Octocoral encrusters of rock substrates in the Upper Cretaceous of Bohemia

Osmičetní koráli české svrchní křídy přitmelení k horninovým substrátům (Czech summary)

(1 text-fig., 2 pls.)

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Four morphological types of octocoral bases are described from the nearshore upper Cenomanian–lower Turonian sequences of Bohemia (Kaňk and Skuteč Members of Korycany Formation, and basal parts of Bílá Hora Formation). All the bases studied still adhered either to the rock clasts or to the rocky bottom and their low number shows that the octocorals were a rare component of encrusting communities. Relations of these communities to the environmental change marked by phosphatization processes is briefly discussed. A great majority of studied octocorals formed a part of *Atreta–Bdelloidina* community, flourishing mainly during the post-phosphatization period.

Introduction

Modern data on the Upper Cretaceous European octocorals are summarized in the paper of Voigt (1958) but important information have brought also more recent papers of Voigt (1968), Nestler (1975), Malecki (1982) and Frieg (1982).

Bohemian representatives of upper Cenomanian–lower Turonian age were decribed by Reuss (1845), Geinitz (1872), Počta (1887) and Frič (1911) and all of them were revised by Voigt (1958). First new occurrences were briefly described by Žítt – Nekvasilová (1990, 1991).

Studied octocorals belong to the benthic epifaunal organisms living attached to various types of substrates (see Bayer 1956). Preservation of complete specimens still adhered to their substrates is very rare. Axial parts of octocoral skeletons easily dissociate postmortally and only their bases may occassionally maintain their connection with substrate. The great majority of so preserved fossil octocoral bases was found cemented to the bioclasts of echinoid, bivalve, bryozoan and belemnite origin (see e.g. Voigt 1958, 1968, Malecki 1982, Pugaczewska 1965). Coral encrustation of rock substrates (clasts) was mentioned by Voigt (1958) but no details were given.

Recent works on faunal encrusters by the authors of this paper in the nearshore upper Cenomanian – lower Turonian sequences of the Bohemian Cretaceous Basin have revealed new interesting octocoral bases. They are attached not only to the rock clasts, but also to the sea rocky bottom. Data about these rare finds are briefly summarized herein.

Acknowledgement: We thank S. Čech (Czech Geological Survey, Prague) for the first information about the Rabštejnská Lhota locality and V. Houša (Geological Institute of AV ČR, Prague) for reading the manuscript.

Geological settings

Octocoral bases were studied in two different depositional settings of similar age (upper Cenomanian–lower Turonian).

The first one is represented by nearshore sequences (Kaňk Member of Korycany Formation and basal parts of overlying Bílá Hora Formation) developed in the erosion parts of sea-shore (see Houša 1991). Kaňk Member consists of basal conglomerates and of overlying locally developed bioclastic limestones. Octocoral bases cemented to rock substrates were, however, discovered only in successions where these limestones are lacking and the conglomerates are directly overlain by the clayey sediments of Bílá Hora Formation (for localities see table 1). Sediments of both formations mostly fill the depressions of rocky bottom situated on the slopes of former submarine rock elevations. Conglomerates are lithologically highly

variable owing to their rather complicated origin. Uppermost parts of conglomerates and sediment-free rocky bottom areas were later phosphatized and, subsequently, more or less reworked. Octocorals colonized the clasts of conglomerates both prior to, and mainly after the phosphatization period (see Discussion). They encrusted also the rocky bottom areas during this latter phase.

The second type od deposits with the occurrence of octocoral bases is represented by beach bioclastic sequence (Skuteč Member of Korycany Formation, see Houša 1991) of upper Cenomanian age (see Klein 1962). This sequence consists of relatively thick bioclastic limestones within which several thin horizons with gneiss clasts are developed. The octocoral base described herein is attached to a gneiss clast coming from the conglomerate horizon exposed at Miskovice locality (see pl. II, fig. 2); for detailed geology of this locality we refer to Klein (1962).

