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CORRELATION OF NEOGENE DIATOMACEOUS EARTH DEPOSITS IN HUNGARY

by

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A new and important endeavour of geological research in Hungary is to carry out the paleogeographic reconstruction and the most complete description of the lithostratigraphic units of Hungary. A basic prerequisite for achieving this is the proper understanding of the geological units.

The examination of fossil diatoms and other siliceous microfossils associated with them is a scientific tool which cannot be dispensed with in up-to-date and complex geological research and exploration.

Where the rock is uniform and homogeneous over tens or hundreds of metres in a vertical section, being apparently sterile or containing no calcareous fossils in a rock sequence deposited during continuous sedimentation, there the siliceous protists such as Archaeomonas, Silicoflagellata, Ebriida, Diatoma and Radiolaria etc are usually present.

The fossil assemblages of diatoms and other siliceous unicellular organisms provide clues to understanding variations of different kinds such as lateral and vertical changes in lithology and facies. They give information on the genetic history of the sedimentary basin involved and, if a larger chronological unit is concerned, on the date of sedimentation as well.

The author has since the fifties studied the Tertiary and Quaternary deposits of Hungary, from the Eocene up to the Recent. In this context she has examined a total of 678 fossil diatom taxa, in addition to the associated representatives of Archeomonas, Silicoflagellata, Ebriida, Phytolitharia, Silicospongia, etc which she has recovered from more than 5500 samples from a total of 72 Miocene localities taken in a wider sense.

The possibilities for sampling were rather limited. The examined rock samples came from surface exposures and boreholes in areas selected during geological mapping and given preference in national mineral exploration projects. In the first place, the diatomaceous deposits of the Mecsek Mountains and their surroundings, the North Hungarian Highland Range and the Tokaj Mountains were studied, and only a smaller fraction derived from similar deposits in the Transdanubian Central Range and the Miocene- and Pliocene-filled marginal basins of the Great Hungarian Plain (Fig. 1).

The deposits involved are connected with the Miocene—Pliocene volcanic and postvolcanic activities, being primarily areas of tuff ejecta and areas of tuffite deposition and geyserite accumulation subsequent to the former. The acidic volcanics were observed, almost as a strict rule, to be overlain by diatomaceous deposits that had been accumulated in a shallow-water sea, in nearshore, lagoonal and partly landlocked bay environments. Comparatively thicker diatomaceous earth, i.e. diatomite deposits were formed in dependence on the volcanic activity, at the optimum of pH and dissolved SiO_2 content of the seawater and, consequently, in a pure, oxygen-rich, well-oxygenated environment (e.g. Hidas, Szurdokpüspöki, Erdőbénye, etc) (Table 1). This accounts for the fact that, when examining deeper-water basin deposits layer by layer, regardless of whether Oligocene or Miocene or Pliocene deposits were intersected by the particular borehole, they are always found to be sterile in terms of diatomaceous earth accumulation.

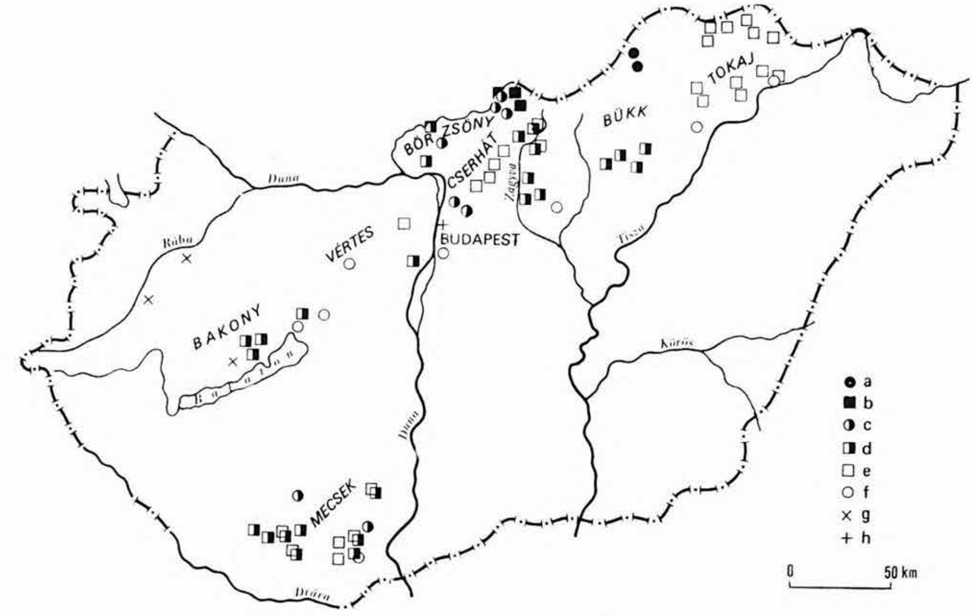

Fig. 1. Occurrences of diatomaceous deposits in Hungary
a Eggenburgian, *b* Ottnangian, *c* Karpatian, *d* Badenian, *e* Sarmatian, *f* Pannonian, *g* Pontian, *h* Holocene

Because of their biofacies the gravity points of diatomaceous earth deposition will always fall outside the areas of the carbonate sedimentation cycle, being lithologically associated preferentially with the fine-sandy, for the most part carbonate-free deposits. If the % $CaCO_3$ content and the percentage of Diatoma specimens in representative layer by layer samples be plotted as a function of sedimentation time, so the percentage maximum of Diatoma will almost appear at the minimum of the carbonate curve.

