55. Preliminary Report on the Upper Triassic Magalodonts discovered in South Kyushu, Japan

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The megalodonts are pachyodont bivalves, including such several genera of the Megalodontidae as *Megalodon*, *Paramegalodus* and *Conchodon* and some others of the Dicerocardiidae. These bivalves having large size and characteristic shape are interesting not only for their living environments but also as the leading fossils of Upper Triassic in the Tethyan realm.

The Yaritaoshi-rapid of the Kuma river cuts across the Yaritaoshi limestone (Y2 member of the Yaritaoshi formation by Kanmera and Furukawa, 1964) in the Kōnose group distributed in the Sambosan belt of Kumamoto Prefecture (i.e. Kōnose belt for Kyushu). Thick shell-bearing limestone boulders have been known for several years in the river at the Yaritaoshi-rapid. However, the taxonomic position of the shell was unknown for all researchers due to difficulty for restoring the outline.

In summer, 1979, Mr. M. Morita, Kuma Junior High School, discovered an exposure of the fossiliferous shelly limestone in the river bottom at the Yaritaoshi-rapid (white triangle in Fig. 2a). As already I reported, extraction of shell from the limestone was very difficult but as the result of laborious work some 10 specimens at hand were cleaned as seen in Figs. 2e-h. Thus they were found megalodonts very important to clarify the age and environment of not only the Kōnose group but also the Sambosan group. I report here a preliminary result of this study because the gregarious occurrence of the typical megalodonts is quite new in Japan, although Kobayashi and Ichikawa, 1950 have reported "*Megalodus*" α sp. and "*Megalodus*" (?) β sp. from the Carnian *Halobia* bed in Sakawa area, Shikoku. Kanmera and Furukawa (1964), Kanmera (1964), Nakao (1969), Tamura (1972) and Koike (1979) have already investigated respectively on stratigraphy and sedimentation, corals, chert, myophorids and conodonts of the Kōnose group. Because of the complicated structure, however, the age of the Kōnose still remains undecided, although the conodonts from the group suggest the age ranging from Upper Carnian to Norian.

The grey to black Yaritaoshi limestone, about 100 m thick, form-

Fig. 1. Index map and fossil localities. a and b: Index map of surveyed area. c: Megalodonts localities in Yariataoshi area.

ing cliff of the Yaritaoshi-iwa and Seishōko-iwa (see Fig. 1c) has a few stratified limestone intercalations but it is generally massive and fine-grained. Fragments of shell, corals and algae are generally rare and foraminifera commonly seen in the limestone. The megalodonts therein occur at six localities in Fig. 1c forming shell banks at some localities (Fig. 2b) but showing sorted occurrence at others (Fig. 2d). As excavation from exposed flat limestone is so difficult, the specimens here treated were obtained from boulders scattered on the river bottom. Tentatively identified species are *Megalodon* sp., *Paramegalodus* A sp., *Paramegalodus* B sp., *Paramegalodus* C sp., *Paramegalodus* sp. cf. *incisus* (Frech), *Paramegalodus* ? sp., *Dicerocardium* sp. cf. *himalayense* Stoliczka and *Dicerocardium* sp. cf. *curioni* Stoppani. *Dicerocardium* species occur commonly together

Fig. 2. Megalodonts and their occurrence. a: Yaritaoshi-rapid and river bottom viewed from lower stream; white triangle is the exposure of megalodon limestone discovered by Morita. b and c: Megalodonts cross sections in the above exposure. d: Exposure of Seishōko-iwa on right side of Fig. 2a; showing sorting. e: Left valve of *Paramegalodus* sp. cf. *incisus*; $\times 1/5$. f: Lateral view of *Paramegalodus* C sp.; $\times 1/5$. g: *Megalodon* sp.; $\times 1/5$; right valve. h: Left valve of *Dicerocardium* sp. cf. *curioni*; $\times 1/5$.

with megalodonts. Judging from the characteristic cross section of valve as seen in Figs. 2a-c, *Dicerocardium* species are fairly common in the Yaritaoshi limestone.

Fig. 3. Restoration of megalodonts. a: *Megalodon* sp. b: *Paramegalodus* C sp. c: *Paramegalodus* sp. cf. *incisus* (Frech). d: *Dicerocardium* sp. cf. *himalayense* Stoliczka. e, f: *Dicerocardium* sp. cf. *curioni* Stoppani.