Notes on localities (see table 1): Precise localizations of octocoral occurrences at Kněžívka, Nákle and Chrtníky are given in Žítt – Nekvasilová (1990, 1991). The locality Rabštejnská Lhota lies in east Bohemia, about 4 km SSW of the centre of Chrudim and about 700 m SE of Rabštejnská Lhota. Octocorals were here attached to the Ordovician quartzite wall situated on the upper margin of an abandoned quarry (pl. II, fig. 1). The locality Kaňk-úvoz lies on the SE slope of the Kaňk-hill at Kutná Hora, in the uppermost part of a hollow-way, about 100 m SE from the National Nature Monument "Na Vrších". The locality Skalka near Velim is represented by an abandoned quarry lying about 800 m SSE of the railway station Velim near Kolín; octocorals were here found in the E part of the quarry, where conglomerates are exposed on the S wall. The Miskovice locality lying about 4.5 km WSW from the centre of Kutná Hora is represented by an abandoned limestone quarry. Precise localization of octocoral base found here is given on pl. II, fig. 2 of this paper.

For geographical settings of most localities see also Žítt – Nekvasilová (1992a, figs. 1, 2).

Table 1:
Distribution of octocoral bases cemented to rock clasts (cl.) and rocky bottom (r.b.) belonging to Kaňk Member of Korycany Formation and to basal parts of Bílá Hora Formation (oyster and *Atreta-Bdelloidina* comunities), and to Skuteč Member of Korycany Formation (unspecified community). Area of larger colonized surfaces is given in parentheses. x – respective substrate present but octocorals absent in the encrusting community, 0 – respective substrate absent, 3/1 = 3 specimens of octocoral base type 1, etc.

Locality	Octocorals in				Substrate petrology
	Oyster community		Atreta-Bdelloidina community		
	cl.	r.b.	cl.	r.b.	
Kněžívka	x	x	2/1	x	silicite
Skalka near Velim	x	x	4/1, 1/4, (0.8m^2); 1/2; 1/1	x	gneiss
Kaňk – úvoz	1/1	0	0	0	gneiss
Chrtníky	x	0	1/1	x	diabase
Nákle	0	0	0	2/1, 1/?, (3m^2)	diabase
Rabštejnská Lhota	0	0	0	6/1, (20m^2)	quartzite
Miskovice	unspecified community, clast, 1/3				gneiss

Description

Owing to the bad preservation and low number of specimens we do not attribute the basal octocoral parts to the so far described genera and species or collective groups (see Malecki 1982). Only the rough morphological types are here distinguished and only tentatively assigned to known taxa. The localization of specimens is included in table 1.

