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A POST GRADUATE TRAINING CENTER REFRESHER COLLOQUIUM IN THE FIELDS OF STRATIGRAPHY AND MICROPALEONTOLOGY, 1971.

by

J. KONDA

The UNESCO Post Graduate Training Center in Vienna (Geologische Bundesanstalt) organized an Inter-Regional Refresher Colloquium in the fields of Micropaleontology and Stratigraphy for the members of the previous years' courses.

A part of this Colloquium was organized -- under the auspices of the Central Geological Office of Hungary -- by the Geological Survey of Hungary, 2-9 of October, 1971.

The participating research workers were as follows: H. HONNAPPA, S. A. JAFAR, D. S. N. RAJU and G. N. SAXENA from India; D. KADAR from Indonesia; Dr. E. KAVARY from Iran; S. K. AL-SHAIBANI from Iraq; U. Z. BILAL UL HAQ from Pakistan; J. KHOGA from Syria; C. HELVACI from Turkey; A. S. A. EL-DAWOODY from Egypt, and J. BENDECK-OLIVELLA from Columbia. The leaders of the participants were Prof. Dr. H. KÜPPER, ex-director of the Bundesanstalt of Vienna, the organizer of the Vienna UNESCO courses, and geologist D. M. SCHMIDT.

The introductory "Address of Welcome" has held on behalf of the Dierctor of the Geological Survey of Hungary (abroad at that time) by M. FÖLDVÁRI, Dr. Sc., head of the Laboratory Department.

In the course of the following three days lectures were held by Hungarian research workers in the fields of diatomology, palynology, foraminiferology and bryozoology, and their methodological, stratigraphic and industrial aspects. The lectures were (in the order of their delivering):

Micropaleontology in the Geological Survey of Hungary, by Prof. E. NAGY, Dr. Sc., Head of the Paleontological Section.

Paradoxes and Use of Bryozoa, by Dr. E. DUDICH.

Siliceous Unicellulars. Their Use for Faciology and Biostratigraphy, by Dr. HAJÓS Cand. Sc.

Role and Importance of Pleistocene and Holocene Palynology, by Dr. M. JÁRAI-KOMLÓDI Cand. Sc.

Aspects of Nomenclature, Taxonomy, Ecology, Cenology, Climatology and Faciology in Palynological Research, by Prof. E. NAGY Dr. Sc.

Comparative Palynology and the Paleoclimate of Bauxite Formation, by Dr. F. GÓCZÁN.

Palynological Practice in the Investigation of Liassic Coal Measures in the Mecsek Mountains, by Dr. J. BÓNA.

Foraminiferal Studies on Miocene Formations of Hungary, by Dr. I. KORECZ-LAKY.

Eocene Stratigraphy of the Dorog Basin, based upon Larger Foraminifera, by Dr. M. JÁMBOR-KNESS.

Biostratigraphic Importance of Cretaceous Foraminifera in Hungary, by Dr. M. SIDÓ, Cand. Sc.

Triassic Foraminiferal Assemblages of Stratigraphic Value in Hungary, by Dr. A. ORAVECZ-SCHEFFER.

The members of the Colloquium presented 3 lectures:

Mid-Tertiary Formaminiferal Zonation in India, by D. S. N. RAJU.

JOIDES Deep Sea Drilling Project (On board the R/v Glomar Challenger), by U. Z. BILAL UL HAQ.

Microbiostratigraphy of Some Upper Cretaceous and Lower Tertiary Sediments in Egypt, by Dr. A. S. A. EL-DAWOODY.

All the lectures were followed by active discussion. After the discussions opportunities for the laboratory work. studying the materials, photographs and literature were provided.

On the occasion of the Colloquium, in the organization of the Hungarian Geological Society, Professor Dr. H. KÜPPER held a lecture entitled to "Methods of Study of Deep-Sea Cores" on 6. October.

During the three excursion days following the lectures, a complete Mesozic profile (Sümeg, Mogyorósdomb), some Neogene sections and their industrial aspects (Sámsonháza, Szurdokpüspöki, Visonta open pit coal-mine, the brick-yard and the new tile-works of Eger) and the Dorog Eocene coal-basin were visited.

The participants became acquinted with the geology of the visited areas and with some historical and cultural highlights of Hungary as well.

ŐSLÉNYTANI VITÁK (Discussiones Palaeontologicae) 21, (1973) Budapest 9-11.

MICROPALEONTOLOGY IN THE GEOLOGICAL SURVEY OF HUNGARY

by

Prof. E. NAGY, Dr. Sc.

Paleontological work began in our 102 years old Institute immediately after its foundation.

In the field of micropaleontology the pioneer work was started by the renowned first director of our Institute, Miksa HANTKEN, on Paleogene sequences of the Dorog coal basin. He had made the first important steps in establishing a stratigraphic chronology based on the stratigraphic succession of small Foraminifera. HANTKEN also studied the larger foraminifers, their microstructure and thus became a precursor of microbiostratigraphic research.

In the 20th century one of the outstanding workers of micropaleontology was Béla ZALÁNYI. He had worked with ostracods, and became one of the internationally most renowned Hungarian paleontologists.

L. MAJZON worked in the Laboratory for Borehole Sample Testing in the thirties. The lion part of his work consisted of studies on small Foraminifera.

At present there are 4 groups in our Section. Of these, 3 are dealing with micropaleontology. Dr. Márta HAJÓS is working in the group of diatomology. Palynological research is done by Dr. F. GÓCZÁN on the Paleozoic and Mesozoic, by Dr. L. RÁKOSI on the Paleogene. I am working on Neogene and two other collaborators are working with Quaternary material.

The very important foraminiferology is represented by several workers: Dr. Mária SIDÓ (Mesozoic) - small forams, Triassic small forams by A. ORAVECZ-SCHEFFER; Dr. M. JÁMBOR-KNESS is working with Eocene larger forams; Miocene small forams are studied by Dr. I. KORECZ-LAKY.

Some aspects of bryozoology are given by Dr. E. DUDICH.

We asked two palynologists from outside the Survey to lecture to this Colloquium: Dr. M. JÁRAI-KOMLÓDI, from the University of Budapest and Dr. J. BÓNA from the Laboratory of the National Exploration and Drilling Company.

I should like to thank them, as well as the other participants, for their contributions.

MIKROPALEONTOLÓGIAI KUTATÁSOK
A
MAGYAR ÁLLAMI FÖLDTANI INTÉZETBEN

Nagy E.

Összefoglalás

A 102 éves Intézet megalapitása óta jelentős őslénytani kutatás folyt. Az Intézet első világhirü igazgatója, HANTKEN Miksa is foglalkozott mikropaleontológiával. A XX. században a legnevezetesebb mikropaleontológusoknak egyike ZALÁNYI Béla, Ostracodákkal foglalkozott.

Jelenleg három mikropaleontológiai csoport van az Intézet Őslénytani Osztályán: Diatomákkal és Coccolithophoridae kutatással foglalkozó csoport,

spóra és pollen kutató csoport,

kis és nagy Foraminiferákkal és Ostracodákkal foglalkozó csoport.

14 mikropaleontológus dolgozik jelenleg Intézetünkben.

ŐSLÉNYTANI VITÁK (Discussiones Palaeontologicae) 21, (1973) Budapest pp. 13-27.

PARADOXES AND USE OF BRYOZOA

by

E. DUDICH

1. Paleosystematics Based on Ambiguous Skeletal Morphology

"Bryozoa", a Greek term for "moss animals", given by K. EHRENBERG in 1831, is a rather odd denomination for a curious group of multicellular invertebrates of minute size and of highly specialized organization, some of which grow onto colonies and even build reefs of considerable dimensions.

Having been classed with so widely different groups of the animal kingdom as corals, brachiopods, worms, graptoliths, and ascidia, nowadays they are generally recognized as an independent phylum, situated somewhere between Protostomia and Deuterostomia.

The phylum Bryozoa comprises more than 150 families, 1200 genera, over 15.000 fossil and about 5000 recent species.

Unfortunately enough, their taxonomic subdivision involves several features of the soft body, e.g. the presence or absence of a hydrostatic organ, the type of larvae etc., which are, of course, completely useless for the study of fossils. As a consequence, the taxonomy of fossil Bryozoa is kind of a labyrinth, a constant battlefield of diverging opinions, particularly so concerning the families and subfamilies.

The class Phylactolaemata, comprising freshwater bryozoans with tentacles arranged in horseshoe-shaped manner around the mouth, can be discarded easily, because they lack any solid skeleton. Only one single find has been recorded from the Cretaceous of Czechoslovakia (Plumatellites).

The class Gymnolaemata, with a circular row of tentacles around the mouth, is characterized by the secretion of more or less solid, usually calcareous, external skeletons. These reveal numerous morphological details, which prompted the elaboration by enthusiastic research workers of an embarrassing, disconcertingly complex morphological terminology, not to be insisted upon here.

The five orders of the class, however, can be discerned surely enough -- in the case of at least tolerable conservation --, relying upon a small number of morphological characters. These are summed up in Table 1.

Further complications arise from polymorphism. This means the presence of diversely shaped individuals within the same colony, which may result in serious doubts about the taxonomic position of some (particularly fragmentary) forms.

Due to these disheartening difficulties, bryozoans generally are among the usually less favorized groups of fossils and paleo-bryozoologists ara suspected to be not too dangereous, but certainly irremediable maniacs, an assumption which can not be refuted convincingly, so let it be accepted good heartedly.

2. Anatomy Interpreted by Mosaic Evolution

The bryozoan organism represents a puzzling peaceful coexistence of primitive, secondarily differentiated and tertiarily reduced anatomical features. E.g., they possess a most simple, one-layered epidermis, a highly developed nervous system, but no true respiratory or excretory system.

This curious state may have been produced by three factors by the way of so-called mosaic evolution, during which various parts of the organism were developing in different ways.

i - changing the freely moving, vagile life to a sedentary, sessile one;

ii - forming of colonies instead of solitary life;

iii - large relative surface favouring easy metabolism, due to the conservation of minute stature.

The following general tendencies are supposed to have been in vigour:

i - The individual organism called zooecium became more and more simplified, with the reduction and rudimentation of some organs;

ii - The organizaton of the colony or zoarium became more and more complicated: a "division of labour" has been established, with specialized individuals performing some functions for the entire colony. Such are: avicularia for mutrition, ovicella for reproduction, rhizoids for fixation, etc. (This is the functional interpretation of the widespread, but by no means universal, polymoriphism.)

iii - The formation of the colony became more and more regular in the geometrical sense.

iv - As for skeletal metabolism, a succession of more and more resistent substances can be observed from the simple organic cuticula through chitine and aragonite to calcite and even dolomitic calcite.

3. Astogeny Reflecting Two-Phase Phylogeny

Bryozoans are hermaphroditic animals, that is, the male and female sex cells develop within the same individual. From the union of the gametes, a freeswimming (necto-planktonic) "cyphonautes" larva arises, somewhat resembling the trochophora type. This settles, usually within

24 hours, on a hard substratum, on a rock, a shell, or an alga stem, and develops into the first zooecium of the colony called the ancestrula. This on its turn develops by budding, that is by one kind of non-sexual reproduction, into a colony or zoarium, thus representing a genetically pure clan. The paradoxical fact is, however, that the ancestrula is in most cases not typical for the given sepcies, it resembles to some more ancient type. The definitive organization of the given species, with its eventual polymorphism, appears much latter in the course of colony growth called astogeny. Following the example of E. HAECKEL's famous rule of biogeny, according to which ontogeny, the development of the individual, to a certain extent repeats or at least recalls some phases of the phylogeny, or historical evolution of the goup, the above fact may be aptly designed as the rule of astogeny.

During Earth's history, the first bryozoan was recorded from the Cambrian (Archaeotrypa FRITZ 1947). It is assumed that five orders of Gymnolaemata were developed along parallel lines from a hypothetic, solitary and freely moving ancestral form. In the Silurian, already orders are known to have been present.

The first bryozoan virence period comprises Ordovician--Permian. It was characterized by the "competition" of two orders, Trepostomata and Cryptostomata. Domination gradually passed from the former to the latter. This long period may be called the paleobryozoan phase, some representants of which occur in the Early Paleozoic of the Szendrő Hills and in the Permian of the Bükk Mountains in North-East Hungary.

At the end of the Paleozoic era, the Cryptostomata disappear; Ctenostomata and Trepostomata are but poorly represented. The Triassic, otherwise rich in reef constructing, carbonate secreting organisms, is remarkably poor in bryozoans: one single family is known to occur. (Vinellidae). This startling fact may be interpreted biogeochemically.

in terms of decrease in the carbonate metabolism of bryozoans, resulting in reduced chances of fossilization.

The second prosperity or boom of Bryozoa, the neobryozoan phase, began in the Late Jurassic. During this period, the orders Cyclostomata and Cheilostomata were competing with each other. The species ratio shows a gradual shift in favour of Cheilostomata. This permits, in the case of an assemblage rich in species, a first approximation of datation by calculating the Cyclostomata/Cheilostomata ratio.

It is corious to note, that certain morphological phenomena, inculding certain types of polymorphism, reappear during this second phase.

This two-phase progressive phylogeny is comparable with the paleohellenite and neohellenite phases of Foraminifera phylogeny as defined by WEDEKIND.

4. Non-Corallian Ecology and Intriguing Cenology

A common mistake among geologists is to attribute to bryozoans an ecology, or environmental requirements, similar to that of colonial or reef building corals. Undoubtedly, there were reef-constructing bryozoans, too, especially in the Permian, in the topmost Cretaceous and in the Miocene. Another likeness is that they, in fact, prefer well-oxigenated, agitated water.

However, they usually prefer shadow to strong light, and live from the seashore down to bathyal depths, not only in warm, but also in rather cool seas, sometimes in brackish and even in fesh water.

Of course, and fortunately, there are among them steno-thermic, stenohaline and stenobath species as well, which are good indicators of a given interval of temperature, salinity, and depth, respectively. Taking into consideration not a single species, but a whole assemblage, and the dominance ratios, a fairly good approximation of the paleoenvironmental conditions may be achieved.

E.g., in the Upper Eocene Bryozoan Marl Member of the Buda Hills here in Budapest several bryozoan assemblages could be distinguished (a total of more than eighty species), in which vicariation or substitution phenomena were observed. I.e., with varying depth some species were substituted by others of the same genus.

In quiet waters branching, tree-like colonies are common, while lamellate, incrusting forms are characteristic of agitated, turbulent waters. Even the shape of the same species may in function of the energy factor.

Bryozoans are commonly associated with red, brown and green algae (another indicator of depth zonation), annelids, decapod crustaceans, gastropods, echinoderms, and more rarely with brachiopods. Characteristic paleocommunities or paleocenoses can be recognized which are, for the geologist, traceable biofacies. E.g., in the same Upper Eocene Bryozoan Marls several such ancient life communities were distinguished and their distribution on space and time established, in function of the nature of substratum, depth and distance from the seashore. They revealed striking resemblances with present-day littoral and sublittoral associations of the Adriatic Sea. In function of time, migration phenomena could be detected and paleogeographic connections between Northern Italy, the Northern Carpathians and the Transylvanian Basin could be ascertained, adding a new item to other arguments.

6. Techniques of Study: Traditional and Up-to-Date.

Traditional techniques of preparation include washing (in the case of loose rocks) and thin sectioning (in the case of compact marls and limestones). Clayey matrix can be removed by the use of caustic potash (KOH) or by Glauber's salts, followed by careful soaking in slightly acidized water.

A 3 to 5 percent hydrochloric acid (HCl) solution may help to recover many a specimen from solid rock.

As for the thin sections, two sections are needed always for exact examination: a longitudial one, parallel to the surrection of growth, and a tangential one, parallel to the surface of the zoarium. A third section, called transverse, cut at right angles to the longitudinal, is very useful in studying stemlike forms.

Loose specimens of Tertiary bryozoans can be studied under a conventional stereomicroscope, eventually tinted pink with a light solution of red ink in order to bring out morphological details more clearly than can be observed on the original material. For the preparation of thin sections, they are to be embedded in Canada balsam or in acrylates, taking care for adequate orientation.

The use of collodium or acetate films for the study of surface features is highly recommended.

Magnifications ranging from 10 to 100 are generally sufficient. Polarization microscopy with crossed nicols is necessary for the study of inner wall structures.

Modern methods of rather wide variety include X-ray photography, 0^{16} - 0^{18} isotope thermometry, (by mass spectrometer), Ca/Mg ratio

determination, trace element analysis, and geometrical evaluation of the zoarium.
Statistical methods are applied as for any other group of mocrofossils.

Drawings and photographs should show both the external morphology and the internal stucture of the zoarium.

7. Application in Faciology and Stratigraphy

From all that was said about their ecology and cenology, it is obvious that bryozoans provide us a valuable tool for facies analysis. An example is presented: the case of the Upper Eocene beds cut in borehole Csv-18 in the southeastern foreland of the Vértes Mountains. These represent a "missing link" in a chain of Upper Eocene Bryozoa occurrences situated from Nothern Italy through the Buda Hills to the Carpatians and to the Transylvanian Basin. As seen in Table 2. the Upper Eocene age is clearly indicated by the assemblage. It could be deduced, that sedimentation occurred in marine water of normal salinity, at first at a depth of 20 to 60 m, later on somewhat deeper, at a maximum of about 100 m; after a slightly more argillaceous episode a regression set in.

The stratigraphic value of bryozoans was pointed out as early as in the first half of the 19th century by A. D'ORBIGNY. In 1904, F. CANU elaborated a "scale" of bryozoans for the Tertiary of South America. In 1922, the greatest of paleobryozoologists, R.S. BASSLER, emphasized the stratigraphic importance of Bryozoa in the Paleozoic of the United States, a fact soon supported and confirmed by the practice of the big American oil companies. In Europe, F. KAISIN for the Devonian of Belgium, J. ROGER, E. BUGE and M. VIGNAUX for the Neogene, M. LABRACHERIE and others for the Paleogene stated the applicability of bryozoan assemblages (not of single species), in microbiostratigraphy. In Hungary, a great pioneer of micropaleontology, M. HANTKEN, first director of this Institute, reported on the Bryozoans of the Buda Hills exactly one hundred years ago.

Table 1.

Basic morphological characteristics of Gymnolaemata

Order	Composition of zooecium	Shape of zooecium	Nature of aperture	Operculum	Diaphragms	Brood chambers and appendicular organs	Mesopores	Nature of zoarium	Range
Cyclostomata	Calcareous	Cylindrical	Terminal and round	None	Rarely present	None	Present or absent	Usually delicate	U. Camb.- Recent
Trepostomata	Calcareous	Prismatic or cylindrical	Round or Polygonal	Present	Abundantly present	Probably present	Present	Variable-, commonly massive	Ord.- Permian
Ctenostomata	Horny or membranous, rarely calcified in part	Tubular or conical	Terminal and round	Present	None	None	None	Small, delicate, stolonoid	Ord.- Recent
Cheilostomata	Membranous, chitinous, calcareous	Conical, tubular, prismatic etc.	More or less anterior, commonly modified	Present	None	Present	None	Delicate, or massive, usually not large	Cretaceous Recent
Cryptostomata	Calcareous	Cylindrical	Round and concealed	Present	Present or absent	None	Usually absent	Delicate, but may be several cm-s high	U.camb.- Permian

Stratigraphic range of the bryozoan species

found in the Eocene of Borehole Csv-18

Species	Age							
	E_1	E_2	E_3	O	M	P	Q	H
Crisia edwardsii		—	—	—	—	—	—	—
Entalophora attenuata	—	—	—	—				
Hornera concatenata			—					
Hornera frondiculata		—	—	—	—	—	—	—
Membranipora macrostoma		—	—		—			
Onychocella angulosa			—	—	—			
Steginoporella elegans			—		—			
Steginoporella similis		—	—					
Orbitulipora lenticularis	—	—	—	—	—			
Batopora multiradiada			—					
Batopora rosula			—	—	—			

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A BRYOZOÁK PARADOXONAI ÉS HASZNA

Dudich E.

Összefoglalás

Az UNESCO mikropaleontológiai-rétegtani továbbképző tanfolyam keretében tartott előadásban a szerző áttekintést adott a fosszilis mohaállatok rendszertanának egyes kérdéseiről, a bryozoák anatómiájának mozaikevolucióval értelmezhető sajátosságairól, telep- és törzsfejlődésük jellegzetességeiről, valamint ökológiai és cönológiai érdekességeiről. Ismertette a fontosabb vizsgálati módszereket, bemutatta az alapvető szakirodalom néhány müvét, végül pedig a facilógiai és rétegtani alkalmazást taglalva, magyarországi példákra hivatkozott.

