Mitt. Bayer. Staatssamml. Paläont. hist. Geol. 8 67—97 München, 15. 12. 1968

Contribution to the Knowledge of the Palaeogene Reef-Complexes of the Myjava — Hričov — Haligovka Zone (West Carpathians)

Ervin Scheibner, Bratislava[1])

14 text-figs., 1 table and plates 4—7

Summary

In the work is given a part of results of the study of the reef-complexes of Palaeogene age from the Carpathians. Some geological problems are dealt with, the basic facies are being distinguished and part of a fauna forming the reef-complexes is described. This work has a preliminary character. It is an introduction to more extensive study of this interesting problem, results of which will be continously published. In paleontological part 3 new species of Foraminifera are described.

Zusammenfassung

In diesem Artikel wird ein Beitrag zur Erforschung der paläogenen Riff-Komplexe in den Karpaten geliefert. Nach dem Aufzeigen der allgemeinen geologischen Zusammenhänge werden die übergeordneten Fazientypen ausgeschieden und ein Teil der riffbildenden Fauna und Flora beschrieben; hierbei konnten 3 Arten der Gattungen *Bullopora, Planorbulina* und *Miniacina* neu aufgestellt werden. Diese Arbeit stellt eine Einführung in den ausgedehnten Fragenkomplex der paläogenen Riffe der Myjava — Hričov — Haligovka Zone der Karpaten dar. Detaillierte Untersuchungen werden fortgeführt und die Ergebnisse in Bälde publiziert.

Contents

[1]) Doc. RNDr. Erwin Scheibner, Department of Geology, J. A. Comenius University, Gottwaldovo nám. 2, Bratislava, Czechoslovakia.

Preface

During geological investigations (mainly mapping) of the Klippen Belt and adjacent areas in the years 1956—1967 has been collected among others a rich material of the reef-complexes of Palaeogene age. A study of part of this material was made by the author during his study stay at the Institut für Paläontologie und historische Geologie of the Maximilian University in Munich in frame of the Dozentenstipendium afforded by the Alexander von Humboldt-Stiftung.

I should like to express my gratitude to the Alexander von Humboldt-Stiftung for a grant of the scholarship, further to the head of the Institut für Paläontologie und historische Geologie Prof. Dr. R. Dehm for a kind allowance to work at his institute.

I am extraordinarily obliged to Prof. Dr. H. Hagn who was not only very helpful in all respects, but also directed my attention to an interesting problem of the reef-complexes and discussed many problems, and for many advices after reading this manuscript.

Very valuable have been also discussions with other colleagues at the Intitute, namely with Dr. D. Herm.

My gratitude belongs also to Dr. H. K. Zöbelein for his help in the question of literature and to all who helped me in my work, namely to Mr. H. Mertel who made excellent thin-sections.

For a technical help during photographic works I am obliged to Dr. W. Ohmert and Mr. F. Schwarz.

A greater part of thin sections and described material is deposited in the Micropalaeontological Department of the Bayerische Staatsammlung für Paläontologie und historische Geologie, 8 München 2, Richard-Wagner-Straße 10/II. The rest of the material is deposited in the Collection of the Department of Geology of J. A. Comenius University, Bratislava, Gottwaldovo nám. 2, Czechoslovakia (KGUK).

A. Introduction

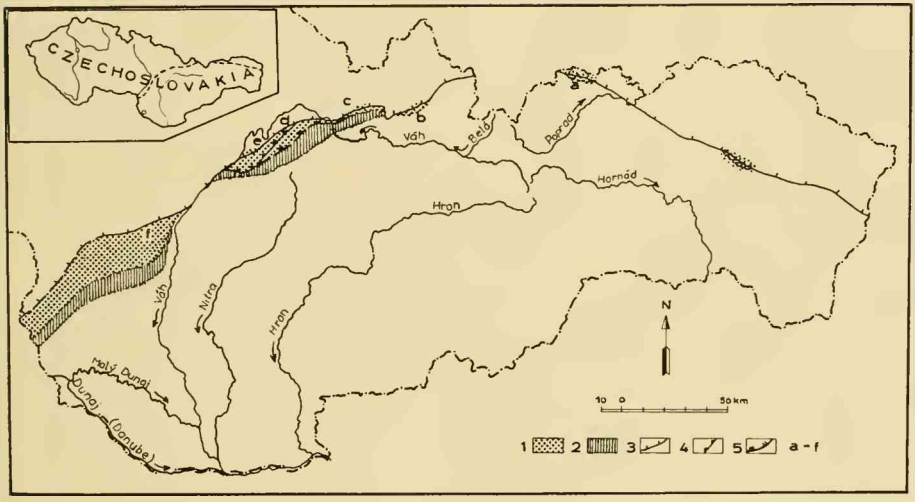
In the Palaeogene there existed in the area of the Carpathian geosyncline three zones of sedimentation: 1) northern zone with nonflysch sedimentation (part of the fore-deep), 2) zone with flysch sedimentation (the entire Flysch Zone and in higher parts also the Central West Carpathian Palaeogene), 3) southern zone with non-flysch sedimentation (Southern Slovakia and Northern Hungary) (compare D. Andrusov 1965, p. 13).

Within the second zone with the flysch sedimentation we can distinguish two completely different facies of the Palaeogene[1]). A boundary between the mentioned two facies is in the area of the Klippen Belt. North of it is the so-called „Outer Palaeogene" (originated in an independent flysch geosyncline) southern

[1]) All comments on page 90.

type of which was named „Magura Palaeogene", starting usually with Palaeocene. South of the Klippen Belt occurs the „Palaeogene of the Central West Carpathians" which mostly begins in the Upper Lutetian in places in the Biarritzian. In the proper Klippen Belt occurs mainly the Magura Palaeogene, in places, however, we can see a mixture of the mentioned facies (mainly in southern part of the Belt). It has to be mentioned that the Outer Palaeogene was strongly folded to the nappe structures (Savian — Styrian Phases) while the Paleogene of the Central West Carpathians was only slightly affected. More intensive deformations we can see near the Klippen Belt.

Palaeogene deposits having some common features with the Palaeogene of the Central West Carpathians (conglomerates of the Súľov type, reefal limestones etc.) were mentioned already by D. Andrusov (1965, p. 209) from the Pieniny Mts and Považie area. This Palaeogene starts, however, in older horizonts than in the area of the proper Central West Carpathians. D. Andrusov (1965, p. 212) proposed to mark the Palaeogene facies occuring locally near a northern margin of the Central West Carpathians (in the Myjava Highland) and near a southern margin of the Klippen Belt in the Považie area and Pieniny Mts as „Myjava facies s. l.". The Palaeogene deposits here start in the Palaeocene. Further, we shall deal with the Palaeogene in the Myjava facies s. l., in which are already known the reefal limestones.



Text-fig. 1: Scheme of distribution of Palaeogene of the Myjava — Hričov — Haligovka Zone (partly after F. Chmelík 1964). 1 — occurrences of the Myava — Hričov — Haligovka Zone Palaeogene; 2 — Palaeogene of transitional zones; 3 — southern tectonic boundary of the Klippen Belt; 4 — Hričov fault; 5 — southern boundary of the Manín Zone. a—f: localities described; a — Haligovka vicinity; b — Kňažia surroundings; c — area around Terchová; d — Hričovské Podhradie area; e — vicinity of Považská Bystrica; f — north of Lubina (Myjava Highland).

F. Chmelík (1967, p. 287) in the Regional Geology of Czechoslovakia II distinguished in the Palaeogene of the Central West Carpathians three large units: 1) the peri-klippen Palaeogene (Myjava — Žilina Zone) of the miogeosynclinal type, 2) the intracarpathian Palaeogene of the epimiogeosynclinal and platform types and 3) Palaeogene of the Pannonian facies, showing the platform or molasse-like development. For our purposes is interesting the first unit — the so-called peri-klippen Palaeogene — the Myjava — Žilina Zone. The term „peri-klippen Palaeogene" does not seem to be the most convenient as this Palaeogene occurs frequently directly on the complexes of the Klippen Belt, although it is necessary to mention that the main part of this zone lied directly near the Klippen Belt from the south. More convenient seems to name this zone „Myjava — Žilina Zone"[2]). However, I must say that such a Palaeogene has a much greater distribution than is mentioned by F. Chmelík (1967, pp. 287—290) and therefore it is proposed to complete the name of the zone as follows: „Myjava — Hričov — Haligovka Zone"[3]) (text-fig. 1). A common sign of this zone are occurrences of the reefal limestones with intercalations of variegated beds and conglomerates, partially olistostromes with exotic material. F. Chmelík (1967, p. 289) writes that it is a post-laramid zone which will be dealt with.

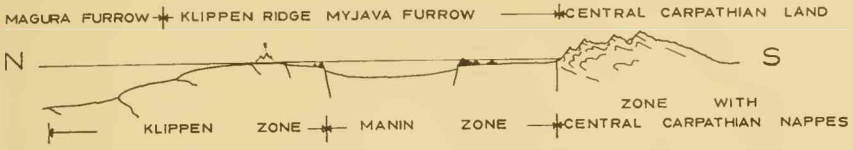
B. Myjava — Hričov — Haligovka Zone

Under this term I understand the northern zone of the Palaeogene of the Central West Carpathians running from northern part of the Central West Carpathians and reaching up to the Klippen Belt area. According to F. Chmelík (1967, p. 287) this zone has a character of miogeosyncline. Palaeogene occurring in this zone is developed in the so-called „Myjava facies s. l." according to D. Andrusov (1965, p. 212).

After the young — Subhercynian movements, a southern part of the Klippen Belt was relatively elevated (southern ridge) while the area adjacing from the south (in the west forming areas in which deposited Cretaceous — Palaeogene complexes of the Myjava and Brezová Highlands; in the central Považie area those built up of the Manín Unit and probably more to the east areas in a frontal part of the Central West Carpathians) was deepened[4]) in the form of more-or-less wide furrow and forms a zone with the Upper Cretaceous sedimentation in the Gosau facies. Undisturbed sedimentation and transitions from the Cretaceous to Palaeogene are given in works by J. Salaj (1960, 1962), O. Samuel & Salaj (1961, 1963) and O. Samuel, J. Salaj, O. Köhler & K. Borza (1967); they are in connection with this zone or the southernmost elements of the Klippen Belt (E. Scheibner & V. Scheibnerová 1961). Laramid movements (phase I, mainly the Laramid phase II sensu A. Tollmann 1966) took place in this furrow only sporadically, while in the Klippen Belt their affectes were very distinct (K. Birkenmajer 1960, E. Scheibner 1967). As affects of the Laramid movements in marginal parts of the mentioned furrow already in the proper Klippen Belt can be regarded

the transgression near Kňažia in the Orava valley (D. Andrusov 1938, 1965; A. Matějka & E. Hanzlíková 1962).

On the basis of the present facies we can reconstruct for the time-period Upper Palaeocene — Lower Eocene the following palaeogeographical picture (text-fig, 2):



Text-fig. 2: Schematic palaeogeographic profile of the Myjava furrow in the area between Považská Bystrica and Žilina for the time-span Paleocene — Eocene. Black marked the reef-complexes.

North of the Klippen Belt is more and more developed the typical geosynclinal flysch Magura furrow, which is part of a large Flysch eogeosyncline. During development of the Magura furrow it was joined with the area of the Klippen Belt. Southern parts of the Klippen Belt form a ridge[5]). South of the former Klippen Belt existed the mentioned furrow of miogeosynclinal character; for an operative manipulation and use I propose to name it „*Myjava furrow*" (text-fig. 2). The Myjava furrow, having a variable breadth, occupied in places also the southernmost elements of the former Klippen Belt. South of the Myjava furrow existed a dry land where a marine sedimentation of epimiogeosynclinal to platformal character (F. Chmelík 1967, p. 287) took place only later — in Biarritzian[6]) (D. Andrusov & E. Köhler 1963).

From the mentioned follows that prior to the Subhercynian or pre-Laramid plan of structure, distribution and arrangement of zones in the Carpathians differs very much in comparison with the post-Laramid ones. So far, it is missing a more detailed analysis, but it is probable that further more distinct changes took place in the Illyrian — Pyrenean cycle (for instance development of the epimiogeosynclinal to platformal area of the Central West Carpathians). Superimposing, partially crossing of sedimentary zones caused complications in stratigraphy, mainly by static observations of development of individual zones; for instance in the Klippen Belt if we study this zone in its original pre-Upper Cretaceous distribution we can make a conclusion that the Laramid movements manifested themselves very strongly while in other places only slightly or not (continuous transitions from the Cretaceous to Palaeogene) etc. These circumstances lead to contradictionary results of different geologists (compare works by S. W. Alexandrowicz, A. Began, K. Birkenmajer, K. Borza, E. Hanzlíková, A. Matějka, E. Köhler, J. Salaj, O. Samuel, E. Scheibner and V. Scheibnerová). It will be necessary to revise the present knowledge from the point of view of new facts.