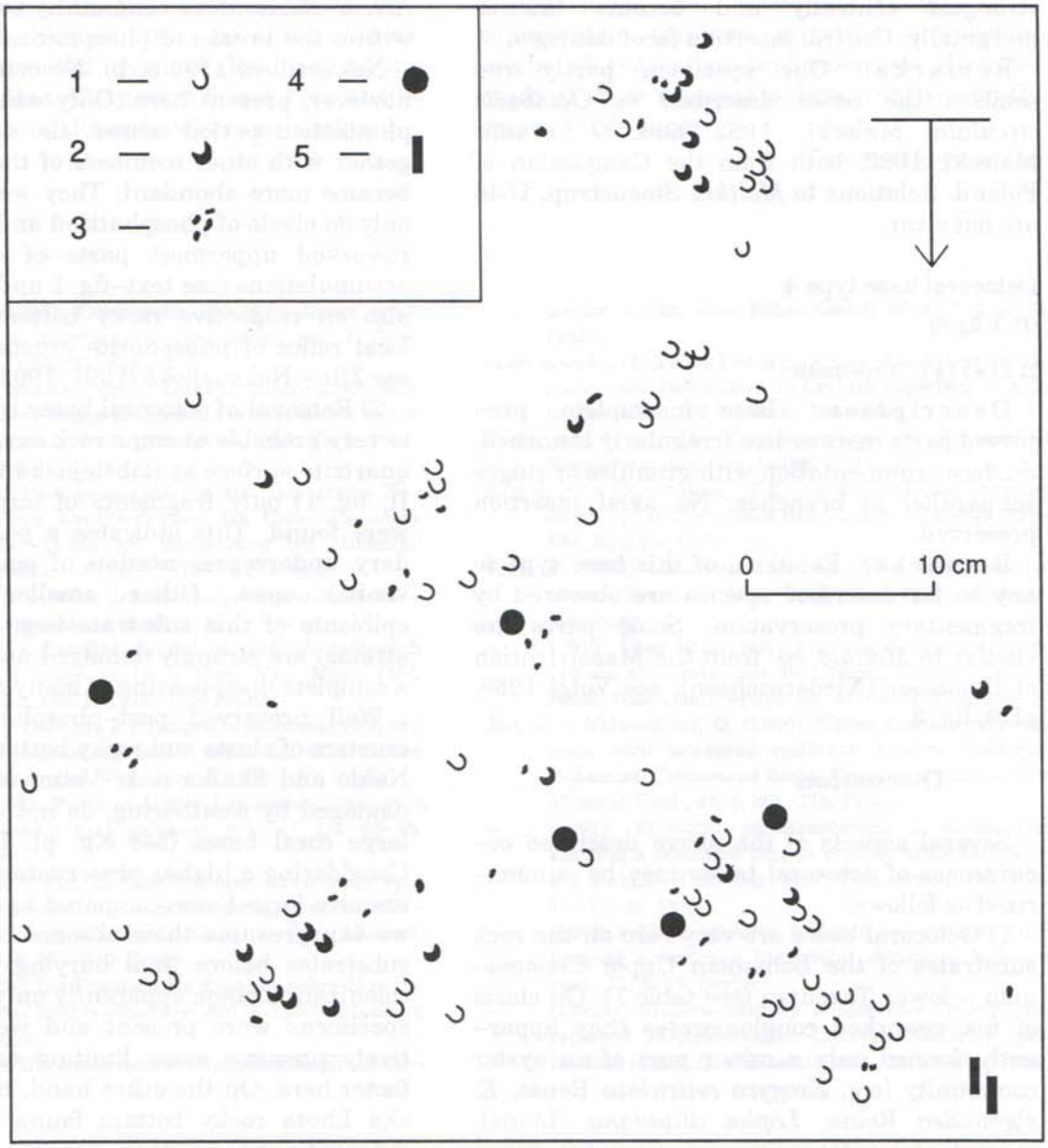
Octocoral base type 1

(Pl. I, figs. 1–3)

Material: 17 specimens

Description: Bases low to highly conical, more or less circular in outline; the smallest of them has 3.0 mm in diameter (see Žítt – Nekvasilová 1991, pl. 3, figs. 1,2). Largest specimen (see pl. I, fig. 3) is very massive. Insertion of axis central and concave. In this part concentric skeletal layers are mostly seen. No surface sculptures.

Remarks: Bases of this type highly prevail in our material. In part they resemble the base of *Stichobothrion solidum* Počta, 1887 (*Moltkia foveolata* Reuss, 1845 sensu Voigt 1958) (see Počta 1887, fig. 6; Frič 1911, fig. 263). Our specimens are not, however, sculptured but completely smooth. They may represent another species of *Moltkia* Steenstrup, 1846.



Text-fig. 1. Distribution of epibionts encrusting a part of one side of a gneiss boulder found in the uppermost horizon of the conglomerate accumulation, Skalka near Velim, S wall of E part of the quarry. Different taxa are shown by symbols; those used for *Atreta*(?) sp. 1 and sp. 2 are similar in shape to the true remains of their cemented valves. The symbols also retain preferential orientation (i.e. slope orientation – see the text) of the valves. For the field drawing, the method of F. Surlyk and W. K. Christensen (1974) was used. Arrow – line of substrate inclination (dip line). 1 – *Atreta*(?) sp. 1, 2 – *Atreta*(?) sp. 2, 3 – indeterminable rests of *Atreta*(?), 4 – octocoral base, 5 – foraminifer *Arculiammina longa* (Tappan).

Octocoral base type 2

(Pl. I, fig. 4)

Material: 1 specimen

Description: Very small and low base of circular outline. Insertion of axis central and concave, surface with low and dense radial striae. Peripheral parts of disc broken off.

Remarks: Small dimensions could suggest a probably not fully grown specimen. By its ornamentation it is somewhat similar to *Isis miranda* Počta, 1887 (see Počta 1887, fig. 3; Frič 1911, fig. 261) from the Zbyslav locality, a species according to Voigt (1958) not belonging to *Isis* Linné and so far of not recognized affinity.

Octocoral base type 3

(Pl. I, fig. 5)

Material: 1 specimen

Description: Large base provided with radial irregularly branching ridges which are

strongest centrally and become thinner marginally. Central insertion facet damaged.

Remarks: Our specimen partly resembles the bases described as *Octobasis circulata* Malecki, 1982 and *O. ornata* Malecki, 1982, both from the Campanian of Poland. Relations to *Moltkia* Steenstrup, 1846 are not clear.

