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ELEVATION FACIES OF THE MALM IN MORAVIA

(Pls. VIII)

Abstract: Microfacies and sedimentological research of shallow-water carbonates of the Malm of the autochthonous Jurassic in the Bohemian Massif (the Brno carbonate platform) and of the Malm in the Flysch Carpathians (the Ernstbrunn and Štramberk Limestones) facilitated the determination of criteria for the differentiation of the sedimentary environments of the carbonate platforms and of the reef complex. The differences were given by the mutual interaction of specific syntectonic manifestations and development of the carbonate sedimentation. This led to the differentiation of facies and formation of different ecological conditions. In the two environments mentioned, mutually differing structural limestone types originated and specific associations of microfacies elements, algae in particular, developed.

Резюме: Микрофациальное и седиментологическое исследование мелководных карбонатов мальма автохтонной юры Чешского массива (бpненская карбонатная платформа) и мальма флишевых Карпат (эрнстбруннские и штрамберские известняки) способствовало определению критерий различения осадочных сред карбонатных платформ и рифового комплекса. Разницы были взаимодействием особых синтектонических проявлений и развитием карбонатного осадконакопления. Это привело к различению и образованию разных экологических условий. В двух упомянутых средах были образованы структурой отличающиеся друг от друга известняки и были развиты особые ассоциации микрофациальных элементов, в частности водорослей.

Introduction

Jurassic sediments of the autochthonous Jurassic of the Bohemian Massif and their relation to Jurassic sediments of the Outer Carpathians were studied within the framework of the research of the deep-seated structure in the region of the Neogene Carpathian Foredeep and Flysch Belt in the period 1967—1984. Our aim was in particular a detailed palaeogeographical classification of the carbonate elevation facies of the Malm. Microfacies analysis of the carbonates obtained from drilling cores, cuttings, outcrops, boulders, and olistoliths was the method applied. This method also facilitated a more accurate biostratigraphic classification of the carbonates studied and therefore mutual correlation.

The relation of the individual microfacies and facies to basic environments of the shallow-water carbonate sedimentation (carbonate platform, carbonate ramp, or to the reef complex (sine Wilson, 1975), and/or the determination of the horizontal and vertical zonations of the carbonate bodies are the main

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problems to be solved from the facies and palaeogeographical points of view. Previous researches have shown that microfacies analysis can be used with advantage in this study (Eliáš — Eliášová, 1984). Along with the facies analysis and ecological evaluation of organisms, sessile benthos in particular, it is also a suitable method for the model reconstruction of the sedimentary environment.

Facies and palaeogeographic conditions of the carbonate sedimentation of the elevation environments of the autochthonous Jurassic in the Bohemian Massif (the Brno platform) and Jurassic of the Outer Flysch Carpathians, i.e. the Pavlov platform, the sedimentary area of the Baška cordillera with three development facies (the carbonate platform, the reef complex, and again the carbonate platform) are also discussed in the paper presented. Moreover, we have also tried to reconstruct the as yet not well known carbonate platforms, on the Silesian cordillera which separates the Silesian sedimentary area from the Magura sedimentary area.

The differentiation of the individual partial environments of the carbonate sedimentation is important both from the palaeogeographical and practical aspects (relation of diagenesis — diagenetic facies — and of the carbonate sedimentary environments to porosity and permeability of rocks).

Several biostratigraphic problems have been consulted with Dr. K. Borza, Geological Institute of the Slovak Academy of Science, Bratislava, to whom we extend our thanks.

Photographic documentation of the microfacies of the Pavlov platform and of the sedimentary area of the Baška cordillera is partly given in Eliáš—Eliášová (1984) and Eliášová (1981).

Palaeogeographic reconstruction of the shallow-water carbonate environments in the Malm

The reconstruction of the Malm sedimentary areas in the Outer Flysch Carpathians has been based on palaeogeographic conditions in the Cretaceous and Palaeogene, and on corresponding distribution systems of clastic material. The reconstruction gave the following significant results:

a) The Malm elevation and slope sediments coincide with the Cretaceous and Palaeogene elevation and slope sediments.

b) The course of the facies in the autochthonous Jurassic in the Bohemian Massif is already roughly parallel with the present-day course of the structures in the Flysch Carpathians. This indicates that the principal palaeogeographic features of the Jurassic up to Palaeogene sedimentary areas in the region of the Outer Flysch Carpathians and their foreland did not change substantially (Eliáš, 1979; Eliáš—Eliášová, 1984).

Amongst the principal elevation facies the following were differentiated during the palaeogeographic reconstruction of the Malm sediments in the Outer Flysch Carpathians and their foreland:

A. The Brno platform (autochthonous Jurassic of the Bohemian Massif).

B. The Pavlov platform (sedimentary area of the Ernstbrunn Limestone occurring now tectonically in the Ždánice unit).

C. Sedimentary area of the Baška cordillera with three stratigraphically evidenced development phases:

1. the Štramberk carbonate platform in the Lower Tithonian;
2. the Štramberk reef complex (mainly Upper Tithonian);
3. the Štramberk carbonate platform in the uppermost Tithonian and Lower Cretaceus (up to Hauterivian).

The Štramberk Limestone occurs as clasts in the Silesian unit.

D. Jurassic up to?Lower Cretaceous carbonate platforms on the Silesian cordillera occur in clastic material of allodaphic limestones and in boulders in sediments of the Silesian unit and Magura flysch.