ŐSLÉNYTANI VITÁK (Discussiones Palaeontologicae) 21. (1973. Budapest pp. 29-39.

SILICEOUS UNICELLULARS. THEIR USE FOR FACIOLOGY AND BIOSTRATIGRAPHY

by

M. HAJÓS

The study of siliceous unicellulars is of increasing importance at a world-wide scale in geology and raw materials exploration, particularly so in the case of sediments containing no other kind of microfossils. By means of their investigation, the age and stratigraphic position of several deposits could be established in Hungary, too, and substantial assistance was given to geological mapping.

Siliceous unicellulars are to be found most likely in acidic tuffs and tufites, or in "diatomites" accompanying these. This fact is due to the circumstance that these rocks provided the silica required for the construction of the siliceous tests.

In 1922 H. POTONIÉ and in 1933 N. L. TALIAFERRO, in a special study, taking into consideration all important diatomite occurences from the Cretaceous to Holocene, established that diatomite formation is a function of the local dissolution of volcanic rocks rich in silica and poor in calcium.

In the Geological Survey of Hungary the siliceous unicellulars are evaluated not only paleontologically, but also from the point of view of applied geology.

The immediate tasks are

-- to establish standard spectra for the further compartive study of diatomite deposits by the microbiostratigraphic investigation of key sections;

-- to decipher the genesis of the sediments, by means of the evaluation of sequences stratum by stratum;

-- to establish the faciological and stratigraphic value of fossil siliceous unicellulars, based on species determinations.

All siliceous unicellulars in question live in, or at least are bound to, water. Accordingly, the composition of the assemblages is controlled by the chemical and physical characteristics of the given aqueous medium. Light, temperature, agitation, chemism of the water are decisive for the propagation of these microorganisms. Changes in these provoke changes in both the sediments and the assemblages enclosed. Indirectly, these changes can be traced under the microscope. Accordingly, conclusions can be drawn as to the changes of climate, local temperature, salinity and impurities.

The most sensitive indicators of such alterations are the diatoms. In addition, they are usually the most abundant both in species and specimen. According to SHIMER and SCHROCK (1949), more than 20,000 species belonging to more than 600 genera are known.

The ecology of the accessory, minor groups of siliceous unicellulars usually corresponds to that of the diatoms they are associated with.

Faciological and microbiostratigraphic evaluations are possible above all if one takes into account the whole assemblage, in function of the sediments which has yielded them.

This synoptic investigation is prompted practically by the circumstance that during the preparation of the rock samples, having removed the anorganic mineral grains, the residue is constituted essentially by several kinds of siliceous unicellulars. Such are: Archaeomonas, Silicoflagellata, Ebridea, Diatomea, Phytolithia, Radiolaria accompanied by fragments of siliceous sponges. It is a common case, however, that slightly chitinous tests of planktonic forms "inceratae sedis" of characteristic morphological features also occur. These may be of considerable stratigraphic value.

For drawing conclusions concerning the biofacies, the ecology and biotopes of the occuring species must be known. This implies the study of recent siliceous unicellulars.

In the evaluation of the ecological factors, one has to proceed very carefully. The ecological valence and conservation of all species of the assemblage must be taken into consideration. The factors are rather numerous, such as salinity, pH, temperature, light, agitation, organic impurities, etc. Unfortunately, for numerous recent species the toleration limits for each factors and the morphological and other changes concomitant with their variations, has not been cleared.

We have to be aware, moreover, that the thanatocoenosis studied by us is not identical with any original biocoenosis.

Special deliberation should be given to the allochtonous and autochtonous forms of the assemblage. Purely marine or purely freshwater sediments are biostratigraphically less important than the littoral and brackish-water ones. It should be emphasized that decrease in salinity can not be deduced from the abudance of freshwater forms in marine sediments. As a matter of fact, rivers carry numerous freshwater forms into the sea, which perish in sea water, thus dominating just normally saline littoral sediments. Decrease of salt content can be, however, inferred from the appartion (immigration) of brackish - water flora, from the disparition and morphological change of stenohaline marine forms.

A very important point is to evaluate the percentage of epiphytic and benthonic species, as far as possible distinguishing the allochtonous species from the autochtonous ones, thus eliminating freshwater forms transported by rivers, or reworked from freshwater sediments.

In my experience the floral assemblage of lagoons and brackish-water lakes is very well recognizable, of endemic character (e.g. Csákvár basin and Hosszuhetény in the Mecsek Mountains). Decrease in salinity causes decrease in species number, changes in ornamentation of the tests and apparition of new species. Complete desalination results in the disparition of the marine assemblage. However, euryhaline species endure (e.g. Coscinodiscus).

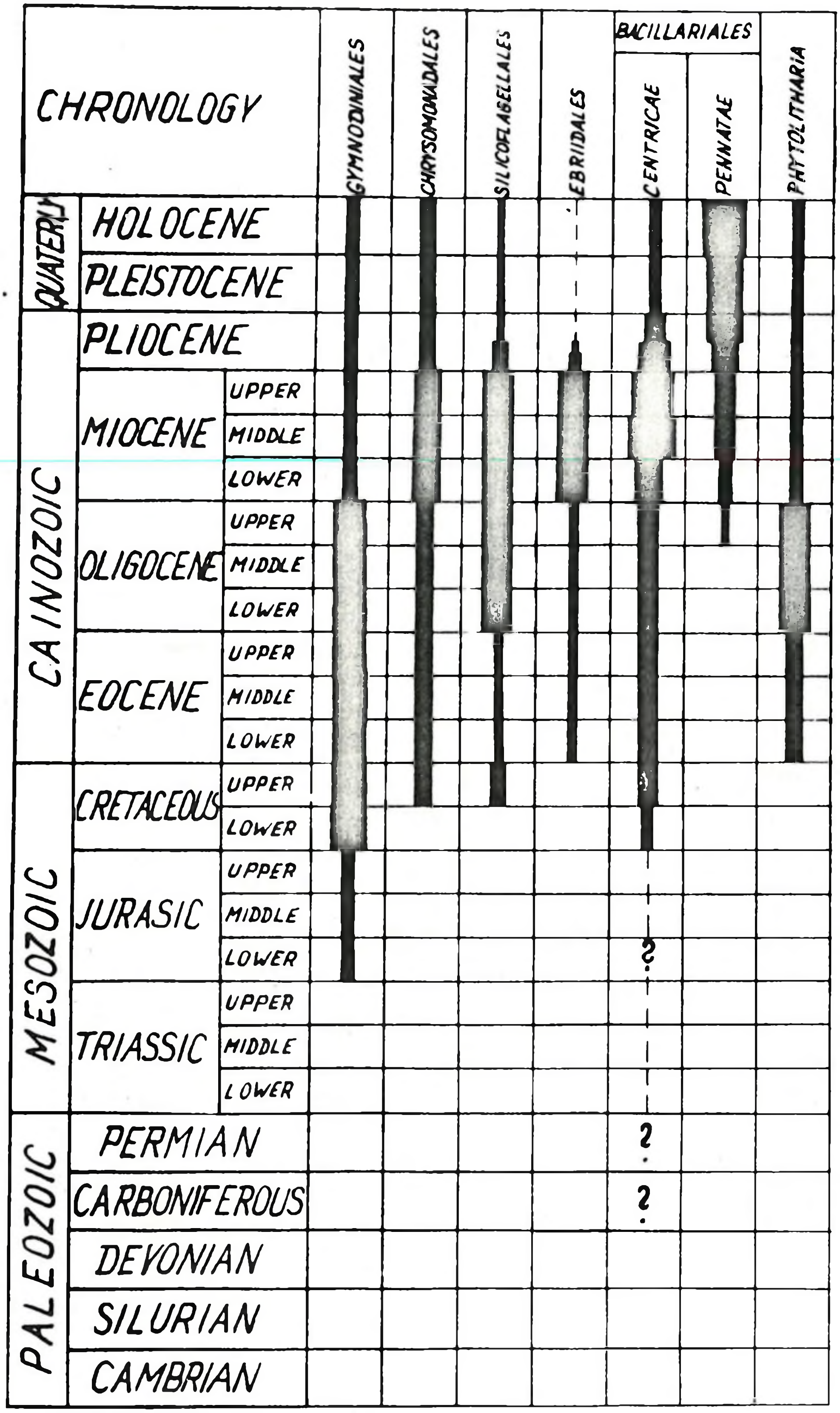
Shifting of the physico-chemical equilibrium results in morphological alterations of the diatom tests, creating innumerable varieties. Quantitative (statistical) studies enabled us to state that with increasing salinity the longitudinal axis of the brackish-water forms becomes longer. In the opposite case, that is of decreasing salinity, the same axis become s shorter, the two ends of the cell show incision, while the central part become enlarged (For instance: Fragilaria construens, Diploneis interrupta, Navicula elegans, N. peregrina, N. hungarica, etc.).

Comprehensive studies have been published on the paleobotanical and geological investigation of the more important diatomite deposits of Eocene, Oligocene and Miocene age of the world. The pioneer work done by Soviet, German, Japanese, Californian and Czechoslovakian research workers was followed up by Hungarian studies.

The region of Quarternary diatomology is the Atlantic, Northern and Eastern Sea shore line of Europe. By means of offshore cores, the direction of Pleistocene transgression and regression, the changes of the shoreline and the gradual decrease of salt content in the Eastern Sea could be cleared up by German, Danish and Swedish scientists.

In Hungary important diatomites are known to occur in the foreland and marginal basins of the mountains (Mecsek, Bakony, Vértes, Börzsöny, Mátra, Bükk and Tokaj). (Fig. 1.) Tehir age varies from Liassic through Oligocene, Miocene and Pliocene to Holocene (Plate I.).

Further studies should be done on Oligocene, Eocene and Cretaceous deposits in Hungary. These may result in important chronological statements. "Marker species", "guide fossils" of short haemeras my be used for stratigraphic datation down to age (stage). In the Tertiary, especially in the Neogene (Plate II.) even assemblages can be used for detailed geochronological subdivision, down to zone, and even for long-distance correlation with the neighbouring countries (Austria, Czechoslovakia, Yugoslavia, Roumania and the Mediterranean Sea).



Cdronological distribution of the certain diatome groups

M. Hajós

LOCALITY	Geographical location	CHRONOLOGY	ROCKS	Ecological environment
ABAÚJSZÁNTÓ	TOKAJ m[t].	PLEISTOCENE ?	ALEURITE	FRESH-W.
ABAÚJVÁR	–"–	L-SARMATIAN	ALEURITE	BRACKISH-W.
AJKA	BAKONY m[t]	L-TORTONIAN	DIATOMITE	MARINE
ARANYOS	TOKAJ m[t]	SARMATIAN	—	BRACKISH-W.
BÁND	BAKONY m[t]	L-TORTONIAN	ALEURITE	MARINE, BRACKISH-W
BOGÁCS	BÜKK m[t]	L-PANNONIAN	ALEURITE	BRACKISH-W.
CEKEHÁZA	TOKAJ m[t]	L-SARMATIAN	DIATOMITE	FRESH-W.-BRACKISH-W.
CSÁKVÁR	VÉRTES m[t]	L-PANNONIAN	ALEURITE	BRACKISH-W.
DIÓSD	TÉTÉNY plateau	L.-TORTONIAN	DIATOMITE	BRACKISH-W.
DÖMÖS	PILIS m[t].	U.-PANNONIAN ?	ALEURITE	FRESH-W.
EGER-TIHAMÉR	BÜKK m[t].	HELVETIAN	DIATOMITE	FRESH-W-BRACKISH-W.
ERDŐBÉNYE	TOKAJ m[t].	U-SARMATIAN	ALEURITE	FRESH-W-BRACKISH-W
FÜZÉRKAJATA	–"–	SARMATIAN	DIATOMITE	FRESH-W-BRACKISH-W
GIBÁRT	–"–	U-SARMATIAN ?	ALEURITE	FRESH-W-BRACKISH-W
GÖNC	–"–	L-SARMATIAN – – U-SARMATIAN	ALEURITE	FRESH-W-BRACKISH-W MARINE
GYÖNGYÖSPATA	MÁTRA m[t]	L.-TORTONIAN	DIATOMITE	BRACKISH-W-MARINE
HASZNOS	–"–	TORTONIAN	DIATOMITE	FRESH-W-BRACKISH-W MARINE
HEREND	BAKONY m[t]	L-TORTONIAN	DIATOMITE	MARINE
HERNÁDCÉCE	TOKAJ m[t]	PLEISTOCENE ?	ALEURITE	FRESH-W.
HIDAS	MECSEK m[t]	TORTONIAN – – SARMATIAN	DIATOMITE	BRACKISH-W-MARINE
HIRD	–"–	SARMATIAN	DIATOMITE	BRACKISH-W-MARINE
HOSSZÚHETÉNY	–"–	SARMATIAN	DIATOMITE	BRACKISH-W-MARINE
KOMLÓ	–"–	HELVETIAN	ALEURITE	MARINE
LAK	BÜKK m[t]	MIOCENE L-PANNONIAN	ALEURITE	FRESH-W-BRACKISH-W
MAGYAREGREGY	MECSEK m[t]	HELVETIAN	ALEURITE	FRESH-W-BRACKISH-W
MOGYORÓD	MOGYORÓDI m[t]	TORTONIAN	ANDESITE TUFF	MARINE
NAGYMAROS	BÖRZSÖNY m[t]	L.-TORTONIAN	DIATOMITE	MARINE
NÓGRÁDSZAKÁL	CSERHÁT m[t].	TORTONIAN	Calcareous marl	MARINE
OLASZLISZKA	TOKAJ m[t].	U-SARMATIAN	ALEURITE	FRESH-W-BRACKISH-W
PETŐFIBÁNYA	MÁTRA m[t]	TORTONIAN	DIATOMITE	FRESH-W
PÉCSVÁRAD	MECSEK m[t].	TORTONIAN – – SARMATIAN	DIATOMITE	BRACKISH-W-MARINE
PUSZTAFALU	TOKAJ m[t].	U-SARMATIAN	ALEURITE	FRESH-W-BRACKISH-W
SÁROSPATAK	–"–	U-SARMATIAN	DIATOMITE	FRESH-W-BRACKISH-W MARINE
SZILÁGY	MECSEK m[t].	SARMATIAN	DIATOMITE	BRACKISH-W-MARINE
SZILVÁSVÁRAD	BÜKK m[t]	HELVETIAN – – TORTONIAN	DIATOMITE	MARINE
SZOKOLYA	BÖRZSÖNY m[t].	L-TORTONIAN – – [illegible]	CLAY, DIATOMITE	MARINE, BRACKISH-W
SZURDOKPÜSPÖKI	MÁTRA m[t].	TORTONIAN	DIATOMITE	BRACKISH-W-MARINE
SZÜCSI	–"–	SARMATIAN	LIMESTONE	BRACKISH-W
TÁLLYA	TOKAJ m[t].	L-SARMATIAN	RHYOLITETUFF	FRESH-W-BRACKISH-W
UJPEST	BUDAPEST	HOLOCENE	DIATOMITE	FRESH-W
VÁRPALOTA	BAKONY m[t]	HELVETIAN	DIATOMITE	MARINE
VISONTA	MÁTRA m[t]	U.-PANNONIAN	DIATOMITE	FRESH-W.
ZENGŐVÁRKONY	MECSEK m[t]	HELVETIAN	CLAY	MARINE

Characteristics of the Hungarian Neogene diatomite occurences

M. Hajós

The diatomite deposits of Hungary

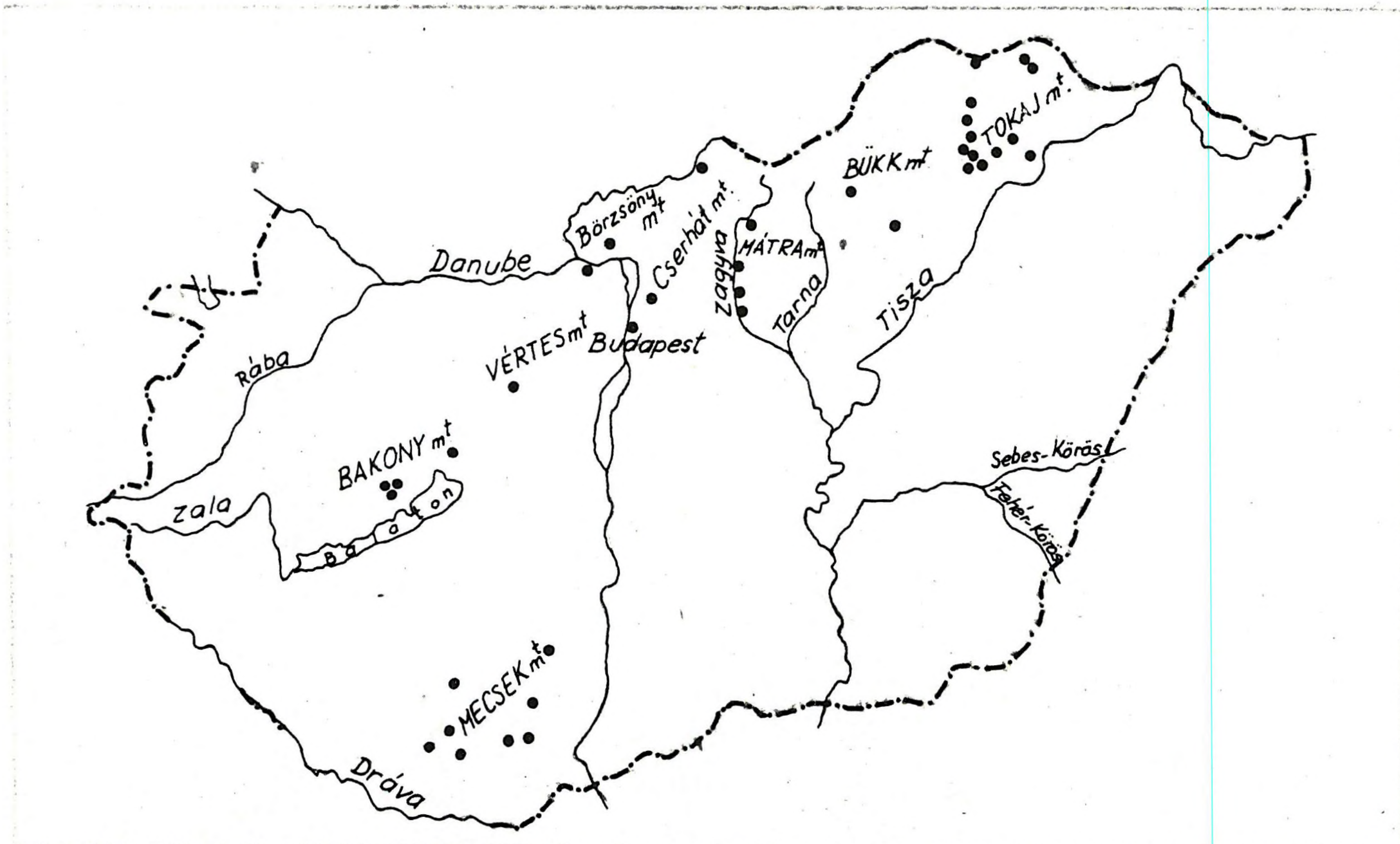


Figure 1.

M. Hajós

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FOSSZILIS KOVÁS EGYSEJTÜEK VIZSGÁLATÁNAK FÁCIESJELZŐ ÉS RÉTEGTANI JELENTŐSÉGE

Hajós Márta

Összefoglalás

A kovás egysejtüek vizsgálata világszerte egyre jelentősebbé válik a földtani és az iparági kutatások kapcsán. Különösen fontos azoknál az üledékeknél, melyek egyéb fossziliát nem tartalmaznak, s ezért rétegtani helyzetük, koruk bizonytalan. Segitségükkel hazánk területén is már számos "meddőnek" vélt üledék korát, rétegtani helyzetét sikerült tisztázni, s a földtani térképezés számos problémáját megoldani.

A kovás egysejtüek elsősorban savanyu, tufás-tufitos üledékekben, vagy ezekkel kapcsolatban előforduló diatomitokban találhatók, mert keletkezésük, elszaporodásuk feltételét, a házuk, vázuk felépitéséhez szükséges oldott kovasavat az üledékgyüjtőkben többnyire e kőzetek jelenléte biztositotta.