Hence the lack of regionally continuous diatomaceous deposits or beds in Hungary. They are restricted to local occurrences, forming lenses of varying size even within formations. We have had to study isolated rock sequences or lenses the vertical stratigraphic connections of which could not be traced from layer to layer even in case of no break in sedimentation. The stratigraphic succession and the even smaller interim changes in facies could be inferred from changes in the composition of the flora.

Accordingly, the diatomaceous deposits of Hungary do not fit directly in the local formation system established on a lithogenetic base, forming intraformational or possibly transformational "facies lenses".

Table 1

Occurrences of diatomaceous deposits in Hungary

● EGGENBURGIAN
Alsószuha
Sajókaza
■ OTTNANGIAN
Ipolytarnóc
Litke
Mihálygerge
◑ KARPATIAN
Nógrádszakál
Litke
Piliny
Diósjenő
Mogyoród
Fót
Magyaregregy
Zengővárkony
◨ BADENIAN
Szurdokpüspöki
Gyöngyöspata
Hasznos
Petőfibánya
Szokolya
Magyarkút
Bernecebaráti
Eger-Tihamér
Demjén
Novaj
Borsodgeszt
Mátraverebély
Mátraszőlős
Diósd
Herend
Szentgál
Bánd
Várpalota
Komló
Hidas
Pétervárad
Szilágy
Tekeres
Magyarhertelend
Magyarszék
Bodolyabér
□ SARMATIAN
Magyarszék
Tekeres
Szilágy
Hird
Hosszúhetény
Pécsvárad
Hidas
Budajenő
Kozárd
Ecseg
Buják
Bér
Hasznos
Mátraverebély
Sárospatak
Tállya
Erdőbénye
Hercegkút
Abaújvár
Cekeháza
Gönc
Pusztafalu
Erdőhorváti
Füzérkajata
Füzérradvány
Kéked
○ PANNONIAN
Szilágy
Vilonya
Csór
Csákvár
Budapest—Népliget
Gyöngyösvisonta
Bogács
Tállya
Sárospatak
× PONTIAN
Pula
Gérce
Várkesző
+ HOLOCENE
Újpest

Since the diatomaceous deposits do not constitute a continuous sedimentary chain, their correlation too can be performed on a bio- rather than lithostratigraphic basis. In attempting to determine their position in the stratigraphic scale we cannot help placing them in the afore-mentioned formations or in lenses in-between.

Ecological requirements of siliceous protists are: a considerable dissolved SiO_2 content of the water, its acidic or, at the most, neutral pH and its being suffiently penetrated by sunlight and well-oxygenated. It follows from the former that, regardless of the lithological order of the formations, the diatomaceous deposits constitute facies either dissecting, interrupting or intersecting them. In other words, the biozonal boundaries must not necessarily coincide with the formation boundaries.

The most important aim of this work has been to fix the stratigraphic position of the diatomaceous deposits. To achieve this goal, the author has sought to establish biozones and abundance zones by determining the stratigraphic ranges of a few short-lived taxa of typical morphology representing the most important members of a total of hundreds of identified species and present in greatest abundance (dominant taxa) (Table 2).

The author has listed for each particular stratigraphic unit just a few taxa considered to be the most important stratigraphic index taxa, because the biostratigraphic relationships, the phylogenetic evolution and the evolutionary lineages of some new taxa are more distinct and more easily traceable. The diatomaceous deposits of Hungary's lithostratigraphic units, formations, their order of sedimentation and biofacies are characterized by fossil assemblages (Table 2).

Statigraphic position of Miocene diatom and

EPOCH	Paleomagnetic epoch	Radiometric ages M.Y.	Regional stages			Standard zones	
			Mediterranean	Central Paratethys	Eastern Paratethys	Planktonic Foraminifers Blow, 1969	Nannoplankton Martini, 1971
UPPER				Dacian	Kimmerian	N18	NN12
		54					
	5		Messinian			N17	
	6						
	7			Pontian	Pontian	N16	NN11
	8						
	9		Tortonian	Pannonian	Meotian		NN10
					Chersonian		
	10	118				N15	NN9
MIDDLE	11				Bessarabian (Sarmatian)	N14	
							NN8
	12			Sarmatian		N13	
	14		Serravollian		Volhynian (Sarmatian)		NN7
					Konkian	N12	NN6
	15				Karaganian	N11	
				Badenian	Tschokrakian	N10	NN5
	16	168	Langhian		Tarchanian	N9 N8	
LOWER				Karpatian	Kozachurian	N7	NN4
	17		Burdigalian	Ottnangian		N6	NN3
	18			Eggenburgian	Sakaraulian	N5	NN2
	19						
	20		Aquitanian	Egerian	Caucasian	N4	NN1
	21	232					
	22						