Octocoral base type 4

(Pl. I, fig. 6)

Material: 1 specimen

Description: Base incomplete, preserved parts more or less irregularly branched. Surface ornamentation with granules or ridges subparallel to branches. No axial insertion preserved.

Remarks: Relations of this base type to any so far described species are obscured by fragmentary preservation. Some parts are similar to *Moltkia* sp. from the Maastrichtian of Hemmoor (Niedersachsen), see Voigt 1958, pl. 9, fig. 2.

Discussion

Several aspects of the above described occurrences of octocoral bases may be summarized as follows:

1) Octocoral bases are very rare on the rock substrates of the Bohemian Upper Cenomanian – lower Turonian (see table 1). On clasts of not reworked conglomerates they apparently formed only a minor part of an oyster community (e.g. *Exogyra reticulata* Reuss, *E. sigmoidea* Reuss, *Lopha diluviana* (Linné), pycnodonte oysters, *Spondylus* sp., bryozoans a.o.). On the rocky bottom covered by these conglomerates the octocoral bases were not yet found.

Shortly before the beginning of phosphatization processes, the encrusting community was enriched by some other species dominated by *Atreta* Étallon (bivalve) and *Bdelloidina cribrosa* (Reuss) (agglutinated foraminifer). The only octocoral base found in cluster with *Bdelloidina* specimens on the small gneiss clast may be tentatively ranged with this period. In this case all the specimens encrust the phosphate-free surface and are phosphatized and covered by a phosphate coating. This clast comes from the reworked uppermost conglomerate part at Skalka near Velim.

During the phosphatization processes the environmental conditions apparently were not favourable for the benthic organisms. The *Atreta–Bdelloidina* community could live only within the breaks of phosphatization (see Žítt – Nekvasilová 1992 a, b). No octocorals were, however, present here. Only when the phosphatization period ceased, the octocorals together with other members of the community became more abundant. They were found not only on clasts of phosphatized and more or less reworked uppermost parts of conglomerate accumulations (see text-fig. 1 and table 1), but also on respective rocky bottom areas with local relics of phosphorite crusts. For details see Žítt – Nekvasilová (1991, 1992b).

2) Removal of octocoral bases by weathering is very probable at some rock surfaces. On the quartzite surface at Rabštejnská Lhota (see pl. II, fig. 1) only fragments of large specimens were found. This indicates a possible secondary underrepresentation of smaller (or juvenile) ones. Other smaller encrusting epibionts of this substrate (e.g. foraminifers, atretas) are strongly damaged and we suggest a complete disappearing of many of them.

Well preserved post-phosphatization encrusters of clasts and rocky bottom surfaces at Nákle and Skalka near Velim which are not damaged by weathering, do not comprise any large coral bases (see e.g. pl. I, figs. 2, 6). Considering a higher preservation potential of massive large bases compared to smaller ones, we can presume their absence on mentioned substrates before final burying. During this colonization stage apparently only young coral specimens were present and we can tentatively presume some limiting environmental factor here. On the other hand, the Rabštejnská Lhota rocky bottom fauna seems to be extraordinary in this aspect and reflects probably local exceedingly favourable environmental conditions.

3) Coral bases cemented to the rocky bottom grew perpendicularly to this substrate, even in cases of its high obliquity (about 40 degrees at Rabštejnská Lhota, see Pl. II, fig. 1). The same growth features were observed on specimens attached on a boulder found at Skalka near Velim (see text-fig. 1; pl. I, fig. 2). The original position of this substrate was oblique during its colonization, which is confirmed by so called slope orientation of atretas (i.e. orientation of cemented valves with umbonal parts directed to the upper left quadrant; more about it see Nekvasilová – Žítt 1988, a.o.).

No signs of substrate selection by octocorals were observed. They encrust all types of gneiss, diabase, quartzite and silicite.

4) In taphocoenoses in conglomerate matrix

and overlying beds, the octocoral bases detached from unknown types of substrates as well as dissociated axial skeletal parts are locally abundant. They were found even at the localities or in sediments where no rock substrates have been observed. Their various preservation confirms a rather complicated origin of respective taphocoenoses. Detailed study of these remains is, however, beyond the scope of this paper.

