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

Proceedings of the VIIIth RCMNS Congress

CONTROVERSIAL APPROACHES TO THE USE OF MIDDLE—UPPER NEOGENE CHRONOSTRATIGRAPHIC UNITS FROM THE TETHYS AND THE PARATETHYS

by

I. ANDREESCU

General remarks on circum-Mediterranean Neogene stages

The Tethys or Mediterranean area s. str. represents the Neogene classical area, where Neogene stages were first established. Consequently, these stages should be considered as a standard for the global Neogene. For various reasons, more or less objective, the present status of the Mediterranean Neogene stages, however is rather unsatisfactory, especially when the Miocene stages are taken into account.

From among the most contradictory features, still hampering a clear meaning of these stages, the following can be mentioned:

— the lack of an unambiguous definition of the base of the Aquitanian stage and of the Miocene—Oligocene boundary respectively;

— the time-span of the Burdigalian stage is still obscure;

— the time-span of the Langhian stage is unknown. Early Langhian transgression took place after a pronounced continentalization time-interval and, as a result, there is a gap between the Burdigalian and the Langhian;

— other hiatuses seem to be located between the Langhian and the Serravallian and between the Serravallian and the Tortonian;

— the relationship between the Upper Tortonian and Lower Messinian is obscure and, on account of this, the lower boundary of the Messinian is often arbitrarily considered;

— the time-span of the Messinian stage is not yet precised and, closely related to this problem is the question of the position of the Miocene—Pliocene boundary.

As regards the Paratethys area, it is sufficient to mention that at least three, if not more, so-called "official" chronostratigraphic scales are currently used for the Neogene deposits. Beside these "official" scales many authors utilize a kind of scales of their own, contributing to make the puzzle of Neogene chronostratigraphy still more discouraging. As a result in the Paratethys the most controversial features regarding the Neogene stages include:

— the position of the Karpatian stage and its correlation with potential equivalent units from the E Paratethyan and Mediterranean area

— the meaning of the Badenian stage and its subdivisions;

— the time-span of the Sarmatian stage in the Western and Central Paratethys on the one hand and in the E Paratethys, on the other;

— the meaning of the Pannonian: Pannonian s.l. versus Pannonian s.str.;

— the time-span of the Meotian stage, its subdivision and correlation in various basins of the E Paratethys;

— the time-span of the Pontian stage in the W Paratethys by comparison with the same unit in the E Paratethys and the chronostratigraphic position of this stage in different basins.

A detailed analysis of all of these highly disputable questions is beyond the purpose of this contribution. Consequently, only some features considered to be crucial in Tethyan—Paratethyan Neogene stratigraphy and correlation will be pointed out.

Main reasons leading to controversial use of Neogene stages

The controversial use of these stages is, above all, conditioned by the meaning and accuracy in which the biochronologic and/or biostratigraphic units have been individualized.

In the Mediterranean area neither planktonic foraminifera and calcareous nannoplankton are always suitable for any reliable zonation or long-distance correlation (BIZON, 1979; MÜLLER, 1979; ELLIS, 1979 etc). On the other hand, magnetostratigraphy is still of limited use in the Mediterranean Neogene record, since the available data are poor and conflicting (RIO et al., 1984). As a result, many datings regarding biotic events in the Mediterranean have been taken, as a rule, from events calibrated in extra-Mediterranean medium- and low latitude realms (RYAN et al., 1974; BERGGREN, VAN COUVERING, 1974; CITA, 1975). In addition, it seems that many planktonic taxa, recorded in various Mediterranean sectors, had a delayed or, on the contrary, an earlier occurrence in comparison with other areas of mid—low latitude. Thus the first occurrence of *Neogloboquadrina acostaensis* in the N Pacific and N Atlantic is dated at about 10.2 Ma, whereas in tropical regions its first occurrence is delayed by 1.6 Ma (BARRON, 1985). On the other hand, the first occurrence of *Globorotalia margaritae* is delayed in Mediterranean in comparison with the extra-Mediterranean regions (RIO et al., 1984). As regards the nannoplankton, MÜLLER (1979) and ELLIS (1979) noted that in the Mediterranean the paucity, or absence, of several index taxa makes difficult, or even impossible, the recognition of Miocene standard zones.

