ANN. INST. GEOL. PUBL. HUNG. | vol. LXX. | Budapestini, 1987

Proceedings of the VIIIth RCMNS Congress

THE BIO-, LITHO- AND CHRONOSTRATIGRAPHY OF THE HUNGARIAN MIOCENE

by

G. HÁMOR, T. BÁLDI, M. BOHN-HAVAS, L. HABLY, J. HALMAI, M. HAJÓS, J. KÓKAY, L. KORDOS, I. KORECZ-LAKY, E. NAGY, A. NAGYMAROSI and L. VÖLGYI

The paper presents, from among the stratigraphic sequences spanning the interval between Hungary's Egerian and Pontian formations, the Eggenburgian—Sarmatian stratigraphy. The Pannonian is dealt with in a separate paper.

1 The above mentioned part of the Miocene is made up of 37 formations forming a continuous vertical succession. Out of these, 26 formations studied in detail are shown in Fig. 1. These formations are very well exposed in surface or drilling key sections, their research history and nomenclature are very well-known. Their boundaries and lithological, sedimentological and facies characteristics are studied in fair detail. The paper synthesizes the results obtained by about 15 biostratigraphic methods, by geochronological methods, by the study of orogenic cycles and palaeogeographical reconstructions.

The most important of these are:

a) the Hungarian Miocene is displays a complete lateral succession of facies: continental deposits—continental and/or basin-margin volcanics—basin-margin facies—central deep-basin facies,

b) the isochronity of these isochronous facies counterparts (the so-called "heteropic" facies) is proved:

— by the isochronous markers represented by the three tuff ejections all over the country and their radiometric dates,

— the interbedding mode of occurrence of the continental and marine (in some cases, volcanic) facies,

— the direct and indirect methods of biostratigraphic zonation.

2 Major motives for the assignation to the Parathethys regional chronostratigraphic system:

2.1 The lower boundary of the *Eggenburgian* stage is characterized by a regional unconformity and the appearance of the "larger pectinids" (pectinid zone P2—3).

Zone PN3 is characterized by the appearance of Faveotriletes rueterbergensis, the extinction of Laevigatosporites pseudodiscordatus, the exclusive occurence of Faveotriletes pessinensis. The N5 Blow zone encompasses the whole marine interval (Budafok Sand Formation, Putnok Schlier Formation). In the marine vertebrate zonation the predominance of the representatives of the genere Hemipristis, Isurus and Lamna is characteristic. At the end of the Eggenburgian a subtropical megaflora (zone MF1) and the zone MN3b appear.

The transition to Ottnangian time and the kinship relation are proved by the continuous sedimentary cycle and the transient Platanus neptuni—Engelhardtia orsbergensis—Laurophyllum—Calamus noszkyi megafloral zone MF1.

2.2 The lower boundary of the *Ottnangian* stage is drawn at the episodical rhyolite tuff ejection event 19.6±1.4 Ma (Gyulakeszi Rhyolite Tuff Formation). Its upper boundary is marked by the extinction of some of the palaeotropical elements (e.g. Platanus neptuni) and of Proboscidea (zone MN4a).

Zone PN4 is characterized by the predominance of Salixipollenites helveticus, S. densibaculatus, Myricipites species and plenty of ferns. The Rhaphoneis subtilissima D2 diatom zone proves the persistence of subtropical climate. The terrestrial vertebrate fauna belonging to zona MN4a is amplified, along with surviving Gomphotherium and Prodinotherium, by Zygolophon, Deinotherium, Palaeochoerus and Rhino I—II forms.

All these features readily correlable with zones NN3 and CPN4 identified in the upper part of the Salgótarján Browncoal Formation.

2.3 The lower boundary of the *Karpatian* stage is marked by a regional unconformity, the basal formations of a new sedimentary cycle, the appearance abundant of Chlamys forms and marine vertebrates (23 taxa) as well as by the joint appearance of Rzehakia forms and Helicosphaera ampliaperta zone NN4.

Zone PN5 is marked by the exclusive occurence of Rudolphisporites species, Phaecocerosporites transversus and Ricciaesporites hungaricus. The megaflora is unsuitable for evaluation because of the marine environment. The Rhaphoneis parilis and Surirella costata—Coscinodiscus pannonicus D3—4 diatom zones are indicative already of a subtropical-mediterranean climate. Only the lower two-thirds of the cycle can be assessed stratigraphically in an exact way on the basis of the zones NN4, N7 and CPN5. The Flabellipecten pasinii—Pecten expansior—Amussium cristatum badense (P4) pectinid zone spans the whole interval of the cycle. At the Karpatian—Badenian boundary, the Tar Dacite Tuff Formation (16.4±0.8 Ma) is found.