Translated by the authors

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Osmičetní koráli české svrchní křídy přitmelení k horninovým substrátům

Z příbřežního vývoje svrchního cenomanu – spodního turonu české křídové pánve (kaňkské a skutečské vrstvy korycanského souvrství a bazální část bělohorského souvrství) se v předložené práci popisují 4 morfologické typy bází osmičetných korálů. Báze byly nalezeny in situ, tj. přitmelené k horninovým substrátům (klasty a skalní mořské dno). Diskutována je distribuce osmičetných korálů v rámci enkrustujících společenstev a jejich vztah k období výrazné změny prostředí, charakteristické fosfatizačními procesy. Početně nejbohatší výskyt bází pochází z post-fosfatizačního období vývoje sedimentárních akumulací a kryje se s maximem rozvoje enkrustujícího společenstva význačného mlži rodu *Atreta* a foraminiferou *Bdelloidina cribrosa*.

Explanation of plates

Photographs of octocoral bases taken by J. Brožek, Geological Institute, Czech Academy of Sciences, Prague. Specimens are deposited in the same institution but later will be transfered to the National Museum, Prague.

Plate I

1. Octocoral base type 1; strongly weathered specimen from Rabštejnská Lhota. Arrow – remain of cemented valve of Atreta(?). Scale bar = 3.0 mm.
2. Ditto; specimen from a boulder (see text–fig. 1) found at Skalka near Velim. Photo of plaster cast. Scale bar = 2.0 mm.
3. Ditto; specimen from a cobble found at Kaňk–úvoz. Scale bar = 5.0 mm.
4. Octocoral base type 2; specimen from a cobble found at Skalka near Velim. Scale bar = 1.0 mm.
5. Octocoral base type 3; specimen from a pebble found at Miskovice. Scale bar = 3.0 mm.
6. Octocoral base type 4; for localization see fig. 2 of this plate. Photo of plaster cast. Scale bar = 2.0 mm.

Plate II

1. Rabštejnská Lhota locality viewed from SW. Left–uppermost part of a quarry wall. Arrow – part of an abraded quartzite surface encrusted by epibionts including octocorals. c – uppermost Cenomanian(?)–lower Turonian claystones covering the quartzite bedrock (dashed line). Photo J. Žítt, 1989
2. Miskovice locality, N part of E quarry wall. Sequence of upper Cenomanian bioclastic limestones. Arrow – weathered part of a conglomerate horizon in which the clast with octocoral base type 3 was found. Photo J. Žítt, 1986

RECENZE

V. Bouška: **Tajemné vltavíny**. – 84 str., Nakl. Gabriel, Praha, 1992.

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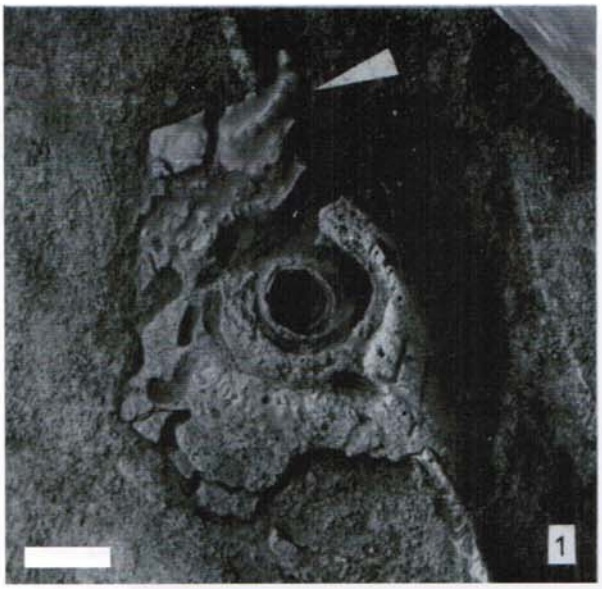
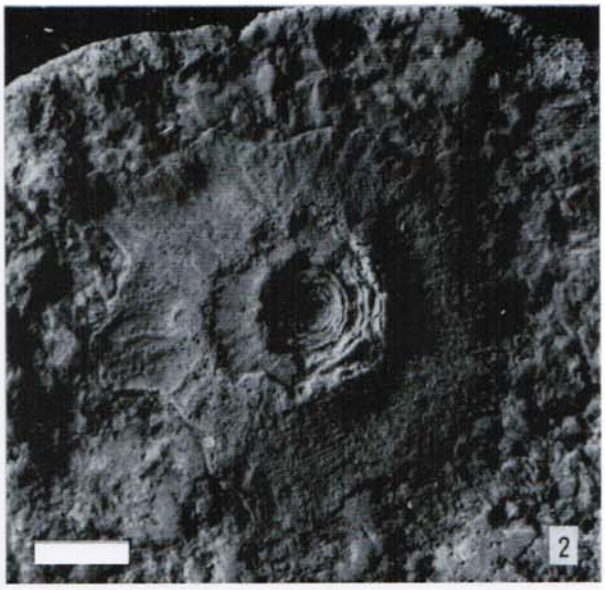
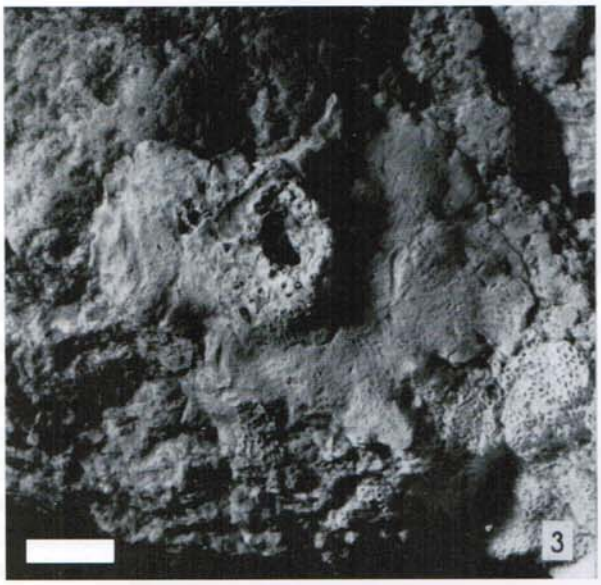
Kniha zajisté by neměla ujít pozornosti laické veřejnosti a zejména pak sběratelů vltavínů i odborníků v dané tematice.