In the post-Palaeogene — Savian movements the mentioned zones were affected with a different intensity. In essentiality the effects are less intensive from

north to south. In the area of the Magura furrow folding movements were very strong and gave rise to folded structures also in the northern parts of the Klippen Belt (K. Birkenmajer 1963). „Core" of the Klippen Belt was consolidated already earlier and in this time played to some degree a role of a fore-land of the flysch geosyncline. Therefore, the flysch geosyncline was folded symmetrically and near the Klippen Belt originated fan-like nappe structures with a southern vergency (more details in Z. Roth 1967, Z. Stráník et al. 1967). In the „core" of the Klippen Belt is more distinct a fault tectonics — the origin of slices with a southern vergency, in places probably pseudodiapiric structures (K. Birkenmajer 1959; E. Scheibner 1967). Complexes deposited in the Myjava furrow were strongly disturbed in the area adjacing to the Pieniny Lineament (unstable substratum). For instance, in the Central Považie area up to the so-called Hričov dislocation by D. Andrusov (1968 — in press).

In general, strongly affected are northern parts of a former Myjava furrow. In majority, there occur slices with a southern vergency. Complexes originated in southern part of the Myjava furrow, thanks to a stable substratum, are only slightly affected — there occur folds with greater amplitudes and mainly germanotype tectonics (faults). The latter in general is valid also for southern parts of the Central West Carpathians.

Palaeogene in the Myjava facies s. l. deposited in formerly defined Myjava furrow is characterized (according to D. Andrusov 1965) [7]) as follows: „ . . . it is characterized by a certain constant feature: by the occurence of bioherms, conglomerates, sometimes with „exotic material", or limestones. These conglomerates have partially a character of submarine slides and very clearly expressed a shore character. They contain olistolites composed of clay sequences of the Klippen Belt. Contemporaneously are seen signs of the „flysch facies".

In this place we shall deal with the occurrence of bioherms. It is a quite convenient to use the term „reef-complex"[8]).

Occurrences of reefs in the Palaeogene which we now place to the Myjava — Hričov — Haligovka Zone were partially known already earlier. Part of these beds was placed to the Central Carpathian Palaeogene (in the vicinity of Hričov, Hričovské Podhradie etc.) and were regarded as being of Middle — Upper Eocene in age (D. Andrusov & M. Kuthan 1944, D. Andrusov 1965). In the area of the Myjava Highland and Považie area the reefs have been placed to the Gosau and their age was stated as Senonian (D. Andrusov 1934, 1945; O. Kühn & D. Andrusov 1937) or Senonian — Palaeocene (L. Lóczy jun. 1915) wihout evidences. In the area of Haligovka, the reefs have not been known so far and sequences with organodetrital limestones and conglomerates have been placed to the Palaeogene of the Central West Carpathians (V. Uhlig 1889; L. Horwitz & F. Rabowski 1929), or to the Magura Palaeogene (A. Matějka 1961).

Up to the present, in the area of the Orava valley near Kňažia, the reef-complexes have not been found. The occurrences of Palaeogene in Eastern Slovakia, which have been placed to this zone and those in which occur the reef-com-

plexes were only recently more detailly studied (F. Bieda 1960; B. Leško 1960; A. Matějka & Hanzlíková 1962, O. Samuel & J. Salaj 1963 etc.).

An important change in knowledge of the reef-complexes is in connection with a work by M. Mišík & J. Zelman (1959). They stated that at least part of the reefs in the area of the Myjava Highland is not Upper Cretaceous, but Palaeogene in age. It must be noted that the presence of Palaeogene in the area of the Myjava Highland in a different facies was stated earlier by D. Andrusov & H. Bystrická (1954). Since this time development of knowledge of these sequences was very rapid (J. Salaj 1960, J. Salaj in T. Buday et al. 1960, O. Samuel & J. Salaj 1961; E. Köhler 1961; O. Samuel & J. Salaj 1963; A. Schaleková 1963, 1964; D. Andrusov & E. Köhler 1963; D. Andrusov & V. Scheibnerová 1963, etc.). Results of study by different authors are often contradictionary and further investigations are desirable. Critical evaluation of some of these results we can find in the work by F. Chmelík (1967). Detailed conclusions corresponding to the state of our knowledge in 1965 is in the work by D. Andrusov (1965). From these conclusions and evaluation we can start.

Description of localities

Myjava — Hričov — Haligovka Zone is very long, running from the area of the Myjava Highland in the west through the Central Považie area (section between Beluša and Žilina) to the area north of the Malá Fatra Mts (a broader vicinity of Terchová) further through the Orava valley (area in the vicinity of Kňažia, Mokrad etc.) to the Eastern Slovakia (Chmeľov — Hanušovce, and Beňatína) (text-fig. 1). It has to be noted that this zone, several hundreds of km long, does not form a continuous outcrop, but recently occurs on the surface in the form of individual fragments of the originally continuous zone.

D. Andrusov (1965, p. 212) distinguished several facies within his „Myjava facies s. l.“: a) facies occurring in the Myjava Highland; b) Makovec facies; c) Hričov — Žilina facies; d) Haligovka facies. It could be possible and reasonable to distinguish further facies, for instance Terchová etc. It means that in essentiality in each partial section of the Myjava — Hričov — Haligovka Zone is possible to observe several differences; there are, however, also many common signs among which the most characteristic is the occurrence of the reef-complexes.

To the proper character of the reef-complexes was paid only very little attention. D. Andrusov (1945, 1959) writes about the so-called „block reefs“, which have to grow in the littoral zone and have been displaced by a surf and waves. M. Mišík & J. Zelman (1959, p. 302) write[9]):

„. . . reefs in the Myjava Highland have a sharp shape so far as is possible to see, in regard to the surrounding conglomerates. Sometimes, however, algae and Bryozoa form constituents of cement of the fine-grained conglomerates. Bioherms started to develope probably on larger pebbles, however, there were no conditions to grow up to large measurements and were disturbed by a surf; and during strong storms and tsunamis they were torn off and partially reworked . . . Growing up on larger, almost immobile pebbles is

easily understood. The absence of sediments characterizing slopes of reefs shows that the reefs participated in sedimentation in this area quantitatively only very slightly. From the mentioned is clear that blocks and pebbles of the reefal limestones are of the same age as surrounding conglomerates".

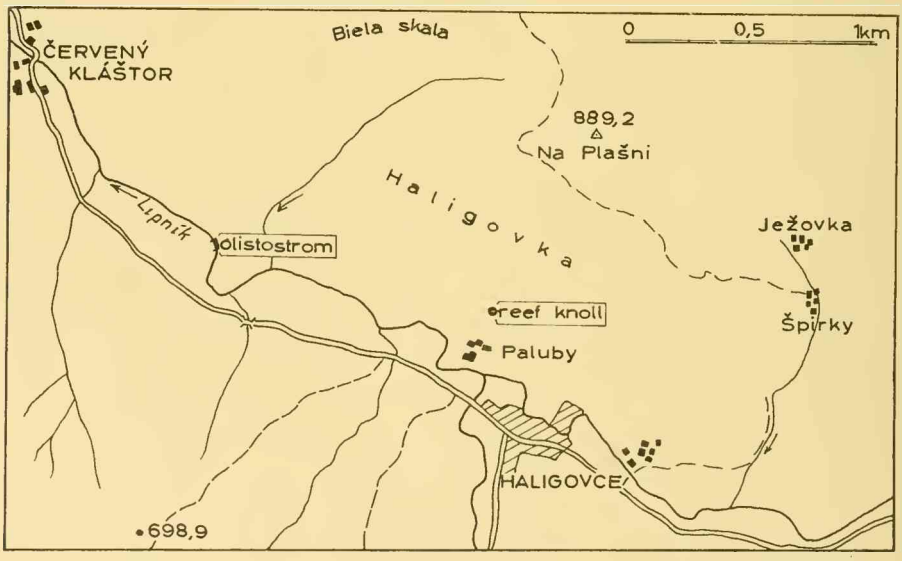
Part of reefs in this area, according to D. ANDRUSOV & V. SCHEIBNEROVÁ (1963) has a character of olistolites in olistostromes to wild flysch and are of Palaeocene — Lower Eocene age. They do not write on the original character of bioherms.

Lenses of organodetrital limestones in the vicinity of Hričovské Podhradie are regarded as bioherms (D. ANDRUSOV 1965, pp. 218—220), however, their character is never described.

Although this work has a preliminary character (as it was already mentioned) today we can determine the basic facies on the basis of litho- and biofacial analysis as well as the general character of the reef-complexes. Localities, further described, have been selected in order to illustrate different facies so far known or they are entirely new.

a) Palaeogene in the vicinity of Haligovka (Pieniny Mts) — vicinity of the villages Haligovce and Červeny Kláštor

In the Pieniny Mts near the villages Haligovce and Červeny Kláštor already to V. UHLIG (1889) was known a special facies of the Palaeogene, more detailly described by L. HORWITZ & F. RABOWSKI (1929) and F. BIEDA (1930). They regarded it as Palaeogene of the Central West Carpathians [10]). A. MATĚJKA (1961)



Text-fig. 3: Locality map showing a distribution of the new-founded reef-complexes near Haligovce and Červený Kláštor.

described the mentioned Palaeogene as one of the Klippen facies of the Magura Palaeogene and marked it as Haligovce facies. He distinguished northern and southern belts. The southern belt is formed of variegated marlstones and claystones with beds of blue-green sandy limestones. Thickness of the beds is 80 m. From a lower part of the sequence comes a Lower Palaeocene microfauna with *Globigerina daubjergensis* BRONNIMANN and higher a microfauna of upper parts of Palaeocene: *Globigerina triloculinoides* PLUMMER and *Globorotalia aequa* CUSHMAN & RENZ and in highest part *Globorotalia pseudobulloides* (PLUMMER) (comp. E. HANZLÍKOVÁ 1959). Higher occurs a sequence of variegated marls or non-calcareous claystones, sometimes with thin beds of siliceous-limy sandstones. E. HANZLÍKOVÁ (1959) found here associations of foraminifers showing Lower, Middle (with *Cyclammina*) and Upper Eocene ages.

In northernmore belt (localities: Na Plašni, Tokarňa and near Červený Kláštor) over the variegated Palaeocene beds occurs a conglomeratic — sandy — limestone sequence. It is formed of conglomerates of the Súľov type (composed mostly of a local limestone — dolomitic material) reaching to 350 m in thickness. In other places are instead of conglomerates gray and blue-gray sandstones passing into organodetrital limestones or fine-grained conglomerates and breccias. From the organodetrital limestones comes (Na Plašni, Tokarňa) a microfauna of larger foraminifers which F. BIEDA (1930) determined as Middle Eocene: „*Borelis melo* (FICHT. & MOLL), *B. haueri* (D'ORB.) and *Nummulites perforatus* (D'ORB.)." Near Červeny Kláštor in the dark-gray calcareous conglomerates the same author found Nummulites of the Biarritzian *(N. perforatus* (D'ORB.), *N. millecaput* BOUBÉE) and higher Alveolina limestones with corals (5 m) of higher Eocene and at the locality Na Plašni in coarse-grained sandstones to fine-grained conglomerates a fauna of (perhaps) Priabonian with *Nummulites incrassatus* DE LA HARPE and *Asterocyclina stella* (D'ARCH.).

In 1960 I have found at the southern slope of the Haligovka Klippe over the Paluby settlement (text-fig. 3) a large block (10 × 8 × 10 m) formed of gray algal-coral biohermal limestones (E. SCHEIBNER 1964, pp. 81—82). After the preliminary study was clear that it is a true bioherm of Palaeogene age[11]). It lays in distance of 45 m from the Mesozoic sequences of the Haligovka Klippe. At first sight it looks as a giant fallen block of a limestone and therefore perhaps it was never found by mapping geologists. It rises from the thick limestone gravels covering steep southern slopes of the klippen. In immediate contact with the bioherm I found sandy foraminiferal-bryozoan-algal biosparite. These beds are steeply raised (in nearly vertical position) and together with bioherms they represent a lense of the mentioned northernmore facies of the Palaeogene, which is in tectonical contact with the Haligovka Klippe. Complete outcrops of the Palaeogene in a deeper facies are in the stream Lipník (Palaeocene and Eocene) approximately 100 m to the south.

In the right bank of the stream Lipník at the eastern end of Červeny Kláštor Spa (text-fig. 3) in a sequence of the variegated Palaeogene is a small olistostrome

(2 × 1 m) (outcropping in a section). Individual olistolites are formed mainly of less reworked fragments of slightly sandy biohermal limestones up to 25 cm in diameter. Some limestone fragments are identical with limestones of the mentioned bioherms.

Studying all up to the present known rocks forming the reef-complexes in the area of Haligovka we come to conclusion that it is possibly very well to apply the facial zones in the reef-complexes of the Middle East described by F. R. S. Henson (1950). It is namely a not very typical open-shoal reef[12]) complex of Upper Palaeocene — Lower Eocene age.

Open-littoral zone is represented by a few olistolites from the mentioned olistostrome. They are strongly sandy intrasparites and biosparites.

Open-reef shoals are represented by sandy foraminiferal-bryozoan-algal biosparites, reef-knolls and patches. One reef-knoll is possible to see (the mentioned bioherm 10 × 8 × 20 m). The reef-knoll is formed of gray biosparites, biosparrudites and algal-coral biolithes.

The majority of the limestone blocks in olistostrome comes from the algal-coral reef-patches. In places around the reef-patches and probably also in the former zone, conditions were very similar to those in lagoons. Part of limestones in olistostromes has some allochthonous terrigenous detritus and represents a transition from biosparites to algal-foraminiferal biolithites.