In the Oxfordian to Upper Tithonian, the Brno platform in the width of approximately 10—15 km passed from the region of the Vienna Forest through the eastern surroundings of Znojmo and Brno towards Vyškov (Eliáš, 1981). The carbonates composing this platform, attain the thickness of 500 m approximately. Two groups of facies are delimited by us on the Brno platform:

a) The marginal facies of the platform (on the NW and/or W and on the SE and/or E), where sediments affected by variously intensive currents originated. The rock association of this facies is composed of oosparitic (Hrušovany) limestones, intrasparitic, biosparitic — in part crinoidal — limestones (a part of the Vranovice Limestones, part of the section on the Stránská skála Hill near Brno — Pl. I/1), and sporadically even onkoidic biosparitic limestones (Vranovice and Novosedly Limestones — Pl. I/2). These sediments represent deposits of dunes and bars on the margins of the shallow-water part of the platform, which are subject to intensive waving.
Biogenic limestones — sponge mounds, which originate both on the margin of the platform and on its slopes (Pl. II/1) are also a component of this marginal facies. Moreover, coral facies in the form of patch reefs belong to this facies. They originated at first in the Oxfordian, soon after the transgression (Stránská skála Hill near Brno, see Eliáš—Eliášová, 1984). They have also been identified in youngest beds in which the growth of corals is dated by finds of *Crassicollaria parvula* REMANE (form of the *Calpionella* zone B — Upper Tithonian up to Berriasian). The patch reefs occur in ecologic succession above the sponge mounds (Pl. II/2).

b) The inner facies of the platform consists of sediments which originated in a relatively quiet environment where the influence of currents was small to negligible. Micritic and biomicritic limestones, pelmicritic limestones, and stromatolitic limestones are characteristic of these parts of the platform. Dolomitization and/or even silicification are typical here. The inner part of the platform yielded even brecciated dolomites which presumably represent collapse breccias associated with the destruction of the evaporite layers.

Of the microfacies elements, the Brno platform is characterized by sponge needles both with canals and rhaxes devoid of axes. Both occur in micritic matrix. The oolitic limestones originated in the Oxfordian (Hrušovany Limestone) as well as in the Middle and Upper Tithonian when also the micritized and coated grains developed. These particles together with ooids are found redeposited in the Kurdějov Limestone.

All these particles indicate that the limestones described originated in shallow subtidal to tidal environments under a variable intensity of currents and varying salinity. The Brno platform declined very gently into the deeper sedimentary area of the Mikulov Marlstones. Morphologically, it presumably corresponds to the carbonate ramp in the sense of Wilson, 1975.

B. The Pavlov carbonate platform represented the sedimentary area of the Ernstbrunn Limestone. Its reconstruction is only possible on the basis of the microfacies analysis of clasts and/or redeposited particles in places of the present-day occurrence of the Ernstbrunn Limestone. Just as in the Brno platform, in dependence on the energy of the environment, a marginal and inner facies may be differentiated in the Pavlov platform. In the marginal facies originated sediments under strong current and normal salinity conditions. In the inner facies the sediments formed in a more sheltered environment and under moderate currents, presumably in hypersaline environment.

The marginal facies of the Pavlov carbonate platform, in the direction of the Ždánice sedimentary area, was characterized by the presence of oosparitic limestones with numerous well-developed multilayered ooids, "lag deposits" with sparitic cement, biosparitic limestones and *Girvanella* onkoids on the order of as much as centimeter dimensions, and additional types of biosparitic limestones. The blocks of coral bioliths indicate that small reefs of the "patch-reef" type also occured in this facies. A very small proportion of organogenic limestones is characteristic of the Ernstbrunn Limestone. Various types of clastic limestones absolutely predominate.

The material in clasts indicates that sediments of the inner facies of the carbonate platform were especially represented in the original sedimentary area of the Ernstbrunn Limestone, in which various types of micritic, pelmicritic, and biomicritic limestones developed. Moreover, micritic limestones with ooids and onkoids along with large *Girvanella* onkoids have also been found. According to their general character, some pelletoidal limestones may be compared with bahamites. Micritized grains, grains with micritized envelopes, coated grains, etc. occur frequently. In addition to the pelletoids, true pellets as, e. g., large pellets of the *Favreina* type are also present. In areas with somewhat stronger currents, at the border with the marginal facies, aggregate grains of the grapestone type developed.

Of the microfacies elements, algae *Marinella lugeoni* PFENDER, *Cayeuxia moldavica* FROLLO, *Solenopora* sp., and the blue-green alga *Girvanella minuta* WETH. (Pls. III—V) are especially characteristic of the Ernstbrunn Limestone.

According to the character of the base-of-slope sediments (allodaphic limestones in the Klentnice Formation, large breccias of the Ernstbrunn Limestone), the Pavlov carbonate platform declined steeply into the Ždánice sedimentary area. Its extent towards the west and the nature of the slopes into the sedimentary area of the autochthonous Jurassic is not known.

For the reconstruction of the western parts of the Pavlov carbonate platform, it will be necessary to study the "Pavlov" microfacies elements in sediments of the autochthonous Jurassic in the eastern parts of its distribution. From this point of view, the occurrence of the alga *Marinella lugeoni* and of further elements typical of the Ernstbrunn Limestone in the Kobylí limestones (borehole Sedlec-1) is interesting.

Dolomitization which affects various types of limestones, is characteristic of rocks of the Pavlov carbonate platform. It is presumably associated with the soaking of magnesium brines which developed in hypersaline conditions of intertidal to supertidal environments of the carbonate platform.

C. The Baška cordillera

The sedimentary conditions were more involved on the Baška cordillera in the sedimentary environment of the Štramberk Limestone in the Upper Malm.

1. Shallow-water carbonate sedimentation in this environment may sofar be documented from the Lower Tithonian (Eliáš—Eliášová, 1985). These oldest limestones are developed in a microfacies of biopelmicritic to pelbiomicrosparitic limestones with sporadic incompletely developed ooids and blue-green algae. The character of these limestones approaches rather the microfacies of the carbonate platform. The material washed from this platform may be found in the form of allodaphic limestones in the Lower Těšín Formation.

Both by its geological position and partly also stratigraphically and in facies, a klippe in Inwald (Poland) is presumably an analogue of the Štramberk carbonate platform in the Tithonian. Książkiewicz (1971 a) compares the sedimentary environment of these limestones with that on the Bahama banks. Nowak (in sine 1976) discusses the age of the Inwald Limestone and refers it to the Middle to Upper Tithonian.