The horizontal and vertical distribution of the Triassic megalodonts were shown by Vegh (1964). The megalodonts occur from Ladinic to Lias in the Alpine Triassic and become gigantic in Norian to Rhaetian (Vegh, 1968). The megalodonts are characteristic bivalves in such a limestone as Dachsteinkalk in the Northern Calcareous Alps and their distribution extends to Himalaya. *Dicerocardium*, as genus, ranges from Carnian to Norian and *Paramegalodus* occurs mostly in Rhaetian. *Dicerocardium himalayense* and *Dicerocardium curioni* are

Norian species and *Paramegalodus incisus* a Rhaetian one. Koike (1979) reported the occurrence of upper Norian conodonts from chert which is overlain by the Yaritaoshi limestone. Judging from these facts on the megalodonts the age of the limestone in question must be Norian to Rhaetian. As shown in Fig. 1b, megalodonts occur at Ōkōchi and Mizukamigoe as boulders and at Hakeai in thick limestone. Their find is expected also further in Shikoku.

The megalodonts bearing Dachsteinkalk in the Northern Calcareous Alps was deposited in lagoon at subtidal zone (Fischer, 1964) and some of the megalodonts discovered at live position partly buried in the sediment (Zapfe, 1957). Although volcanic materials are almost destitute in the Alpine area, the Yaritaoshi limestone is considered as deposits in similar environment. Kanmera and Furukawa (1964) proposed "Early Mesozoic Volcanic Belt" for the Kōnose belt by occurrences of rich volcanic materials, chert and limestone and poor clastic material. Further the sediments show slump structure often. So the megalodonts bearing Yaritaoshi limestone was deposited in subtidal zone in lagoonal environment on volcanic islands in warm open sea.

The two important conclusions introduced by the study are that the discovery of the megalodonts from the Yaritaoshi limestone confirms the eastern extension of the Tethys from Alps to Japan via Himalaya and that the assemblage of the megalodonts indicates the existence of Rhaetian formation in Japan.

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References

- Fischer, A. G. (1964): The Lofer cyclothems of the Alpine Triassic. *Kansas Geol. Surv. Bull.*, **169**, 107-149.
- Kanmera, K. (1964): Triassic coral faunas from the Konosé Group in Kyushu, by Kanmera, with notes on Stratigraphy by Kanmera and Furukawa. *Mem. Fac. Sci., Kyushu Univ.*, ser. D, **15** (1), 117-147, text-figs. 1-5, pls. 12-19.
- Kanmera, K., and Furukawa, H. (1964): Stratigraphy of the Upper Permian and Triassic Konosé Group in Kyushu. *Sci. Rep. Fac. Sci., Kyushu Univ., Geol.*, **6** (3), 237-259, pl. 19.
- Kobayashi, T., and Ichikawa, K. (1950): *Anodontophora* and some other Carnic Pelecypods from the Sakawa Basin, in Shikoku, Japan. *Jour. Fac. Sci., Univ. Tokyo*, sec. 2, **7** (3), 231-243, pl. 4.

- Koike, T. (1979): Biostratigraphy of Triassic conodonts. Commemorative Vol. for Retirement of Prof. M. Kanuma, pp. 21-78.
- Nakao, S. (1969): Chert in the Konosé Group of the Sambosan Belt, Southern Kyushu. Sci. Rep. Fac. Sci., Kyushu Univ., Geol., **10**(1), 11-24, pls. 4-6.
- Tamura, M. (1972): Myophorian fossils discovered from the Konose Group, Kumamoto Prefecture, Japan, with a note on Japanese myophorids. Mem. Fac. Educ. Kumamoto Univ., **21**, sec. 1, 66-72, pl. 1.
- Vegh-Neubrandt, E. (1964): A Triasz Megalodontidák Rétegtani jelenősége (Stratigraphische Bedeutung der Triasischen Megalodontiden)-Földt. Közloñy, **94**, 195-205.
- (1968): A Megalodontidák Fejlödésének föbb vonásai (Hauptzüge der Entwicklung der Megalodontiden). *ibid.*, **98**, 227-240.
- Zaphe, H. (1957): Dachsteinkalk und Dachsteinmuscheln. Natur u. Volk, **87**, 87-94.