. 33°24′ N, Long. 133°14′ E). When KATTO visited again the same locality, he collected *Dosiniopsis* sp. and other bivalves. (fig. 1)

Description: Shell-form not accurately measured because of the secondary deformation. Observed facts suggest the relatively compressed whorl, fairly narrow umbilicus, outer whorl overlapping the two thirds of the inner, rounded umbilical shoulder, steep and low umbilical wall which is perpendicular to the plane of coiling.

Size of the shell presumably about 6 cm. in diameter.

Suture-line only partially exposed, being finely incised and not of a reduced type nor of a pseudoceratitic style.

Shell in the preserved last half volution, which represents probably the living chamber, is ornamented with coarse radial ribs separated by interspaces as broad as the rib. The septate part which precedes the above described stage is provided with numerous closely set ribs. The ribs are subradial, showing only a slightly forward bent near the umbilical margin, almost perfectly radial in the main part of the flank, crossing without interruption the ventral side, where no remarkable forward curvature** is shown. There are primary and secondary ribs. The primary one is somewhat elevated at the umbilical shoulder but not forming a tubercle, while secondary one is of unequal length, beginning sometimes near the umbilical margin and sometimes near the midst of flank. One, or rarely two, secondaries alternate with the primary rib. Ornamentation of the inner whorls not well observable.

Remarks: Judging from the observed characters, the assignment of the present form to a certain group of the Parahoplitidae seems highly probable. In its subradial ribbing and the sparsely set and regularly alternating primary and secondary ribs of the last stage, this form falls within the limits of the genus *Kazanskyella*, STOYANOW (1949) of the subfamily Parahoplitinae. It

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** In the deformed portion this curvature is considerably modified.

differs, however, from the hitherto known two species of the genus, *K. arizonica* STOYANOW and *K. daghestanica* STOYANOW (= "*Parahoplites melchioris*" KAZANSKY, non ANTHULA), in that the crowded ribs occur even in the middle stage of growth and are not confined to a limited portion of the entire shell. Accordingly T. MATSUMOTO is inclined to give a new name for the present species, although more perfect material is necessary.

Horizon: The Susaki formation of J. KATTO (1952). The formation disconformably overlies the Hayama formation, which, in turn, contains lenticular limestones of the Jurassic Torinosu aspect. The Susaki formation itself consists of the thick series of alternating sandstone and shale with some rediolarian chert. In the previous geological map it was assigned to the "Higashigawa formation" of T. KOBAYASHI, i.e. the "lower division" of the Shimanto complex in southern Shikoku, and was tentatively correlated to the Triassic.

The two species of the genus *Kazanskyella* have been known from the upper Aptian, one in Arizona and the other in Caucasus. The subfamily Parahoplitinae mostly occurs in the Aptian. Accordingly the Susaki formation probably includes the equivalent of the Aptian.

Concluding remarks

The two specimens of the ammonites derived from the southern part of Kochi Prefecture, Shikoku deserve particular attention because they throw a light on the stratigraphy of the undivided Mesozoic complex in the Outer Zone of Southwest Japan. The significance of the discovery is as follows.

(1) Although the fossils are not in a perfect state of preservation, they are identified, as described above, as *Dipoloceras* aff. *fredericksburgense* SCOTT and *Kazanskyella* (?) *japonica* MATSUMOTO. The former indicates the Middle Albian stage and the latter suggests the Upper Aptian stage, both being included in the Miyako series of the Japanese Cretaceous scale. The formation from which these fossils were derived had been tentatively assigned to the Jurassic or even to the Triassic by previous authors. Thus the preliminary correlation from lithological grounds has to be fundamentally revised.

(2) There have been discussions as to the sedimentary environment of the Shimanto complex. Someone insisted that it was the bathyal condition of the continental slope, others assumed the neritic shelf. Of course, the analysis should be done from various respects and in reference to various ages.

The ornamented forms of the Dipoloceratidae and the Parahoplitidae are generally common in the neritic environment of Europe and other continents. The necroplanktonic shell of ammonites can be distributed, however, in facies which are considerably unfamiliar to the living organisms. The solitary occurrence may suggest such a case. But the presence of living chamber in two examples and coexistence of bivalves in one instance have to be accounted for. Anyhow, these two ammonites are part of the available data for the discussion of the subject.

(3) The species of genus *Kazanskyella* have been reported from Arizona of America and Caucasus of Eurasia. The occurrence of *Kazanskyella* (?) *japonica* MATSUMOTO from Japan may serve to link these widely separated areas. The family Parahoplitidae, to which this genus belongs, has a world-wide distribution in the Aptian and the lower Albian. Thus, in Japan its representatives are not rare in the Miyako series of Northeast Honshu and Kyushu.

The genus *Dipoloceras* is one of the Albian ammonites which has world-wide distribution. Its occurrence in Japan is, therefore, very natural, although we feel some curiosity in the fact that no specimen of this genus has been found from the ammonite-bearing formations in other areas of Japan.

Finally the two forms under consideration afford us the positive evidence for the statement that the Japanese province in the Miyako epoch has relatively free biogeographical communication with other provinces of the world as compared with other epochs of the Cretaceous.

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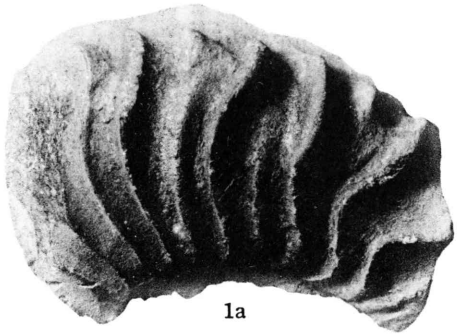
Explanation of Plate

Explanation of Plate XIII

Fig. 1 *Dipoloceras* aff. *fredericksburgense* SCOTT
Reg. No. GK. H-4021, Loc. Kita-yama, Takaishi-mura, Takaoka-gun, Kochi Prefecture, Japan. ×1. a. Lateral view, b. External view. 180

Fig. 2 *Kazanskyella* (?) *japonica* MATSUMOTO, sp. nov.
Reg. No. GK. H-4022, Loc. Taru. Kamibun-mura, Takaoka-gun, Kochi Prefecture, Japan. ×1. a. Lateral view, b. External view. 181

(C. UEKI Photo.)



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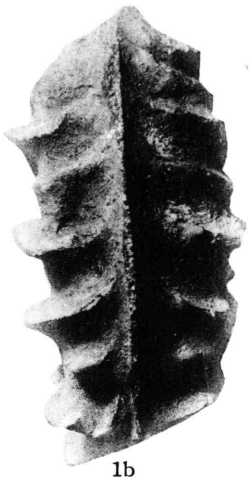

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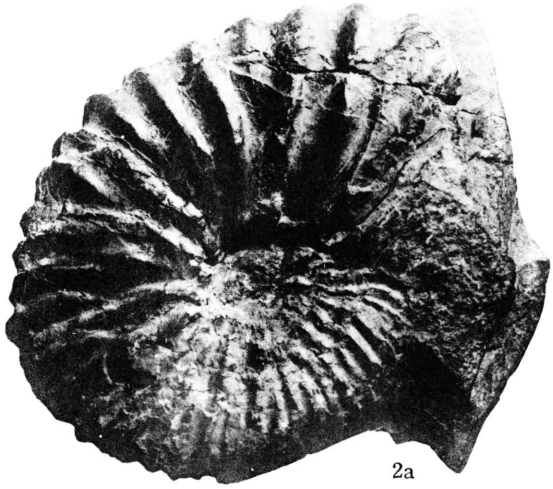

2a

2b