In the circum-Mediterranean region large areas are covered by Neogene sequences with brackish or freshwater fossils (Mollusca, Ostracoda, etc). Since the brackish-water organisms evolved faster than the marine or the freshwater ones, they frequently provide valuable markers for distinquishing minor stratigraphic units (substages or even "horizons"), but their usually restricted area of distribution does not allow, in many cases, any long-distance correlation. As a result, a stage, or substage, established in one basin, may not accurately be separated in other, neighbouring basins. Thus, in the Paratethyan area, the Sarmatian substages of the E Paratethys could not be identified in W Paratethys; the Meotian stage of the E Paratethys is roughly equivalent to the middle—upper part of the Pannonian s.str. (W Paratethys); the Dacian stage (E Paratethys), individualized in the Dacian basin on the basis of Lymnocardids and Congeria taxa, has been adopted in the W Paratethys as well in spite of the fact that, in this region, the diagnostic molluscs of the Dacian stage are absent.

In the circum-Mediterranean sections the marine sequences occasionally alternate, or intertongue, with brackish, freshwater or terrestrial deposits. When terrestrial deposits contain mammal remains, these represent tenable tie-points in age assignation and interregional correlation attempts. Unfortunately, in many instances, mammal fossils have been found unrelated to any other fossils. Moreover, beside the scarcity of mammal sites, no correlation between larger sites and smaller mammal sites has so far been available. As a result, the stratigraphic position of most mammal zones, and especially of MN_9—MN_{13} zones, i.e. the biochronologic units defining

the Vallesian and Turolian land stages, is still highly controversial. These controversies are closely dependent on the following features:

– insufficient knowledge of some mammal taxa ranges;
– possible diachronism of various taxa, or assemblages, in different regions;
– misinterpretation of palaeomagnetic polarity reversals (if available), leading to an inaccurate age assignation of the mammal sites.

In our opinion, most confusion is induced by miscalibration of sequences containing mammals. Hence the need for some pertinent considerations as to the palaeomagnetic method, increasingly felt in biostratigraphy in recent years as it is.

As pointed out by RYAN et al. (1974), BERGGREN and VAN COUVERING (1974) and BERGGREN et al. (1983) the palaeomagnetic scale is a relative time-scale. Its weakest aspect consists in a somewhat subjective polarity interval delimitation and nomenclature. Since in both the ocean floor lineation and sedimentary columns no unique palaeomagnetic polarity pattern is available at present, several palaeomagnetic scales for the Neogene are in use. Consequently, there is a wide field in optioning for one scale or another and, in close dependence on age assignation, the adopted scales often differ substantially even for one and the same site, when investigated by various authors. A spectacular example in this sense is given in Table 3, showing that the