2. During the (?) Middle and Upper Tithonian, a coral reef complex developed on the Baška cordillera. It reached its climax in the Upper Tithonian, in the biochron of the *Calpionella* zone A. The stratigraphic assignment is documented by tintinnids trapped in coral colonies. The Štramberk reef was already an analogue of recent reef complexes, in which corals are the main builders and algae the most important binding elements (Eliášová, 1981; Eliáš—Eliášová, 1984).

According to data (Milliman, 1974), a living reef produces a 4 to 5 times greater volume of detrital limestones than is the volume of the organogenic limestones proper. Due to mechanical and biogenic destruction of organogenic limestones, a vast amount of biogenic detritus was released also in the Štramberk reef complex, which along with other carbonate particles produced thick deposits on the front side of the reef (reef breccias — rudites and other clastics), and/or reef platform, which represents the rear part of the reef complex. The fossiliferous limestones from the ephemeral period of the reef existence are therefore the most voluminous and most characteristic sediments of all types of shallow-water carbonate deposits on the Baška cordillera.

At the time of the reef sedimentation, ooids and coated grains were relatively rare. Onkoids, apart from anomalously great lag-?onkoids (Eliášová, 1981), have not been found in the Štramberk Limestone. Likewise dolomitization has not been ascertained in the Štramberk Limestone with the exception of very rare traces of more closely unknown age.

Of the microfacies elements, especially algae are characteristic of the Štramberk Limestone from the period of the existence of the reef complex. They are the following: *Teutloporella socialis* PRATURLON, *T. obsoleta* CAROZZI, *Triploporella remesi* STEINM., *Nipponophycus* cf. *ramosus* YABE et TOYAMA, *Archaeolithothamnium* sp., *Parachaetetes* sp. (Pls. VI—VIII).

3. During the *Calpionella* zone B (Uppermost Tithonian/Berriasian), the sedimentary conditions (tectonic regime) began to change on the Baška cordillera and the reef sedimentation passed again into a more common and more widely distributed type of the carbonate platform. The corals accumulated into tiny

reefs (patch-reefs), the proportion of the clastic sedimentation increased, and the carbonate grains acquired a different character than on the reef complex: pelletoids, coated grains, more strongly micritized grains of varied origin, and poorly developed ooids began to occur in masses. These sedimentary conditions lasted on the Baška cordillera till the Hauterivian (Eliáš—Eliášová, 1985).

The washed-down material from this younger Štramberk carbonate platform forms the material of the allodaphic Těšín Limestone (Książkiewicz, 1971 b) and of some rocks of the Těšín—Hradiště Formation.

The Štramberk carbonate platform and the Štramberk reef complex declined steeply into the Silesian sedimentary area.

D. Malm and (?) Lower Cretaceous platforms on the Silesian cordillera

In the Upper Jurassic, shallow-water carbonate sedimentation occurred on both sides of the Silesian cordillera. It is still little known about its character. The sediments correspond to those of a poorly developed carbonate platform (similarly as in the Štramberk carbonate platform).

The existence of the Upper Tithonian carbonate platform, which bordered the Magura slope of the Silesian cordillera, has been proved by Eliáš—Eliášová, 1984.

The shallow-water sedimentation from the opposite side of the Silesian cordillera has sofar been evidenced by sporadic finds of boulders of shallow-water limestones from the Ostravice Sandstone (Andrusov, 1959; Eliáš—Eliášová, 1984). Recently, material deriving from this platform in the form of boulders of shallow-water limestones and particles of allodaphic limestones (ooids, pelletoids, bioclasts from shallow-water organisms) has been identified also in the Těšín—Hradiště Formation in the environs on Frenštát pod Radhoštěm.

Reconstruction of the sedimentary environment

The microfacies and sedimentologic research of the Brno and Pavlov carbonate platforms on the one hand, and of the Štramberk reef complex and Štramberk carbonate platform on the other hand has indicated appreciable differences that existed between all these sedimentary environments. They are reflected both in the qualitative and quantitative representation of limestones of various structural types and in different sets of microfacies elements. The differences are, moreover, apparent in the total association and diversification of macrofauna (Eliášová, 1981; Eliáš—Eliášová, 1984). Likewise the platforms of the Silesian cordillera have a distinctive character.

The differences mentioned were caused by different conditions during sedimentation, which are especially the function of different tectonic conditions (rate of subsidence in particular) on the one hand, and by the compensation of this subsidence by carbonate sedimentation on the other hand. Additional factors which have to be considered include hydrodynamic and hydrochemical effects (currents, temperature, salinity, etc.). These determined the sedimentary and ecologic conditions in the individual facies and affected the differences in the associations of organism in various parts of the carbonate platforms or reef complex, and were also reflected in the character of grains.

Compared with the Štramberk reef complex which originated on the Baška cordillera, both the Brno and the Pavlov carbonate platforms were less mobile since they had in their basement relatively not much mobilized components of the epi-Variscan platform. This was displayed in slower sedimentation and in the thickness of the Ernstbrunn Limestone which was about 4 times smaller than that of the Štramberk Limestone. The slower rate of subsidence of the carbonate platform appreciably affected the distribution of the sedimentary and ecologic conditions. The tectonically relatively less active environment presumably determined only the local development of the organogenic coral limestones in the form of patch reefs. The slow sedimentation on the relatively extensive platform in a subtidal to supratidal environment provided, however, favourable conditions for a low sedimentation rate and for the origin and accumulation of well developed ooids, micritic onkoids, and additional types of onkoids, from onkoidic envelopes up to great *Girvanella* and polymictic algal-foraminiferal onkoids. In the rear of the marginal facies, sheltered facies with micritic sedimentation and with micritic, pelletal and pelletoidal limestones with a strong micritization of particles (the equivalent of bahamites) developed. In less sheltered parts of the platform, the conditions favoured the origin of aggregate grains of the grapestone type of varied size, and of strongly micritized aggregate grains. The shallow-water environment is also indicated by various cavities of the "Stromatactis" type infilled with sparitic calcite.

Both on the Brno and Pavlov carbonate platforms, the conditions were favourable for the origin of magnesium brines in hypersaline environment. These brines were the most likely the source of Mg ions during dolomitization.