POTONIÉ 1920-ban, majd TALIAFERRO 1933-ban külön tanulmányában - számbavéve a krétától napjainkig képződött minden jelentős diatomaföld előfordulást - igazolta, hogy a diatomitok keletkezése mennyire függvénye a kalciumszegény, kovasavdus vulkáni kőzeteknek.

A Földtani Intézetben nem csupán őslénytani, hanem alkalmazott földtani szempontból is értékeljük a kovás egysejtüek vizsgálati eredményeit. E cél megvalósitása érdekében közvetlen feladatunk:

1.) hogy - egyes alapszelvények mikro- és biosztratigráfiai feldolgozásával összehasonlitó alapspektrumokat szolgáltassunk a további diatomás üledékek vizsgálatához;

2.) hogy az előfordulások üledéksorát rétegváltozásonként vizsgálva és a maradványokat statisztikusan értékelve megoldjuk az üledékképződés genetikáját;

3.) hogy a faj-meghatározások alapján megállapithassuk a fosszilis kovaalgák réteg ani és az egyéb kovás egysejtüek fácies- és korjelző értékét.

Az általunk vizsgált kovás egysejtüek kivétel nélkül vizben vagy vizhez kötötten élnek, ezért a viznek, mint élettérnek fizikai, kémiai tulajdonságai határozzák meg a bennük kialakult társulások összetételét. A fény, a hő, a viz mozgása, kémiai összetétele döntő szerepet játszanak e mikroorganizmusok elszaporodásában. E tényezők változásai változást idéznek elő az élőlények együttesében, az üledék szerves és szervetlen alkotóiban és ezeket a változásokat észleljük, közvetve, a mikroszkópban. Az időjárás-változások, hőmérsékletingadozások, áradások, a viz hőfokának, sótartalmának, szennyezettségi fokának változásai mind igen lényegesen befolyásolják a mikroflóra-mikrofauna kialakulását.

E fizikai és kémiai változások legérzékenyebb indikátorai a Diatomák, mert a kovás egysejtüek között faj és többnyire egyedszámban is a Diatomák a leggazdagabbak (több mint 20,000 faj és 600 genus ismert (SHIMER et SHROCK 1949)). Ezért nem véletlen, hogy a Diatomák ökológiája a legtanulmányozottabb. Mi is elsősorban ennek ismeretében vonjuk le paleobotanikai következtetéseinket, annál is inkább, mert a Diatomák mellett a többi, a kőzetben járulékos elegyrészként előforduló kovás egysejtüek ökológiája többé-kevésbé azonos azzal a Diatoma együttesével, melynek társaságában előfordulnak.

A kovás egysejtüek vizsgálatainak adatai, faciológiai-finomrétegtani értékelésre elsősorban akkor alkalmasak, ha nem elszigetelten egy-egy kiragadott csoportot, hanem az üledékben előforduló teljes maradványegyüttest vizsgáljuk, az őket bezáró üledék függvényében.

A kovás egysejtüek teljes maradványegyüttesének vizsgálata önként is kinálkozik, mert a kőzet feltárása, preparálása alkalmával az ásványi organikus szemcséket eltávolitjuk, s az igy nyert maradék jelentős része a kovás egysejtüek: Archaeomonasok, Silicoflagellaták, Ebriidák, Diatomák, Phytolithariák, valamint Radiolariák és kovaszivacsok héj és vázelemeinek halmaza. A maradványegyüttesben azonban sok esetben elszórtan gyengén kovásodott kitinhéju, de jellemző morfológiáju "incertae sedis" planktonformák is előfordulnak. Ezek szerepe jelentős, szintjelző lehet.

Ahhoz, hogy a fosszilis maradványokból az egykori biofáciesre helyesen következtethessünk, nem elegendő a kőzetmintában előforduló fajok meghatározása, hanem ismernünk kell a kovás egysejtüek életmódját, életterét is. Ezért a fosszilis kovás egysejtüek kutatása a tágabb értelemben vett "diatomológia" és a jelenkori kutatások = "Aktualforschung" szorosan összefüggnek.

Jelentősebb magyarországi diatomás üledékek a Mecsek, Bakony, a Vértes, Börzsöny, Mátra, Bükk és a Tokaj-hegység előterében és peremi medencéiben fordulnak elő (1. sz. ábra), felső-liász, oligocén, miocén, pliocén és holocén korban (I. - II. táblázat).

A felsoroltakból kitünik, hogy vizsgálatainkat elsősorban a Diatomák fáciesjelző tulajdonságaira alapozva és fokozatosan kiterjesztve az idősebb hazai oligocén, eocén, majd kréta rétegösszletek vizsgálatára is, fontos kronológiai megállapitásokat eredményezhetnek. Vizsgálataink alapján a kihalt fajok elsősorban az un. rovid fajoltőjü "vezérkövületek" nagyobb időegységek, időszakok, korok, emeletek elhatárolására szolgálnak. A harmad- és negyedidőszakban nem csupán a vezérkövületek, hanem a fajok társulásai is az üledékek részletes geokronológiai tagolására (kor, emelet, szint), sőt távkorrelációra (Ausztria, Bulgária, Csehszlovákia, Jugoszlávia, Magyarország, Románia), és telepek, rétegek azonositására szolgálnak.

ŐSLÉNYTANI VITÁK (Discussiones Palaeontologicae) 21. (1973) Budapest pp.41-49.

ASPECTS OF NOMENCLATURE, TAXONOMY, ECOLOGY, CENOLOGY, CLIMATOLOGY AND FACIOLOGY IN PALEOPALYNOLOGICAL STUDIES

by

Prof. E. NAGY

Regular palynological investigations of informative nature, intended to support geological studies were started in the early fifties and are still being conducted in the Geological Survey of Hungary. The palynological research work comprises more or less the whole geological time scale.

The results are aids for the geological mapping of the respective territories.

In the following, the methodological approach should be disscussed which may be of use for other palynologists working in similar conditions.

Paleopalynology has many difficulties. The importance of the really good and clean sampling, the different maceration technics depending on the nature of the sediments should simply be mentioned here.

One of the most important items of palynological work is the indentification of the forms. On account of the huge amount of the samples examined, particular care is taken to register the results as precisely as it is possible and to make as much photgraphs as possible.

The photographs have been made by the aid of conventional light microscope only. To enhance comparisons, the final photos represent 1000 x magnification. Our slides are stabilized preparates which allow investigators to carry out repeated analyses in ever fuller detail. The microscope coordinates are also recorded for forms which are considered to be worthy of attention.

Morphological indentification is the basis of all further work. The valid binominal nomenclature is used, according to the Rules of the International Code of Botanical Nomenclature.

For the purpose of detecting eventual botanical affinities, confrontation with living plants is possible to a different degree in function of geological time, in inverse ratio with it. In the case of earlier periods one is happy if some connection can be found betwen the fossil disperse spores and some major botanical taxa, perhaps with some macrorest. In younger periods of the Earth's history in principle the forms are nearer to the recent flora; however this fact does not make the study easier.

During the Tertiary several types of vegetation could be established. It is difficult to point out the differences between these and the recent flora of the tropical and subtropical zones of the Earth. There are many question marks left and naturally in the fossil relict assemblages of spores and pollen grains there are even more problems.

Ecological and cenological considerations are of some help in this respect.

The author tried in many cases to determine biocenosis. In some cases it was not possible to integrate some specimens with the ecological type. In these cases there are two alternatives:

1.) these forms are allochtonous, or
2.) their oekotype has been changed to another type. E.g. warm climate species develop step by step a flora of a lower temperature demand.

The found single or few specimens were also taken into consideration. The spore and pollen production of plants is very different. Moreover, the differences in the circumstances of fossilization are also considerable, so every single specimen can be characteristic of an association or facies or geological period. The author examined especially for the Neogene the spores and pollen grains of recent species similar to the fossil ones. Utilizing the possibility of the identification, paleoecological conclusions were drawn. In the author's work on Upper Pannonian lignites the changes of the paleovegatation, the paleocenosis, in time were described with particular attention to the sedimentological variations.

In an other work from South Hungary (Mecsek Mts) the paleofloral patterns and paleoecological evaluations were established (Fig. 1-2.).

From the indentification the spores and pollen grains, from the paleoecological and paleocenological results it is possible to draw conclusions as to the paleoclimate (Fig. 3.).

The taxa used for paleoclimatological evaluations are but rarely identifiable within present-day spores and pollens. The determination is considered successful only if the genera are identified. However, by the aid of some families, certain climatic conclusions can be drawn (e.g. Palmae, Sapotaceae, Symplocaceae, etc.). There are also some ubiquitous genera which do not allow a more precise estimation. In spite of the fact that plant remains are used first of all to evaluate the ancient climate, in the Miocene we are far from being able to apply directly in each cases the principle of actualism as it can be done in the Pliocene or Pleistocene.

By elucidation of botanical relations, mainly the temperature demands are cleared.

The conclusions drawn on the basis of the analysis of pollen spectra helped only in the reconstruction of the local climate, although the ancient vegetation was highly influenced by the microclimate. Our present knowledge is not sufficient for the evaluation of such details.

Changes of temperature can be due to differences in the height above the sea level. Very often only a realistic evaluation is possible on this basis. The author's researches, together with geological investigations, contributed to paleogeographic reconstructions. It is supposed that there was a mountain near the basin in the area studied. Thus the elements indicating a colder climate are interpreted as common highland elements of the subtropical climate.

On the basis of the pollen analysis there was hardly any possibility for estimating the precipitation conditions. At the same time the Ephedra, Ilex species and Compositae forms were taken for representatives of a drier climate.

As to the regime of winds it was supposed, relying upon the present-day conditions that what played a great role concerning pollen transport, could be the littoral or coexisting mountain-valley daily wind which brought the pollen material independently from the dominat wind into the sedimentation basin. Of course, if the daily wind direction coincided with the dominant one, it was able to bring the pollen grains from a very great distance. This air movement assumed pollen transport even in lacustrine phases. This hypothesis is justified by the fact that in the spectra pollen grains of highland plants are constantly found.

The areas studied show a littoral position. Because of their presupposed state as a wide-spread Pliocene inner lake shore, they assured a balanced climate for vegetation in the Late Neogene. In the whole Neogene the general type of the climate was subtropical.

A tropical climate is not manifested anywhere by vegetation; tropical floral elements are relatively few. Tropical floral elements can occur in subtropical areas as undergrowth (RÜBEL 1930, pp. 69-70.), it means that the presence of some tropical species do not absolutely indicate a tropical climate. The author interpreted as tropical elements some Bryophytae (Anthocerotaceae), the representatives of Echinatisporites, Polypodiaceoisporites and of the spores from the Cicatricosisporites and the Gleicheniidites species, the pollen grains representing the Cycadaceae and Acmopyle, the Sapotaceae family, Jussiaepollenites, Dipterocarpacearumpollenites species, some species (edmundi, euphorii types) of the Araliaceae family and of the Arecipites species.

An orogenic movement could be shown in the Mátra Mountains (north of Hungary) during the Pleistocene. As a consequence of JASKÓ's investigations (1947), we can assume that during the Pliocene the Mátra Mountains were 400-500 m higher than today. Therefore, where now we find the oak and in the higher regions the beech zone, during the Pliocene - if we take into consideration also the northern slopes of the mountains - it was the habitat of pines of a more elevated area (NAGY 1958, p. 138 and p. 271).

Examining through the Petőfibánya adit the Upper Pannonian brown-coal complex of Mátraalja, it was possible to evaluate the so called main coal-seam on the basis of 3 exposures and 2 boreholes. As the palynological analyses involved only the coal complex and chiefly the main seam, the climate results were much similar. Analyses of samples taken of small vertical intervals or rather the results of detailed studies (the intervals were generally of 20 cm) have shown that a finer evaluation could be made. At the paleoclimatological evaluation of the brown-coal facies, we had to account undoubtedly with a special local climate. I could distinguish four local climatic types:

a) the local climate of the marsh and fernwood,

b) of the coastal forest,

c) of the piedmont forest and that

d) of the higher mountain forests.

(NAGY 1958, pp. 126-130 and pp. 256-261.)

For the geologists one of the most important results is the faciological conclusion. To this purpose, the planktonic organisms are very useful which occur together with the spores and pollen grains in the slides.

There are typical forms indicating fresh-water environment (Ovidites ligneolus R. POT., Tetraporina quadrata BOLCH., Pediastrum sp.).

There are fossils characteristic of marine waters as well: Emslandia australiense (DEFL. et COOKS.), Crassosphaera concinna COOKS. et MAN., Tytthodiscus sp., remains of forams (microforams).

Actynocyclus octonarius EHRBG. and Thalassiphora pelagica EIS. et GOCHT for example are indicative of brackish environment.

Starting from the ecological nature of the known microfossils one attempts to determine that of the new species. For example Savitrinia miocaenica NAGY occurs with fresh-water species, or Margosphaera velata NAGY with Tytthodiscus mecsekensis, indicative of marine environment.

Comparing the palynological data with the results of foraminiferal studies, some conclusions can be drawn as to the facies and to redeposition. It is an other interesting and difficult question.

The redeposition from the older layers was taken into consideration which gives information about the circumstances of the formation of sediments. E.g. in the Neogene materials of the Mecsek Mountains many

Paleozoic-Mesozoic forms are found redeposited from the central Paleozoic-Mesozoic mass of the mountains.

Summarizing the results of palynology some biostratigraphic conclusions can also be drawn. The floral patterns reconstructed from the Mecsek Mts material are useful for local correlations in Hungary. At the end 3 figures are given as examples of the biostratigraphic method sketched above.

1. Borehole H. 53 in Mecsek Mts. The forms having similar morphological and ecological character were drawn together. The result was: the possibility of biostratigraphic zonation (Fig. 4.).

2. A borehole from North Hungary (Alsóvadász No. 1.). Here the species were drawn up in the order of their disappearence.

3. Borehole H. 53 from Mecsek Mts where the climatical change can be seen in time scale from the Upper Helvetian till the Upper Pannonian. This part of the diagram has the same character as that of an other borehole in East Mecsek Mts (Komló 120) and of other samples of outcrops from the West Mecsek Mts.

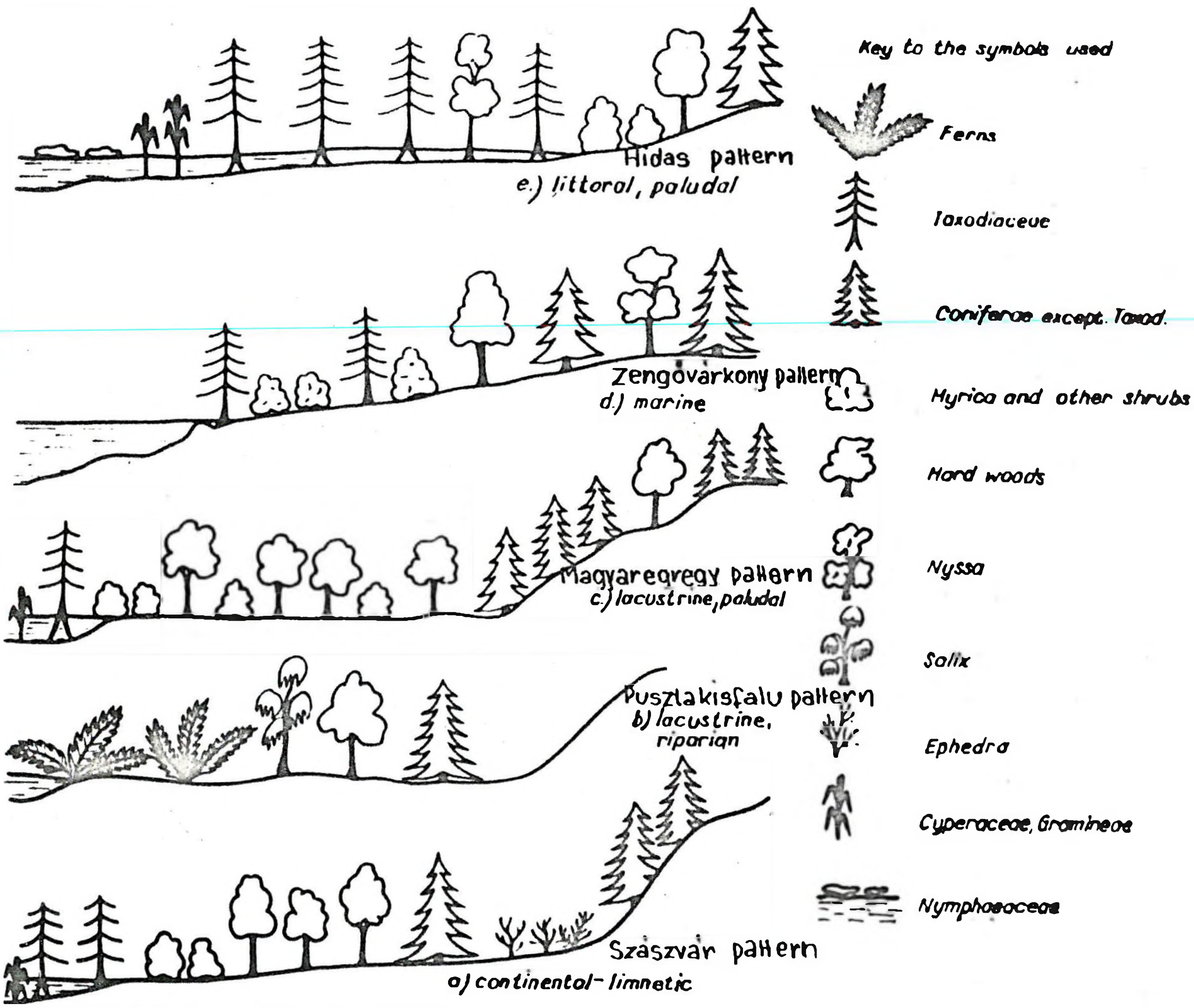

Fig. 1. Reconstructions of vegetation from the Miocene of the Mecsek mountains

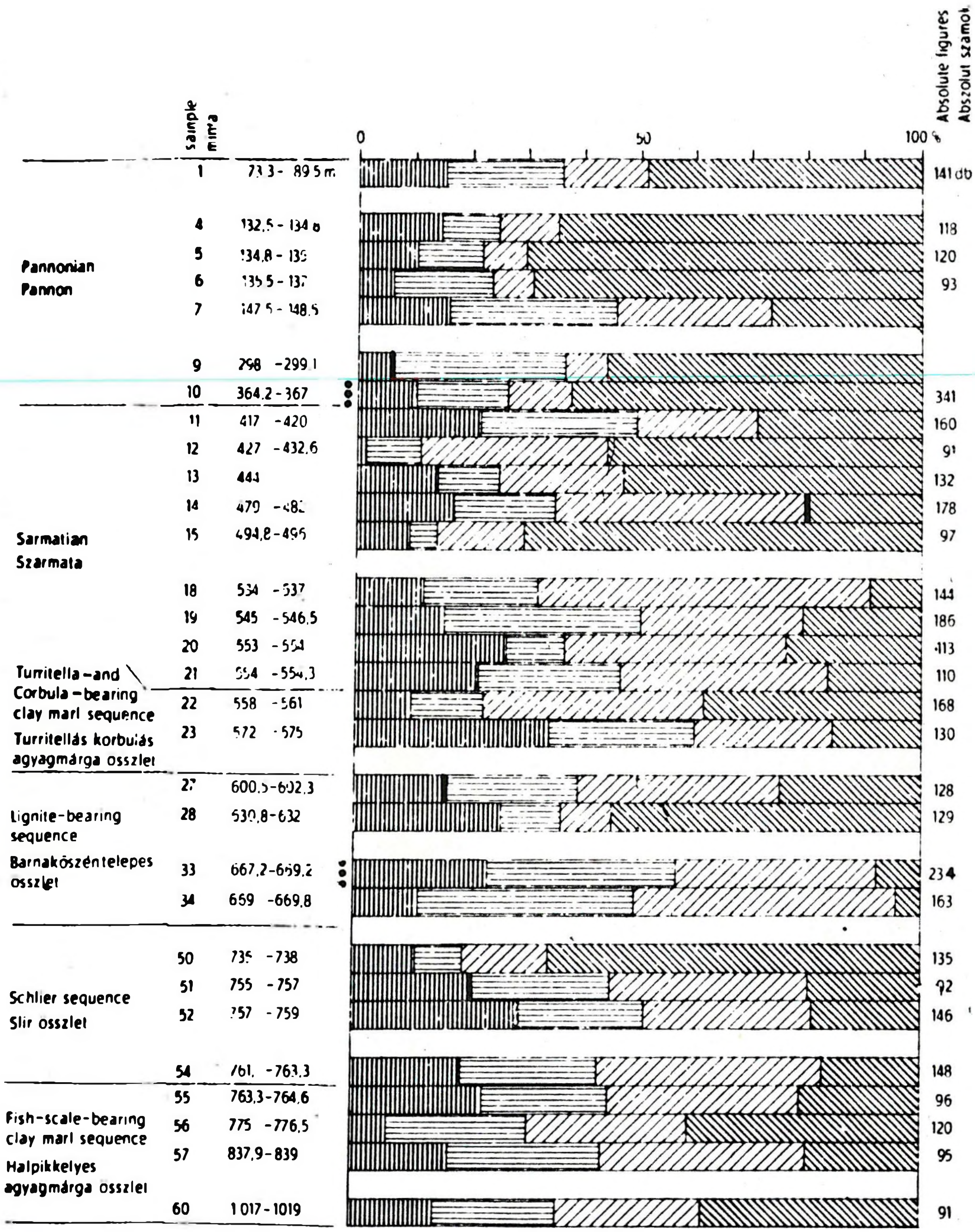

Fig. **2.** Paleoecological diagram of borehole Hidas-53.
2. *ábra.* Hidas 53. sz. fúrás paleoökológiai diagramja.