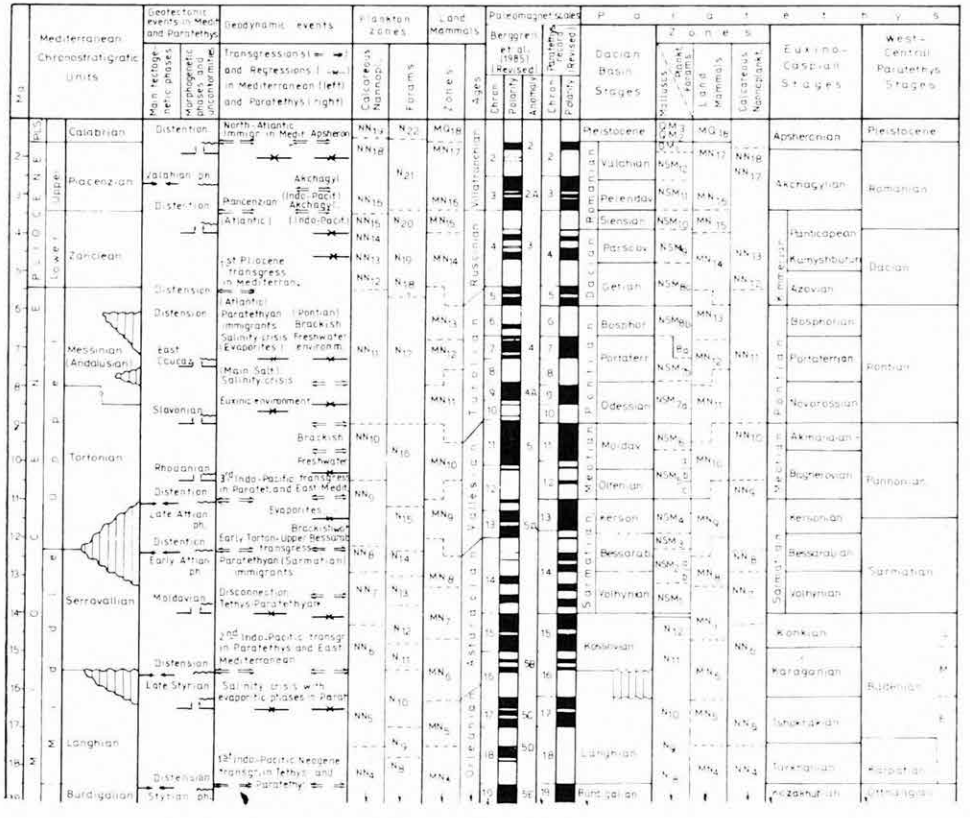

Fig. 1.

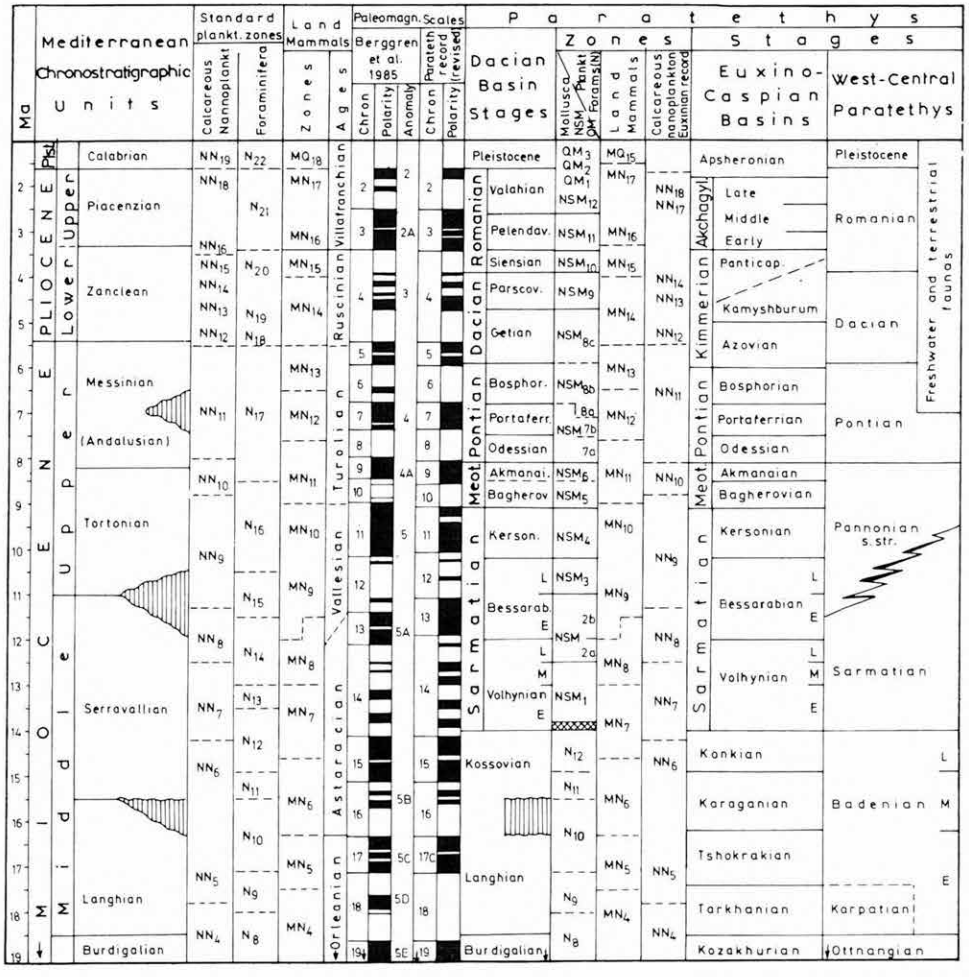

Fig. 2.