Fore-reef transitional zone is represented by a sequence of variegated Palaeogene beds with olistostromes; olistolites descend from the former two zones.

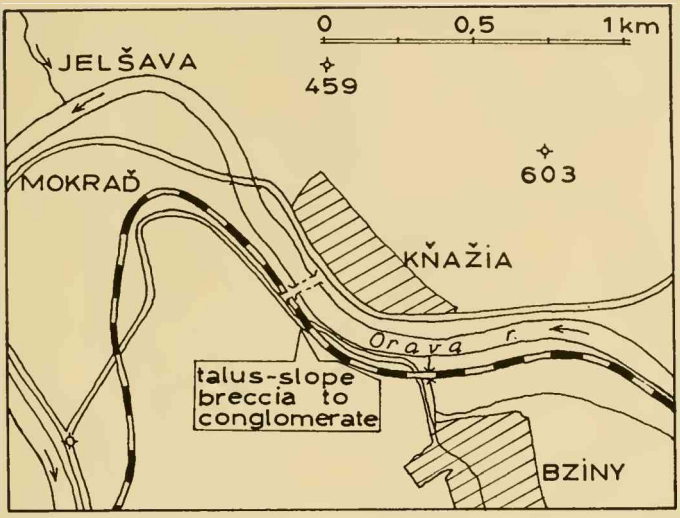
Open basinal zone is represented by contemporaneous variegated marlstones ans claystones with benthonic and planktonic microfauna described by E. Hanzlíková (1959).

Shallow littoral or sublittoral character of sedimentation lasted in this area up to the Upper Eocene (northern belt of Palaeogene described).

b) Palaeogene in the vicinity of Kňažia in the Orava valley (text-fig. 4):

Between Senonian of the Klippen Belt near Knažia and Middle Eocene of the Central West Carpathians (Flysch) occurs a Palaeogene sequence lying disconformably on the Senonian (D. Andrusov 1938, 1959). Recently A. Matějka & E. Hanzlíková (1962) found that here is represented the Palaeocene (*Saccammina placenta* (Grzyb.), *Nodellum velascoense* (Cushman), *Kalamopsis grzybowskii* (Dylaż.), *Globigerina* ex gr. *triloculinoides* Plummer etc. Also the Eocene beds have been found here.

Although it is a very important profile which was studied by several authors several times, there are still many problems. In 1967 in a left part of the outcrop, approximately 5 m above the basis of the Palaeogene sequence calcareous rocks were found forming an intercalation in clayey — marly shales. It is a talus — slope breccia to conglomerate; fragments up to 10 cm are formed of the reefal, mainly sandy biosparites. In these limestones very typical are frequent discocyclinas, sometimes bryozoans and agglutinated foraminifers.



Text-fig. 4: Locality map showing the new find of a reef-complex near Kňažia.

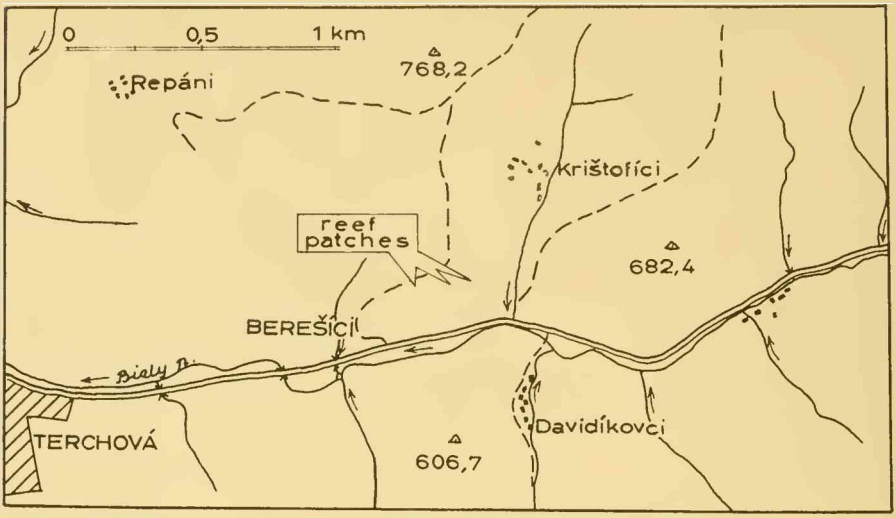
Facially it is a fore-reef zone or fore-reef transitional zone and it is clear that in not very distant area the proper bioherms occurred. In shales of the basinal zone in substratum were found minute Palaeocene globigerinas. The character of fauna in the limestones is identical with the occurrences near Haligovka; the age is Upper Palaeocene — Lower Eocene.

c) Palaeogene in the vicinity of Terchová north of the Veľká Fatra Mts. (text-fig. 5):

In 1961 a sequence of Danian age was described in the vicinity of Terchová (Nižní Berešíci, Krištofíci and in the valley before the Stráža settlement near Varín) (E. Scheibner & V. Scheibnerová 1961). It is a sequence of variegated shales, olistostromes and flysch beds. Near settlement Nižní Berešíci and Krištofíci in not clear tectonic contact with the Danian occurs a similar folded vertical sequence of the Palaeogene. It is represented by littoral, shallow-water sediments in which small reef-patches have been found (3—5 m high, maximum 8,5 m) occupying a plane of around 10—15 m², maximum 22 m². A core of the reef-patches is formed of sandy-coral-algal-bryozoan intra-sparites. A greater amount of the allochthonous material shows a growing of hermatypical organisms in inconvenient environment (probably open littoral). The reef-patches at the margin pass into the fine-grained conglomerates.

d) Palaeogene in the vicinity of Hričovské Podhradie (text-fig. 6):

This Palaeogene is quite detailly described by D. Andrusov (1965, pp. 218—220). Reef-complexes are well developed here. Biohermal limestones form large



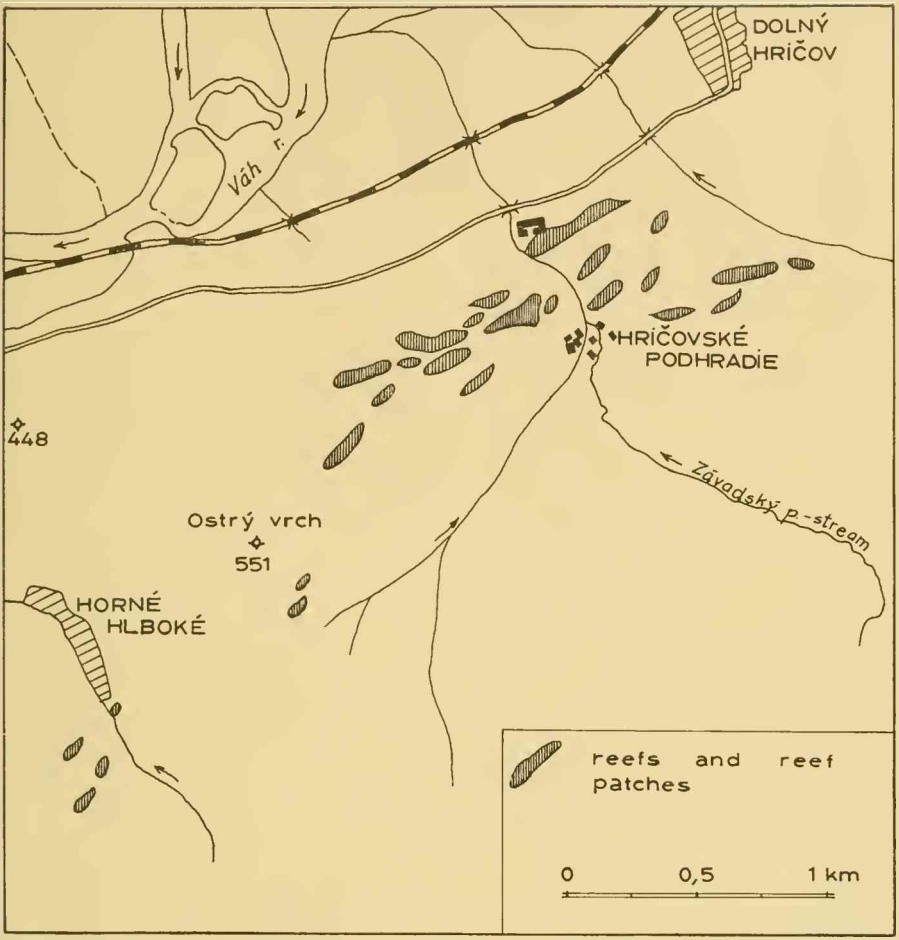
Text-fig. 5: Locality map showing the distribution of reef-patches near the Berešíci settlement.

lenses 30—40 m in thickness and 10—200 m in length. Frequent are also small patches (2—3 m). Both fauna and flora of these limestones was well described (P. Lemoine 1934, J. Pia 1934, D. Andrusov 1938, D. Andrusov & M. Kuthan 1944, D. Andrusov 1950, M. Mišík & J. Zelman 1959, E. Köhler 1961, O. Samuel & Salaj 1963, A. Schaleková 1963, 1964 etc.) (see table of distribution of fauna). The reef-complex is up to 200 m thick and occurs in 10 km long belt between Jablonica and Žilina. The age was stated on the basis of *Discocyclina seunesi* Douv. and *D. douvillei* (Schlumb.) (E. Köhler in D. Andrusov 1965, p. 212) as Palaeocene to Lower Eocene.

On the basis of a preliminary study of several reefs and reef-patches we come to conclusion that they are the so-called fringing reefs. Back-reef shoals are represented by the Miliolid limestones and small reef-patches (algal-coral biolithites and biosparites — biosparrudites). The reef-wall facies is represented by algal-coral biolithites. In a peripheral part of some reefs were observed breccia — limestones which could represent the talus — slope facies. These fringing reefs fringed a southern margin of the Myjava furrow in the Považie area.

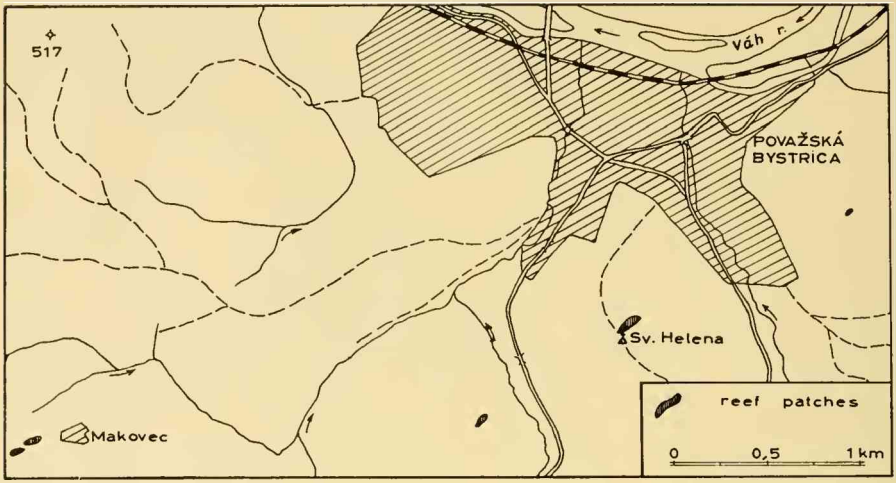
e) Reef-complexes in the vicinity of Považská Bystrica (text-fig. 7):

In the vicinity of Považská Bystrica (localities Svätá Helena, Makovec etc.) are known the occurrences of light-gray conglomerates mainly with limestone — dolomitic material in which occur lenses of organogenous and organodetrital lithothamnian — coral limestones regarded as bioherms by D. Andrusov (1945, 1965). Originally, these limestones were placed by the cited author to the

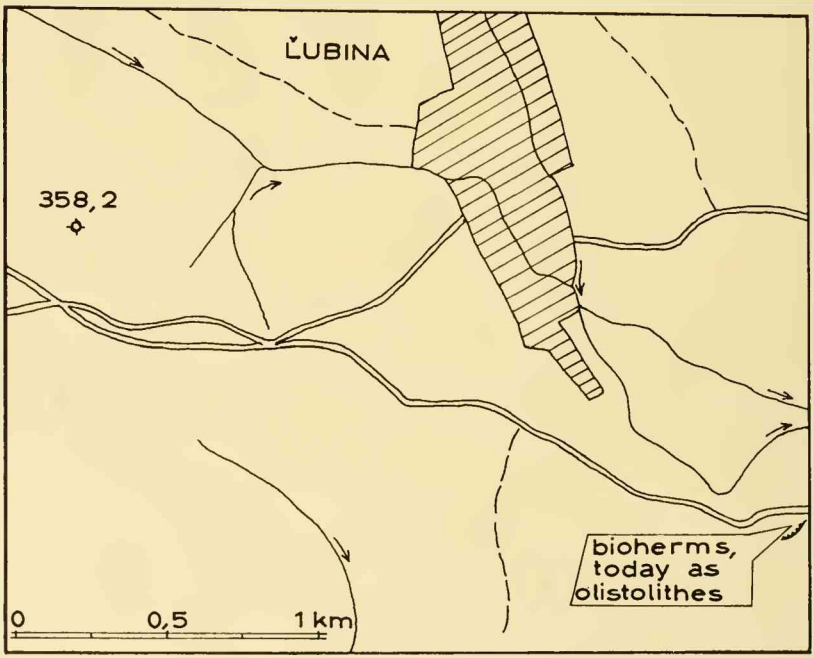


Text-fig. 6: Locality map showing the distribution of reefs and reef-patches near Hričovské Podhradie. Based on geological map by D. Andrusov & M. Kuthan (1945).