1 Swamps-and-marsh forests, 2 riparian forests, 3 mixed deciduous forests, 4 deciduous and coniferous forests of the piedmont areas and hillsides, 5 Botryococcus 6 Ephedra

E. NAGY

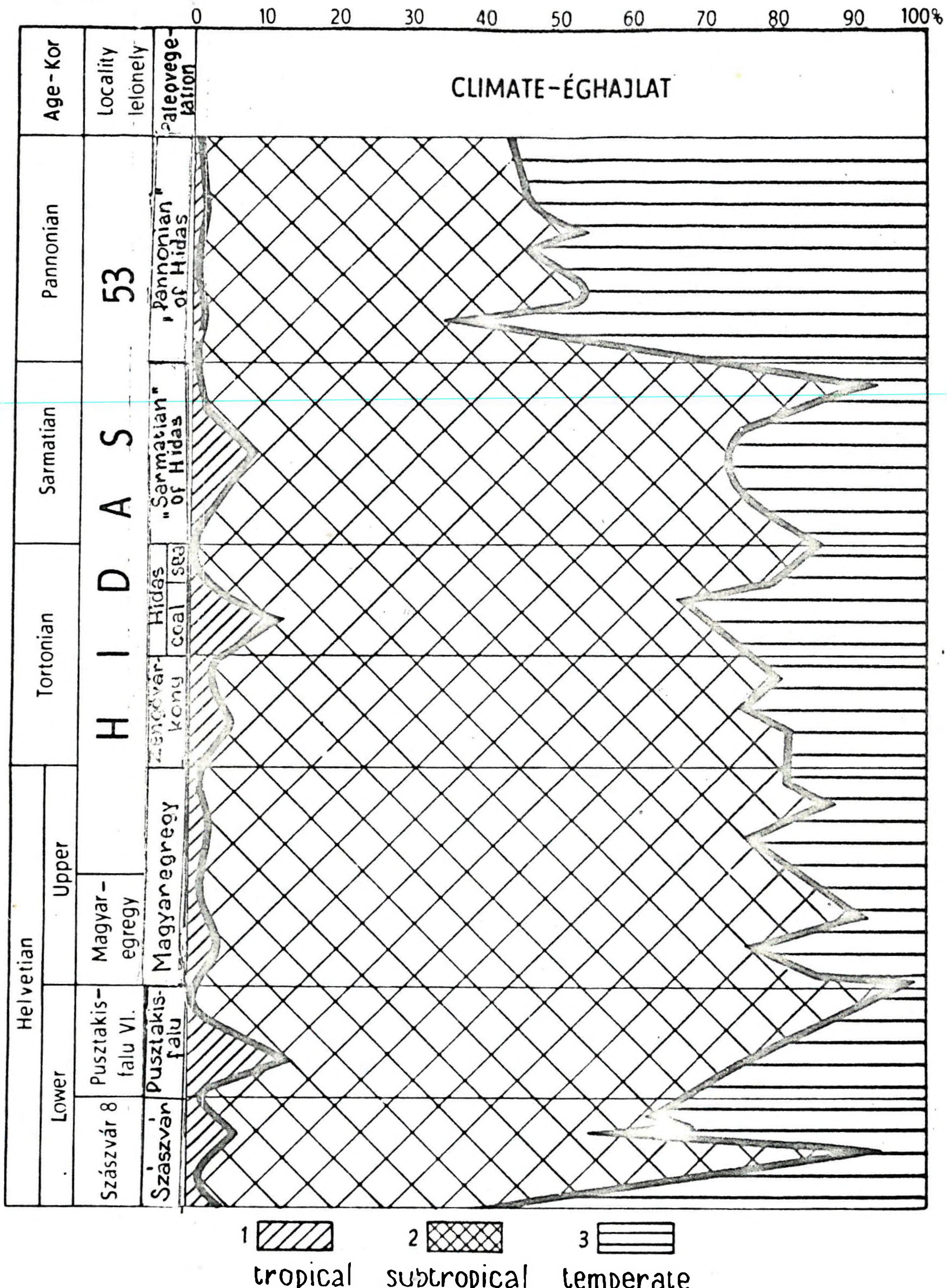

Fig. 3.

Climatic diagram for the Mecsek Mountains Neogene

E. NAGY

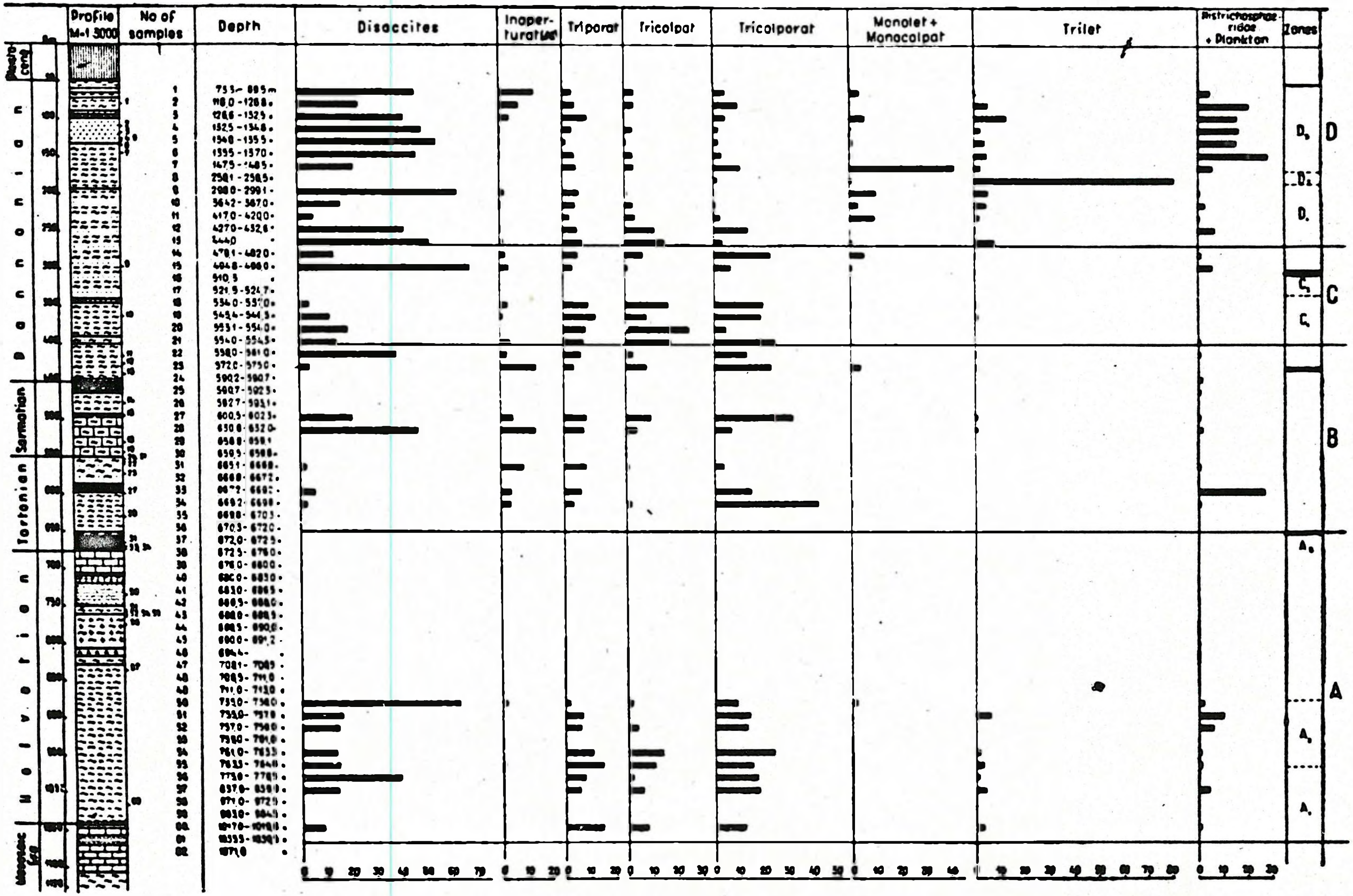

Fig. 4.
Diagram of Borehole Hidas 53.

E. NAGY

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A PALEOPALYNOLÓGIAI KUTATÁSOK NOMENKLATURAI, TAXIONÓMIAI, ÖKOLÓGIAI, CÖNOLÓGIAI, KLIMATOLÓGIAI ÉS FACIOLÓGIAI VONATKOZÁSAI

Nagy Lászlóné

Összefoglalás

A paleopalynológiai kutatás néhány módszertani vonatkozásu kérdését tárgyalja a szerző. Az anyaggyüjtésen, laboratóriumi munkán tul-menően a meghatározás, a morfológiai, botanikai azonositás nehézségeiről és fontosságáról esik szó. Ezek pontosságán mulik minden további tudományos és gyakorlati következtetés. A hazai palynológiai kutatásaink paleoklimatoló-giai zónák felállitását is eredményezték. Faciológiai következtetések - felhasz-nálva az áthalmozódást is - különösen fontosak az ipari kutatások számára is.

A levonható biosztratigráfiai értékelés a geológiai térképezés-nek ad komoly segitséget. Természetesen a palynológiai értékelés együtt történik a mikro- és makropaleontológiai, üledékföldtani adatokkal. Három neogén rétegekből készült diagrammon szemlélteti a szerző a különböző értéke-lési lehetőségeket.

ŐSLÉNYTANI VITÁK (Discussiones Palaeontologicae) 21. (1973) Budapest pp. 65-71.

PALYNOLOGICAL PRACTICE IN THE INVESTIGATION OF LIASSIC COAL MEASURES IN THE MECSEK MOUNTAINS

by

J. BÓNA

In the Mecsek Mountains from the Late Permian up to the Cretaceous a practically unintermitted sedimentation occurred. After E. NAGY the sedimentary rocks formed during this interval belong into two major cycles. The earlier cycle is Late Permian - Rhaetian, and the later one Jurassic - Cretaceous. The earliest, continental part of the latter cycle is the lowermost Jurassic coal-bearing sequence of 200 to 1200 m in thickness, which develops continuously from the underlying 150 to 200 m thick Rhaetian sediments of fluvial, deltaic and lacustrine facies.

The above mentioned facts determine the aims of palynological studies on the Lower Jurassic of the Mecsek Mountains, as follows:

1.) Approximative determination of the degree of carbonization;

2.) Designation of the Triassic/Liassic boundary;

3.) Separation of the fossil swamp zones and correlation of the coal seams;

4.) Outlining of the paleogeography.

1.) Approximative determination of the degree of carbonization

The Lower Jurassic coals of the Mecsek Mountains are varied from palynological point of view. In the central part of the coal field region (in the Komló, Máza South and Tornavárafja South areas) seams rich in pollen-grains are present. The here mined coals are of high volatile content. In the Southern coal-fields (i.e. at Pécs, Vasas, Hosszuhetény) the seams are free from pollen material. Here the degree of carbonization is equal to, or higher than that of the fat coals. The same holds true for certain northern coal-fields (e.g. Szászvár. Császta, Máza. Tornaváralja). As suggested by NÉMEDI-VARGA, Z. the high degree of carbonization as well as the vitritization of the pollen exine in the lowermost Jurassic coals of the Mecsek Mountains can be due to tectonic stresses rather than to sediment-pressure. As metallurgical coke basic materials, the high volatile coals of the pollen--rich seams are the most valuable.

2.) Designation of the Triassic/Liassic boundary

While the coal seams of the Pécs area - due to the high degree of carbonization - yield no spore and pollen material, the underlying Upper Triassic rocks occasionally yield numerous sporomorphs. The preservation is in the most cases poor, but the Upper Triassic floral character of the Mecsek Mountains is determinable even on the basis of the fragmentary specimens. A well determinable Upper Triassic pollen association has been found in the underlying rocks of the Nagymányok coal-field. The standard material derives from Boreholes P. 28 and P. 39. The sequence developed here represents the Upper Triassic reference section for the Mecsek Mountains. During the studies it was proved, that in the Upper Triassic certain spore and pollen forms appear which are missing in the coal seams, but reappear in their hanging wall. The hitherto determined Upper Triassic and Lower Liassic flora consists of altogether 128 forms. Among those 45 forms are confined to the Upper Triassic and 38 to the Lower Liassic, while the rest can be found both in the Triassic and Liassic.

In the Upper Triassic the highly sculptured spores and pollens are more common as in the Lower Liassic. The ephedrids are found in the Triassic only, suggesting more arid climate for the Late Triassic as compared to the Early Liassic.

3.) Separation of the fossil swamp zones and correlation of the coal seams

On the basis of palynological studies three well separable swamp zones can be distinguished within the Lower Jurassic coal-field region of the Mecsek Mountains. These following swamp zones occur in superimposition as well as juxtaposition.

a.) Deep-swamp zone, mainly allochtonous (high-land) pine pollen grains,

b.) Shallow-swamp zone, mainly with allochtonous (high-land) pine pollen grains and Calamospores,

c.) Forested-swamp zone, mainly with fern-spores, pteridosperm pollen grains and Inaperturopollenites reissingeri.
This is considered a gymnosperm pollen grain, belonging to the family Palyssiaceae or Podozamitaceae. This zone is the most extended and commonest type in the Mecsek Mountains' Lower Jurassic coal-fields.

The zonal differentiation of the swamps is indicated by the pollen and spore enrichment, as shown in Fig. 1. The coal-petrological investigations by Mrs. A. PAÁL proved that the coal-petrological and palynological changes are correlative. Accordingly, the two methods can be checked by each other.

The deep-swamp, shallow-swamp and forested-swamp zones are characterized by specific features. By close sampling vertical and horizontal changes are traceable. The palynological data suggest identical floral associations through the whole coal-bearing sequence (Hettangian - - Lower Sinemurian). This is supported by the coal-petrological studies too.

This is why correlation is difficult. The few spores and pollens confined to certain seams are too sporadical for useful correlation. However, in certain coal seams the ratio and order of the strip-types is determined and within limited area these are characteristic. Similarly characteristic is the succession of the pollen floras due to facies changes. The genetic diagram of two neighbouring shafts is usually identical.

4.) Outlines of the paleogeography

The main problem is the position of the land-masses on which the Upper Triassic - Lower Liassic flora of the Mecsek Mountains existed. Although the pollen-analitical data are insufficient for an exact reconstruction, the available facts allow us to outline some affinities of the Mecsek Mountains flora.

To the West from Hungary the Upper Triassic - Lower Liassic floras were studied in detail. The Triassic flora of the Eastern Alps is known from the works of KLAUS (1969), the German Basin was studied by SCHULZ (1967), MÄDLER (1964), REISSINGER and LESCHIK (1955). The results of the studies on the Kössen Marls (Rhaetian, uppermost Triassic) were described by VENKATACHALA and GÓCZÁN. The Karnian assemblage of Borehole Mesteri 1. was published by E. HUTTER (1964). The present writer studied coal samples deriving from the Gosau Liassic and Upper Triassic materials from Boreholes Mány-24, Mány-52 and (more recently) from Borehole Vállus-3. The data suggest that the Upper Triassic of the region to the North of Lake Balaton contains many spores and pollens which are common in the German and Austrian areas. For example the species of Granuloperculatipollis, Aratrisporites, Dabinasporites, Ovalipollis ovalis, Triancoraesporites, pine pollens, Camerosporites, Euzonalosporites and Duplicosporites. These spores and pollens are missing in the Upper Triassic and Lower Liassic of the Mecsek Mountains, as well as in the Upper Triassic and Liassic of Schonen (Sweden) and from the Liassic of Eastern Poland. The pollen floras of the latter regions are known principally from the works of MALJAVKINA (1953), NILSSON (1958) and ROGALSKA (1954, 1956). The resemblance between the Polish, Russian, Swedish floras and the flora of the Mecsek Mountains is striking. In conclusion, there was no floral exchange between the Bohemian Mass and the Rhodope Mass during the Late Triassic and the Early Liassic.

The region of the Balaton Highland and the Keszthely Hills was influenced by the vicinity of the Bohemian Mass during the Late Triassic. The Mecsek Land and the Bohemian Mass were separated by a consolidated sea, forming an inpenetrable barrier for the graniferous plants. According to the paleogeographical map of E. NAGY, the axis of this sea-branch extended roughly along the line of Lake Balaton, then curved to the North towards Zakopane in Poland, and probaly continued in broad branch towards Sweden. It is supported by the paleogeographic maps of Poland, although the tracing of the connection is doubtful in the Carpathians. On the eastern coastal region of this sea-branch existed a flora very similar to that of the assemblage of the Upper Triassic - Lower Liassic of the Mecsek Mountains.

During that time the Rhodope and the Podolian Mass were in floral connection with the Russian Platform. Between the Russian Platform and these large islands repeated floral exchanges existed. The Bohemian Mass, however, was isolated from these latter, and floral exchange did not occur, not even by the way of islands.

The possibilities of the floral isolations and migrations are sketched in Fig. 2.

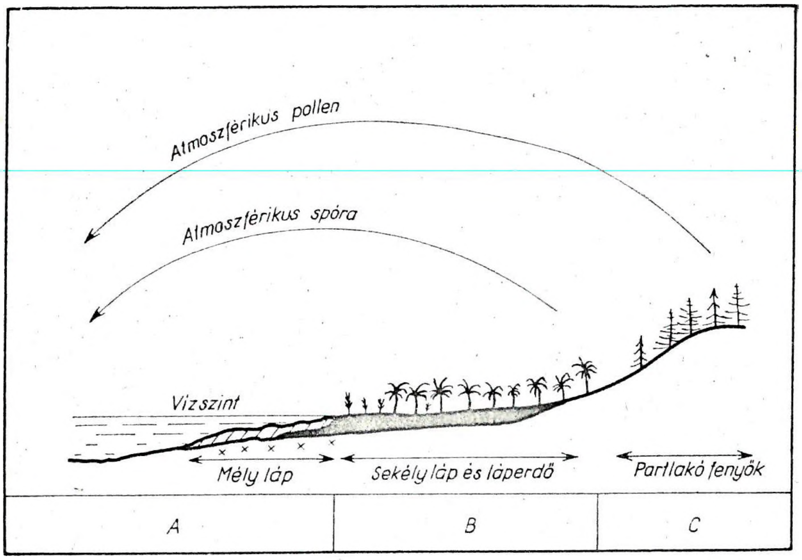

Fig. 1.

The principle of pollen and spore enrichment and differentiation.

Legend: A.: Atmospheric spore and pollen supply, B.: The majority of the falling spores preserved, C.: The majority of the falling spores destructed.