The Štramberk reef complex flourished in the Upper Tithonian. Presumably, this was at the time of intensive subsidence movements which were compensated by a rapid growth of organogenic limestones. Specific reef facies developed: the reef front (the most voluminous), the reef core, which is the main region of organogenic sedimentation, and probably a relatively narrow lagoon with open circulation. As the binding elements in the structure of the organogenic coral limestones, which formed the framework of the reef, especially algae and foraminifers played a significant part. Also hydrozoa, bryozoa, ?sponges, and various organisms incertae sedis coated the coral colonies or infilled the spaces between their branches, and thus consolidated the surface of the reef.

Bioclastic limestones are a significant component of the reef complex volume. Their particles originated by destruction of organogenic limestones, or by accumulation of loose skeletal elements of various organisms. The primary structure of the particles has mostly been preserved (usually micritic envelopes are only present). Ooids, coated grains, and more intensely micritized grains were rare in the period of the existence of the reef complex. The occurrence of irregular cavities usually infilled with two or more cement generations, and sometimes partly also with vadose silt, is typical. An early diagenesis in marine environment (generation of A-cement), which is an important factor in the consolidation of limestones already during the growth of the reef, was very significant for the limestones of the Štramberk reef complex. The Štramberk Limestone is not dolomitized.

The Štramberk reef complex may best be compared with reefs in the Caribbean region. The model of the Great Bahama Bank which lies in the proximity of these Caribbean reefs, best explains the nature of the sediments that originated on the Brno and Pavlov carbonate platforms.

However, the model of the Great Bahama Bank is not suitable for the near-cordilleran platforms on the Baška cordillera and, in particular, on the Silesian cordillera. These carbonate platforms were narrow and they were strongly affected by the adjoining land. Owing to the specific tectonic mobility of the substratum, the products of the carbonate sedimentation were quickly washed down from these platforms into the adjacent sedimentary regions. Therefore in the material deriving from these platforms, phenomena of micritization are less frequent, the ooids are poorly developed, and there are no proofs of the development of more complicated ecosystems of shallow-water organisms. It is only evidenced by rare finds of little diversified coral assemblages in the Cretaceous and Palaeogene of the Flysch Belt (E l i á š o v á, 1969, 1974).

On the other hand, however, these platforms were significant producers of micritic calcite (of?algal, ? blue-green algae origin) and of the bioclastic components of allodaphic limestones and siliciclastic turbidites. In some stratal bodies (the Baška Formation, the Palaeocene sandstones of the Magura Flysch, etc.), this proportion attained more than 40 %, and this amount must be taken into consideration in the calculation of the sources of the material supplied from the cordilleras.

Conclusion

According to the occurrence of typical microfacies in the Malm of the Jurassic of the Bohemian Massif, and in the Malm and Lower Cretaceous of the Outer Carpathians, it is possible to distinguish two principal environments of shallow-water carbonate sedimentation, i.e., the carbonate platform and the reef complex.

Compared with the sedimentation on the reef complex, the Pavlov and Brno carbonate platforms, similarly as the recent carbonate platform of the Great Bahama Bank, are characterized by relatively slower sedimentation of carbonate muds and clastic limestones. This is associated with strong micritization of the carbonate grains, the occurrence of coated grains, the presence of great amounts of pellets and pelletoids (bahamites), of micritic and *Girvanella* and polymictic onkoids, and with the origin of aggregate grains. The presence of well-developed ooids is typical. The sedimentary and thus also the ecological conditions were affected by the occurrence of facies with increased salinity and simultaneous insufficient circulation. In the sediments studied, this was displayed by the presence of a typical association of algae as, e.g., on the Pavlov carbonate platform: *Marinella lugeoni* PFENDER, *Cayeuxia moldavica* FROLLO, *Solenopora* sp., and the blue-green alga *Girvanella minuta* WETH. The organogenic sedimentation was suppressed (limited to patch reefs). The carbonate platforms originated under tectonically more stable conditions.

On the Štramberk reef complex dominated organogenic sedimentation and it was deposited under conditions of normal salinity and pronounced circulation. In addition to the reef-building organisms which were simultaneously an important source of material for the clastic limestones, binding organisms, algae in particular, participated in the formation of the reef complex. The following are especially characteristic of the Štramberk reef complex: *Teutloporella socialis* PRATURLON, *T. obsoleta* CAROZZI, *Triploporella remesi* STEINM., *Nipponophycus* cf. *ramosus* YABE et TOYAMA, *Archaeolithothamnium* sp., *Parachatetes* sp. A rapid marine diagenesis also played a significant part in the consolidation of the limestones. Sedimentation occurred on a substratum of medium mobility, the growth of the reef complex was compensated by subsidence of the basement. That was why the clastic grains could preserve more or less their primary structure.

Compared with the Baška cordillera, in which compensated sedimentation occurred at the time of the existence of the reef complex in the Upper Tithonian, the Silesian cordillera was characterized either by very slow subsidence or even moderate uplift. On the carbonate platforms, on both sides of the Silesian cordillera, especially intensive deposition of micritic calcite accompanied by occasional formation of poorly developed ooids and pelletoids took place. Presumably, scattered reefs (patch reefs) also occurred (this is indicated by the find of the hermatypic coral *Ovalastrea* sp. in a boulder at Komíny near Kostelany S of Kroměříž). Both platforms on the Silesian cordillera were especially the source of carbonates (micrite and particles) for allodaphic limestones of the Silesian as well as the Magura sedimentary areas (e.g., the Těšín—Hradiště Formation and the Kurovice Limestone).

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REFERENCES

ELIÁŠ, M., 1971: Litostratigrafická a sedimentologická charakteristika autochtonního mesozoika v oblasti Jih. Manuscript, Geofond, Praha.

ELIÁŠ, M., 1974: Mikrofaciální výzkum karbonátů naftonadějných oblastí na příkladě autochtonní jury jihovýchodních svahů Českého masívu. Zem. Plyn Nafta (Hodonín), 19, 2, pp. 359—374.