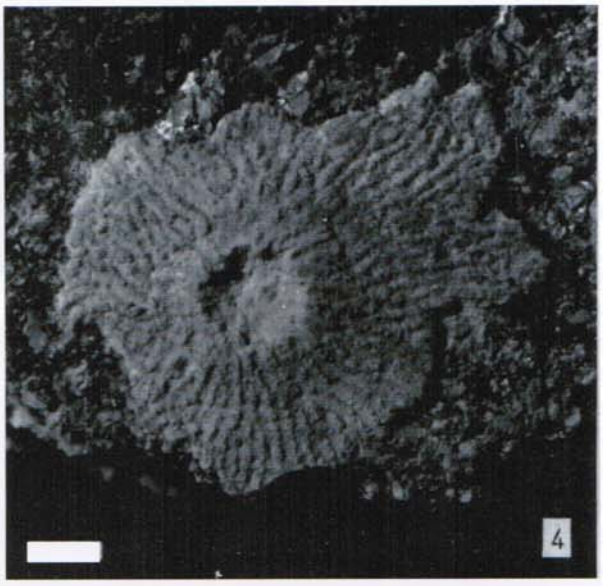
Pavel Kašpar

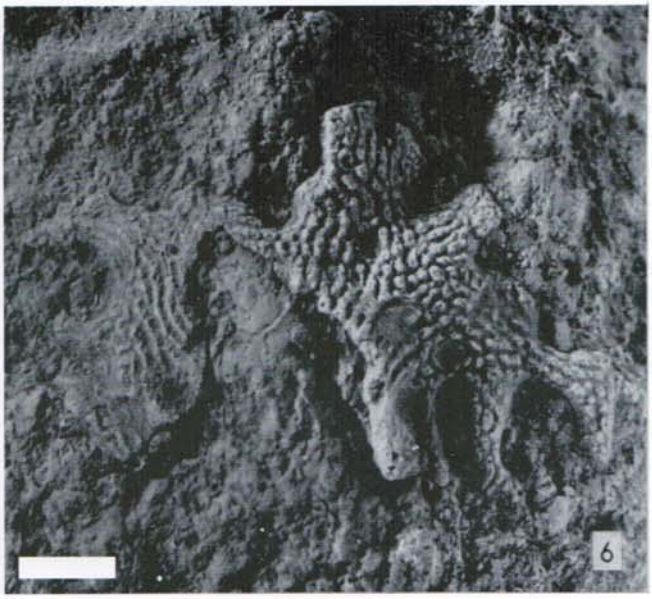
J. Žítt – O. Nekvasilová: Octocoral encrusters of rock substrates .. (Pl. I)











For explanation see p. 76

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