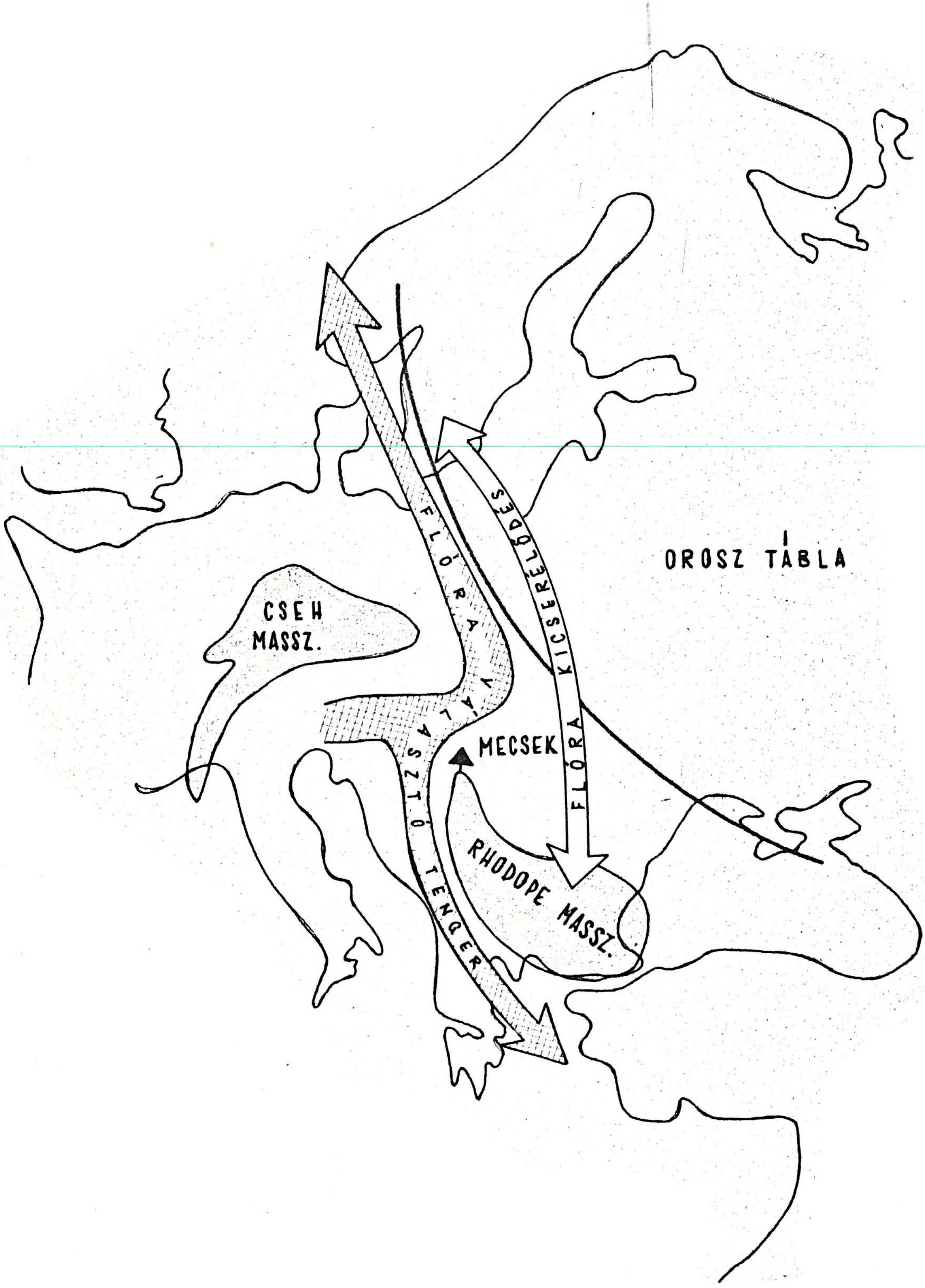

Fig. 2.

Paleogeographic sketch map indicating the floral connections of the Mecsek Mountains

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ŐSLÉNYTANI VITÁK (Discussiones Palaeontologicae) 21. (1973) Budapest pp. 73-80.

FORAMINIFERAL STUDIES ON MIOCENE FORMATIONS OF HUNGARY

by

I. KORECZ-LAKY

The large-scale drilling made for exploration and mapping purposes provided an oppotunity to study the Miocene microfauna in Hungary. On the basis of the stratigraphically important Foraminifera species and foraminiferal assemblages the Miocene can be divided into stages, horizons and facies. (Table I.)

The Oligocene rocks are overlain by the Eggenburgian (Burdigalian) terrestrial variegated clay, then marine clay-marl, sandy marl and fine-grained sandstone beds. These latter marine beds contain a relatively rich Foraminifera fauna of 96 determinable forms (NYIRŐ 1967). In the fauna the genera Cibicides, Globigerina and Nonion are present with the greatest species number. Regarding the specimen number, the buliminids, cassidulinids and the species Robulus inornatus, Rotalia beccarii, Globigerina woodi woodi, Globigerina ciperoensis ciperoensis and Gl. ciperoensis angustiumbilicata are dominant. The faunal constitution coincides with that of Southern Slovakia and the Burdigalian beds of Eggenburg. Characteristic is the minute size of the specimens, indicative of the sandy facies rather than the salt-content. The microfauna is completed by several sponge-spicules, echinoderm spines and small fish teeth.

The depostits of the Ottnangian (Lower Helvetian) are represented by rhyolitic tuffs (the so-called "Lower Rhyolitic Tuffs"), brown-coal measures and Cardium-bearing clay-marl beds. Foraminifers of greater specimen and species number occur only in these latter, Cardium-bearing beds. Here two Foraminifera horizons (lower and upper) can be distinguished. The lower horizon yields exclusively benthonic forms, i.e. rotaliids, nonionids and Elphidium, while the upper is characterized by the planktonic bolivinids, globigerinids and Cibicides. In the unproductive intercalations of the coal measures fragile agglutinated forms of the genus Miliammina can be found, indicating the facies only, without age-determining value.

The rock-types of the Carpathian (Upper Helvetian) -- the Oncophora-sand, the Chlamys-bearing sandstones and the Schlier beds -- are rich in Foraminifera. In the Schlier beds a biofacies containing mainly benthonic, an other yielding agglutinated (particularly trochaminids), and a third, rich in planktonic forms can be distinguished.

The most characteristic elements of the benthonic assemblage are the species Uvigerina graciliformis, Dyocibicides biserialis, Plectofrondicularia diversicostata, Robulus inornatus, Amphimorphina haueriana. In addition several specimens of the genera Dentalina, Cibicides, Bulimina, Spiroplectammina and Bolivina complete the assemblage. In the horizon rich in planktonic elements all of the above mentioned forms can be found, complementary are the species Globigerina woodi, Gl. foliata, Gl. juvenilis, Gl. concinna, Gl. apertura, Gl. bulloides and Globorotalia acostaensis. The minute-sized forms of this assemblage can be found also in the Oncophora-sands. In the microfaunas of the Carpathian rocks sponge-spicules and skeleton-portions, occasionally with great profusion are present. The association is completed by echinoderm spines, rare fish remains and radiolarians. This type of Carpathian sediments are exclusively known to N-NE of the river Danube line. To the South of this line an other facies, the so-called "Fish-scale clay-marl" is represented. Foraminifers (e.g. Globigerina bulloides, Rotalia beccarii) in this Fish-scale clay-marl can be found in the ingressive intercalations only. On the other hand, the great profusion of sponge-spicules and skeleton-portions, fish remains and radiolarians are characteristic. The uppermost member of the Carpathian is the pumiceous, biotite-rich rhyolitic tuff overying the Schlier beds. This tuff-horizont is known as the "Middle Rhyolitic Tuff" in Hungary. Within the rhyolitic tuffs only the clayey strata yield scarce microfauna (Rotalia beccarii, Nonion granosum).

The volcanic tuffs are overlain uncomformably by the sediments of the Badenien (Tortonian). In the clay-marl beds of the Lower Tortonian the Foraminifera fauna is constituted by a mass of planktonic elements and the genera and species of the family Lagenidae. Here first appear Orbulina universa and O. suturalis, the species which are dominant together with Globigerinoides trilobus, Gl. quadrilobatus and Gl. rubra in the assemblage. With smaller specimen number the species Globigerinoides bisphaericus, Globigerina drury, Gl. diplostoma, Gl. glomerata, Gl. bollii and Globorotalia scitula are represented in the fauna. The species Globoquadrina altispira, G. conglomerata, G. globosa and G. dehiscens are also present. Beside the planktonic forms the benthonic elements are also of greater quantity. The predominance of the species of the family Lagenidae is characteristic.

During the basinal deposition of the Lagenidae beds, in the near-shore areas the Leitha limestone was formed. In this peculiar near-shore complex fine-grained sandstone, sandy marl, crumbly to massive limestone beds alternate. In the near-shore sediments of the Lower Tortonian, in the so-called "Lower Leitha Complex" the species Amphistegina haueriana, Heterostegina costata, H. granulatatesta and H. papyracea gigantea are characteristic. Additionally other Tortonian forms, i.e. the species Asterigerina planorbis, Elphidium crispum, Siphonina reticulata, Uvigerina pygmoides etc. are also present. The microfauna is completed by bryozoans, lithothamnia and echinoderm remains.

In the Bakony and Mecsek Mountains onto the Lower Tortonian clay-marls or the Lower Leitha Complex succed brackish-water, fresh-water beds containing brown-coal measures. In these sediments certain euryhaline species are present with small specimen number (Rotalia beccarii, miliolids).

Overlying the brown-coal measures follow the shallow-water Corbula-Turritella-bearing beds of the Upper Tortonian. These have been divided into three parts on the basis of the Foraminifera. In the immediate overlying beds of the brown-coal measures the bulk of the fauna is represented by the species of the genus Rotalia, therefore it is named "Rotalia Horizont". Characteristic species are the Rotalia beccarii, R. papillosa, Pyrgo inornata, P. clypeata, P. simplex and Elphidium crispum. Above the Rotalia Horizont, due to the increasing transgression, fine-grained, clayey sediments succeed. The typical feature of its rich foraminifer fauna is the presence of the agglutinate forms, but additionally numeros calcareous and planktonic elements also can be found. These beds form the the "Spiroplectammina Horizont", with the characteristic Ammodiscus miocenicus, Philopsammina adanula, Ph. hungarica, Haplostiche rudis, Sigmoilina celata, Martinottiella communis, Textularia agglutinans, Spiroplectammina carinata, Sp. deperdita, Sp. scaligera, Globoquadrina posonensis, Globigerina microstoma, Gl. eamesi, Globigerinoides rubra, Adelosina laevigata, Ptychomiliolina separans species.

The Foraminifera assemblage of the Uppermost Tortonian is characterized by the profusion of the species of the family Buliminidae. In the fauna of this "Buliminidae Horizon" the species Uvigerina tenuistriata, U. venusta lieringensis, Bulimina elongata, B. pupoides, B. buchiana, Cassidulina oblonga, Bolivina dilatata and Globigerina bulloides occur in great specimen number.

The heteropic, near-shore facies of the Corbula-Turritella-bearing complex divided into Rotalia, Spiroplectammina and Buliminiade Horizons is the Upper Leitha Complex. Characteristic rock-types are the Bryozoa-Ditrupa- and trace-fossil-bearing sands and sandstones. The determinable Foraminifera fauna of the sandy beds of the Upper Leitha Complex consists of Borelis melo, Peneroplis planatus, Dendritina elegans, D. haueri, Vertebralina foveolata and Spirolina austriaca. On the basis of the different Foraminifera assemblages, the Lower and Upper Tortonian Leitha Limestones can be easily distinguished.

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The brackish-water sediments of the Sarmatian succeeds continuously onto the Tortonian. The boundary can only be drawn on the basis of paleontological studies. In the Sarmatian of Hungary the following facies can be proved by means of Foraminifera:

Miliolidae facies in the clay-marls of the basal Sarmatian. In the fauna the genera and species of the family Miliolidae are dominant.

Cibicides facies is characterized by the profusion of the species Anomalina badenensis and Cibicides lobatulus.

Ammomarginulina facies with the species of the genera Ammomarginulina and Ammobaculites.

These assemblages, constituted by thin-shelled, agglutinate forms lived in near-shore, brackish-water basins, which were occasionally connected with the open sea.

The Nodophthalmidium facies is known from sandstone and marl beds. Besides the species Nodophthalmidium sarmaticum and Articulina problema the genera Meandroloculina and Nubecularia can also be recognized. The genus Nubecularia, characteristic of the Russian Middle Sarmatian (Bessarabian), marks rather the facies, owing to its affinity to calcareous sediments.

The Rotalia beccarii facies is characterized by the great specimen number of the nominate species. Remarkable is the minute size of the rotaliids, probably due to some derease in salinity.

Nonion granosum facies. In the clay beds the species Nonion granosum occurs in great specimen number. The faunal assemblage is completed by the species Elphidium crispum, E. hauerium, Rotalia beccarii and some miliolids.

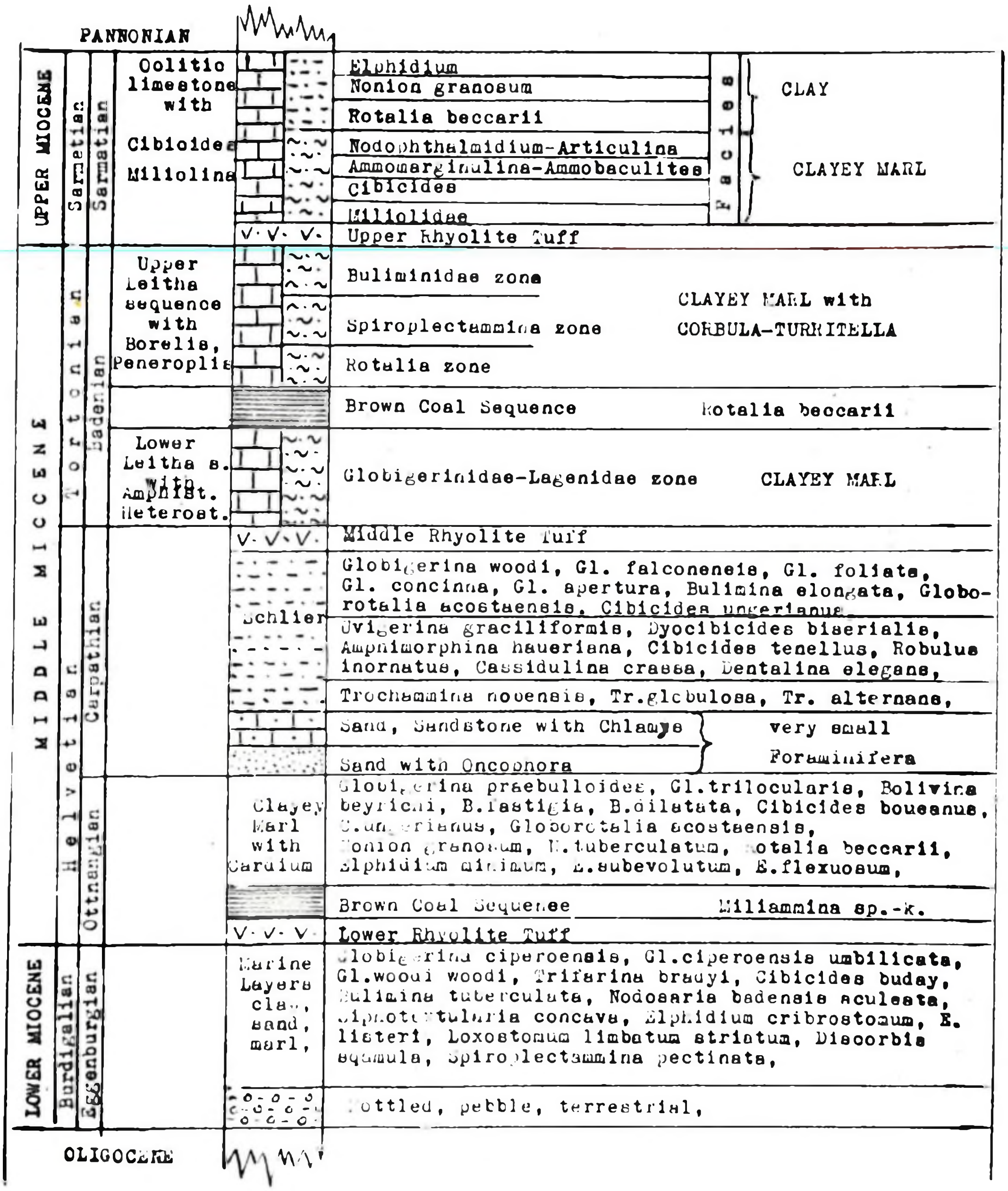
These latter three foraminiferal facies are characteristic of the basinal development of the Sarmatian.

The above mentioned listings do not mean succession, because the facies occur alternatingly or in reverse order, too. On the basis of our studies the Nonion granosum facies can be usually found in the upper, the Nodophthalmidium facies in the middle, and the Miliolidae facies in the lower part of the Sarmatian.

The Sarmatian near-shore sediments are represented by Milio-lina- and Cibicides-bearing, oolitic limestones, and subordinate calcareous marls.

Table I.

FORAMINIFERAL ASSEMBLAGES OF HUNGARIAN MIOCENE DEPOSITS



I. Korecz-Laky

FORAMINIFERA VIZSGÁLATOK MAGYARORSZÁG MIOCÉN KÉPZŐDMÉNYEIBŐL

Koreczné Laky I.

Összefoglalás

Magyarország miocén összlete a rétegtani szempontból fontos Foraminiferák és Foraminifera együttesek alapján emeletekre, szintekre és fáciesekre tagolható.

Legidősebb miocén lerakódásaink, a burdigalai (eggenburgien) emeletbe sorolható tengeri anyagmárga rétegek, viszonylag gazdag Foraminifera faunát tartalmaznak. A fauna összetétele megegyezik a dél-szlovákiai, valamint az eggenburgi rétegek azonos koru faunájával.
Az alsó-helvéti (ottnangien) emelet üledékeit riolittufa (u.n. alsó riolittufa), barnakőszéntelepes összlet és Cardiumos agyagmárga képviselik. Foraminiferák nagyobb faj- és egyedszámban csak a Cardiumos összletből mutathatók ki.
A felső-helvéti (karpatien) emelet képződményei - Oncophorás homok, Chlamysos homokkő és slir rétegek - Foraminiferákban már igen gazdagok. Kimutatható egy agglutinált házu, főleg Trochamminákat tartalmazó, egy bentoszban és egy planktonban gazdag biofácies. Az emelet képződményei ilyen kifejlődésben a Duna vonalától É-ÉK-re ismeretesek. A Duna vonalától délre más fácies, a halpikkelyes agyagmárga képviseli, gyér Foraminifera faunával. Az emelet zárótagja a biotitos, horzsaköves középső riolittufa.

A vulkáni rétegekre diszkordánsan települő alsó-tortonai (badenien) képződményeket gazdag Foraminifera társulás jellemzi. Itt jelennek meg először az Orbulina fajok. A lebegő formák mellett jellemző a Lagenidae család fajainak vezető szerepe. Amig a medencékben a Lagenidaes - Globigerinás

rétegek rakódtak le, addig vele egyidőben a peremi részeken a lajtamészkő jellegzetes partszegélyi képződményei (homokos márga, finomszemü homokkő, laza és tömött mészkő) települtek. Jellemző Foraminiferái az Amphisteginák és Heterosteginák. A Bakony és a Mecsek-hegység területén az alsó-torton képződményekre barnakőszéntelepeket tartalmazó csökkentsósvizi, édesvizi rétegek következnek. A barnakőszéntelepek fedőjében felső-torton (badenien) Corbulás-Turritellás agyagmárga rétegek települnek, melyek Foraminiferák alapján 3 szintre (Rotalitás, Spiroplectamminás, Buliminidaes) tagolhatók. Heteropikus fáciese a peremeken a felső lajtamészkő, melynek jellemző alakjai a Borelisek, Peneroplisok, Dendritinák. A Foraminifera fauna különlegessége révén az alsó- és felső-torton lajtamészkövek jól elkülönithetők.

A szarmata emelet csökkentsósvizi rétegei üledékfolytonossággal települnek a torton összletre. Az izopikus fáciesü rétegek elkülönitése csak az őslénytani vizsgálatok alapján lehetséges. Igy a szarmata összleten belül Miliolidaes, Cibicideses, Ammomarginulinás, Nodophtalmidiumos, Rotalia beccariis, Nonion granosumos és Elphidiumos fácies mutatható ki. A szarmata emelet medenceperemi kifejlődéseit Miliolinás, Cibicideses és oolitos mészkövek, alárendelten mészmárgák képviselik.

A magyarországi miocén képződmények Foraminiferás társulásairól eddigi vizsgálataink alapján ezt a képet tudtuk kialakitani, mely a további kutatások során még teljesebbé válhat.

ŐSLÉNYTANI VITÁK (Discussiones Palaeontologicae) 21. (1973. Budapest pp. 81-89.