ELIÁŠ, M., 1977: Paläogeographische Entwicklung des Mesozoikums und des Tertiärs am Rande der Karpaten und des Böhmischen Massivs. Erdöl-Erdgas-Z. (Wien—Hamburg), 93, Sonderausgabe, pp. 5—11.

ELIÁŠ, M., 1979: Model flyšové sedimentace ve vnějších Karpatech. Seminář k 60. výročí založení Ústř. Úst. geol. (Praha). Sbor. přednášek, pp. 59—64.

ELIÁŠ, M., 1981: Facies and palaeogeography of the Jurassic of the Bohemian Massif. Sbor. geol. Věd, Geol. (Praha), 35, pp. 75—144.

ELIÁŠ, M. — ELIÁŠOVÁ, H., 1984: Facies and palaeography of the Jurassic in the western part of the Outer Flysch Carpathians in Czechoslovakia. Sbor. geol. Věd, Geol. (Praha), 39, pp. 105—170.

ELIÁŠOVÁ, H., 1969: Korálová fauna ždánické jednotky. Manuscript, Geofond, Praha.

ELIÁŠOVÁ, H., 1974: Hexacoralia et Octocoralia du Paléogènes des Carpates externes. Sbor. geol. Věd, Paleont. (Praha), 16, pp. 105—156.

ELIÁŠOVÁ, H., 1981: The Tithonian Reef of Štramberk Limestone (Czechoslovakia. West Carpathians). Čas. Mineral. Geol. (Praha), 26, 2, pp. 113—124.

ELIÁŠOVÁ, H. — ELIÁŠ, M., 1985: New biostratigraphic material from the Mesozoic of the Flysch Carpathians and their foreland. Věst. Ústř. úst. geol. (Praha), 60, 2, pp. 105—106.

KSIAZKIEWICZ, M., 1971 a: On the origin of the Inwald Limestone (Outer Carpathian Klippes). Bull. Acad. pol. Sci., Sér. Sci. géol. géogr. (Varsovie), 19, 3, pp. 91—99.

Plate I

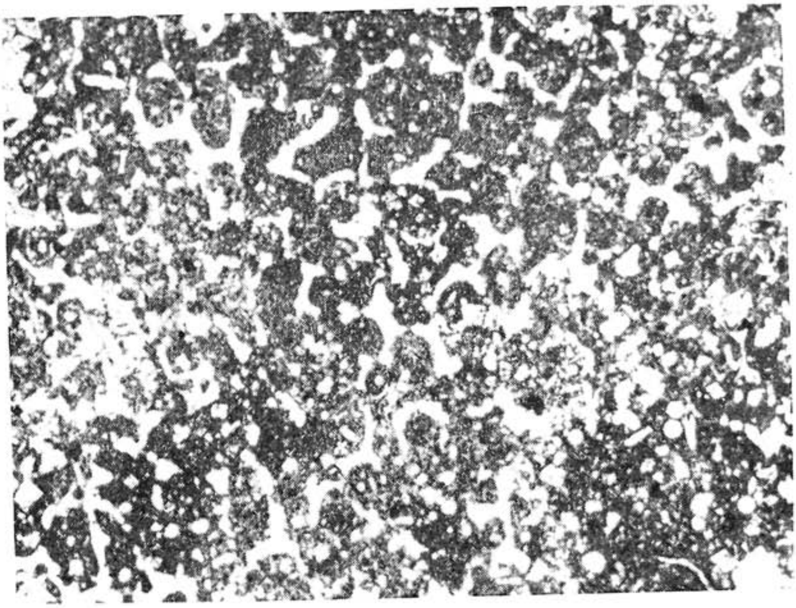


Fig. 1

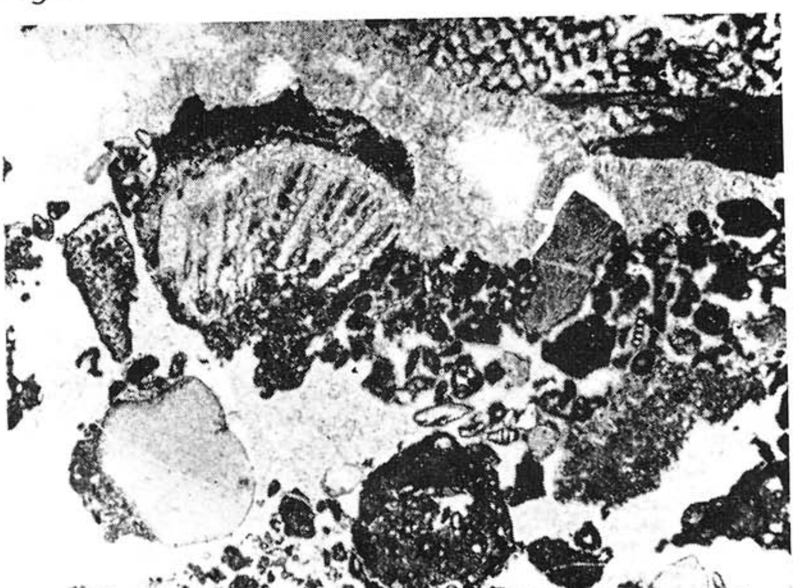


Fig. 2

Fig. 1. Crinoidal biosparite. Thin section. Stránská skála near Brno, Oxfordian, ×46.5; Fig. 2. Onkoidal biosparite. Thin section. Dolní Dunajovice-1, 1559—1565 m; 0.8—0.9 m. Vranovice Limestone and dolomite, Oxfordian, ×21.

