61. Permian Corals of Salt Range

A Preliminary Report

By Makoto KATO and Yoichi EZAKI

Department of Geology and Mineralogy, Faculty of Science,
Hokkaido University, Sapporo 060

(Communicated by Teiichi KOBAYASHI, M. J. A., Sept. 12, 1986)

Occurrence of corals in the Permian of Salt Range, Pakistan, has been known for many years. DeKoninck (1863) was the first to describe some corals from there, and Waagen and Wentzel (1887) published a monographic treatment on them. Among corals described by Waagen and Wentzel, *Lonsdaleia indica* was later chosen as the type species of the genus *Waagenophyllum*. Likewise *Lonsdaleia salinaria* was designated as the type species of the genus *Wentzelella*. These two genera are representing the family Waagenophyllidae (also the subfamily Waagenophyllinae) and the subfamily Wentzelellinae respectively. Geographic distribution of members of the family defines so well the extent of Permian Tethys (Minato and Kato, 1977). Thus the Permian of Salt Range should be the key section for Tethyan corals, for which, however, only sporadic studies by Smith and Ryder (1926), Sen (1931a-c), Smith (1935), Heritsch (1937) and Minato and Kato (1965) are available after Waagen and Wentzel's work.

Recently Pakistani-Japanese Research Group (1985) published their result of a detailed stratigraphic study on the Upper Permian-Lower Triassic strata in Salt Range, and their collections of corals made in 1975-1976 and in 1979 were entrusted to the present authors for study. More than 100 thin sections prepared out of 31 coralla available form the bases of the present investigation. And the result of identification of corals is shown in Fig. 2. Although the material herein treated is not at all exhaustive, yet it clearly indicates the stratigraphic distribution of important coral species within what used to be called the Productus Limestone.

The Permian Zaluch Group, which is equivalent to the Productus Limestone, has been divided into 3 formations (Teichert, 1966). The lowest Amb Formation consists mainly of sandstone and is devoid of corals. It is characterized by the occurrence of a fusulinid species, *Monodioxodina kattaensis*; and thus it would be correlatable with *Neoschwagerina simplex* Zone in fusulinid zonation. The middle division, the Wargal Formation is further lithologically divided into several units. Corals are rare in the Unit 1 and are common in the Unit 2 where limestone is dominated. In these units such rugose genera as solitary *Iranophyllum*, and massive *Wentzelella* (*Wentzelella*), *Wentzelella* (*Szechuanophyllum*) and *Wentzelellites* are represented. All these rugose corals are the members of the subfamily Wentzelellinae with higher orders of septa. A shallow marine condition must have prevailed during the time of deposition of the Units 1 and 2. On the other hand no corals were obtained from the Units 3 and 4a, though both these units are composed of limestones. Dolomitic limestone of the Unit 3 is probably of a restricted environment and packstone of the Unit 4a is of a rather variable conditions. At any rate both of these two units are the deposits under

the conditions unfavourable to coral growth. Brachiopods are also said to be absent or extremely rare in these units (Pakistani-Japanese Research Group, 1985). While in the Units 4b and 5 fasciculate corals of *Waagenophyllum* are quite common in bioclastic wackestone and biomicrite. But corals become impoverished in the Chhidru Formation. Only one corallum of *Waagenophyllum*

Fig. 1. Index map.

(*W.*) *indicum* from the formation is at hand. It was collected from a horizon some 34 m below the top of the Chhidru Formation at Narmia Nala in Surghar Range, according to verbal information of Prof. K. Nakazawa. The horizon may correspond to the Unit 2 of the Chhidru Formation in Salt Range, as shown in Fig. 2. Specimens of *Waagenophyllum* from the Unit 5 of the Wargal Formation and the Chhidru Formation are all associated with profound assemblage of foraminifera including *Colaniella* and *Codonofusiella*. And the concerned sequence is correlatable with the Wuchiapingian. No corals have been found from the Triassic strata in Salt Range.

Fasciculate coralla of *Waagenophyllum* from Salt Range reveal considerable variation in many respects. For instance *Waagenophyllum* (*W.*) *virgalense* having prominent stereowall may be merely a varietal form of *W.* (*W.*) *indicum* which originally contained in it forms assignable to *W.* (*W.*) *pulchrum*, however. The above mentioned Chhidru specimen belongs to *W.* (*W.*) *virgalense* type, and represents probably one of the youngest waagenophyllids in and around this region.