Upper Cretaceous, later by O. Samuel & J. Salaj (1963) to the Upper Palaeocene. These bioherms we can mark as reef-patches originated in the environment of the open-shoal reefs on a northern margin of the Moyjava furrow near the Klippen Belt. The reef-patches are mostly small (2 x 3 m), some of them are larger (5×10—12 m) and in thickness reach 5 m. They are formed of algal-coral biolithites and biosparites with terrigenous material.



Text-fig. 7: Locality map showing the distribution of reef-patches near Považská Bystrica. Based on geological map by D. Andrusov (1950).



Text-fig. 8: Locality map showing the locality of bioherms occurring today as olistolites in flysch sequences; old quarry near the road over Ľubina.

f) Bioherms, today as olistolites in flysch sequences near the village Lubina (text-fig. 8):

Palaeogene in the area of the Myjava Highland was recently quite detailly described by D. Andrusov (1965) a. o. Occurences of the bioherms in flysch sequences of Palaeocene — Lower Eocene age are quite frequent. Some of them have a character of olistolites (compare D. Andrusov & V. Scheibnerová 1963). These bioherms originally deposited in the open-shoal environment; part of the limestones, however, has features typical of the fringing-reef environment. Of such a character are also the occurrences of bioherms forming olistolites (1,2×3 m and more) in the flysch outcropped in an old quarry near Ľubina.

Facies of the reef-complexes in the Palaeogene of the Myjava — Hričov Haligovka Zone

During a study of the reef-complexes of the mentioned Zone it is possible to state that they originated mostly in the open-shoal reef environment and less as fringing reefs.

Open-shoal reef environment. Open littoral: In this zone originated littoral deposits occurring in a greater or lesser distance from the reef-patches. In this case, to these deposits it was not paid a greater attention. In the olistostrome near Červený Kláštor (text-fig. 3) have been found sandy limestones deposited in this zone. Some of these limestones studied had a character of strongly sandy (angle-shaped quartz grains, up to 0,5 mm, rarely zircon grains up to 0,15mm) intra-bio-calcarenites. From among organisms were typical large coarse-agglutinantia (agglutinating grains up to 0,15 to 0,2 mm), fragments of *Lithothamnium*, *Miniacina multiformis* n. sp., bryozoans, *Serpula* etc.

Open-shoal reef zone: The main part of the reef-patches and reef-knolls occurring at the localities described (except for the vicinity of Hričovské Podhradie) originated in such an environment. Lithologically they are represented by limestones, sometimes slightly sandy: algal-coral biolithe with transitions into biosparites or biosparrudites.

In the reef-knoll south of Haligovka (text-fig. 3) and in bioherms forming today the olistolites in the flysch sequence near Ľubina occur the algal-coral biolithes with structure and organic association characteristic of the reef-wall (plate 4, figs. 2, 3), although here probably existed the reef bodies of a limited extent (knolls). Common are encrusting algae, articulate coralline algae, corals *(Porites* and octocorals) encrusting Foraminifera, thick-walled Foraminifera, *Serpula* etc. Typical is an alternation of encrusting algae and Foraminifera with corals. The remaining part of the rock is formed of non-oriented carbonate ooze. This type of limestone is often very porose with hollows which are later partially filled up by detritus, sometimes with graded-bedding debris or has been filled by clear, coarse-grained sparry calcite probably directly precipitated (plate 4, fig. 2).

The majority of limestones forming the reef-patches and reef-knolls has a

character of the reef-breccia limestone (plate 4, fig. 1) as are described by M. J. Forman & O. Schlanger (1957) or represent a combination of the reef-breccia and reef-wall limestone. The fossil content is similar to that in the reef-wall limestones. Differences are in the intergrain relation of the components. By the reef-breccia limestones the components have a detrital nature. These limestones have a character of the intra-bio-sparite or bio-sparrudite. They are mainly calcarenites. The large fragments float in a calcarenitic mass; small fragments are mainly angle-shaped. Encrusting Foraminifera (plate 6, fig. 4) and algae also in our case are restricted to coatings on detrital fragments and do not serve to any binding function. These limestones are also porous. Infillings of voids are formed of sparry calcite clearly precipitated (left side of fig. 4, plate 1).

Described type of the reef-breccia limestone can pass into the fore-reef or off-reef detrital limestones. Such conditions are near the reef-knoll on the locality south of Haligovka. As off-reef-shoal limestones we can mark the well-sorted foraminiferal-algal sparite (plate 5, fig. 3). As fore-reef detrital limestone can be designed sandy discocyclina-algal-bryozoan sparite (plate 5, fig. 1). In some limestones of this type there are several agglutinated forms which have a function of a binding detritus; a frequent occurrence of miliolids shows the origin in an adjacing lagoon.

Fore-reef transitional zone: The occurrence of the olistostrome near Červeny Kláštor (text-fig. 3) is possible to place into this zone. Similarly also the newly discovered talus-slope-breccia or conglomerate near Kňažia (text-fig. 4). At the last locality, there were found interesting sandy bio-intra-sparites, which correspond to description of the fore-reef detrital limestone by M. J. Forman & S. O. Schlanger (1957). Besides the mentioned, there were found sandy bio-intra-sparites with a considerable amount of attached agglutinated foraminifers *(Belloidina, Haddonia, Placopsilina* — plate 6, fig. 6) sometimes a binding organic detritus (plate 5, fig. 2), which represents a transition from the off-reef shoal to lagoonal limestones.

Open basinal zone is represented by a sequence of marly silty rocks or flysch sequence of the same age.

Back-reef shoal zone is characterized by miliolid limestones, fo- Hričov (text-fig. 6) originated perhaps in the mentioned environment. Typical is a small amount of the terrigenous material in comparison with the open-shoal reef environment.

Back-reef shoal zone is characterized by miliolid limestones, foraminiferal-algal-bryozoan calcarenites, acicularian calcarenites (M. Mišík 1966, tab. LXXIX, fig. 1). These limestones today occur as a constituent of biohermal bodies.

Reef-wall zone is formed of algal-coral biolithites, algal-biolithites (M. Mišík 1966, tab. LXXX, fig. 1) and algal-coral sparite sometimes sparrudites. The majority of the biohermal bodies is formed of the reef-breccia limestone (calcarenite).

Talus-slope: Studying some biohermal bodies, mainly west of Hričovské Podhradie, was found that their marginal part has a coarse-brecciated to conglomeratic character and originated perhaps on slopes of the fringing reefs.

Fore-reef-shoals: In such an environment originated smaller reef-patches formed on intra-bio-calcarenites. Frequent are foraminiferal-algal-bryozoan sparites. From such rocks were described *Discocyclina seunesi* (Douv.) and *D. douvillei* (Schlumb.) (E. Köhler 1961).

Fore-reef transitional zone is represented by thin intercalations of sandy bio-calcarenites in detrital flysch sequence.

The mentioned results are only preliminary and represent a result of orientation study of the reef-complexes of the Myjava — Hričov — Haligovka Zone.

C. Paleontological part

Family Polymorphinidae d'Orbigny 1839
Subfamily Webbinellinae Rhumbler 1904
Genus *Bullopora* Quenstedt 1856
Bullopora multicamerata n. sp.
Text-figs. 9—13

Holotypus: text-fig. 9, deposited in Slg. Munich Prot. 2858, thin section G 961 a/68 (Munich)

Paratypus: text-fig. 10, thin section V 1980 — KGUK, Bratislava; text-fig. 11, thin section V 1834 — KGUK, Bratislava; text-fig. 12, thin section V 1982 — KGUK, Bratislava; text-fig. 13 thin section V 1994 — KGUK, Bratislava.

Derivatio nominis: named after typical polythalamous test.

Stratum typicum: Upper Palaeocene — Lower Eocene reef-complexes of the Myjava — Hričov — Haligovka Zone (Palaeogene of the Central West Carpathians)

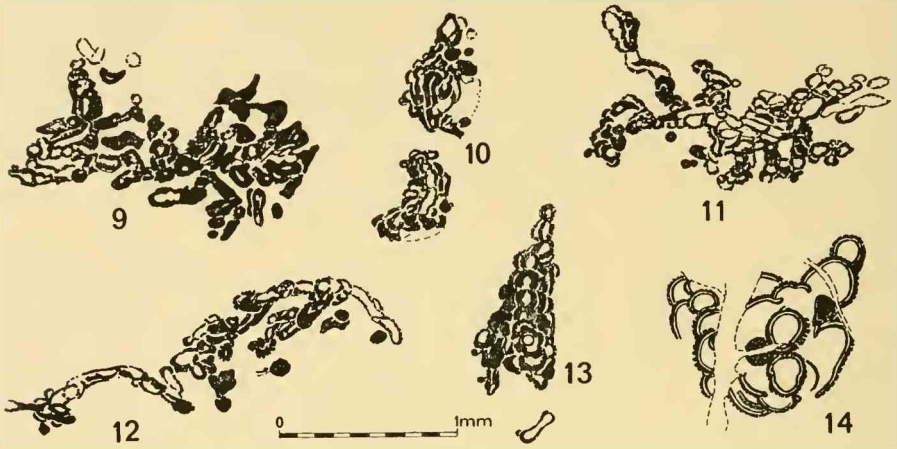
Locus typicus: reef-knoll on a southern slope of the Haligovka Klippe over the Paluby settlement, village Haligovce, Pieniny Mts Carpathians (text-fig. 3)

Diagnosis: test multicamerate, attached; initial part composed of spherical proloculus. Further chambers varying in shape (oval, drop or flash-like) mainly uniserial, irregularly curved forming irregular clusters and accumulations.

Material: 4 complete adult specimens, 12 less complete sections in thin-section from limestones. Besides holotype all deposited in the Collection of the Department of Geology, J. A. Comenius University in Bratislava.

Description: test attached to various sessile organisms like corals (scleractinids or octocorals), foraminifers *(Nubecularia, Placopsilinidae)*, algae (sometimes among thalli). By clusters attached only older chambers. Further grow freely on older ones. Maximum diameter of the test 2 cm. Proloculus of mega-

lospherical form about 0,1 mm (text-fig. 13). Length of chambers up to 0,25 mm, bright (height) up to 0,1 mm. Thickness of the wall from 0,015 to 0,035 mm. Walls are formed of hyaline-calcite, perforated; pores 0,005-0,01 mm in diameter. 15 to 20 chambers making up the adult stage.



Text-figs. 9—13: *Bullopora multicamerata* n. sp. Drawings after microphotographs from thin sections; black is calcite.

9 — holotype (Slg. Munich Prot. 2859) approximately vertical section through an irregular cluster attached on a coral. Thin section (G 963 a/68 Munich) from gray biohermal limestone; reef-knoll on a southern slope of the Haligovka Klippe, over the Paluby settlement.

10 — Paratype (deposited in the Collection of the Department of geology, Bratislava). Section through two small clusters, probably one individual; thin section (V 1980 — KGUK, Bratislava) from gray algal-coral biolithite to sparite; locality as on text-fig. 9.

11 — Paratype (deposited in the Collection of the Department of geology, Bratislava). Section through an irregular branching form (?) attached in a hollow on *Pseudolithothamnium* sp. Thin section (V 1834 — KGUK, Bratislava) from gray biohermal limestone (locality as on text-fig. 9).

12 — Paratype (deposited in the Collection of the Department of geology, Bratislava). Section through an individual with long chambers attached on *Archaeolithothamnium* sp. and *Nubecularia* sp. Thin section (V 1982 — KGUK, Bratislava) from gray coral-algal biolithite; locality as on text-fig. 9.

13 — Paratype (deposited in the Collection of the Department of geology, Bratislava). Section through a compact cluster with inflated chambers and proloculus in the centre. Thin section (V 1994 — KGUK, Bratislava) from white reef-breccia limestone; old quarry on a western margin of Hričovské Podhradie.

Text-fig. 14: Horizontal section through *Planorbulina uva* n. sp. Paratype (deposited in the Collection of the Department of geology Bratislava). Drawing after microphotograph from a thin section; black is calcite. Between two calcitic layers a thin pseudochitinous membrane. Typical aperture on peripheral margin of chambers with a narrow lip. Further data as on text-fig. 13.

Notes and variability: the new species described resembles in the form of chambers *Bullopora negevensis* Avnimelech & Reiss which was described from the Lower Cretaceous, probably Lower Albian or Upper Aptian. It differs from it in having much more chambers and building clusters and irregular accumulations.

Sometimes chambers of the new species form a long neck and so it resembles *Bullopora rostrata* Quenstedt, however, this form of chambers is very rare.

Distribution: the new species was found in biohermal limestones (biosparrudite, algal-coral biolithite) not only at the locality Haligovka, but also at several localities of the Myjava — Hričov — Haligovka Zone, namely at Kňažia (in blocks, fragments of the mentioned type of limestones), Berešíci, Hričov, Makovec, Svätá Helena Ľubina (and old quarry), Stará Turá and others already described.