Plate II

Fig. 1

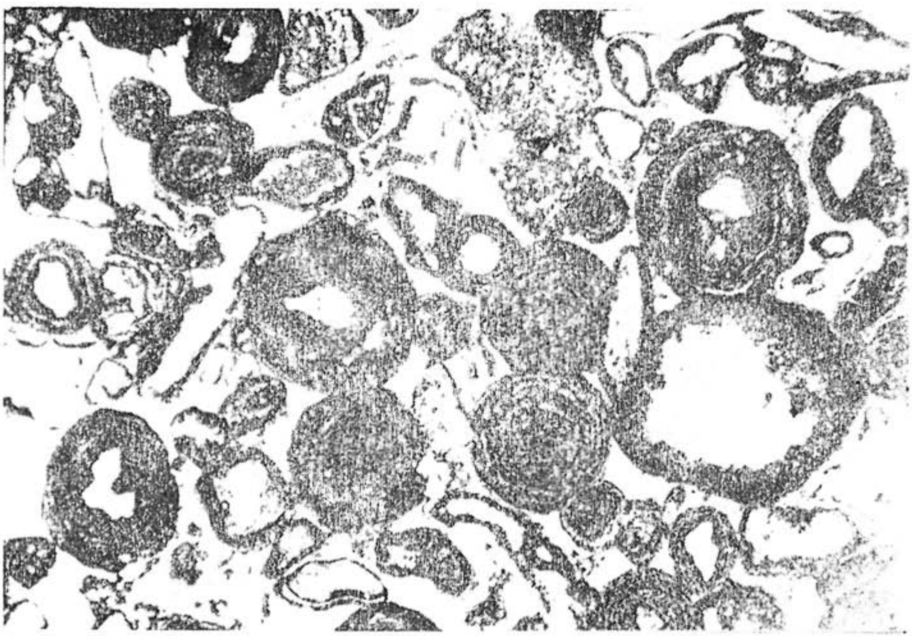


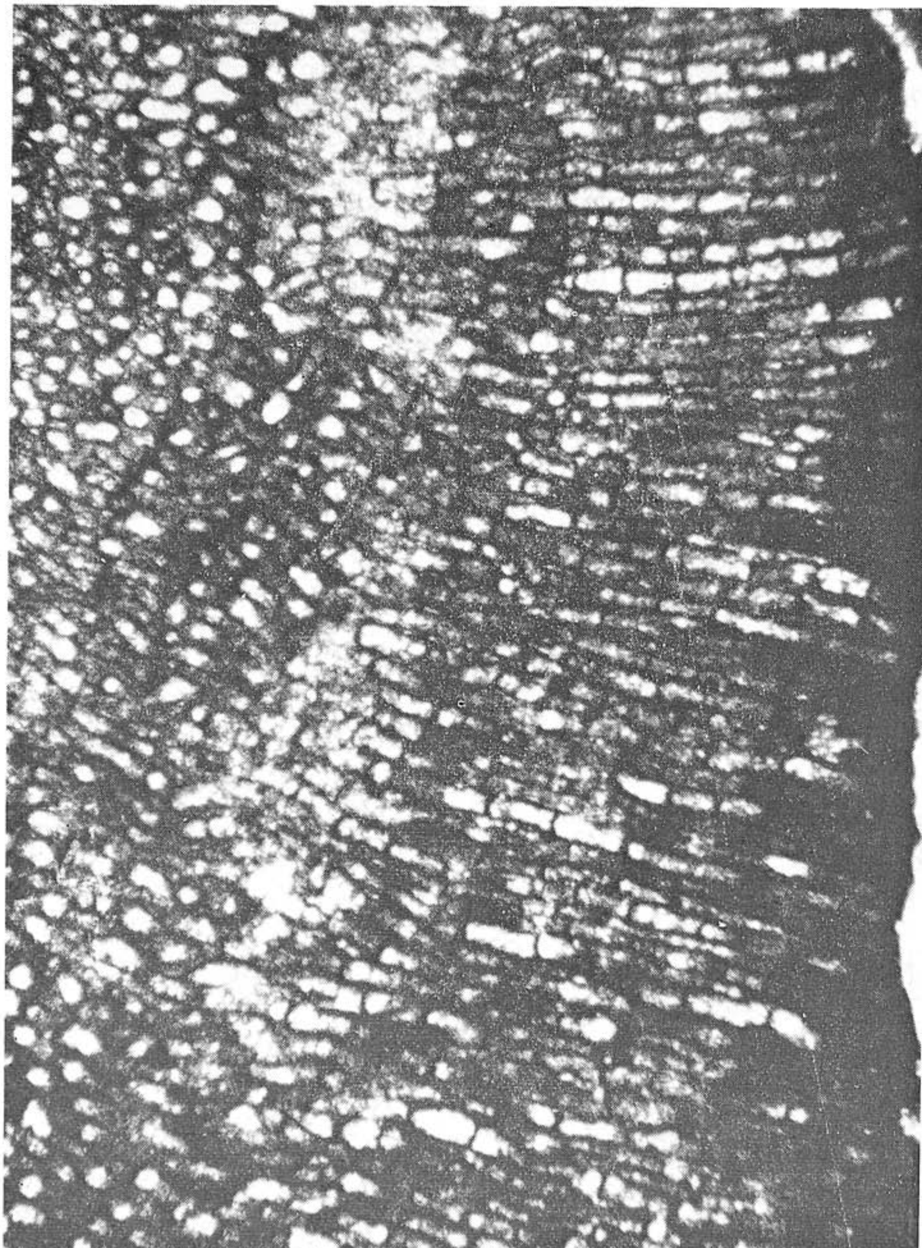
Fig. 2

Fig. 1. Sponge biomicrite. Thin section. Stránská skála near Brno, Oxfordian, × 21; Fig. 2. Biomicrosparite with fragments of corals and onkoid (bottom in the middle). Thin section. Novosedly near Brno. Boulder of Upper Tithonian shallow-water limestone from the Brno platform, × 7.5. Cavities are infilled secondarily with sparite.

