



MAASTRICHTIAN AND DANIAN CORALS FROM DENMARK

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Corals are locally rock-building in the Danian deposits (e.g. Fakse Quarry), but they also occur fairly commonly elsewhere in the Danian. In the Maastrichtian white chalk, scleractinian corals are most common in the topmost part, where they profited from the relatively rich benthos, particularly bryozoans, which provided suitable substrates. It can be shown that the scleractinians of this uppermost Maastrichtian fauna are closely related to the Danian scleractinians.

'Hydrocorals'

A rich fauna of 'hydrocorals' (stylasterines and milleporines) occurs in the Danian coral limestone of Fakse (Nielsen, 1919). The occurrence here of the light-dependent *Millepora* has been used as a depth-indicator (Rasmussen, 1973). Rare finds of stylasterines have now also been made in the Maastrichtian.

Octocorals

Octocorals are normally rare in the soft white chalk of the Maastrichtian. Three to four species belonging to the genera *Epiphaxum*, *Isis* and *Moltkia* have been described (Nielsen, 1925a; Ødum 1926; Voigt, 1958). In addition, at least six, partly undescribed species of *Isis*, *Moltkia*, *Gorgonella* and *Graphularia* have now been found.

One of the richest and best known fossil octocoral faunas occurs in the Danian (Steenstrup, 1847; Hennig, 1899; Nielsen, 1913, 1917b, 1925, 1938; Rosenkrantz, 1920; Voigt, 1958). This fauna consists of 12-15 species belonging to the genera *Epiphaxum*, *Gorgonella*, *Graphularia*, *Heliopora*, *Isis*, *Moltkia* and *Primmoa*. (A further species, possibly

representing a new genus, is being studied).

The octocorals are most common in bryozoan limestone facies. Locally (mainly in borings in southern Sjælland) the amount of skeleton fragments even indicates the development of thickets or similar structures, in some cases dominated by *Molthkia*. The light-dependent *Heliopora* occurs only in scleractinian coral limestone and has been considered in connection with depth estimates (Floris, 1962, 1971). *Graphularia* is restricted to soft bottoms.

Scleractinian corals

Scleractinians are well known both from the Maastrichtian and the Danian. They have mainly been studied by Beck *in* Lyell (1837), Hennig (1899), Nielsen (1922), Ødum (1926), Rosenkrantz (1939), Rasmussen (1966, 1977) and Floris (1967, 1968, 1972). Studies of the palaeoecology of the scleractinians have mainly concerned the middle Danian corals at Fakse (Floris, 1962, 1967, 1971, 1972, 1975).

In the following list of genera new records are indicated by an asterisk, and records redetermined here are cited in brackets. Only ahermatypic scleractinians have been found.

Genera in the Maastrichtian (representing about 16 species):

Oculina ('*Amphihelia*')
Caryophyllia *
Coelosmilia
*Dendrophyllia**
Parasmilia
Trochocyathus?

Genera in the Danian (representing about 35 species):

Brachyocyathus?
Caryophyllia (incl. '*Ceratotrochus*' and possibly '*Rhizotrochus*')
Cyathoceras
Coelosmilia?
Dendrophyllia
Discotrochus
Faksephyllia
Flabellum
Oculina
Parasmilia (incl. '*Ceratotrochus*', '*Epitrochus*' and '*Sphenotrochus*')
*Stenocyathus**
Trochocyathus?

Some of the Maastrichtian scleractinians belong to the wide-spread soft bottom fauna well known from Campanian/Maastrichtian chalk of NW Europe and USSR. The topmost Maastrichtian chalk in Denmark is relatively rich in benthic skeletons (bryozoan chalk facies) and in SE Denmark shows a concomittent increase in numbers of scleractinians. Among these, a species of *Oculina* may even have formed thickets. Remarkable in the Maastrichtian fauna is a very early *Dendrophyllia* sp.

The scleractinians of the Danish Danian show very close relationships to the Danian faunas of Sweden and West Greenland. The fauna was sparse in most localities and almost exclusively represented by solitary forms. Bryozoan limestone facies dominates at these localities. In a few places scleractinians proliferated and formed coral limestone (Aggersborggaard in northern Jylland; Fakse Quarry and borings at Spjelderup and Herlufsholm in southern Sjælland). The frame-building corals seem always to be one or more of the three dendroid species *Dendrophyllia candelabrum* (Hennig, 1899), *Faksephyllia faksoensis* (Beck in Lyell, 1837) and *Oculina becki* (Nielsen, 1922).

At present this coral limestone is only exposed in Fakse Quarry, where coral banks lie between bryozoan banks. At this locality only one scleractinian is common to bryozoan and coral limestone, and about 16 are restricted to the coral limestone. In the coral banks all three dendroid species mentioned above were frame-building. Associated corals mainly belong to the genera *Caryophyllia* and *Cyathoceras*.

It is believed that the coral banks of Fakse were formed in a subtropical sea, at a depth averaging about 50 m and with a temperature at the sea floor of probably about 18°. The absence of hermatypic scleractinians may be explained by low water temperature.

The question of modern parallels to the Fakse coral banks has been discussed for a long time. Among contributors are Darwin (in Lyell, 1837 - reef), Teichert (1958 - Norwegian banks) and Asgaard (1968 - banks off SW Europe). In a comparison with the Recent banks, Floris (1972) concluded that parallels preferably should be found in the shallowest *Dendrophyllia* banks off Morocco (Gruvel, 1923; 80 m, 15°-16° C) and also in Holocene *Dendrophyllia-Madracis* thickets in the Gulf of Guinea (Allen & Wells, 1962; 40 m, probably 15° - 20° C).

Remarkable in the Danian fauna is the occurrence of a very early *Cyathoceras*, and the *Dendrophyllia* and *Flabellum* are also among the earliest known.