EOCENE STRATIGRAPHY OF THE DOROG BASIN, BASED UPON LARGER FORAMINIFERA

by

M. JÁMBOR - KNESS

The author has been studying larger Foraminifera since nearly 10 years in the Geological Survey of Hungary. Eocene stratigraphy being based on the larger Foraminifera, their study is of practical importance partly for geological mapping (i.e. to distinguish stages and horizons) and partly for the raw material exploration (e.g, in the Dorog Basin below the Nummulites subplanulatus horizon of the Ypresian practically always can be found the brown coal-bearing member of clays, non-fossiliferous sands, sandstones or freshwater limestones.)

Eocene deposits are exposed in a considerable part of Hungary: in the Transdanubian Central Mountains, in the Naszály Hills on the left bank of the river Danube and in the foreland of the Bükk Mountains. As revealed by oil, water and deep-structure drilling, buried Eocene rocks are present in almost the whole Transdanubia and in the central part of the Great Hungarian Plain.

The present paper is a brief survey of the larger Foraminifera of the Dorog Basin and a summary of the stratigraphic succession of stages and horizons based on the larger Foraminifera species. This succession, with minor modifications, has been the basis of the Dorog Basin Eocene stratigraphy for 100 years.

Even in the present days, the Dorog Basin Eocene stratigraphy is relying upon the stratigraphic data by HANTKEN (1871) and ROZLOZSNIK - - SCHRÉTER - TELEGDI - ROTH (1922), enlarged with recent contributions (Table I.). This stratigraphic subdivision is shown on the left side of Table I.

By the side of this column is placed the idealized section of GIDAI (1969).

All the formations figured here, with the exception of the Nummulites subplanulatus-bearing clay-marls are exposed in the area. The local, relatively thin Upper Lutetian brown coal-bearing member is not developed here.

In Table I, some thinner beds are represented jointly, relying upon their faunistical and lithological similarities. On the right side of Table I, is shown the Nummulites zonal succession, and the middle portion presents the vertical range and the quantitative distribution of the larger Foraminifera species known from the Dorog Basin.

The larger Foraminifera are grouped according to the succession of their appearance. The thickness of the lines indicates the abundance, the lenght the vertical range of the respective species (e.g. the range of the Nummulites striatus extends from the Middle Lutetian up to the Lower Priabonian). On the right side of Table I, the planktonic foraminiferal zones of the Dorog Basin, after L. ZILAHY-VITÁLIS (1967) are also shown.

In Hungary, the most common bedrock of the Eocene is Upper Triassic Dachsteinkalk. Locally, as in the Bajót area, the Eocene overlies Jurassic limestones or cherty sediments, while in other places as in the Lábatlan region, Lower Cretaceous marls. Owing to the unconformity, the stratigraphic hiatus and the lithological difference as well, the Eocene and the Mesozoic rocks can be easily distinguished.

Before starting the review of the lowermost Eocene it should be noted that the subdivision esteblished by ROZLOZSNIK - SCHRÉTER - - TELEGDI - ROTH (1922) has been somewhat modified. Thus the Sparnacian constituting the earliest age of the Paleocene according to the previous authors, is regarded here, on the basis of their positions in comparison to foraminifer-bearing Ypresian sediments, as the earliest portion of the Lower Eocene.

LOWER EOCENE

Sparnacian Stage

1.) Variegated clay, sandstone, freshwater limestone member underlying the brown coal-bearing member. Deposited under terrestrial conditions. The variegated clays are non-fossiliferous, and the mollusc fauna of the freshwater lime stones indicates the facies rather than the age of the sediments.

2.) Brown coal-bearing member. It comprises freshwater limestones and brackish-water marl intercalations, and can be divided into numerous facies-areas within the basin. The thickness varies betwen 10 and 20 m, comprising 3 to 7 coal seams. In the freshwater limestone intercalations the gastropod species Bithynia carbonaria MUNIER-CHALMAS occurs in great profusion in some places.

As it was mentioned above, the brown-coal-bearing member and its underlying rocks, both lacking diagnostic fossils, are ranged into the Sparnacian, on the basis of their position in the sequence.

Ypresian Stage

The brown coal deposition of the Sparnacian was ended by a transgression changing the area into brackish-water lagoons. Then these lagoons were overflooded by the sea and so an open-sea connection came into being with the lagoons of the surrounding area. This first marine period of deposition lasted till the end of the Ypresian. The characteristic shallow-water marine sediments of the Ypresian are ranged into the

3.) Nummulites subplanulatus and Operculina-bearing clay-marl member. This includes the N. subplanulatus and N. anomalus - N. subramondi horizon, and the Globorotalia pentacamerata Zone, respectively. The mainly clay-marly member contains in its lower part alternatig brackish-water and marine beds of 10 to 20 centimetre in thickness. The middle and the upper part were deposited in shallow water. Maximum thickness is 120 metres.

In connection with this shallow-water member the new record on the larger foraminiferal assemblage yielded by the upper part of the Operculina--bearing clay-marls of ROZLOZSNIK - SCHRÉTER - TELEGDI - ROTH (1922) is worthy of mention. This fauna is ranged into the Upper Ypresian and designated to the N. anomalus - N. subramondi horizon. This is delimited from the somewhat older, but also Ypresian N. subplanulatus horizon by a thick, p ctically unfossiliferous portion.

MIDDLE EOCENE

Lutetian Stage

The Late Ypresian - earliest Lutetian regression is indicated by nummulitic and coral-bearing clay-marls and sandstones, with the appearance of variegated clays and coal traces due to relief changes. However, a certain part of the area remained under marine conditions during the earliest Middle Eocene too. This contin ous marine sedimentation is characterised by the

4.) Nummulites perforatus-bearing clay, sandstone, clay-marl member, comprising the N. perforatus horizont and both the Globigerapsis higginsi and G. kugleri Zones repectively. The maximum thickness of this member of varied lithology is 20 metres. (For characteristic species see Table I.).

The middle part of the Lutetian is characterized by marked facies changes, i.e. the alternation of freshwater, brackish-water and marine conditions. Here the near-shore, coarse detrital sediments alternate with shallow-water, N. striatus-bearing deposits. These latter can be divided into two major units:

5.) N. striatus and mollusc-bearing sand, clay, sandy marl member. This comprises the N. striatus horizon and the Globigerina corpulenta Zone, respectively. The rich foraminifer fauna of this member frequently represented by the specimens of the species Nummulites striatus and its varieties. Both planktonic and benthonic small foraminifers and also molluscs abound. Maximum thickness is 80 metres. (The characteristic larger foraminifer species are shown in Table I.)

In the upper part of the sequence the so-called "unfossiliferous sandstone" indicates a regression, with repeated freshwater beds and coal seams. These intercalations are summarized as the

6.) Poorly fossiliferous, gravely, clayey member with brown coal measures. This is the closing member of the Lutetian. Lithologically the scarcity or lack of carbonate content, paleontologically the marked decrease in abundance of the fossils is characteristic. Maximum thickness is 100 to 120 metres.

UPPER EOCENE

Priabonian Stage

The coastal deposition of the Upper Lutetian was succeeded by near-shore, shallow-water sedimentation in the Priabonian. This change can be due to a new transgression producing shallow-water, near-shore calcareous to biogene deposits in the uppermost Lutetian and in the basal Upper Eocene. This is already the period of the N. millecaput-bearing limestone and marl deposition, consolidated during the Late Eocene.

In the present stratigraphic subdivision we abandoned the designations "N. tchihatscheffi Beds" of HANTKEN (1871), and even its stratigraphical interpretation. The species described by HANTKEN as N. tchihatscheffi is in realitiy the macrospheric form of the species N. millecaput and on the basis of recent studies the role of this species as index fossil is doubtful because of its occurrence in both Lutetian and Priabonian faunal assemblages. Therefore the N. millecaput "horizon" in Table I is in inverted commas and is delimited with dotted lines, indicating necessity of further studies. The Upper Eocene rock-types are summarized as Nummulites-, Discocyclina and Foraminifera bearing limestone, marl and calcareous siltstone member.

In conclusion, the transgressive period started in the Late Lutetian, consolidated in the Late Eocene and apart from minor local oscillations produced the Nummulites-, Discocyclina and Lithothamnium--bearing limestones and marls from the uppermost member of the Lutetian. These sediments are summarized as

7.) Nummulites- and Discocyclina-bearing limestone, marl and foraminiferal calcareous siltstone member. This includes the N. millecaput horizon and the Globigerapsis semiinvoluta and Globorotalia cocoaensis Zones, respectively.

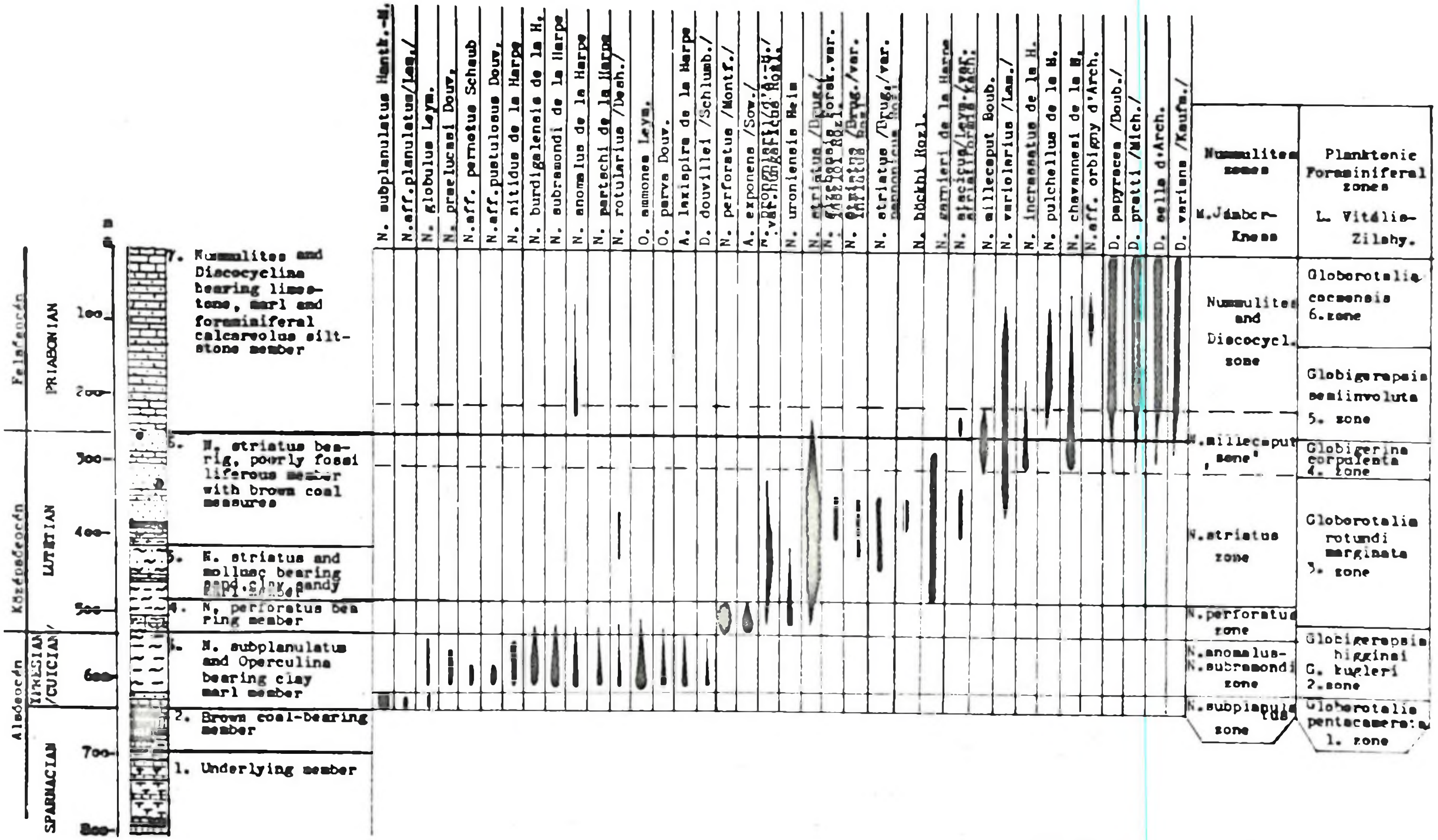
Its larger foraminifer accociation is characterized by the prevalence of the operculinids, operculinellids and discocyclinids. This mainly near-shore rock-type is rather rich in planktonic foraminifers and Lithothamnium. Its maximum thickness is nearly 250 metres. (For the characteristic larger foraminifers see Table I.)

The Eocene is usually overlain by the basal Middle Oligocene freshwater to brackish-water and marine sediments containing agglutinated foraminifers or in the upper part foraminifera-rich claymarls. The locally represented Upper Oligocene consists of poorly fossiliferous sandy clays and sands.

Traces of volcanic activity, i.e. tuffs can be found both within the Lutetian and Priabonian. In the NE vicinity of the Dorog Basin the products (dacites, dacitic tuffs) of volcanoes existing during the Eocene and Oligocene are widespread.

The sturcture of the area is characterized by alternating tectonic troughs and horsts linked by transitional steps.

Table I.



M.Jámbor - Kness

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A DOROGI MEDENCE NAGY FORAMINIFERÁKON ALAPULÓ EOCÉN RÉTEGTANA

Jámborné Kness M.

Összefoglalás

A szerző táblázatban ismerteti a medence egyik eocén típus-területének nagy Foraminifera megoszlását, a litológiai és földtani adatok felhasználásával. Korbeosztása HANTKEN M. (1971), ROZLOZSNIK P.- SCHRÉTER Z. - TELEGDI-ROTH K. (1922) által megadott rétegtani terminológiákat követi, kibővítve a jelenlegi sztratigráfiai kutatások (GIDAI L. 1969) és a saját nagy Foraminifera kutatásai (JÁMBORNÉ KNESS M. 1965) adataival. A táblázat szemlélteti a területről ismeretes Nummulites szinteket, vertikális helyzetük és mennyiségi előfordulásuk szerint. Vonalvékonysággal (ill. -vastagsággal) jelzi az egyes nagy Foraminifera fajok mennyiségét, míg a vonalak hosszusága (ill rövidsége) a nagy Foraminifera fajoknak az egyes eocén emeletekbe való átterjedését mutatja. Ezáltal a terület nagy Foraminifera faunaképe áttekinthető, és a távoli országok kutatói is könnyen tájékoztathatók.

ŐSLÉNYTANI VITÁK (Discussiones Palaeontologicae) 21.(1973) Budapest pp. 91-104.

BIOSTRATIGRAPHIC IMPORTANCE OF CRETACEOUS FORAMINIFERA IN HUNGARY

by

M. SIDÓ

The stratigraphy and correlation of the Mesozic rocks in the Hungarian Basin were primarily based on macrofaunistic studies. Recent micropaleontological studies, however, permit the subdivision and characterization of the sequences on the basis of benthonic and principally planktonic assemblages.

The present paper is a review of the micropaleontological results of the author's detailed studies on the Hungarian Triassic, Jurassic and Cretaceous assemblages, their chrono- and biostratigraphic interpretation, on the example of the Sümeg reference section.

In the Sümeg reference section (Fig. 1.) the lowermost exposed rock-type is large Megalodontid-bearing Dachsteinkalk. On the basis of analogy it is dated as uppermost Triassic (?Rhaetian). It contains only a scarce microfauna.

In the section under consideration the Triassic beds are uncomformably overlain by Jurassic rocks. These beds yield a significant foraminifer fauna (representatives of the families Lagenidae and Nodosaridae). Also the genera Trocholina, Spirillina, Palzovella and Epistomina are stratigraphically important in the Middle and Upper Liassic rocks of the Bakony, Gerecse and Mecsek Mountains.

In the Middle and Upper Jurassic cherty facies the radiolarians are significant. In the Upper Jurassic the frequently concomitant or alternating Globochete, Lombardia, Saccocoma, Cadosina, Stomiosphaera and Tintinnina associations are dominant and characteristic from the point of view of faciology and stratigraphy. In Hungary the Oxfordian, Kimmeridgian and Tithonian can be well characterized and subdivided on the basis of the above mentioned forms, which are also suitable for tracing paleogeographic relationship. (see NAGY, I. 1966).

The most exhaustive part of our studies concerns the Cretaceous rocks.

The Lower Cretaceous (Neocomian) is chiefly represented by light and dark-grey calcareous marls and limestones. From the Aptian up to the Senonian clays, clay-marls and calcareous marls yielding rich planktonic and benthonic foraminiferal associations become dominant. Whithin the Hungarian Cretaceous three larger division can be separated on the basis of planktonic foraminifers.

The first division is characterized by planktonic forms and extends from the Valanginian to the Middle Albian, inclusive. In the Valanginian and Hauterivian rocks the planktonic foraminifers are still missing, but other planktonic forms, as the tintinnids, the radiolarians and the nannpolanktonic elements are important.
The earliest plankton-foraminiferal assemblage, with tiny, flattened globigerinellids, biglobigerinellids, hedbergellids and clavihedbergellids appears rather sporadically in the Barremian. In the Aptian and Albian rocks various zonal index species and abundant, adult specimens of the genera Ticinella and Globigerinelloides can be found.

The second plankton-foraminiferal division extends from the Upper Albian up to and including the Turonian, and is characterized by the unicarinate rotaliporids. These forms appear first at the lower boundary of the Vraconian, where the flattened rotaliporids, i.e. the Rotalipora appenninica (RENZ) group is still dominant, and in the Cenomanian the rather inflated, more angulate forms, as the Rotalipora greenhornensis (MORROV), Roralipora cushmani, etc. are characteristic. Here appear firts the praeglobotruncanids, too. The flourishing of the latter marks the Turonian.

The third plankton-foraminiferal division, extending from the Turonian up to and including the Senonian is characterized by the globotruncanids. The ture, double-keeled globotruncanids already appear in the Turonian. In the Senonian the great specimen and species number of the single-keeled, double--keeled and conical forms is characteristic. In the course of the globotruncanid evolution a marked parting line occurs within the Maestrichtian, where the conical forms are dominant. Moreover, certain genera of the family Heterochelicidae and representatives of the genus Rugoglobigerina are also of great importance.

On the basis of foraminiferal studies, different biofacies and faunal associations were distinguished by stages. These are shown in Table 2.

The light- or dark-grey limestones of theValanginian, resting conformably (or sometimes paraconformably) on the Tithonian limestones could be recognized in several localities of the country. The open and shallow-water sediments of "biancone-type" often contain profuse microfaunas, with mainly Radiolaria, Tintinnida, Nannocouns, Coccolithophora, Cadosina, Stomiosphaera, Foraminifera and Echinodermata remains. On the basis of the Tintinnida associations the Tithonian ad Valanginian stages, and even the Berriasian substage can be recognized. (Sidó 1957).

The microfauna of the Berriasian limestone is distinguished beside Calpionella carpatica (CAD.) surviving from the Tithonian, the common Tintinnopsella carpatica (MURG.-FIL.) and some specimen of Globocheta alpina (LOR.) by the typically Berriasian species Coxliellina berriasensis COLOM and Faveolides balearica COLOM.

The Valanginian can also be well characterized by the nannoplankton and the tintinnids. After M. BÁLDI-BEKE the species Nannoconus steinmanni KAMPTER, Coccolithus pelagicus (VAL.) and Discolithus cretaceus (ARCH) are characteristic. The tintinnid assemblage of the Valanginian is dominated by the forms Tintinopsella longa (COLOM), T. cadischiana (COLOM), Calpionellopsis simplex (COLOM), C. undelloides COLOM, Salpingellina simplex COLOM, etc. The foraminiferal association, however, is not so diversified; in the material studied some trocholinids, spirillinids and textulariids are present in great specimen number.

The Hauterivian "biancone-type" sediments recognized also in the Bakony, Vértes, and Mecsek Mountanins overly conformably the Valanginian rocks. The Hauterivian microfauna is less varied and hardly distinguishable from the associations of the previous stage. In the poor foraminiferal assemblage the benthonic spirillinids and trocholinids suggest shallow-water marine environment. The age-determination is mainly based on ammonites.

In the Sümeg reference section the Barremian stage is represented by marine sandy conglomerate and marly facies. In contrast to its rich ammonite fauna the foraminiferal association is rather poor. Here appears the earliest Cretaceous planktonic Foraminifera assemblage, containing small hedbergellids. The clayey marl facies yields a rich nannoplankton, too.