On plate LXXII, fig. 2 J. Cuvillier (1961) figured a detrial limestone with *Miscellanea* sp. and feather-like algae (?) resembling the genus *Distichoplax* from the North Pyrenean border, Ypresian in age. Above the centre of the photomicrograph is a section through *Bullopora multicamerata* n. sp., however, not mentioned by the cited author in the explanation to this figure.

Family Planorbulinidae Schwager 1877
Genus *Planorbulina* d'Orbigny 1826
Planorbulina uva n. sp.
Plate 4, fig. 2; plate 6, figs. 1—3
text-fig. 14

Holotypus: figured on plate 4, fig. 2; plate 6, fig. 2. Deposited in Slg. Munich Prot. 2859; thin section G 963 a/68 (Munich).

Paratypus: plate 6, fig. 2; V 1578 — Kguk, Bratislava. Plate 6, fig. 3; V 1093 — KGUK, Bratislava. Text-fig. 14: V 1994 — KGUK, Bratislava.

Derivatio nominis: named after the characteristic grapeshape of test.

Stratum typicum: Upper Palaeocene — Lower Eocene, reef-complexes of the Myjava — Hričov — Haligovka Zone (Palaeogene of the Central West Carpathians).

Locus typicus: Ľubina, old quarry near the road (text-fig. 8), biohermal bodies occurring today as olistolites in flysch sequences. Myjava Highland, West Carpathians.

Diagnosis: test adherent, irregularly subglobular; flat, concave or uneven on attached spiral side due to adaptation to irregularities of substratum. Peripheral margin rounded. Chambers numerous enlarging gradually in size, more indistinct layers of chambers added superficially; last ventral chambers rounded having the granular tubercles. Radiate calcareous wall perforate on pseudochitinous membrane. Sometimes inner calcareous layer with rare pores[13]).

Apertures on peripheral margin of chambers with a narrow lip (text-fig. 14), by lateral chambers two on both sides. Maximum diameter 2,4 mm, thickness 1,5 mm; Holotype: maximum diameter 0,575, thickness 0,89 mm.

M a t e r i a l : description based upon 4 complete specimens and about 10 fragments in thin sections from limestones. With exception of holotype and some incomplete specimens all material deposited in the Collection of the Department of Geology, J. A. Comenius University, Bratislava.

D e s c r i p t i o n : test attached to various sessile organisms, corals, algae, foraminifers etc. building irregularly subglobular masses, rarely between two thali of algae (Archaeolithothamnium). Test subglobular, irregular. Spiral side attached, flat, concave in the case of irregular substratum cariously curved. Proloculus 0,07 mm, its wall from pseudochitinous mass and very thin calcitic layer. First row of chambers in holotype resembles by an arrangement the type of genus. Chambers are adapted to irregularities of substratum, often irregularly inflated and toward periphery enlarge. Similarly are enlarged superficial chambers; they are inflated and have a thicker wall. Superficial chambers are added in 4 to 6 irregular layers or rows. Diameter of chambers moves around 0,25 mm. On ventral chambers are typical granular tubercles on which Parker and Jones in the species *Planorbulina larvata* wrote: „that in the seas of hot climates a large amount of exogenous granular matter is formed on the surface of the shell". Thickness of a wall is 0,025—0,1 mm (pseudochitinous membrane 0,003—0,005 mm). Sometimes under the pseudochitinous membrane is a further calcitic layer (0,008—0,01 mm thick) with rare pores (text-fig. 14)[13]). Outer calcitic layer of a wall is perforated, pores have a diameter of 0,005—0,008 mm, in ventral chambers around 0,01 mm. Apertures on peripheral margin of chambers have sometimes a visible narrow lip, by later chambers in horizontal section two apertures on both sides present (text-fig. 14).

N o t e s a n d v a r i a b i l i t y : a new species resembles *Planorbulina larvata* Parker & Jones var. *crispata* Chapman in adding several series (or rows) of superficial chambers but not in giving rise of curled or semilunar-shaped test, but in irregular manner giving rise of irregular subglobular test. The new species has more rounded margin. *Planorbulina larvata crispata* Chapman was only briefly described without data on inner structure, and also it seems that in this subspecies are missing granular tubercles on ventral chambers. Chambers in a new species are more rounded, inflated (convex) and proliferated. Interesting is that *Planorbulina larvata crispata* Chapman comes from the Funafuti lagoon from a depth of 24 fathoms.

D i s t r i b u t i o n : the species described was found in biohermal limestones in Ľubina (in algal-coral biolithes living attached in hollows), in bio-calcarenite at Hričovské Podhradie (reef- western margin of the village), in biosparrudite to algal-coral biolithes in the reef-knoll at Haligovce and fragments in the biohermal limestones all over the Myjava — Hričov — Haligovka Zone (West Carpathians).

Family Homotrematidae Cushman 1927
Subfamily Homotrematinae Cushman 1927
Genus *Miniacina* Galloway 1933
Miniacina multiformis n. sp.
Plate 6, fig. 7; plate 7, figs. 1—7

Holotypus: plate 7, fig. 1 and 3; deposited in Slg. Munich Prot. 2860; thin section G 954 a/68 Munich, mainly encrusting type.

Paratypus: plate 7, fig. 2 (Slg. Munich Prot. 2861); plate 7, fig. 4 (Slg. Munich Prot. 2862); plate 7, fig. 6 (Slg. Munich Prot. 2863); plate 6, fig. 7 (Slg. Munich Prot. 2864).

Derivatio nominis: named after the typical multiform character.

Stratum typicum: Upper Palaeocene — Lower Eocene reef-complexes of the Myjava — Hričov — Haligovka Zone (Palaeogene of the Central West Carpathians).

Locus typicus: reef-knoll on a southern slope of the Haligovka Klippe over the Paluby settlement, village Haligovka, Pieniny Mts (text-fig. 3).

Diagnosis: test mainly encrusting, less branching. Encrusting types can form thin layers with perforated lamina, sometimes with simple openings (0,03 mm or more) with double walled vertical pillars. Last type of crusts can reach some cm in length (4 cm or more) and height 1, 5 cm and more. Branching types form irregular cones or small piles of some mm, maximum 10 mm. Laminae are connected by double-walled hollow-pillars. Sometimes there occur tubular imperforate chambers; wall hyaline.

Material: description based upon variably oriented thin sections from limestones. Free specimens were not in disposal. Except for holotype, and paratypes, all specimens deposited in the Collection of the Department of Geology. 20 large and 15 smaller specimens, about 30 not complete specimens.

Description: test attached to various sessile organisms, mainly octocorals (*Epiphaxum*), scleractinia (*Porites, Actinacis, Stylosmilia*), algae etc. Thin crusts are very common, thick large crusts less frequent (living only in convenient reef-wall environment). Crusts grow often from below on projecting hermatypic organisms. Thin crusts are formed of one or two layers. One layer is formed usually of two superimposed mostly perforated lamina 0,15—0,5 mm long. Lamina are convex to the outer. They bear 8, maximum 10 pores with a diameter of about 0,005 mm. Lamina are closely connected by margins with a vertical pillar which overlies lamina. The lamina sometimes are so close that they form a limbate wall with a small opening. Thickness of lamina moves around 0,01 mm. Lumen among lamina has 0,1 mm in height and has a form of rounded oblong or is lunar- or kidney-shaped. Further there occur crusts formed of 1—2 layers. Space between two lamina is 0,3 mm, thickness of a wall up to 0,03 mm without perforation, usually with one greater opening (up to 0,05 mm). Lumens are oblong, pear-like, polygonal. Lamina are joined with vertical double-walled

pillars. The most typical are encrusted forms built up of several layers reaching more than 1 cm in thickness an with a length of more than 4 cm. One layer is formed of 2 lamina in distance of 0,06—0,15mm, 0,25—0,4 mm long. Thickness of lamina is 0,015—0,04 mm. Lamina on margins are close and touch the vertical pillars which overlap the lamina (they have 0,17 mm in length and 0,03 mm in thickness), sometimes branching, rarely double-walled (if originated from two neighbouring lamina). Upper lamina are rarely perforated on the contrary to the first type described. Mostly, upper lamina have one large opening (diameter 0,05 mm). This opening may enlarge so that the upper lamella is rudimentary and lumen is represented by a calix form. Some lumens are connected by openings in a wall (diameter 0,03 mm). They have a form of rounded oblong, oval, elongated, lense-like etc. Spaces among layers are usually so large as individual layers or larger. Among the layers grow up other organisms, mainly *Nubecularia,* less *Cibicides* etc. Sometimes is possible to see intercalations with thali of *Lithothamnium, Archaeolithothamnium, Pseudolithothamnium* or layers of *Epiphaxum.* Branching forms have 0,5 to 10 mm in diameter. Small forms are formed of a few tubular chambers with imperforated walls. In large forms we can distinguish quite irregularly distributed chambers, oval or polygonal (rounded) (diameter 0,15—0,2 mm) hollow pillars (diameter 0,03 to 0,1 mm). Interlocular spaces are large, irregular. Some tubulous chambers were also observed.

Notes and variability: a new species (namely its branching types) resembles in the form of chambers and hollow pillars the species *Miniacina miniacea* (Pallas), however, they differ in measurements. Also encrusted types are specific. Such types and mainly so large have never been described. In general, however, I must emphasize a close relations to the recent species *M. miniacea.*

Distribution: a new species was found in limestones of the reef-complexes, Upper Palaeocene — Lower Eocene in age, of the Myjava — Hričov — Haligovka Zone at all localities already described. The largest specimens occur in the reef-wall limestones, small and thin crusts are distributed overall from the open-littoral to fore-reef transitional zones. Very typical branching forms are in the off-reef shoal limestones.

F. Chapman (1901, pp. 200—201) quotes that *P. miniaceum (= M. miniacea)* occurs in the samples from both the lagoon and outer part of the reef at Funafuti, as well as from deeper soundings down to 360 m. It is most typical for the outer side of the reef-wall. Similar distribution has probably also a new species.

Some notes to flora and fauna

Flora in the reef-complexes of the Myjava — Hričov — Haligovka Zone has been studied by A. Schaleková. A review of all up to the present determined forms is given in table, as well as fauna occurring in the reef-complexes. Further, the author will pay attention to a detailed study of some groups of organisms. Part of the fauna mentioned has not been known in the reef-complexes described as it is in the table marked. From among foraminifers, interesting are large agglu-

DISTRIBUTION OF FAUNA IN THE REEF COMPLEX

OF THE MYJAVA-HRIČOV-HALIGOVKA ZONE

COMP. BY E. SCHEIBNER 1968

— rare ◆ frequent ✦ predominating

O older determinations

tinantia, for instance genera *Bdelloidina* and *Haddonia* (figured *Haddonia* sp., pl. 6, fig. 5) typical of shallow environments close to lagoons. More detailly, genus *Haddonia* and related forms is studied by H. Hagn (1968). Data on the occurrence of genus *Gypsina* in the Carpathians are also very rare. This genus, however, needs a more detailed study. Nubecularias are also very frequent, however, their identification in thin sections is rather difficult. Further, a plenty of problematical organismus has been observed, identification of which, however, requires a further material.

Coelenterata have a considerable share in the fauna; they are mostly strongly recrystallized which does not enable their identification. Frequent are also Bryozoa, material of which will be offorded to a specialist. Vermes (serpules) in some cases occur in a rock-forming amount; determination of species has not been done.

Other groups of organisms are only sporadically represented.

Comments

[1]) History of the study of the Carpathian Palaeogene is detailly described by D. Andrusov (1965) — in Slovak; compare also Regional Geology II—2, Prague 1967 (English edition 1968).

[2]) It is not reasonable, however, to use the name of Žilina town as in the vicinity of this town there are but a very few occurrences, while the classical finds of the reef-facies are near Hričovské Podhradie and Hričov village — already D. Andrusov (1965) used the term „Myjava — Hričov Zone".

[3]) As far as A. Matějka (1961) used the term „Haligovce facies" after the village Haligovce and placed it to the Magura Palaeogene, I propose to use the name of the hill Haligovka, where this Palaeogene is well represented. F. Chmelík (1967, p. 289) writes about similarity of this facies with his Myjava — Žilina zone.

[4]) The mentioned vertical movements of different zones (blocks) of the Klippen Belt and adjacent areas are in connection with the existence of the Pieniny lineament (E. Scheibner 1968, in press).

[5]) This area, however, was broader than the Middle — Upper Cretaceous exotic ridge which disappeared probably in Laramid movements.

[6]) Older continental sediments are probably represented by the so-called Kľuknava facies of the Palaeogene (D. Andrusov 1965, recent works by R. Marschalko).

[7]) Freely cited — translated

[8]) The term „reef-complex" is applied to the aggregate of the reefal limestones and the calcareous rocks genetically (?) associated with them (cited according to F. R. S. Henson 1950).

[9]) Freely translated

[10]) It was in connection with a fact that there occurs a facies typical of the Palaeogene of the Central West Carpathians (conglomerates of the Súľov type, Nummulites limestones etc.) and also because the Haligovka Unit was regarded as a High-tatric sequence and so as a part of the Central West Carpathians. The mentioned Palaeocene occurs immediately on the contact with the Haligovka Unit. Recently K. Birkenmajer (1959) placed the Haligovka Unit to the Klippen Belt (compare also E. Scheibner 1967) and consequently it changes also the position of the surrounding Palaeogene.