MN_{11} zone has been assigned to the Upper Sarmatian (Kersonian), the Meotian, or the Upper Meotian—Lower Pontian interval, respectively.

Similar paradoxical chronostratigraphic conclusions can be reached for any group of fossils, when palaeomagnetic polarities are used without any proper tie-point correlation. Thus HSÜ (1978), relying on lithologic record and spore-polen and diatom assemblages and taking into account some palaeomagnetic data acquired at Site 380, Black Sea (DSDP, Leg. 42/B), concluded that the lower segment (210 m) of the column would pertain to the Messinian stage. In fact these deposits are Sarmatian in age, as KOJUMDGIEVA (1983) pointed out. The following sequences of the same site assigned by HSÜ (or his co-workers) to various chronostratigraphic units, are shown in Table 4. As a matter of fact this table needs no further comments because it is significant enough to express the controversial results which could sometimes be reached in circum-Mediterranean Neogene chronostratigraphy.

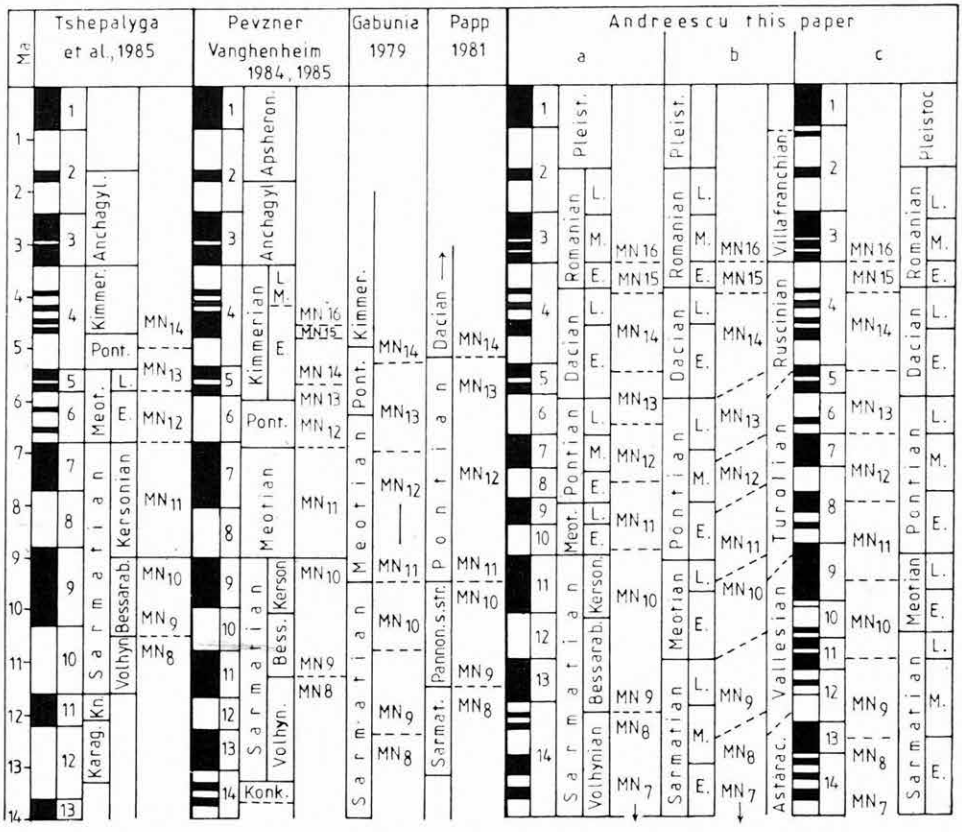

Fig. 3.