The Aptian stage is represented by grey marls and crinoidal limestones. Within the Cretaceous the flourishing of the Foraminifera, mainly of the planktonic forms, began in the Aptian. It is both the larger and smaller foraminifers occur in greater specimen and species number. The blue and dark-grey clay and clay-marl of the Lower Aptian is characterized by nannoplanktonic and radiolarian assemblages, but the foraminifers take still second place. Beside the lenticulinids, frondiculariids and agglutinate textulariids, some Hedbergella and Ticinella species, and small, flattened Globigerinelloides species are also present. The foraminifers of the overlying echinoderm-bearing limestone facies and the intercalated clays and clay-marls are much more profuse and characteristic. Here - as a rule - the planktonic elements are dominant, with the zonal index hedbergellid, ticinellid and globigerinelloid forms. The more common species are Hedbergella infracretacea (GLAESSNER), H. trochoidea (GAND.), Ticinella roberti (GAND.) and Globigerinelloides algerianus (CUSHM. et TEN DAM). In the benthonic fauna the following genera are present: Textularia, Spiropectinata, Marsonella, Dorothia, Conorboides, Gyroidia, Globorotalites, Lenticulina, and Frondicularia, and in certain clay-marl intercalations orbitolinids can be found The zonal index Globigerinelloides algerianus (CUSHM. et TEN DAM) indicates undoubtedly the Upper Aptian (SIDÓ 1970).

The ingressive and transgressive variegated clay and clay-marls, light-grey calcareous marls and occasionally limestones indicative of terrestrial, freshwater, brackish-water and marine facies respectively, are missing in the section under consideration, but they are well known in other areas of the Bakony Mts and in the foreland of the Vértes Mts. This sequence of 20 - 200 m in thickness is assigned into the Lower Albian. The assemblages are rich and diversified, i.e. calcareous algae (Munieria baconica)-, foraminifer-, Ostracod- and echinoderm - bearing facies can be distinguished. The characteristic associations are the Ammobaculites-, Lenticulina-, Flabellamina-, Cuneolina-, Involutina-, Choffatella-, Pseudotextularella and Orbitolina bearing ones. These characteristic associations are of microstratigraphic value.

The shallow-water and pelagic light-grey clays, clay-marls and calcareous marls of 40 - 60 m thickness in the Villány Mts, Bakony Mts, in the Tata basin and in the foreland of the Vértes Mts can be ranged into the Middle Albian or the basal Upper Albian on the basis of the microfauna and the cephalopods. These beds contain rich benthonic and planktonic foraminiferal associations. The benthonic associations are the Epistomina- Tritaxia-, Spiroplectammina-, Planulina-, Glavelinella- and Orbitolina- bearing ones, and the planktonic zonal indices belong to the Globigerinelloides-Ticinella-Hedbergella-Planomalina associations. The Pithonella- and Radiolaria-bearing biofacies are also abundant, but mainly in the calcareous marls and limestones.

The 100-200 m thick dark-grey, often nodular, glauconitic clay-marls and calcareous marls containing rich and characteristic Turrilites and Rotalipora assemblage, missing in the Sümeg reference section, are well exposed in other areas of the Bakony Mts, and can be ranged into the Upper Albian, or Vraconian substage. On the basis of our studies, within the complex three plankton-foraminiferal zones can be distinguished (SIDÓ 1971):

1.) Planomalina buxtorfi - Rotalipora apenninica Zone,

2.) Globigerinelloides aeglefordensis - Rotalipora cf. greenhornensis Zone,

3.) Rotalipora greenhornensis - R. cushmani Zone.

The firstly and secondly mentioned zones belong to to the Vraconian s. str., the third into the Lower Cenomanian s. str.

The Turrilites-bearing marls of the Bakony Mountains represent the Lower Cenomanian Rotalipora greenhornensis - R. cushmani Zone. On the other hand the Flysch -like, pelagic facies from the Vékény Valley of the Mecsek Mountains is younger, containing the characteristic Rotalipora montsalvensis MORROV and Praeglobotruncana stephani (GAND) species. On the basis of the faunal associations the Cenomanian of the Mecsek Mountains shows affinities to the Carpathian flysch-zone, while the Bakony Mountains Cenomanian is of epicontinental type. (The great Cenomanian transgression can be traced from the West to the South-East).

In Hungary, the only faunistically proved marine Turonian rock is that from the Borehole Kerekegyháza-5, in 850 m depth (SIDÓ 1969). In Hungary in this flysch-like, red-brown clay-marl appear first the globotruncanids, with the double-keeled Gl. lapparenti BROTZEN, Gl. lapparenti coronata BOLLI, Gl. marginata (RSS.), Gl. sigali REICHEL and the genus Praeglobotruncana flourishes also here. The species Praeglobotruncana renzi THALMAN - GAND., Praegl. helvetica BOLLI and Praegl. sigali REICHEL are common and characteristic elements of the assemblage. The foraminiferal associations suggest pelagic facies related to the Carpathian flysch belt.

In the presented Sümeg section there is a hiatus from the Upper Aptian up to the Senonian (Fig. 1.), on the other hand nearly the complete Senonian is represented (Fig. 3.). However, the most complete Senonian sediment-complex is known from certain boreholes of the Zala oil field region and the Bakony Mountains. In these latter profiles the different Senonian facies of nearly 800 m thickness can be studied. On the basis of the appearance and dominance of certain foraminifer species different assemblages and biozones can be separated (SIDÓ 1963.). Succeedingly over the variegated clays the lowermost member of the Senonian is the clayey - marly, freshwater, Pyrgulifera-bearing coal complex overlain by the Lower Santonian succession with near-shore, shallow-water Vidalina-Nummofalothia-Miliolidaea assemblage. The conformably succeeding, similar clayey, marly rocks contain the Upper Senonian Goupillaudina - Epistomina-, Hedbergella-, coral- and mollusc-bearing association. The marly sedimentation continued into the Campanian substage, with shallow-water and pelagic facies. In this substage the Glavellina-, Bulimina-, Exogyra and Gryphaea-bearing biofacies of the Globotruncana globigerinoides and Gl. concava Zones are characteristic. During the Late Campanian a thick, Pachyodont-bearing, shallow-water reef facies, the so-called "Hippuritic limestone of Ugod" developed gradually from the "Exogyra-bearing marls of Jákó".

These two latter rock-types are heteropic facies in other areas of the Bakony Mountains.[x]

In Hungary the uppermost and the thickest Senonian member is the Inoceramus- and Globotruncana -bearing clay-marl, marl, carcareous marl of Polány. Its foraminifer association is the richest and most diversified, with the predominance of planktonic forms (inc. new forms). Its micro-biostratigraphic subdivision has been established on the basis of the planktonic forms.

1.) In the lower part of the complex, at the Upper Campanian/ Lower Maestrichtian boundary the Globotruncana calcarata association is the zonal index.

2.) The Gl. conica - Gl. stuarti - Gl. contusa zone in the middle portion of the complex marks the Middle Maestrichtian.

3.) The Gl. mayaroensis - Gl. pseudotextularia association of the upper part of the complex marks the Upper Maestrichtian.

The sediments of this latter substage can be traced in some places only and in small thickness in the Zala oil field region, because of the great post-Cretaceous erosion.

The foraminifer fauna of the Senonian is predominantly characterized by the above mentioned forms of zonal index value. The wide areal distribution and strict vertical extension of these forms are suitable to trace the paleogeographic connections.

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[x] Their Foraminifera associations is characterized by Rhapidionina spp., Rhipidionina liburnica, Dyciclina schlumbergeri, Accordiella conica and Miliolidae.

The Hungarian Senonian sequence suggests a large-scale gradual transgression. The Transdanubian Senonian, with a North Eastern coastline, show direct Yugoslavian (Croatian) and indirect Italian faunal connections. On the other hand the Senonian of the Great Hungarian Plain and the Bükk Mountains can be correlated with the flysch formation of the Slovakian, Polish and Roumanian Carpathians.

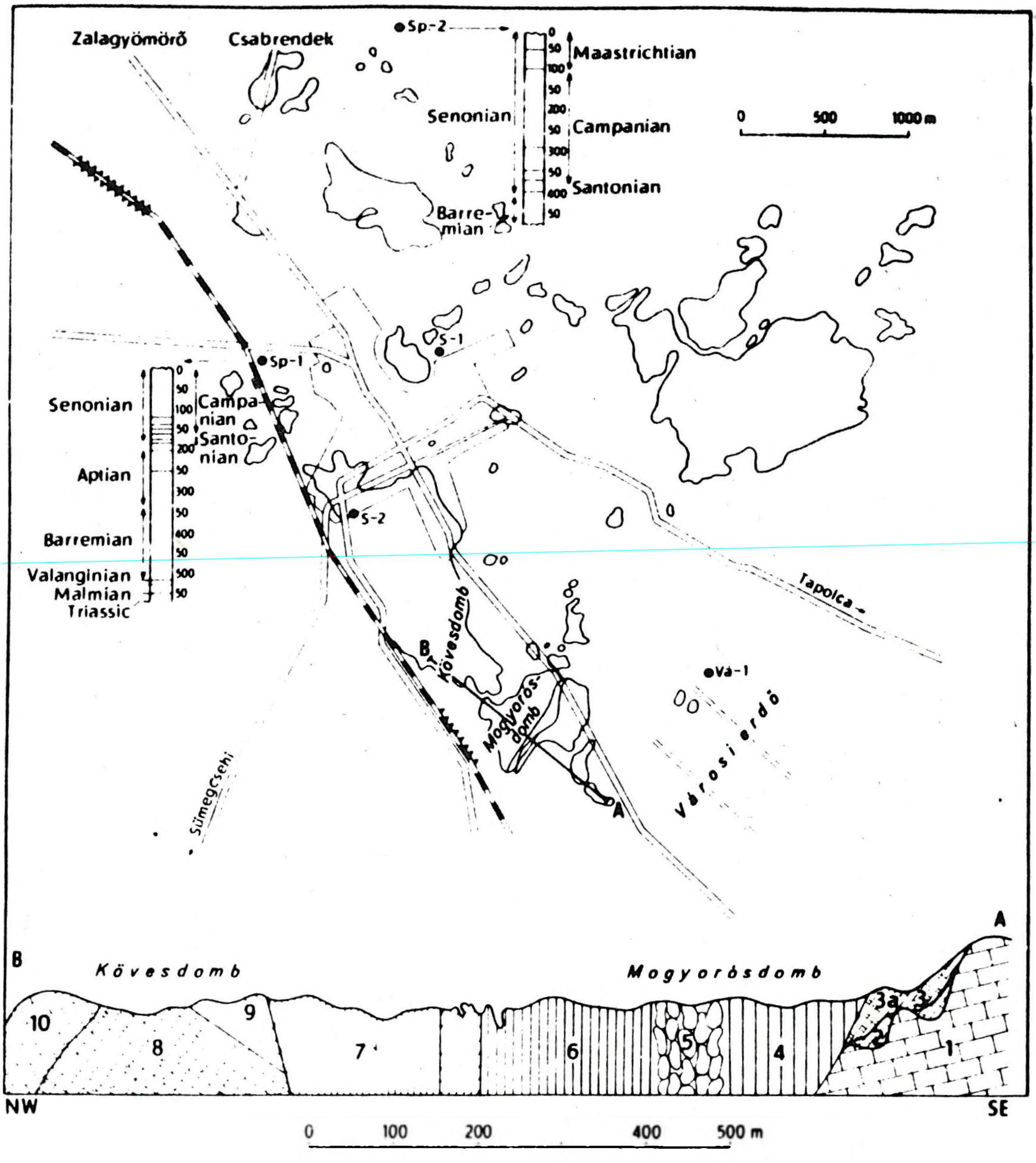

Fig. 1 – Geological sketch map of the Sümeg area and cross section through Mogyorósdomb–Kövesdomb. (The sketch map shows the Mesozoic outcrops only.) – *1.* Upper Triassic "Dachsteinkalk", *2.* Middle Liassic light red limestone, *3+3a.* Upper Liassic brownish-red limestone, *4.* Dogger radiolarite, *5.* Malm cephalopodal nodular limestone, *6.* Tithonian, *7.* Berriasian–Valanginian–Hauterivian–Barremian calcareous marl ("biancone"), *8.* Campanian Hippuritic limestone of Ugod, *9.* Campanian corallian–molluscan clay-marl of Sümeg, *10.* Upper Aptian crinoidal limestone of Várhegy Hill

M. Sidó

CHRONO-, LITHO- AND BIOSTRATIGRAPHICAL SUBDIVISIONS OF THE HUNGARIAN CRETACEOUS

Age			Formations	Foraminifers: Characteristic associations	Foraminifers: Zonal index forms	Other micro- and macro-fossils
CRETACEOUS – UPPER	Senonian – U	Maestrichtian	Inoceramus - and Globotruncana - bearing claymarl, calcareous marl, oolitic limestone of Polány; autigenic limestone-breccia	Siderolites-Ventilabrella-Heterohelix-Globotruncana-bearing, Bolivinoides-Heterostomella-bearing, Stensiöina-bearing associations	Globotruncana mayaroensis; Pseudotextularia elegans; Ventilabrella; Gl. conica, Gl. contusa; Gl. gagnebeni, Gl. stuarti; Globotruncana calcarata	Sporomorphs, Dinoflagellata, Acritarcha, Pitonella, Radiolaria, Stomiosphaera, Inoceramus div. sp., Echinodermata, Cephalopoda, Fish-remains
	Senonian – L (U/L)	Campanian	Terrestrial sediments (Bakony-Zala area); Exogyra-bearing limestone of Jákó; coral-and mollusc-bearing complex; Coal measure (Bükk Mts); Hippuritic limestone of Uzsa; Hiatus with basal conglomerates; Hiatus (Great Hung. Plain)	Rhapidionina-bearing, Dictyoconus-Dicyclina-bearing, Cuneolina-Heterohelix-bearing, Bulimina-Gavelinella-bearing, Hedbergella-Reophax-bearing ass. s.	Globotruncana globigerinelloides; Gl. concavata; Gl. marginata	Sporomorphs, Dinoflagellata, Acritarcha, Algae, Exogyras, Gryphaeas, Echinodermata remains
		Santonian		Gounilloudina-Vaginulina-bearing, Epistomina-Nonionella-Nummofalotia-Rotalia-bearing, Vidalina-bearing, Miliolidea-bearing associations	Hedbergella div. sp. - Globigerinelloides div. sp.	Sporomorphs, Dinoflagellata, Acritarcha, Corals, Lima spp., Echinodermata, Ostracoda, Calcareous algae, Bryozoans
		Coniacian				
		Turonian	Globotruncana-bearing clays and marls of Kerekegyháza /Great Hungarian Plain/	Globotruncana-bearing, Praeglobotruncana-bearing ass. s, Hedbergella div. sp.	Praeglobotruncana renzi – P. helvetica; Globotruncana lapparenti	Molluscs
MIDDLE	U	Cenomanian	Rotalipora-bearing red claymarls of Vékény /Mecsek Mts, Szigetvár/; Turrilites - and Rotalipora-bearing clay- and calcareous marls /Bakony and Vértes Mts/	Rotalipora-bearing, Praeglobotruncana-bearing, Hedbergella-bearing ass. s.; Gavelinella - Hedbergella bearing	Rotalipora montsalvensis – R. cushmani; Rotalipora greenhornensis – R. cushmani	Molluscs, Fish remains, Sporomorphs, Pitonella, Stomiosphaera, Radiolaria, Spongia
	L	Vraconian		Epistomina-bearing, Tritaxia-Lenticulina-bearing ass. s.	Globigerinelloides aeglefordensis; R. cf. greenhornensis; Planomalina buxtorfi	Molluscs, Echinodermata, Cephalopoda
	U	Albian	Ammonite-, mollusc- and foraminifer-bearing marls and limestone /Villány, Bakony and Vértes Mts/	Hedbergella-Ticinella-bearing, Epistomina-Spiroplectinata-bearing, Dorothia-Pseudotextulariella and Orbitolina-Miliolidea-bearing ass. s.	Ticinella ticinensis; Praeglobotruncana stephanis; Schackoina sp. Hedbergella div. sp.	Sporomorphs, Dinoflagellata, Acritarcha, Radiolaria, Pitonella, Stomiosphaera, Cadosina, Molluscs, Echinodermata, Cephalopoda
	L		Munieria-bearing clays and claymarls /Bakony and Vértes Mts/	Ammobaculites-Haplophragmoides-Lenticulina-Miliolidea-bearing, Flabellammina-Cuneolina-bearing, Schoffatella-Involutina-Dorothia-Pseudotextulariella-bearing, Orbitolina-bearing associations	Hedbergella div. sp.	Munieria baconica, Sporomorphs, Ostracoda association, Molluscs, Bryozoans, Echinodermata, fish-rem.
	U	Aptian	Crinoideal limestone, calcareous marl of Vár hegy /Bakony, Vértes Mts, Tata/	Hedbergella-Ticinella-Globigerinelloides-bearing, Dorothia-Spiroplectammina-bearing	Globigerinelloides algerianus	Radiolaria, Spongia, Echinodermata, Molluscs, Bryozoans, Algae
	L		Dark-grey radiolarian calcareous marls /Bakony and Vértes Mts/	Lenticulina div. sp., Hedbergella div. sp., Globigerinelloides sp.	Globigerinelloides blowi ?	Sporomorphs, Dinoflagellata, Acritarcha, Radiolaria, Coccolithophora, Molluscs, Nannoconus, Echinodermata
LOWER		Barremian	Nodulouse, crinoidal, brachiopod-and ammonite-bearing limestones /Villány, Bakony and Gerecse Mts/	Hedbergella div. sp., Clavihedbergella sp., Globigerinelloides sp., Orbitolinopsis-bearing, Orbitolina-Cuneolina-bearing associations	tiny hedbergellids – Globigerinelloides ?	Sporomorphs, Algae, Coccolithophora, Nannoconus, Radiolaria, Cephalopoda, Crab and fish remains, Brachiopoda, Echinodermata
	Neocomian	Hauterivian	Radiolarian, echinodermata brachiopoda - and ammonite-bearing limestones /Mecsek, Bakony, Gerecse Mts/	Trocholina, Spirillina sp., Epistomina		Radiolaria, Ostracoda, Echinodermata, Brachiopoda, Cephalopoda
		Valanginian	Calcareous marl and limestone of „biancone"-type /Mecsek, Bakony and Gerecse Mts/	Trocholina div. sp., Spirillina sp., Nodosaridae div. gen., Ammodiscus sp.		Tintinnidae div. gen., Nannoconus, Coccolithophora, Stomiosphaera, Cadosina, Radiolaria, Spongia, Brachiopoda, Echinodermata
		Berriasian	Limestone and calcareous marls /Gerecse, Bakony and Mecsek Mts/	Trocholina div. sp., Spirillina sp.		Coccolithophora, Globochaeta, Cadosina, Tintinnidae div. gen., Brachiopoda

Fig. 2.