[11]) Material of algae I gave to Dr. Schaleková. Preliminary results of floristic determination are given in the work by D. Andrusov (1965, p. 223).

[12]) The term „shoal-reef" descend from Molengraaf (1930) who translated by this word a term of Niemyer (1911) „Plaatrif". R. W. Fairbridge (1950) translated the last term as „platform reef". Recent patch- or platform-reefs discribed R. W. Fairbridge (1950) as typical of the continental shelf. The patch reefs are smaller ones, platform reefs are the larger ones. In our case we cannot use to a considerable degree the synonymous term „platform reefs" as it is clear that it was no reef-complex of the continental shelf, but in shallow zone in geosynclinal area. Continent in this, however, has been only originating and from the continent in the north it was divided by a broad flysch geosyncline.

[13]) In a majority of material it is visible a thick outer perforated calcareous wall and thin dark non-perforated layer built up of pseudochitineous material. Only very rarely there occurs on the inner side of the dark layer a thin calcareous layer. In this case the wall has a typical bilamellate character to which called my attention Professor Dr. H. Hagn.

D. References

Andrusov, D., 1938: Rôlo des *Thallophytes* dans la constitution des roches sédimentaires des Carpathes tchécoslovaques. Vestn. Král. česk. spol. nauk, tř. mat. přír., pp. 18—35, Praha

Andrusov, D., 1938 a: Geologický výskum vnitřního bradlového pásma v západních Karpatech. Č. III-Tektonika. Rozpr. St. geol. úst. ČSR, 9, 135 p., Praha

Andrusov, D., 1945: Geologický výskum vnútorného bradlového pásma v Západných Karpátoch. Č. IV—V. Stratigrafia dogeru, malmu a kriedy. Práce št. geol. úst. ČSR, 13, 176 p., Bratislava

Andrusov, D., 1950: Skameneliny karpatských druhohôr I. Rastliny a prvoky. Práce št. geol. úst., 25, 164 p., Bratislava

Andrusov, D., 1959: Geologia československých Karpát — II. 375 p., Vyd. Slov. Akad. Vied., Bratislava

Andrusov, D., 1965: Geológia československých Karpát — III. 392 p., Vyd. Slov. Akad. Vied, Bratislava

Andrusov, D. & Bystrická H., 1954: O náleze paleogénu v kriedovom pásme Brezovského pohoria. Geol. sborn., 5, 1—4, pp. 198—199, Bratislava

Andrusov, D. & Köhler E., 1963: Nummulites, facies et dévelopment prétectonique des Karpates occidentales Centrales an Palèogène. Geol. sborn., 14, 1, pp. 175—192, Bratislava

Andrusov, D. & Kuthan M., 1944: Vysvetlivky ku geol. mape Slovenska. List Žilina (4361/2). Práce št. geol. úst., 10, 196 p., Bratislava

Andrusov, D. & Scheibnerová V., 1963: On the Origin of Redepositions of Foraminifera in the Cretaceous and Paleogene of Carpathians. Geol. sborn., 14, 1, pp. 145—148, Bratislava

Bermúdez, P. J., 1952: Estudio sistemático de los Foraminiferos rotaliformes. Venezuela Minist. Minas et Hidrocarb., Bull. Geol., 2, 4, pp. 1—35, Caracas

Bieda, F., 1930: Nummulity trzeciorzedu pienińskiego pasa skalkowego. Roczn. Pol. tow. Geol., 6, (1929), pp. 98—104, Kraków

Bieda, F., 1960: Veľké foraminifery priútesového flyšu na východnom Slovensku. Geol. práce, 18, 30 p., Bratislava

Birkenmajer, K., 1959: Znaczenie skalki haligowieckiej dla geologii pienińskiego pasa skałkowego. Roczn. Pol. tow. Geol., 29, 1, pp. 19—23, Kraków

Birkenmajer, K., 1960: Geology of the Pieniny Klippen Belt of Poland. Jb. geol. Bundesanst., 103, 1, pp. 1—36, Wien

Buday, T. et al., 1963: Vysvetlivky k přehledné geologické mape ČSSR 1 : 200 000, M—33—XXX, Gottwaldov. GÚÚ, 285 p., nakl. ČSAV, Praha

Bursch, J. G., 1947: Mikropaläontologische Untersuchungen des Tertiärs von Gross Kei (Molukken). Schweiz. Palaeont. Gesell., Abh., 65, pp. 1—69, Basel

Carozzi, A. & Zadnik V., 1959: Microfacies of Wabash reef, Wabash, Indiana. Journ. Sedim. Petrol., 29, 2, pp. 164—171, Tulsa

Carter, H. J., 1876: On the *Polytrema* (Foraminifera), especially with reference to their Mythical Hybrid Nature. Ann. Mag. Nat. Hist., ser. 4, 17, 99, pp. 185—214, London

Carter, H. J., 1877: On a Melobesian Form of Foraminifera *(Gypsina melobesioides,* mihi); and further Observations on *Carpenteria monticularis.* Ann. Mag. Nat. Hist., ser. 4, 20, pp. 172—176, London

Carter, H. J., 1877: Description of *Bdelloidina aggregata* a new Genus and Species of Arenaceous Foraminifera, in which their so-called „Imperforation" is questioned. Ann. Mag. Nat. Hist., ser. 4, 19, 111, pp. 201—209, London

Chapman, F., 1892: Some new forms of hyaline Foraminifera from the Gault. Geol. Mag., new ser., dec. 3, 9, pp. 52—54, London

Chapman, F., 1900: On some new and interesting Foraminifera from the Funafuti Atoll, Ellice Island. Linnean Soc., Journ.-Zool., 28, pp. 1—27, London

Chapman, F., 1901: Foraminifera from the lagoon at Funafuti. Linnean Soc., Journ. Zool., 28, pp. 161—210, London

Chapman, F., 1902: On the Foraminifera collected round the Funafuti Atoll from Shallow and Moderately Deep Water. Linnean Soc., Journ. Zool., 28, pp. 379—417, London

Chmelík, F., 1967: Paleogén centrálních Karpat (in Regionální geologie ČSSR II-2; Engl. ed. 1968), pp. 287—386, Academia-Praha

Cushman, J. A., Todd, R. & Post, R. J., 1954: Recent Foraminifera of the Marshall Island. U. S. Geol. Surv. Prof. Paper 260—*H*, pp. 319—384, Washington

Cuvillier, J., 1961: Stratigraphic Correlations by Microfacies in Western Aquitaine. Int. Sed. Petr. Ser., 2, 34 p., 100 pls., Brill, Leiden

Douvillé, H., 1924: Un nouveau genre d'algues calcaires. C. R. Soc. Géol. Fr. 1923, pp. 169—170, Paris

Elias, M. K., 1950: Paleozoic *Ptychocladia* and related Foraminifera. Journ. Paleont., 24, 3, pp. 287—306, Tulsa

Elliott, G. F., 1955: Fossil calcareous algae from the Middle East. Micropal., 1, pp. 125—131, N. Y.

Elliott, G. F., 1964: Tertiary Solenoporacean Algae and the reproductive Structures of the Solenoporaceae. Palaeontology, 7, 4, pp. 695—702, London

Ellis, B. F. & Messina A., 1940: Catalogue of Foraminifera. Amer. Museum Nat. Hist. (suppl., post-1940), Washington

Fairbridge, R. W., 1950: Recent and Pleistocene coral reefs of Australia. Journ. Geol., 58, 4, pp. 330—401, Chicago

Felix, J., 1903: Verkieselte Korallen als Geschiebe im Diluvium von Schlesien und Mähren. Centralblatt f. Min., pp. 561—577, Stuttgart

Folk, R. L., 1962: Spectral subdivision of Limestone types. Symposium, Classif. of Carbonate rocks, Mem. *1*, Am. Ass. Petrol. Geol., pp. 62—84, Tulsa

Forman, M. J. & Schlanger, S. O., 1957: Tertiary reef and associated limestone facies from Louisiana and Guam. Journ. Geol., 65, 6, pp. 611—627, Chicago

Hagn, H., 1955: Fazies und Mikrofauna der Gesteine der Bayerischen Alpen. Int. Sed. Petr. Ser., 1, 29 p., 71 pls., Brill, Leiden

Hagn, H., 1968: *Haddonia heissigi* n. sp., ein bemerkenswerter Sandschaler (Foram.) aus dem Obereozän der Bayerischen Kalkalpen. Mitt. Bayer. Staatssamml. Paläont. hist. Geol. 8, pp. 3—50, München

Hagn, H. & Wellnhofer, P., 1967: Ein erratisches Vorkommen von kalkalpinen Obereozän in Pfaffing bei Wasserburg. Geol. Bavarica, 57, pp. 205—288, München

Hanzawa, S., 1957: Cenozoic Foraminifera of Micronesia. Geol. Soc. Am., Mem., 66, 163 p., Washington

Hanzawa, S., 1961: Facies and Micro-organisms of the Paleozoic, Mesozoic and Cenzoic Sediments of Japan and her adjacent Islands. Int. Sed. Petr. Ser., 5, 420 p., Brill, Leiden

Hanzlíková, E., 1959: Mikrobiostratigrafické vysvetlivky ke křídovým sedimentům vnitřního bradlového pásma a přilehlým paleogenním sedimentům na gen. mape Vysoké Tatry. Geofond, Praha

Henson, F. R. S., 1950: Cretaceous and Tertiary reef formations and associated sediments in Middle East. Amer. Assoc. Petr. Geol., Bull., 34, pp. 215—238, Tulsa

Hickson, S. J., 1911: On *Polytrema* and some allied genera. A study of some sedentary Foraminifera based mainly on a collection made by Prof. Stanley Gardiner in the Indian Ocean. Linn. Soc. London, Trans. Zool., ser. 2. 14, pp. 443—462, London

Hofker, J., 1927—1951: The Foraminifera of the Siboga Expedition. Pt. I. *Tinoporidae*, *Rotalidae*, *Nummulitidae*, *Amphisteginidae*. (1927). Siboga Expedition, 78 p., Leiden

Horwitz, L. & Rabowski, F., 1929: Przewodnik do wycieczki Pol. Tow. Geologicznego w Pieniny 18—21. V. 1929, Roczn. Pol. tow. Geol., 6, pp. 109—155, Kraków

Hottinger, L., Lehmann, R. & Schaub, H., 1962: Données actuelles sur la biostratigraphie du nummulitique méditerranéen. Coll. sur le Paleog. pp. 611—652, Bordeaux

Karrer, F. & Sinzow, J., 1877: Über das Auftreten des Foraminiferen-Genus *Nubecularia* im sarmatischen Sande von Kischinew. Sitzb. Akad. Wiss., Math.-nat. Kl., 74, Abth. 1, pp. 272—284, Wien

Köhler, E., 1961: Veľke foraminifery v rífových vápencoch Brezovského pohoria. Geol. sborn., 13, 1, pp. 17—28, Bratislava

Kühn, O. & Andrusov, D., 1937: Weitere Korallen aus der Oberkreide der Westkarpathen. Vestn. Král. česk. spol. nauk, tř. II, 1936, pp. 1—18, Praha

Ladd, H. S., 1950: Recent Reefs. Bull. Amer. Ass. Petr. Geol., 34, 2, pp. 203—214, Tulsa

Ladd, H. S., et al., 1950: Organic growth and sedimentation on an atoll. Jour. Geol., 58, pp. 410—425, Chicago

Lemoine, P., 1934: Vápnité řasy u čel. *Corallinaceae* nasbírané v Západních Karpatech D. Andrusovem. Vestn. St. geol. ùst. ČSR, 9, 5, pp. 269—289, Praha

Leško, B., 1960: Paleogén bradlového pásma na východnom Slovensku. Geol. sborn., 11, 1, pp. 95—103, Bratislava

Lóczy, L. jun., 1915: Die geologischen Verhältnisse der Gegend zwischen Vág—Ujhely, Oszombat und Jablánc in den Nordwestkarpathen. Jahrber. Ung. geol. Reichsanst. 1914, pp. 157—234, Budapest

Loeblich, A. R. Jr. & Tappan, H., 1964: Treatise on Invertebrate Paleontology, Part. C: Protista 2, (1—2), 900 p., Kansas

Maslov, V. P., 1956: Iskopaemie izvestkovie vodorosli SSSR. (In Russian) Akad. nauk SSSR, Trudy inst. geol. nauk, 160, 297 p., Moskva

Matejka, A., 1961: O haligoveckém mezozoiku a paleogénu. Zprávy o geol. výzk. v r. 1959, pp. 133—135, Praha

Matejka, A. & Hanzlíková, E., 1962: O paleogénu od obce Kňažia na Orave. Zprávy o geol. výzk. v r. 1961, pp. 194—196, Praha

Mišík, M., 1966: Microfacies of the Mesozoic and Tertiary Limestones of the West Carpathians. 229 p., Vyd. Slov. Akad. vied, Bratislava

Mišík, M. & Zelman, J., 1959: O príslušnosti riasovo — koralových rifov Myavskej pahorkatiny (Brezovské pohorie) k paleogénu. Geol. sborn. 10, 2, pp. 301—308, Bratislava

Moore, R. C., 1953: Treatise on Invertebrate Paleontology. Part G — Bryozoa, 253 p., Kansas