Plate III

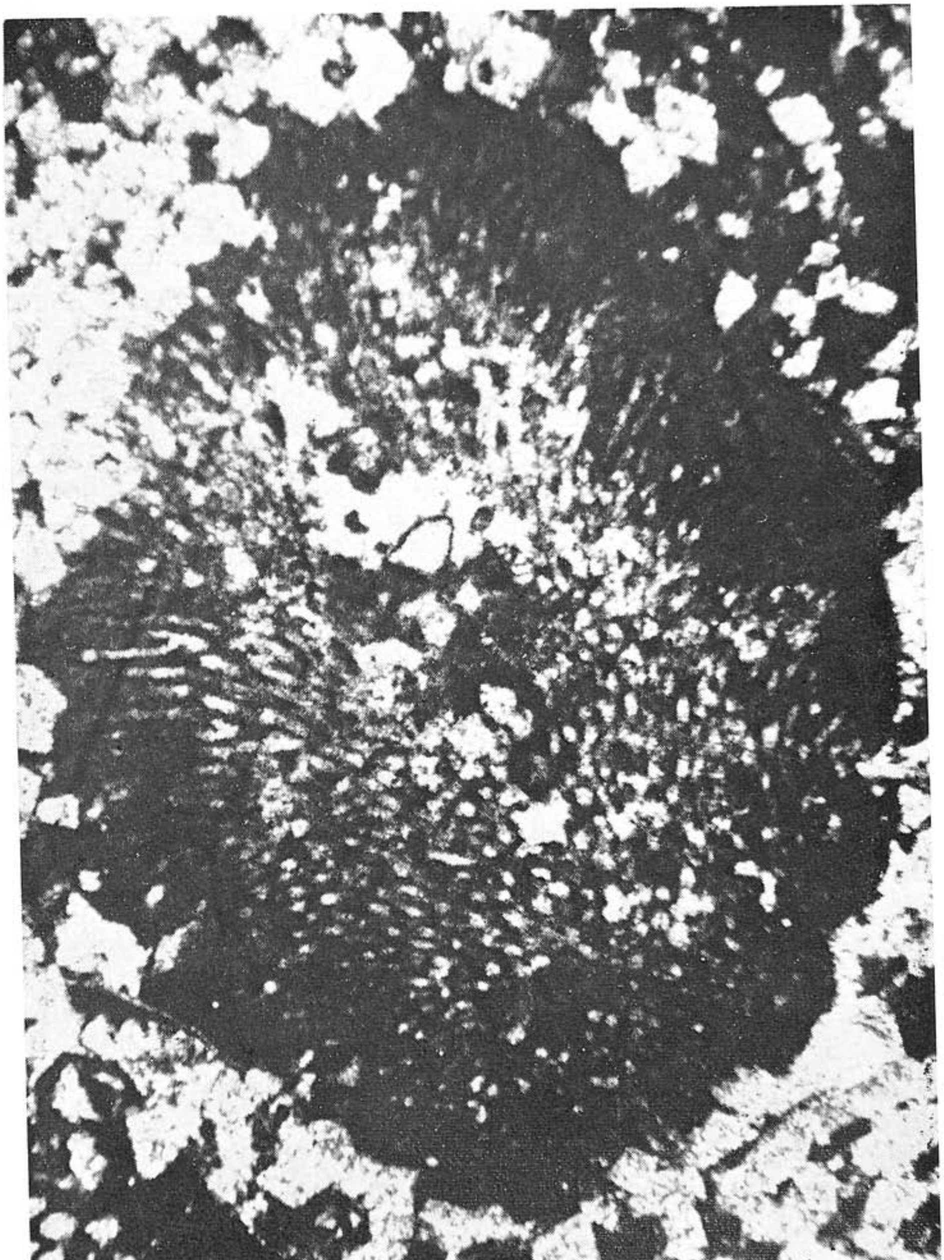
Marinella lugeoni PFENDER, 1939. Thin section. Pavlovské vrchy, Ernstbrunn Limestone, Tithonian—Lower Cretaceous, × 25.87.

Plate IV



Solenopora sp. Thin section. Pavlovské vrchy, Ernstbrunn Limestone, Tithonian—Lower Cretaceous, × 69.75.

Plate V



Cayeuxia moldavica FROLLO, 1938. Thin section. Pavlovské vrchy, Ernstbrunn Limestone, Tithonian—Lower Cretaceous, × 50.5.