M. Sidó

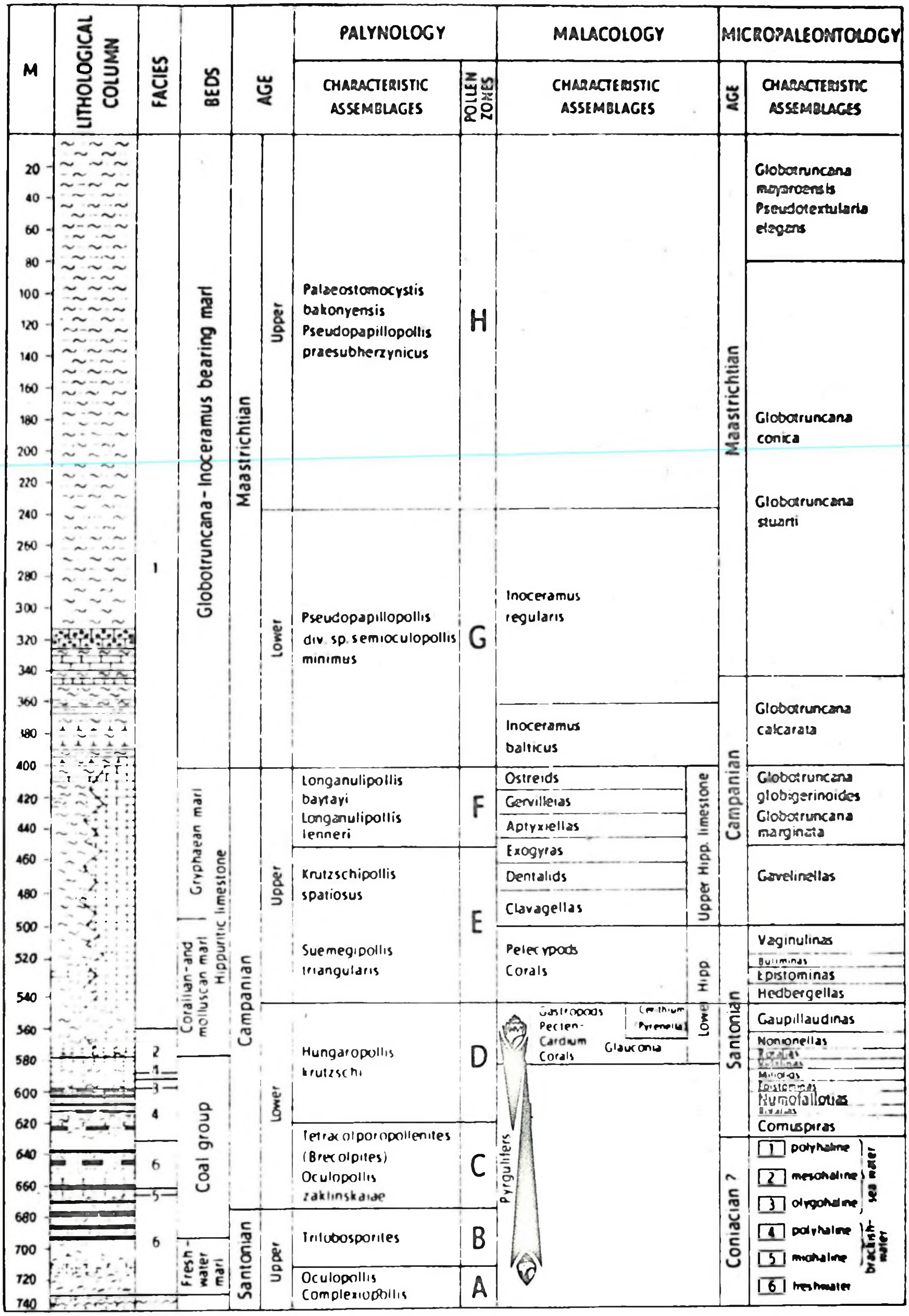

Fig. 3 Stratigraphic subdivision of the Senonian in Hungary

(by F. Góczán)

M. Sidó

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A MAGYARORSZÁGI KRÉTA FORAMINIFERÁK BIOSZTRATIGRÁFIAI JELENTŐSÉGE

Sidó M.

Összefoglalás

Szerző elsősorban a sümegi (Sp. 1., Sp. 2.) standard furási szelvények és a bemutatott külszini profil, valamint az ország különböző területeiről vizsgált anyag nyomán rövid átfogó képet kiván nyujtani a magyarországi jura, de főleg a kréta kori képződmények eddig elért mikropaleontológiai vizsgálati eredményeiről az egyes mikrofauna társulások megismeréséről, azok krono és mikrobiosztratigráfiai értékelhetőségéről. Faciológiai és sztratigráfiai szempontból a nannoplanktonnak és főleg a plankton Foraminiferáknak és mellettük még az egyes bentosz társulásoknak tulajdonit igen jelentős szerepet. Különösen az ősföldrajzi kapcsolatok nyomonkövetésére és a korrelációra ezek a szervezetek igen alkalmasnak bizonyultak.

A plankton Foraminiferák filogenetikus elemzése alapján 3 nagyobb fejlődési szakaszt állapit meg a magyarországi krétán belül.

Az első szakasz a valangini emelettől a középső albai emeletig bezárólag tart, melyre főleg a Nannoplankton, a Tintinnidea a Radiolariá-s társulások, valamint a Foraminiferák: a Hedbergella, Ticinella és Globigerinelloides-félékkel jellemzők. Az egyes fa ok megjelenésével és eltűnésével az emeletek, alemeletek rögzithetők, a rétegtani határok jól megvonhatók. Ezen a szakaszon belül felsőaptira jellemzőnek tartja a Globigerinelloides algerianus-os zónát.

A második plankton foraminiferás szakasz a felsőalbaitól a turonig bezárólag tart, melyre a Rotalipora-félék, a Planomalina és a Praeglobotruncanák a jellemzőek. A vraconi emelet alsó határán jelennek meg a laposabb Rotaliporák,

ahol a R. appenninica formakör dominál. A cenomán emeletre a duzzadtabb, szögletesebb formák jellemzők. Ezen a szakaszon belül a Planomalina buxtorfi-s, a Globigerinelloides aeglefordensis-es - Rotalipora "aff. greenhornensis-es" és a Rotalipora cushmani-s zóna különíthető el.

A harmadik plankton foraminiferás szakasz a turontól a szenonig bezárólag tart, ez a Globotruncana-félékkel jellemezhető, melyeknek két élü formái már a türonban fellépnek. A szenon emeletben az egy élü, a két élü és kupos formák nagy faj és egyedgazdagsága egyaránt jellemző. A Globotruncanák fejlődésében markáns választóvonal jelentkezik a maestrichti alemeletben, ahol viszont a kupos formák dominálnak. Az egyes fajok megjelenésével, gyakoriságával biotársulások és zónák rögzithetők; mégpedig a szenonon belül a Globotruncana concavata-s, a Gl. calcarata-s és a Gl. mayaroensis-pseudotextularias zónát sikerült rögziteni. A krétán belül zónajelző értékkel biró plankton formák széles areáju és kis fajöltőjü alakok igen alkalmasak a paleogeográfiai összefüggések nyomozására, a faunisztikai kapcsolatok kimutatására, valamint a lokális és regionális korrelációra.

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TRIASSIC FORAMINIFERAL ASSEMBLAGES OF STRATIGRAPHIC VALUE IN HUNGARY

by

A. ORAVECZ-SCHEFFER

Until the last ten year period, Triassic micropaleontology was one of the most neglected sectors of stratigraphic paleontology both in Hungary and abroad. It is probably due not only to the sparsity and, in general, poor preservation of the Triassic microfossils but also to the fact that the marine Triassic sediments are but of slight interest for raw material exploration. However, recently these investigations got a great impulse.

A very considerable part of the Hungarian Mesozic sequences consists of marine Triassic deposits, including several well-known classical sections. Their subdivisions have been based mostly on macrofaunistical features. In many cases, however, these layers contain very typical and determinable microfaunal assemblages, too. By the thorough study of these, a more complete stratigraphic and economic knowledge can be achieved, even in those formations which are poor in macrofossils.

In the Triassic microfaunas, beside the flourishing Dasycladaceae, several groups of foraminifers, ostracods, condonts and different types of microscopical remains of echinoderms are represented.

Of these groups, the present writer studies the foraminifers which are of considerable interest because of their variety and practical stratigraphic value.

In addition numerous echinoderm fragments, holothurian sclerits, asteroid fragments and ophiuroids were studied, which are valuable for age and facies determinati ons. These were regarded only as supplementary elements in the samples; some typical forms were identified. Their detailed investigation should be done in the years to come.

The method used in Foraminifera investigations was to study both outer and inner structures. The isolated specimens obatined by the traditional washing procedures were mounted into Canada balsam. The inner structures were studied using series of sections of different depht. In the case of limestones and other unwashable materials the traditional thin section method was followed. This is sometimes faster and more convenient because in a rather large number slides-beside the oblique sections also well orientated specimens occur, and even species determinations are possible. Another great advantage of thin section examinations is that the whole, original microfacies is visible without any subjectivism, which is unavoidable during picking from washing residues.

In the following a very brief summary of some typical Hungarian Triassic foraminiferal assemblages ranging in age from Lower Campilian to uppermost Rhaetian should be given.

The Lower Triassic sediments are subordinate in the sections studi ed. The majority of them are fine-grained sandstones and chemical deposits: dolomites with some anhydrite. The mostly hypersaline environment of course excluded the possibility of life.

At the beginning of the Campilian marine regime of normal sal inity was established with favourable life-conditions for Foraminifera. In the Campilian marls and marly limestones the agglutinate forms appear first. These mostly belong to the genus Ammodiscus, and to Glomospirella. They are closely related to some Upper Permian microfaunas.

In the upper part of the Campilian beds, in the limestones of the Tirolites cassianus Zone, a very characteristic foraminifer fauna has been found. It is very homogenous, consisting of thousands of specimens of Meandrospira iulia (PREMOLI SILVA) in each cubic centimetre. This species is a very good guide-fossil: its hemera is restricted to the Campilian. It is extremely abundant not only in Hungary, but also in 16 localities of the Dinarids, in 6 localities in the Alps and in several parts of China. This widespread occurrence and great abundance would suggest a planktonic way of life, but of cousre the adults of this species were benthonic forms.

In the Anisian stage the foraminifer faunas are less abundant but much more varied. We have encountered them at two localities:

1.) Aggtelek, Noth-East Hungary. There is a series of Pelsonian-Illyrian limestone outcrops full of different types of Dasycladacea. This is a well recognizable recifal facies. The foraminiferal assemblage consists of some rather well preserved specimens of Ammobaculites radstadtensis KRISTIAN-TOLLMAN, A. wirzi KOEHN-ZAN, Neondrothyra reicheli REITLINGER, Endothyranella bicamerata SALAJ, E. pentacamerata SALAJ, Earlandinita elongata SALAJ, E. oberhauseri SALAJ, and first of all the Meandrospira dinarica KOCHANSKY, DEVIDÉ-PANTIC, which indicates Anisian age.

2.) Another Anisian microfauna was studied from South Hungary, from the Villány Mountains. In the thin sections of the Pelsonian so-called "recoaro" limestones there are numerous echinoderm and ostracod fragments, and only a few poorly preserved foraminifers, mostly belonging to the genera Glomospira and Dentalina. The most peculiar organic remains on this microfauna are the various ophiuroid elements which have been described nowhere, as to the author's knowledge.

Unfortunately the famous Anisian and Ladinian profiles of the Balaton Highland have not yet been examined microfaunistically in detail. Nevertheless, from these outcrops a very characteristic foraminifer fauna is expected on the analogy of the Alpine occurrences. This investigation is one of the tasks of the years to come.

The basal beds of the Carnian develop with continuous litho-logical and faunistical transition from the uppermost Ladinian. There are several good exposures of them in the Bakony Mountains. Among others the Lower Carnian outcrops on the Northern shore of Lake Balaton were studied microfaunistically, too. This is the so-called "Lower Marl Group" with Estheria and with the marker ammonite species Carnites floridus. I should like to mention that the description of these Foraminifera - by E. VADÁSZ in 1910 - was one of the first publications dealing with Triassic microfossils in the history of micropaleontology.

This microfauna is composed almost entirely of nodosarids. The most important and frequent species are Pseudonodosaria obconica (REUSS), Lenticulina carnica (OBERHAUSER) and Frondicularia klebelbergi (OBERHAUSER). These are characteristic of the Raibler beds. Carnian marls and limestones have also been intersected by our deep-stucture exploratory boreholes (at the Northern border of the Bakony Mountains: Borehole Bakonyszücs 1.; and in the mountains on the left bank of the Danube: Borehole Csővár 1.). The thickness of the intersected Carnian-Ladinian sequence was more than 1000 m. There is a striking lithological, faciological and faunistical difference between the formations cut in these two boreholes:

a.) In the Northern Bakony area there was a quiet silty shallow water environment favouralbe for thin-walled small Foraminifera. Homogenous fine-grained pelitic sediments were deposited. About 50 species of 8 foraminiferal families are encountered. Out of them two significant groups merit particular attention. The representatives of the Miliolacea are the most typical and common members of this microfauna with some new species described from here.

The other are the members of the Variostomidae, beacuse Variostoma exile KRISTIAN-TOLLMAN and V. pralogense KRISTIAN-TOLLMAN - indicative of the Cordevolian - are found as far only in this material beside the Austrian type locality.

b.) On the contrary, in the Csővár area in this period sedimentation of organogenetic limestones was going on in a very near-shore environment in the belt of the rolling sea. This clean, agitated water saturated with oxygene, and of high carbonate content deriving from the calcareous bottom rocks provided optimal life conditions for the larger, thick-walled Foraminifera. This accounts for the presence of the most varied and well-preserved foraminiferal assemblage yet described from Carnian deposits. The description and illustration of the whole fauna is in progress.

In the Hungarian Central Mountains during the Norian-Rhaetian ages a vigorous carbonatic sedimentation took place, forming the well--known deposits of the Hauptdolomit and the Dachsteinkalk of considerable thickness, interfingering with each other. The slides of the dolomite are generally void of microfossils, but the Dachsteinkalk samples sometimes may contain a very rich microfauna (for instance in Borehole Tata 5.). First of all Triasina hantkeni (described in Hungary by MAJZON in 1954) should be mentioned. This species appears in a great quantity and in this level only. Along with Triasinas the various species of Involutina (I. communis KRISTIAN, I. tenuis KRISTIAN, I. impressa KRISTIAN), of glomospirellids (G. friedli KRISTIAN), of trocholinids (T. pemodiscoides OBERH.) are common.

In the "Dachsteinkalk sequence" there are often interbedded thin layers of yellow marly limestone. Their microfauna consists of some thin, fragile ostracod fragments and different sections of Turrispirillina minima PANTIĆ.

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SZTRATIGRÁFIAI JELENTŐSÉGŰ TRIÁSZ FORAMINIFERA TÁRSULÁSOK MAGYARORSZÁGON

Oraveczné Scheffer A.

Összefoglalás

Rövid módszertani bevezetés után a szerző sorra veszi a legjellemzőbb magyar mikrofauna együtteseket.
Röviden áttekinti a dunántuli campili Meandrospira iulia rétegek és a bakonyi ill. villányi anisusi Glomospirás és Meandrospira dinarica tartalmu képződmények Foraminiferáit. Részletesen elemzi a balatonfelvidéki, északi bakonyi és dunabalparti karni emeletbeli gazdag fajtársulásokat, majd ismerteti a raeti dachsteini mészkő mikrofaunisztikai jellegeit.
A Foraminiferákon kívül felhívja a figyelmet a mikroszkopikus Echinodermata maradványok (Holothuroidea, Asteroidea, Ophiuroidea) gyakoriságára és sztratigráfiai ill. ökológiai jelentőségére.

ŐSLÉNYTANI VITÁK (Discussiones Palaeontologicae) 21. (1973) Budapest p. 115.

JOIDES DEEP SEA DRILLING PROJECT

(On board the R/v Glomar Challenger)

by

Bilal Ul Haq. U. Z.

Abstract

Historical review of the Deep Sea Drilling Project was presented. The more important aims and the results obtained up to date of the Project were reviewed. Technical data on the R/v Glomar Challenger was also presented. A general view of the activities of the scientific personnel on board the ship and their responsibilities on shore and the working conditions were given.

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ŐSLÉNYTANI VITÁK (Discussiones Palaeontologicae) 21 (1973) Budapest 117-118.

MICROBIOSTRATIGRAPHY OF SOME UPPER CRETACEOUS AND LOWER TERTIARY SEDIMENTS IN EGYPT

by

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Abstract

The Late Cretaceous - Early Tertiary sediments from Upper and Lower Egypt are examined in detail, and the calcareous nannoplankton as well as the planktonic and larger Foraminifera are applied here to characterize the stratigraphy of the succession. This succession is subdivided into distinct litho- and biostratigraphic units. Two systems of biostratigraphic zonation are followed: one is based on the planktonic foraminiferal species and, in the abscence of their knowledge, the larger Foraminifera represents the main guide fossils upon which zoning is achieved. The other is based on the calcareous nannoplankton species indentified in the examined sections.

The following is a tentative correlation of zones of the Upper Cretaceous - Lower Tertiary succession:

AGE		Biostratigraphic zones		
		planctonic Forams	Calc. nannoplancton	Larger Forams
EOCENE	U.	Truncorotaloides rohri	Discoaster barbadiensis	N. contortus-striatus
EOCENE	M.			N. lyelli
				N. champollioni gizehi
				N. zitteli
				A. fromentiformis
EOCENE	L.	? ? Gr. aragonensis	Marthasterites tribrachiatus	
		Gr. subbotinae	Discoaster binodosus	
PALOCENE	U.	Gr. valescoensis	Marthasterites contortus	
			Discoaster multiradiatus	
		Gr. pseudomenardii	Heliolithus klunpelli	
		Gr. angulata	Fasciculithus tympaniformis	
PALOCENE	L.	Gr. uncinata	Cruiplacolithus tenuis	
		G. pseudobulloides drubjergensis	Markaibus astoporus	
MAESTRICHTIAN		Globotruncana-Heterohelix	Arkhangelskiella cymbiformis	

N = Nummulites; A = Alveolina; Gr. = Globorotalia; G = Globigerina

Beside, microfacies studies on this sections representing Quesir Variegated Shale, Duwi Phosphate, Dakhla Shale, Turawan Chalk, Esna Shale, Thebes Formation, Minia and Mokkattam Limestones are carried out. The paleoenvironmental conditions of these formations are interpreted.

ŐSLÉNYTANI VITÁK (Diskussiones Palaeontologicae) 21. (1973) Budapest pp. 119-120.

MID-TERTIARY FORAMINIFERAL ZONATIONS IN INDIA

by

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Abstract

A brief summary of the results of the studies carried out by the author on Upper Eocene, Oligocene and Early Miocene Foraminifera of Cauvery Basin, Cambay basin and Kutch is presented. Two independent zonal schemes are proposed - one for the deeper marine (middle shelf to bathyal) sediments based on planktonic Foraminifera from Cauvery basin and another for shallow marine (innershelf) sediments based on larger Foraminifera of Kutch and Cambay basin.

Very rich assamblages of planktonic Foraminifera are recorded from exploratory wells of Cauvery basin and the zones recognized include: EARLY MIOCENE:

<u>Globigerinoides primordius</u> (<u>Globorotalia kugleri</u>) zone

OLIGOCENE:

<u>Globigerina angulisuturalis</u> zone
<u>Globigerina ampliapertura</u> zone
<u>Globigerina sartrii</u> zone
<u>Globigerina gortanii</u> zone

UPPER EOCENE:

<u>Globorotalia cerroazulensis</u> zone
<u>Globigerapsis mexicana</u> zone

Planktonic Foraminifera are rare or absent while larger Foraminifera are abundant in the shallow marine sediments known from Kutch and parts of Cambay basin. The larger foraminiferal zones are:

OLIGOCENE:

M. (Miogypsinoides) complanata - M. (M.) cf. bermudezi zone

Nummulites fichteli - intermedius/Eulepidina zone

Nummulites fichteli - intermedius zone

UPPER EOCENE:

Pellatispira / Nummulites fabianii zone

The Eocene - Oligocene boundary was placed both in well and exposed sections at the top of the Globorotalia cerroazulensis zone and at the extinction level of Pellatispira. The Oligocene - Miocene boundary was set at the first appearance level of Globigerinoides primordius and between M. complanata and M. gonteri.

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NAGY I.:	Hozzászólás az 1971. évi Rétegtani Kollokviumon. 19. (1972). 52-53. old.

NAGY I. Z.: Megjegyzések a mono- és polyphylia kérdéséhez. 11. (1969), 3-8. old.

NAGY L. -né: Hozzászólás az 1971. évi Rétegtani Kollokviumon. 19. (1972), 54-56. old.

PÁRDUTZ Á.: lásd KEDVES M.

SCHOLZ G.: Hozzászólás az 1971. évi Rétegtani Kollokviumon. 19 (1972), 57-58. old.

STEGENA L.: Hozzászólás az 1971. évi Rétegtani Kollokviumon. 19. (1972), 59-60. old.

SZEPESHÁZY K.: Hozzászólások az 1971. évi Rétegtani Kollokviumon. 19. (1972), 61-66. old.

SZÖ Gy.: Hozzászólás az 1971. évi Rétegtani Kollokviumon. 19. (1972), 67-71. old.

TOPÁL Gy.: Barbastella rostrata n. sp. a tartői kőfülke középső pleisztocénjéből. 15. (1970), 5-18. old. (angol kivonattal)

TÓTH K.: Paleoökológiai megfigyelések a Vértes hegység DK-i előtere pannoniai molluszkáin. 13. (1969), 41-55. old. (angol kivonattal)

VÉGH S. -né: Hozzászólás az 1971. évi Rétegtani Kollokviumon. 19. (1972), 72-73. old.

VÖRÖS A.: A kericseri (Bakony hg.) pliensbachi chiopoda fauna vizsgálata 14. (1970), 61-76. old. (angol kivonattal)

VÖRÖS A.: lásd CALÁCZ A.

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