Moore, R. C., 1956: Treatise on Invertebrate Paleontology. Part F — Coelenterata, 498 p., Kansas

Narayana, Rao, S. R. & Varma, C. P., 1953: Fossil Algae from the Salt Range. II. *Solenomeris* (?) *Douvillei* sp. nov. from the Laki (Lower Eocene) Limestone. The Palaeobotanist, 2, pp. 21—23, Delhi

Neumann, M., 1958: Révision des Orbitoidés du Crétacé et de l'Eocéne en Aquitaine Occidentale. Mém. Soc. Géol. Fr., N. S., 83, 174 p., Paris

Pfender, J., 1926: Sur les organismes du Nummulitique de la collinede San Salvados pres Camarosa. Boletin de la Real Soc. esp. de Hist. natur., 26, pp. 321—330, Madrid

Pfender, J. & Basse, E., 1947: *Elianella* nov. gen. *elegans* nov. sp. organisme constructeur de calcaires typiquement développé dans le Paléocene du SW Malgache. Bull. soc. géol. Fr., 5. sér., 17, pp. 275—278, Paris

Pia, J., 1934: Kalkalgen aus dem Eozän der Felsen von Hríčovské Podhradie im Waagtale. Vestn. St. geol. úst., 10, pp. 14—18, Praha

Pia, J., Narayana Rao, S. R. & Sripada Rao, K., 1937: Dasycladaceen aus Zwischenlagen des Dekkantrapps bei Rajahmundry in Süditalien. Sitzber. Ak. Wiss., Math.-natur. Kl., Abt. I, 146, 5—6, pp. 227—236, Wien

Rama Rao, L. & Pia, J., 1936: Fossil Algae from the Uppermost Cretaceous Beds (the Ninyur Grap) of the Trichinopoly District, S. India. Palaeontologia Indica, N. S., 21, Mem. 4, 49 p., Delhi

Rhumbler, L., 1904: Systematische Zusammenstellung der recenten Reticulosa. Archiv Protistenkunde, 3, pp. 181—294

Roth, Z., 1967: Západní úsek flyšového pásma československých Karpat (in Regionální geologie ČSSR II-2; Engl. ed. 1968), pp. 109—204, Academia-Praha

Salaj, J., 1960: Predbežná zpráva o mikrobiostratigrafii gosauskej kriedy a paleogénu Myjavskej pahorkatiny. Geol. práce, Zprávy, 18, pp. 119—130, Bratislava

Salaj, J., 1962: Mikrobiostratigrafia dánu gosauskej kriedy a centrálneho paleogénu Myjavskej pahorkatiny. Geol. práce, Zprávy, 24, pp. 245—259, Bratislava

Samuel, O. & Salaj, J., 1961: Niekoľko poznámok k mikrobiostratigrafii „dánu" — paleocénu. Geol. sborn., 12, 2, pp. 165—174, Bratislava

Samuel, O. & Salaj., J., 1963: Contribution to Paleogene of Myjavska Pahorkatina, vicinity of Považska Bystrica, Žilina and of eastern Slovakia. Geol. sborn., 14, 1, pp. 149—163, Bratislava

Samuel, O., Salaj, J., Köhler, E. & Borza, K., 1967: Relation of the Cretaceous to the Paleogene in the Klippen Belt of the Váh Riverside (West Carpathians). Geol. sborn., 18, 1, pp. 125—132, Bratislava

Schaleková, A., 1963: Die Algenfloren der kretazischen und paläogenen Kalksteine der Slowakei. Geol. sborn., 14, 1, pp. 165—167, Bratislava

Schaleková, A., 1964: New Information on the Calcareous Algae in the Bioherm Limestones of the Paleocene-Lower Eocene in Western and Central Slovakia. Geol. sborn., 15, 1, pp. 57—73, Bratislava

Schaleková, A., 1964: Über die stratigrafische Verbreitung von *Distichoplax biserialis* (Dietrich) Pia in den slowakischen Karpaten. Geol. sborn., 15, 2, pp. 239—242, Bratislava

Scheibner, E., 1964: Biostratigrafický výskum mezozoika v. r. 1963. Zprávy o geol. výskume za r. 1963, pp. 81—82, Bratislava

Scheibner, E., 1967: Karpatské pásmo bradlové (in Regionální geologie ČSSR II-2; Engl. ed. 1968). pp. 7—108, Academia-Praha

Scheibner, E., 1968: Some notes to the Pieniny Lineament (in print). Acta geol. et geogr. Univ. Com., Geologica, 15, Bratislava

Scheibner, E. & Scheibnerová, V., 1961: O výskyte dánu v bradlovom pásme Západných Karpát na Slovensku. Acta geol. et geogr. Univ. Com., Geologica, 5, pp. 193 bis 200, Bratislava

Schubert, R., 1911: Die fossilen Foraminiferen des Bismarckarchipels und einiger angrenzender Inseln. Abh. geol. Reichsanst., 20, 4, 130 p., Wien

Schultze, M. S., 1854: Ueber den Organismus der Polythalamien (Foraminiferen), nebst Bemerkungen über die Rhizopoden im Allgemeinen. 68 p., Leipzig

Stráník, Z. et al., 1967: Východní usek flyšového pásma československých Karpat (in Regionální geologie ČSSR II-2; Engl. ed. 1968), pp. 203—286, Academia-Praha

Tappan, H., 1943: Foraminifera from the Duck Creek Formation of Oklahoma and Texas. Jour. Paleont., 17, pp. 476—517, Tulsa

Tollmann, A., 1966: Die alpidischen Gebirgsbildungs-Phasen in den Ostalpen und Westkarpaten. Geotekt. Forschungsheft., 21, 156 p., Stuttgart

Trauth, F., 1911: Die oberkretazische Korallen-Fauna von Klogsdorf in Mähren. Zeitschr. Mähr. Landesmuseums, 11, 104 p., Brünn

Trauth, F., 1918: Das Eozänvorkommen bei Radstadt im Pongau. Denkschr. kaiserl. Ak. Wiss., Math.-natur. Kl., 95, 108 p., Wien

Uhlig, V., 1886: Über eine Mikrofauna aus den Alttertiär der westgalizischen Karpathen. Jb. geol. Reichsanst., 37, pp. 141—214, Wien

Uhlig, V., 1889: Ergebnisse geologischer Aufnahmen in den westgalizischen Karpathen I. Die Sandsteinzone zwischen dem pieninischen Klippen-Zuge und dem Nordrande. Jb. geol. Reichsanst., 38, (1888), pp. 83—264, Wien

Wilson, W. B., 1950: Reef Definition. Bull. Amer. Ass. Petr. Geol., 34, p. 181, Tulsa

Wallich, G. C., 1877: On *Rupertia stabilis,* a new Sessile Foraminifer from the North Atlantic. Ann. Mag. Nat. Hist., ser. 4, 19, 114, pp. 501—504, London

Plate 4

Fig. 1: Photomicrograph of the reef-breccia limestone from the reef-knoll on a southern slope of the Haligovka Klippe over the Paluby settlement. In right part of the picture *Epiphaxum* sp. with attached *Miniacina multiformis* n. sp. (from below and on left side). From one side *Nubecularia* sp. and *Placopsilina.* Fragments of algae also in voids filled up by clear sparry calcite. Thin section G 955 a/68 Munich. x 16

Fig. 2: Photomicrograph of the reef-wall limestone from the bioherms which today occurs as olistolites in flysch sequences; old quarry by the road near Lubina. A large cavity filled up from below by a graded bedded detritus, higher by a fine mud. The remaining part of the cavity filled up by clear sparry calcite. In the cavity left grows *Planorbulina uva* n. sp. — holotype and opposite to it *Miniacina multiformis* n. sp. Thin section G 963 a/68 Munich. x 13

Fig. 3: Photomicrograph of the reef-wall limestone as on Fig. 2. The limestone has a character of algal-coral biolithite. Besides *Archaeolithothamnium lugeoni* Pf., Poritidae, octocorallia (*Polytremacis* sp. — on the picture), often *Serpula* sp., Foraminifera (*Gypsina ogormani* [Douv.], *Miniacina multiformis* n. sp., *Nubecularia* etc.) building up the bioherm. Thin section V 1504 — Kguk[13]), Bratislava. x 18

Plate 5

Fig. 1: Photomicrograph of the fore-reef detrital limestone from surroundings of the reef-knoll on a southern slope of the Haligovka Klippe, over the Paluby settlement. Sandy foraminiferal-bryozoan-algal sparite — micrite. In centre *Discocyclina* ex gr. *seunesi* Douv.; several sections through Bryozoa. Thin section V 1823 — Kguk, Bratislava. x 18

Fig. 2: Photomicrograph of the off-reef shoal limestone with a transition to lagoonal limestone (Kňažia, fragment in talus-slope breccia). Sandy foraminiferal-algal-bryozoan sparite. Typical are branching forms of algae with encrusting Foraminifera. In voids detritus with discocyclinas (*Discocyclina* ex gr. *douvillei* [Schlumb.], *Discocyclina* sp.), frequent Miliolidae, *Nubecularia* out of the picture *Planorbulina*, Bryozoa etc. Thin section G 965 a/68 Munich. x 20

Fig. 3: Photomicrograph of the reef-shoal limestone from infillings in the upper part of the reef-knoll on a southern slope of the Haligovka Klippe over the Paluby settlement. Sandy-foraminiferal-algal sparite. Typical is a frequency of Rotaliacea (*Miscellanea* sp.) and Miliolidae; from among algae typical is *Distichoplax biserialis* (Dietrich). Thin section V 1821 — Kguk, Bratislava. x 18

Plate 6

Fig. 1: *Planorbulina uva* n. sp., paratype (deposited in the collection of the Department of Geology, Bratislava). Encrusting on *Archaeolithothamnium* (?) *proprium* Lem. Thin section (V 1578 — Kguk, Bratislava) from white-yellowish biolithite to sparite. Old quarry on western margin of Hričovské Podhradie. x 25

Fig. 2: *Planorbulina uva* n. sp. — holotype (Slg. Munich Prot. 2859). Attached on a coral growing in a hollow (comp. Pl. 4, fig. 2). Thin section (G 963 a/68 Munich) from the yellowish reef-wall limestones which today occur as olistolites in a flysch sequence; old quarry by the road near Ľubina. x 35

Fig. 3: *Planorbulina uva* n. sp. Paratype (deposited in the collection of the Department of Geology, Bratislava). Specimen torn off from the ground in sandy off-reef detrital limestone. Thin section (V 1093 — Kguk, Bratislava) from gray sandy biosparite; the reef-knoll on a southern slope of the Haligovka Klippe, over the Paluby settlement. x 35

Fig. 4: *Gypsina ogormani* (Douv.) attached on *Epiphaxum* sp. Thin section (V 1094 — Kguk, Bratislava) from the reef-breccia limestone, locality as on fig. 3. x 65

Fig. 5: *Haddonia* sp. Thin section (G 959 a/Munich) from the off-reef shoal limestone with a transition to lagoonal limestone. Around the reef-knoll; locality as on fig. 3. x 18

Fig. 6: *Placopsilina cenomana* d'Orb. Thin section (G 965 a/68 Munich) from the off-reef shoal limestone with a transition to lagoonal limestone; Kňažia, fragment in talus-slope breccia. x 30

Fig. 7: *Miniacina multiformis* n. sp. Paratype (Slg. Munich Prot. 2864). Thin encrusting type on *Stylosmilia* sp. The upper perforated lamina well visible. Thin section (G 958 a/68 Munich) from gray coral limestone; locality as on fig. 3. x 16

Plate 7

Miniacina multiformis n. sp.