Conclusions

Some features leading to the controversial use of Neogene chronostratigraphic units from the Tethys and the Paratethys have deliberately been overlooked, or only suggested in this too short contribution. However, we think the reader will be able to detect them, and finally to discern himself the difficulties which may discourage those who are less familiar with this real welter of Neogene stages. Unfortunately, given the limited space available, we have been unable to argue for our own opinion. Nevertheless, some of them are rendered out in the accompanying tables (1—4) and in ANDREESCU et al., this volume, p. 113. In Tables 1 and 2 an integration of biochronologic units of the Langhian—Early Pleistocene interval with the main geotectonic and geodynamic events of Tethys and Paratethys has been attempted. The calibration and age assignation of these units have been made by using two somewhat different palaeomagnetic scales (both being quite plausible). Note that in Table 2 in spite of the fact that same palaeomagnetic scales, as in Table 1, were used, the biochronologic and chronostratigraphic units of the Sarmatian—Pontian time span have been calibrated in a sensibly different manner. This calibration seems to be rather plausible as far as the Sarmatian is concerned but it is less reliable for the Meotian and Pontian (see also: ANDREESCU et al., this volume).

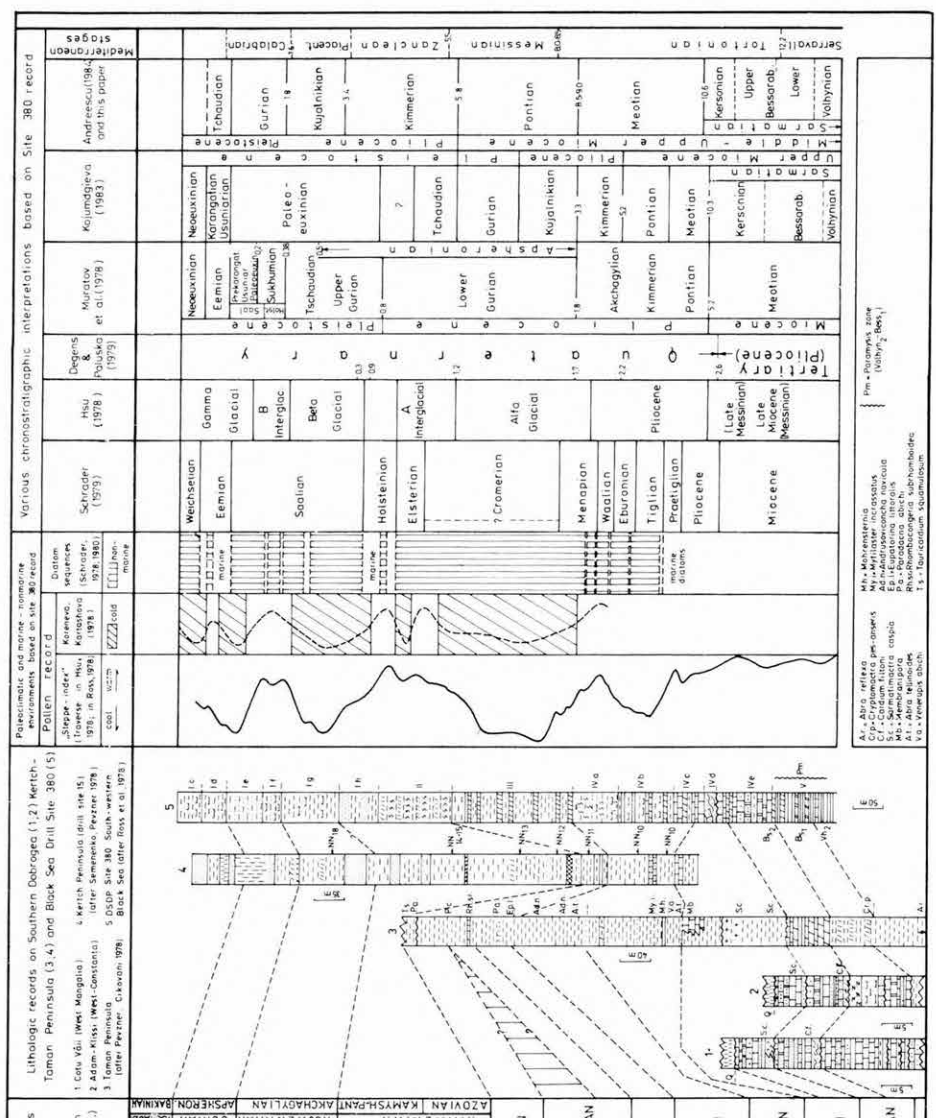
Chronostratigraphic units in Dacian Basin and Euxino-Caspian Basin (Eastern Paratethys part.) (Andreescu 1981)
Lithologic records on Southern Dobrogea (1:2) Mertich-Taman Peninsula (3,4) and Black Sea Drill Site 380 (5)
1 Cetu Văi (West Mangalia) 4 Kertch Peninsula (drill site 15), 2 Adam-Kiosi (West-Constanta) later Semenenko Peninsula 1978)
3 Taman Peninsula (after Pevzner Cikovani 1978) 5 DSDP Site 380 South-western Black Sea (after Ross et al 1978)
Various chronostratigraphic interpretations based on Site 380 record
Schrader (1979)
Hsü (1978)