2.4 In *Early Badenian* time a break in sedimentation can be recognized over a part of the study area owing to a latest Karpatian emergence. In case of openwater, continuous sedimentation, the lower boundary can be drawn by the appearance of Heterostegina costata, H. simplex, Orbulina bilobata and O. suturalis.

The lower Badenian is marked by zone PN6 with the predominance and then extinction of Bifacialisporites grandis-Mecsekisporites miocaenicus—M. aequus—M. zengoevarkonyensis. In addition to its stratigraphic value, the Parrotia pristina (predominant) — Quercus pontica miocaenica (first appearance) MF2 megafloral zone proves that a riverian flora came into prominence, i.e. the landmass area widened. The age of the formations assigned to the Lower Badenian is determined, along with nanno NN5 zone and the foraminiferal zones N9, CPN7—8, by the pectinid zones Chlamys elegans and Ch. revolutus (P5a). The transient Actinocyclus ingens diatom zone supports primarily the peristence of the subtropical—mediterranean climate.

2.5 The time interval of the *Middle Badenian* is spanned, practically in full, by the andesitic volcanism. The stratigraphic assignation was done on the basis of the intertonguing with the NN5 nanno zone, a number of radiometric *K/Ar* age determinations (14.5±0.4 Ma Mátra Andezite Formation) and of the underlying formations. Long-distance, interregional correlation is extremely difficult, because within the Carpathian realm, west of the zone of volcanic activities, a biostratigraphically based interregional correlation is handicapped by brackish-water—paralic—palustrial brown coal formations, and east of it by hypersaline—lagoonal evaporitic accumulations.

2.6 The lower boundary of the *Upper Badenian* substage is marked by the appearance of sedimentary formations, a regional unconformity and basal deposits. In the bios, the extraordinary changes are marked by the appearance of Coniferae pollen

grains, the P. leythaianus—P. aduncus D5b pectinid zonezone and, most of all, by that of a Caspian—brackish Mollusca fauna (Modiolus, Musculus, Ervilia, Cerithium taxa). The *Late Badenian* is determined by the predominance of deciduous arctotertiary elements (Populus populina, P. palsamoides—Salix—Ulmus, MF3 megafloral zone), the Navicula pinnata D6 diatom zone, NN6—7, N12, CPN9 zones, and the terrestrial vertebrate zone MN6—7 at the base furthermore by the contemporaneous predominance of marine vertebrates Charcharodon—Myliobatis.

2.7 In the *Sarmatian* stage, zone PN9 is characterized by the first appearance of Tsugaepollenites helenensis, by the exclusiveness of Manikinipollis tetradoides and Echinotisporites cserhátensis and the extinction of E. longechinus. The megafloral zone Zelkova zelkovaefolia—Quercus kubinyii—Lauraceae MF4 and the D7 diatom zone Anaulus simplex testify to the coming into prominence of thermophilous species of Near East—Mediterranean affinitinity. Along with the zones NN6—7, N13—14 and CPN10 that can be identified with some difficulty, additional contributions to the stratigraphic assignation of the Sarmatian were provided by the radiometric age of the third rhyolite tuff ejection (Galgavölgy Rhyolite Tuff Formation, 13.7±0.8 Ma).

Proposals

a) It is timely and justified to revise and reformulate the notions Lower, Middle and Upper Miocene that are now being used according to different interpretations.

b) Spanning the interval between 24—5.5 Ma, the Miocene can be subdivided into 3 superstages: Lower Miocene, Middle Miocene and Upper Miocene.

c) On the basis of the regional stratigraphic nomenclature of the Central Paratethys the Lower Miocene spans the Eggenburgian—Ottnangian interval, the Middle Miocene the Karpatian—Lower Badenian—Middle Badenian interval, the Upper Miocene the Upper Badenian—Sarmatian—Pannonian interval. The authors propose to use the term Atlantian for the new Lower Miocene superstage, the Mediterranean for the new Middle Miocene superstage and the Caspian for the new Upper Miocene superstage. This proposal is motivated by the data presented in Fig. 1 and by quantitative biostratigraphic evidence.

G. HÁMOR—M. BOHN-HAVAS—
J. HALMAI—M. HAJÓS—
J. KÓKAY—L. KORDOS—
I. KORECZ-LAKY—E. NAGY
BUDAPEST
H-1442 P.O.B. 106
Hungary

T. BÁLDI—A. NAGYMAROSI
BUDAPEST
H-1088 Múzeum krt. 4/a
Hungary

L. HABLY
BUDAPEST
H-1476 P.O.B. 222
Hungary

L. VÖLGYI
BUDAPEST
H-1502 P.O.B. 22.
Hungary