Fig. 1: Holotype (Slg. Munich Prot. 2860). Encrusting form. Among layers *Nubecularia* sp. Thin section (G 954 a/68 Munich) from gray biohermal limestone. Reef-knoll on a southern slope of the Haligovka Klippe, reef-wall limestone. x 18

Fig. 2: Paratype (Slg. Munich Prot. 2861). Thin encrusting type on *Stylosmilia* sp. Upper perforated lamina connected with a vertical pillar. Visible also a large opening. Thin section (G 957 a/68 Munich) from gray coral limestone; same socality as above. x 105

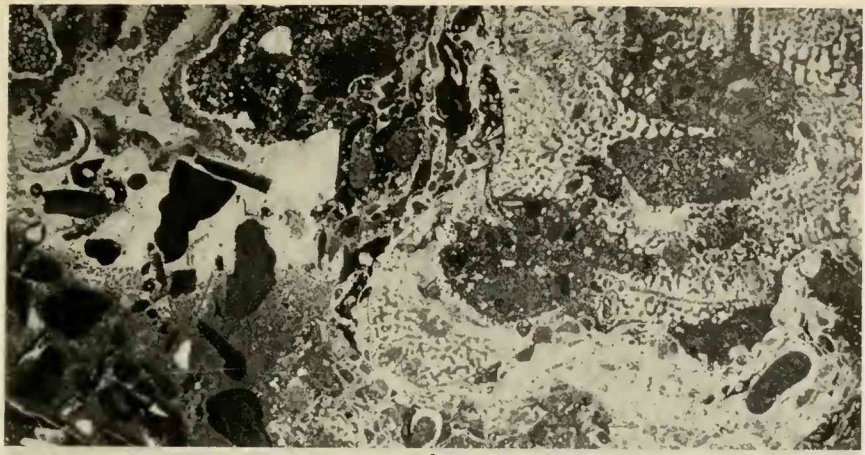
Fig. 3: Detail from the holotype showing a perforation of some upper lamina in encrusting form and an opening in the wall among two „chambers". Further data as on fig. 1. x 65

Fig. 4: Paratype (Slg. Munich Prot. 2862). Small hollow pillars. Thin section (G 960 a/68 Munich) from the gray biohermal limestone. Locality as on fig. 1; reef-breccia limestone. x 105

Fig. 5: Paratype (deposited in the Collection of the Department of Geology, Bratislava). Vertical section through encrusting type formed of large „chambers". Visible also some openings; lumens oblong, pear-like, polygonal. Thin section (V 1099 — Kguk, Bratislava) from the reef-breccia limestone; further data as on fig. 1. x 18

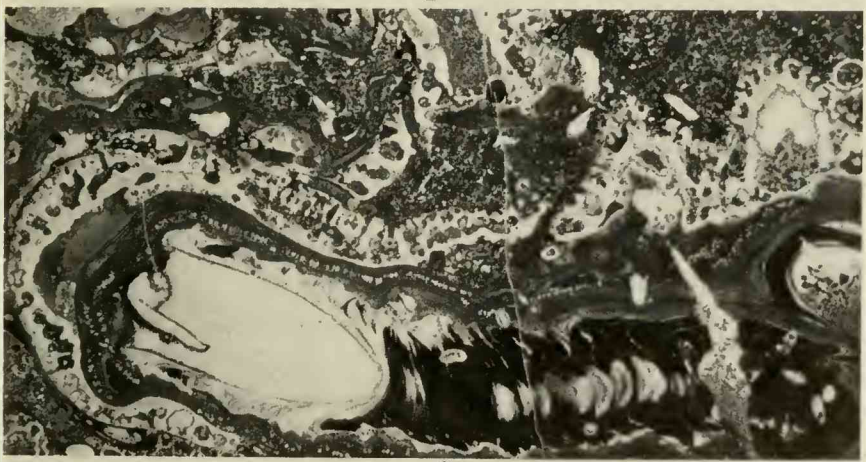
Fig. 6: Paratype (Slg. Munich Prot. 2863). Vertical section of a branching form. Thin section (G 966 a/68 Munich) from the reef-breccia limestone, old quarry on a western margin of Hričovské Podhradie, reef-wall limestone. x 35

Fig. 7: Paratype (Slg. Munich Prot. 2864). Nearly horizontal section through a branching type showing chambers and pillars. Further data as on fig. 4. x 65

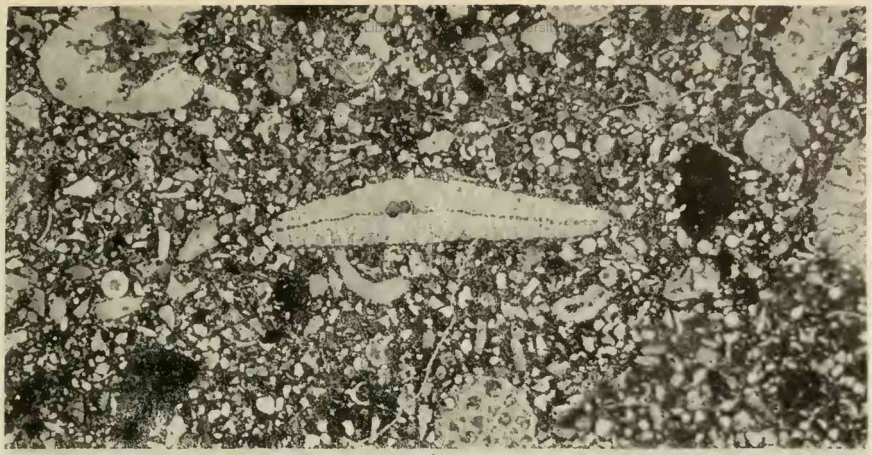


1

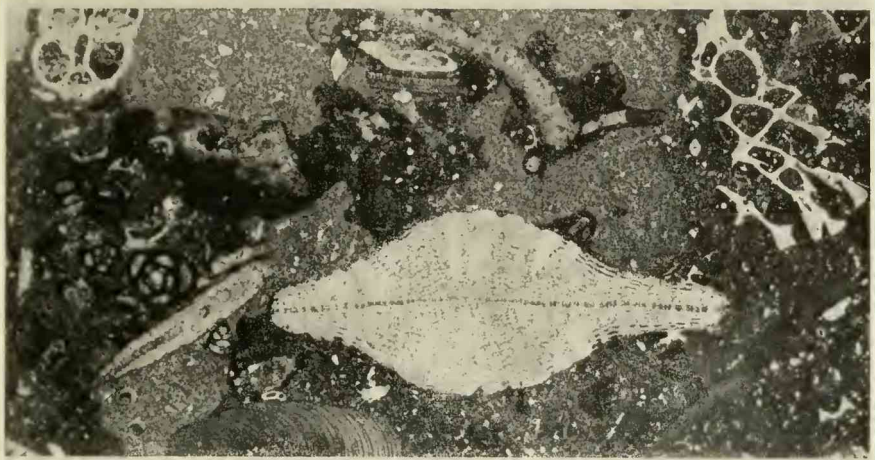
2



3

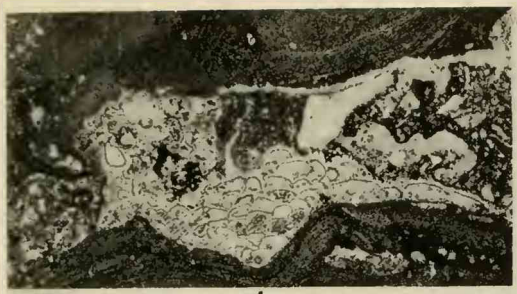


1

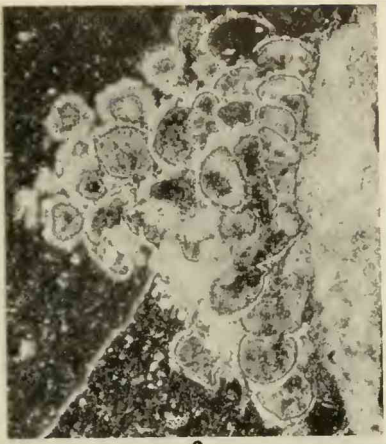


2

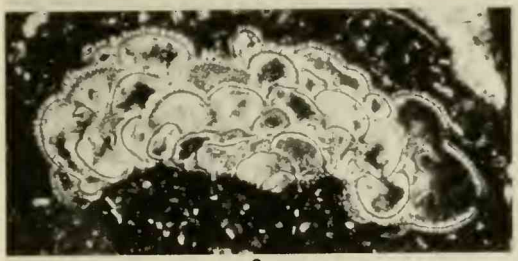
3



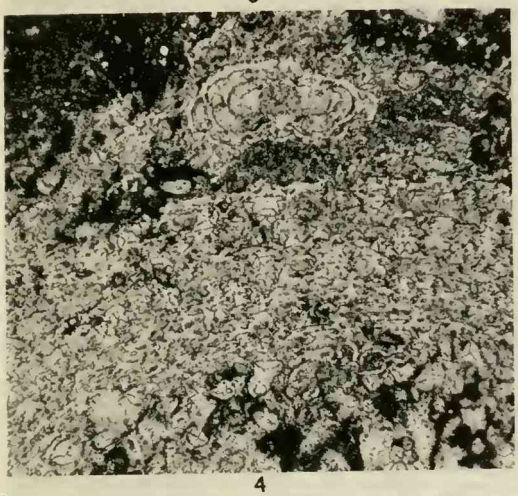
1



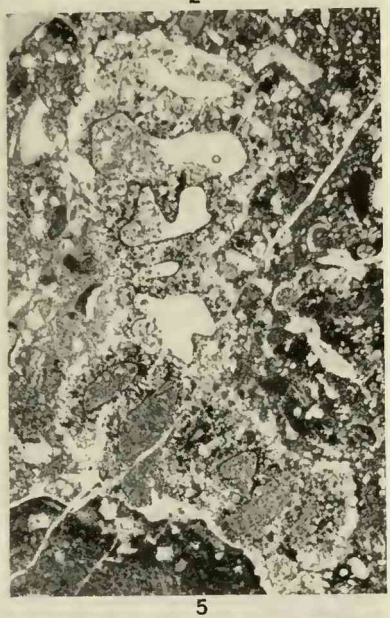
2



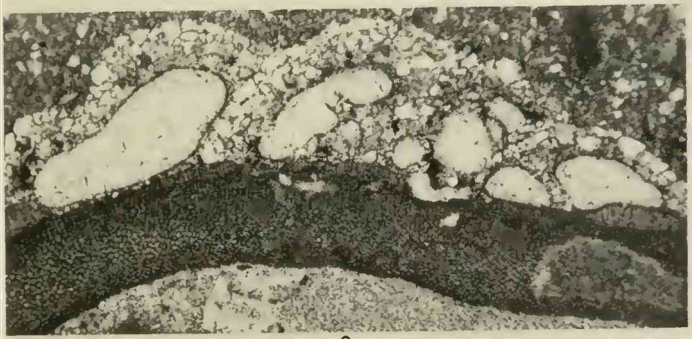
3



4



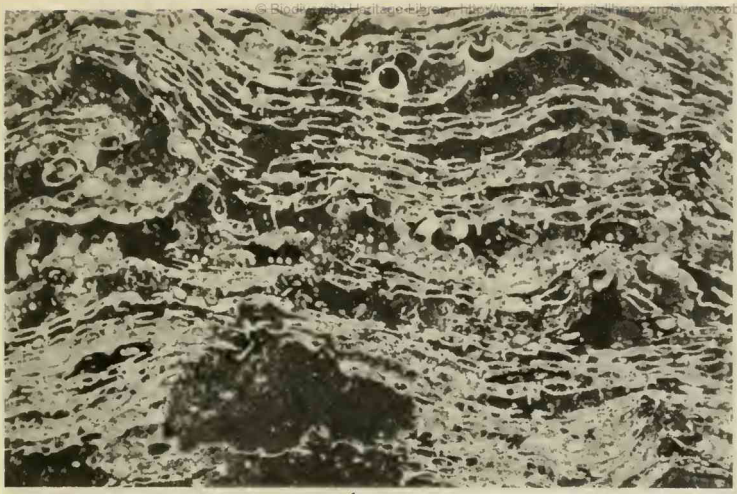
5



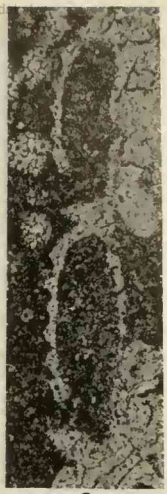
6

7

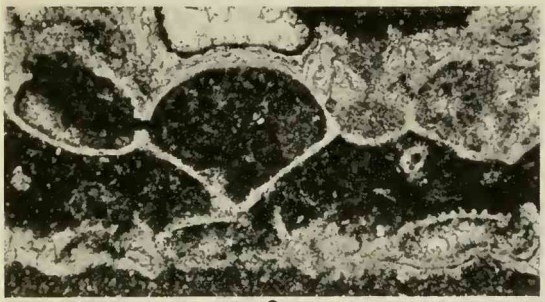
Tafel 6



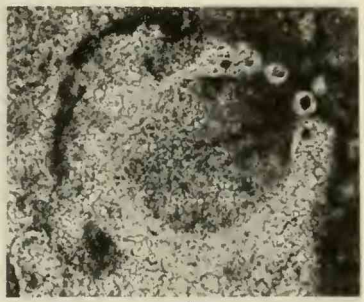
1



2

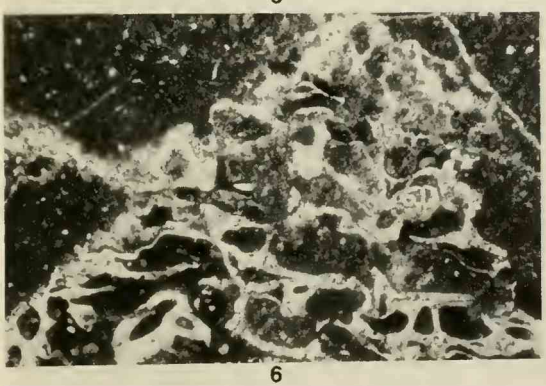


3

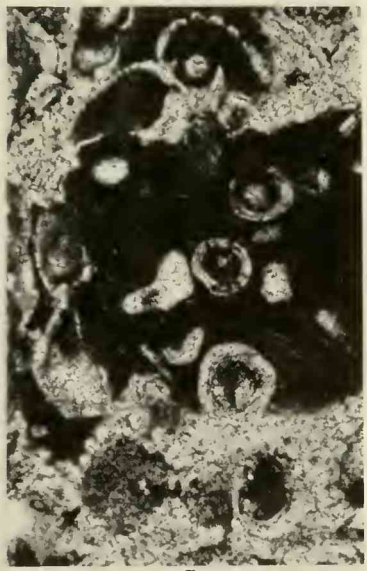


4

5



6



7

Tafel 7