Degens & Poluska (1979)
Muratov et al. (1978)
Kojumdgieva (1983)
Andreescu (1984) and this paper
Mediterranean stages
Paleoclimatic and marine - nonmarine environments based on site 380 record
Pollen record
Diatom sequences (Schrader, 1978, 1980)
Kvasova Kontratieva (1978)
Stepan - index* (Traverse in Hsü 1978, in Ross, 1978)
cool warm
marine
nonmarine
Weichselian
Eemian
Saalian
Holsteinian
Elsterian
? Cromerian
Menapian
Waalian
Eburonian
Tiglian
Pretiglian
Pliocene
Miocene
Gamma Glacial
B Interglac
Beta Glacial
A Interglacial
Alfa Glacial
Late Messinian
Late Miocene Messinian
Tertiary (Pliocene)
Quaternary
Neoeuxinian
Karangatian
Usunlarian
Paleo-euxinian
Tchaudian
Gurian
Kujalnikian
Kimmerian
Pontian
Meotian
Sarmatian
Kersonian
Bessarab.
Volhynian
Neoeuxinian
Eemian
Prevarnyan
Uzunlarian
Karangatian
Tchaudian
Upper Gurian
Lower Gurian
Akchagylian
Kimmerian
Pontian
Meotian
Kersonian
Bessarab.
Volhynian
Neoeuxinian
Karangatian
Usunlarian
Paleo-euxinian
Gurian
Kujalnikian
Kimmerian
Pontian
Meotian
Kersonian
Upper Bessarab.
Lower
Volhynian
Tchaudian
Gurian
Kujalnikian
Kimmerian
Pontian
Meotian
Sarmatian
Calabrian
Piacenzian
Zanclean
Messinian
Tortonian
Serravallian
Pleistocene
Pliocene
Miocene
Middle
Upper
Lower
Middle
Upper
Lower
Middle - Upper Miocene
Pliocene
Pleistocene
Quaternary
Romanian
Dacian
Pontian
Meotian
Sarmatian
Middle
Lower
Valahian
Pelendavian
Siensian
Parscovian
Getian
Bosphorian
Portaferrian
Odessian
Akmanian
Bagherovian
Kersonian
Bessarabian
Volhynian
Gurian
Apsheronian
Akchagylian
Kujalnikian
Kamyshlakian
Kimmerian
Azovian
Bakunian
Geochronometric scale in Ma
Ar - Abra reflexa
Cyp - Cryptomastra pes-anseris
Cd - Cardium fittoni
Cc - Cardium (Plicatum) carsicola
Mb - Membranipora
Ab - Abra tellinoides
Ks - Kerassia tricki
Mb - Mastogerinella
Myt - Mytilaster lineatus
Ad - Adacnarca nitida
Cc - Cerastoderma
Pa - Paradacna abichi
Rho - Rhombocongeria subhimbeides
Ts - Tarraconella tauricum
Pm - Pterompyis zone (Hystrix, 1984)

Fig. 4.