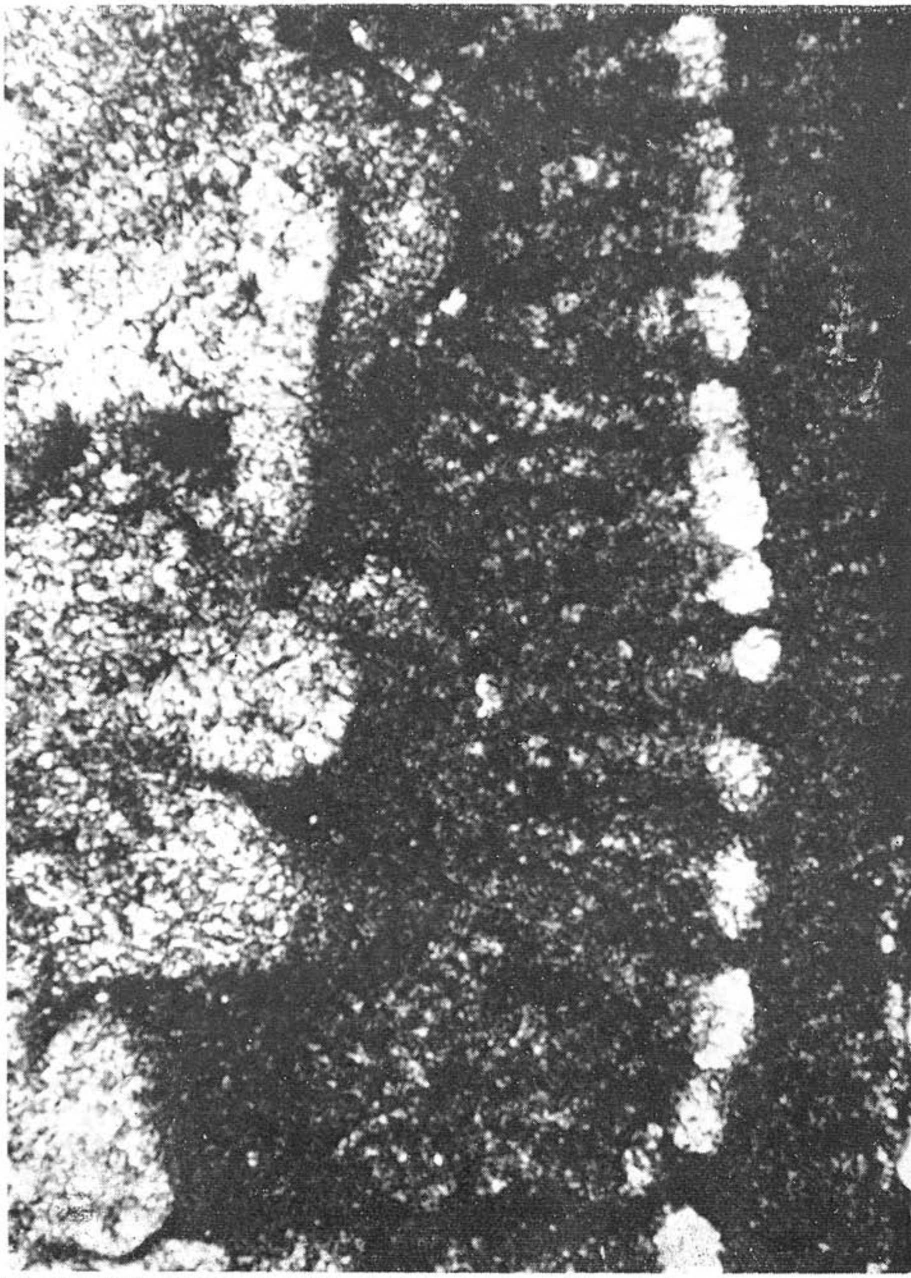
Plate VI

Teutloporella obsoleta CAROZZI, 1954. Thin section. Štramberk, Štramberk Limestone, Tithonian, × 26.

Plate VII

Nipponophycus cf. *ramosus* YABE et TOYAMA, 1928. Thin section. Štramberk, Štramberk Limestone, Tithonian, × 25.5.

Plate VIII



Archaeolithothamnium sp. Thin section. Jasenice, Štramberk Limestone, Tithonian × 180.

All photographs: ÚÚG — K. Navrátilová.

KSIĄŻKIEWICZ, M., 1971 b: On the origin of the Cieszyn Limestone in the Carpathian Flysch. Bull. Acad. pol. Sci., Sér. Sci. géol. géogr. (Varsovie), 19, 3, pp. 131—136.
MILLIMAN, J., 1974: Marine carbonates. Part 1. Springer Verlag. Berlin—Heidelberg—New York.
VAŠÍČEK, Z., 1977: Zpráva o biostratigrafickém výzkumu jurských uloženin na jižní Moravě v r. 1977. Manuscript, Geofond, Praha.
WILSON, J. L., 1975: Carbonate facies in geological history. Springer Verlag. Berlin—Heidelberg—New York.
sine, 1976: Geology of Poland, stratigraphy 2, Mesozoic. Wydawnictwo Geologiczne, Warszawa.

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РЕЦЕНЗИЯ

F. F. Steininger — J. Seneš — K. Kleemann — F. Rögl: Neogene of the Mediterranean Tethys and Paratethys. Vol. 1, 2., Institute of Paleontology, University of Vienna, 1985. Vol. 1—189 pp., 10 maps, Vol. 2 — 536 pp.

После завершения Проекта № 25 Международной программы геологической корреляции (МПГК — ЮНЕСКО) «Корреляция неогена средиземноморского тетиса и паратетиса», проходящего с 1973 по 1983 гг. под руководством Геологического института Словацкой академии наук в Братиславе, основные заключительные результаты Проекта были опубликованы в двух обьемистых томах произведения Neogene of the Mediterranean Tethys and Paratethys. В журнале Geologický Zborník — Geologica Carpathica (6, 36, с. 725—746) была также опубликована короткая информация о самых значительных результатах возрастной корреляции неогена района между Атлантическим и Индийским океанами.

Первые два тома содержат подробное изложение развития неогена, 10 цветных карт большого формата и графическое представление ревизованной стратиграфии неогена на 540 таблицах, на которых обозначены литологические единицы согласно региональным ярусам Западно-Центрального и Восточного паратетиса в отношении к ярусам средиземноморского реликта тетиса, их литологическое развитие и толщины в отдельных осадочных регионах, биостратиграфические, радиометрические и палеомагнитные данные, временная идентификация оседания и подъема отдельных регионов, координация кислых, промежуточных и основных вулканитов в их временном и пространственном распределении, несогласные залегания или перерыв осадконакопления в течение неогена в отдельных регионах, затем региональные названия толщ и формаций, и подробный список литературы.

Эти два тома являются основой для современной палеогеографической и геодинамической оценки периода с верхнего олигоцена по плейстоцен.

Самые важные задачи Проекта МПГК были решены при помощи частных заданий, т. н. „first order topics". Детальные результаты этих заданий будут опубликованы вероятно в Elsevier Publ. Comp. в Нидерландах. Они занимались прежде всего важными проблемами корреляции между разными регионами паратетиса и реликта тетиса.

Решением задания Проекта № 25 МПГК изменилась целая концепция стратиграфии и стратиграфической корреляции неогена на этой большой и классической территории циркумсредиземноморского неогена между атлантической и индотихоокеанской биопровинциями.

Мы предполагаем, что до сих пор изданные произведения в рамках этого Проекта находят применение в знакомстве с разнообразием развития, с геодинамическими и палеогеографическими применениями неогена с многолетним действием не только у специалистов, но и у студентов геологии. Эти произведения имеют большое значение для перспективы поисков новых залежей полезных ископаемых.

Оба тома можно заказать у проф. Ф. Штайнингера, адрес: Prof. Dr. F. F. Steininger, University of Vienna, Inst. Paleontology, Universitätsstr. 7, A-1010 Vienna, Austria.

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