silicoflagellata zones in the Central Paratethys *Table 2*

Biostratigraphy					
Zones					
Diatoma			Silicoflagellata		
ŘEHÁKOVÁ, 1975	ŘEHÁKOVÁ, 1977	HAJÓS, 1985	HAJÓS, 1985	BACHMANN and MARTINI, 1972	DUMITRICA, 1985
		Anomoenois sphaerophora			
		Actinoptychus trilobatus Coscinodiscus jambori		?	
		Frag. bituminesa			
Coscinodiscus doljensis, Anaulus simplex	*Coscinodiscus doljensis*	*Haynoldiella*		*Dyctiocha rombica*	*Distephonus lemmermanni D. macilentus Distehanopsis longispinus*
		Anaulus simplex	*Deflandriocha intercalaris*		
?	?				
		Navicula pinnata	?		*Distephanopsis stauracanthus*
Denticula lauta Actinocyclus ingens	*Denticula punctata*	*Rhaponeis mediopunctata, Denticulopsis lauta*	*Distephanus crux v. longispina*		*Paracannopilus picassoi*
	Coscinodiscus lewisanus	*Surirella costata C. pannonicus*	?	*Dictyocha triacantha*	
Diploneis microtatos Aulacodiscus grunowii	*Raphidodiscus marylandicus*	*Rhaphoneis parilis*	*Mesocena elliptica*		
Actinoptychus truanii f. trivittata Coscinodiscus moronensis	*Coscinodiscus moronensis*	*Rhaphoneis subtilissima*	*Corbisema triacantha v. flexuosa*		
?	*Actinoptychus amblyoceras*	*Melosira hispanica*		*Naviculopsis navicula*	
Cladogramma conicum	*Cladogramma conicum v. campanutatum*	?	?	*Naviculopsis lata*	

The diatomaceous areas are discussed on the basis of the type areas of the biozones by taking into consideration the degree of understanding of the areas concerned and, not in the last place, the sea currents pattern and plaeogeographic distribution of the diatomaceous sedimentary basins and by establishing their hierarchy of importance.

Having summarized the biostratigraphic and faciological data of three decades of research, I attempted at summing up the stratigraphic results concerning the Hungarian diatomaceous deposits. On the basis of the nomenclatural evaluation of Diatoma, by taking into consideration and critically evaluating the relevant literature available, I sought to determine their lateral distribution and vertical range.

In listing the fossil assemblages I have adopted the valid data of Van Landingham (1967—1979).

My stratigraphic statements and conclusions concern primarily the Hungarian deposits of the Central Paratethys. In comparisons with more remote areas, I have not restricted myself to my own data, having used data from J. Pantocsek (1886—1905) and other authors of a monographic coverage of the neighbouring countries (Krestel, Řeháková, Temiskova-Topalová, etc) as well.

The paleogeographic distribution of diatoms in the Central Paratethys (Fig. 2) has been reconstructed on the basis of data hitherto available. Finally, I made an attempt at a chrono-, litho- and biostratigraphic correlation of the deposits.

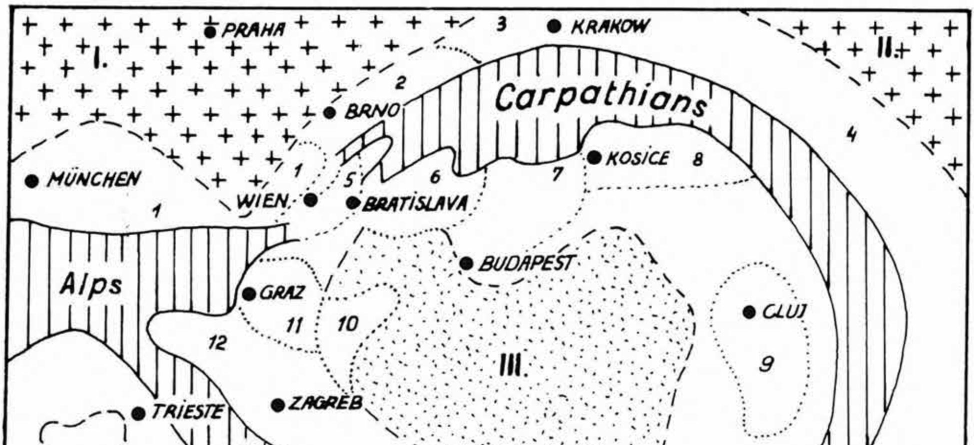

Fig. 2. Lower and Middle Miocene sedimentary basins of the Central Paratethys (Seneš et al., 1971)

1 N foredeep of the Alps, *2—4* external foredeep of the Carpathians, *5* Vienna basin, *6—8* sedimentary basins in N Hungary and S Slovakia, *9* Transylvanian basin, *10* Transdanubian basin, *11* Graz basin, *12* Zagreb basin—Drava—Sava basin.—*I* Bohemian massif, *II* Podolian massif, *III* Pannonian basin

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