In Table 3 various ways of age assignation of Neogene Mammal units have been illustrated by using 4 different palaeomagnetic scales. In this table, our option goes towards alternative (c).

Concerning some references cited in the text, the reader is kindly requested to consult the exhaustive bibliography presented by F. RÖGL in the second part of the volume "Mediterranean and Paratethys Neogene, Report on Activity of the RCMNS Working Groups and Bibliography, 1979—1984.— Budapest, 1985."

ION ANDREESCU
Institute of Geology and Geophysics
1, Caransebeş Str.
78344 BUCHAREST, Romania

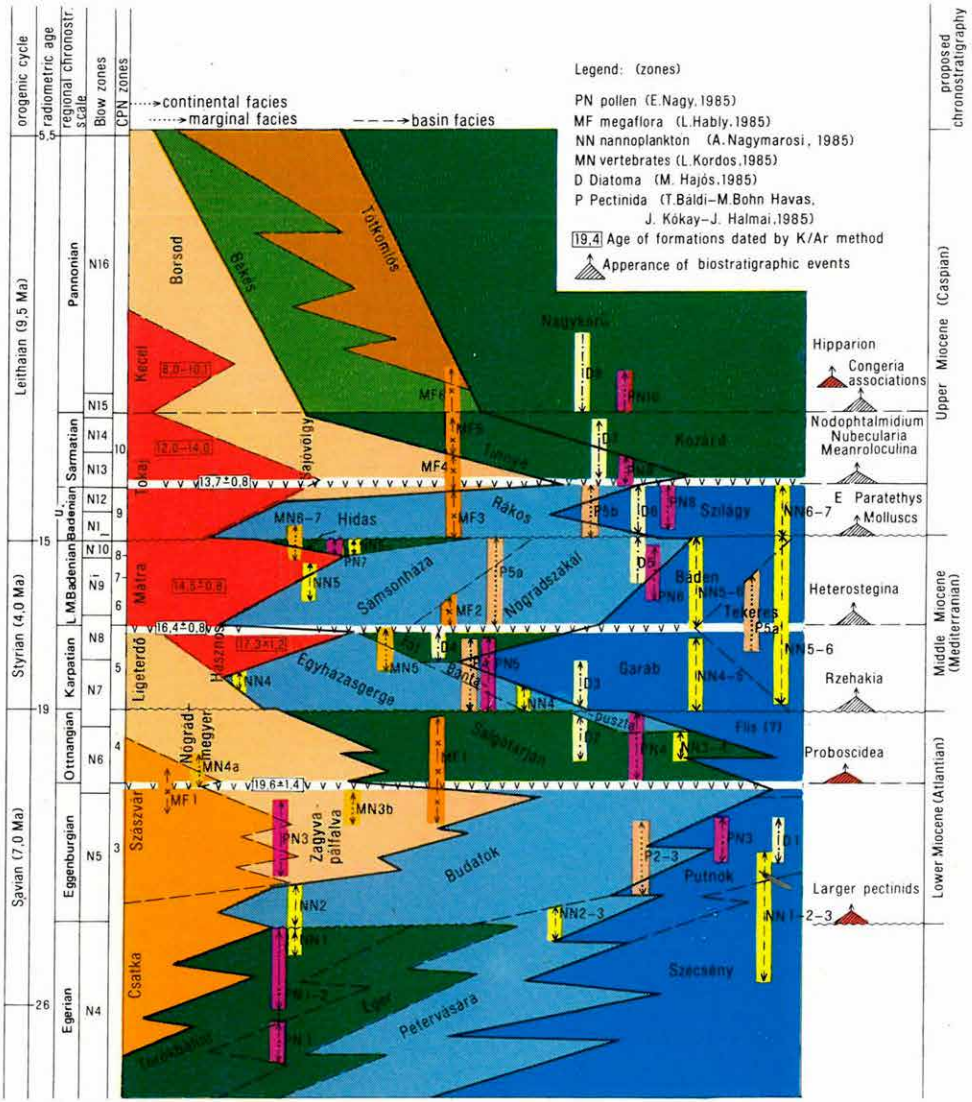

Fig. 1. Miocene bio-, litho- and chronostratigraphy of Hungary