Massive rugose corals with tertiary or more orders of septa, which may or may not possess lonsdaleoid dissepiments disappear in the lower part of the Wargal Formation yielding *Neoschwagerina* aff. *margaritae*. Then fasciculate *Waagenophyllum* without higher orders of septa and lonsdaleoid dissepiments became flourished in the upper part of the Wargal Formation. This turning point appears to have occurred somewhere within the *Yabeina* Zone in fusulinid zonation. It has been noted in the Permian that massive rugosa disappears first in the lower sequence, which is followed by fasciculate forms, then by solitary

Fig. 2. Stratigraphic distribution of corals in Salt Range, Pakistan. Lithologic column is compiled from data by Pakistani-Japanese Research Group (1985).

ones (Flügel, 1970; Iranian-Japanese Research Group, 1981). And this tendency appears to be also noticeable in Salt Range corals.

Conspicuous seasonal growth is found especially in massive rugose corals, in which annual growth rate amounts to as much as 9 mm. In a specimen of *Wentzelella* (W.) *irregularis* prismatic corallites suddenly contract and are mutually separated at about a dense band of coral skeleton in vertical section. In transverse section these separated corallites are round in outline and are seen as representing a fasciculate form. This is probably due to rejuvenescence, and the corallum however quickly resumes original cerioid form. Growth rate is much reduced in this rejuvenated part. Increase is by peripheral budding in this form. New offsets arise at about the same level a little after dense bands.

Palaeogeographically Salt Range was situated in the southern part of the Permian Tethys. In Salt Range, at least in early *Neoschwagerina* time, a warm sea with waagenophyllids transgressively invaded on Gondwana where the Lower Permian continental and partly glacial deposits with Gondwana flora and fauna were previously formed. In Oman limestone of *Neoschwagerina schuberti* Zone, with waagenophyllids, unconformably overlies basement rocks (Oekentorp *et al.*, 1978). Therefore this marine transgression may be further traced along the northern rim of Gondwana.

The authors greatly acknowledge Dr. Teiichi Kobayashi, M. J. A., Professor Emeritus of University of Tokyo, for his interests given to the present study and for his kindness in communicating it to the Academy. They thank Dr. Keiji Nakazawa, Professor Emeritus of Kyoto University and all the other members of the Pakistani-Japanese Research Group worked in Salt Range to kindly let the authors study coral specimens collected by them.

References

- DeKoninck, L. (1863): *Quart. Jour. Geol. Soc. London*, **19**, 1–19.
- Flügel, H. (1970): *Verh. Geol. B.-A.*, Heft 1, 146–161.
- Heritsch, F. (1937): *Sitzungsberichte d. mathem.-naturw. Kl., Abt. 1*, 146(1–2), 1–16.
- Iranian-Japanese Research Group (1981): *Mem. Fac. Sci., Kyoto Univ., Ser. Geol. and Mineral.*, **47**(2), 61–133.
- Minato, M., and Kato, M. (1965): *Jour. Fac. Sci., Hokkaido Univ., Ser. 4*, **12**(3–4), 1–241.
- (1977): *Mém. Bur. Rech. Géol. Min.*, no. 89, pp. 228–233.
- Oekentorp, K., Montenat, C., und Fontaine, H. (1978): *N. Jb. Geol. Paläont., Abh.*, **155**(3), 374–397.
- Pakistani-Japanese Research Group (1985): *The Tethys* (eds. Nakazawa, K., and Dickins, J. M.). Tokai Univ. Press, pp. 219–312.
- Sen, A. (1931a): *Quart. Jour. Geol. Min. Met. Soc. India*, **3**(1), 9–11.
- (1931b): *ibid.*, **3**(2), 35–36.
- (1931c): *ibid.*, **3**(3), 125–133.
- Smith, S. (1935): *Jour. Paleont.*, **9**(1), 30–42.
- Smith, S., and Ryder, T. A. (1926): *Ann. Mag. Nat. Hist.*, ser. 9, **17**, 149–159.
- Teichert, C. (1965): *Rec. Geol. Surv. Pakistan*, **15**(1), 1–20.
- Waagen, W., and Wentzel, J. (1887): *Palaeont. Indica*, Ser. 13, **1**, 835–982.