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MAIN FEATURES OF THE PRE-TERTIARY BASEMENT OF HUNGARY

(Figs. 5)

Abstract: According to the development patterns of pre-Tertiary formations, the territory of Hungary can be divided into two basically different megatectonic units. To the north of the Central Hungarian Structure Zone, there are subunits representing the continuation of the internal zones of the Alps, Dinarides and the West Carpathians or exhibiting features related to these. To the south of the Central Hungarian Structure Zone the Tisza unit can be outlined showing affinities with the Apuseni Mountains. The evolutionary history of the two units has essential differences at least until the beginning of Neogene.

Резюме: Согласно моделям развития дотретичных формаций, територрию Венгрии можно разделить на две существенно разные мегатектонические единицы. К северу от центральной венгерской структурной зоны находятся единицы представляющие продолжение внутренних зон Альп, Динарид и Западных Карпат или проявляющие черты близкие к этим. К югу от центральной венгерской структурной зоны можно выделить тисскую единицу выявляющую сходства с Апусенами. Эволюционная история этих двух единиц значительно отличается по крайней мере до начала неогена.

The geological understanding of the mountains surrounding the Carpathian Basin led to remarkable results concerning the structure and genetic history of the mountains already in the last century. The basin substratum was almost totally unknown up to the 1930's, scarcely one or two drills having reached down to the bottom of the depression. As for geophysical exploration, in spite of gravimetric measurements by Eötvös' torsion balance, it was still at the very beginning of its development.

The apparent uniformity of the basin area and the relative simplicity of the structure of the inselbergs compared with the surroundings compelled first Lóczy (1918) and then Kober (1921) to interpret the basin substratum as a uniform, rigid body. Hence their coining the concept of a „median mass". As a result of the works published by the two scientists, the "median mass" would be introduced as a peculiar and rare structural unit of the Alpine mountain system in the relevant literature.

The results of regular and large-scale hydrocarbon exploration and water prospecting as well as renewed geological mapping in the mountainous regions of Hungary started in the beginning of the 50's did not corroborate the "median mass" theory, some data even disproved it. The most important development in this context has been the discovery of flysch formations in the basement of the Alföld (Great Hungarian Plain).

Some years later of the publication in 1967 of the first map of the basin substratum (Dank et al.), Wein (1978) gave a summarizing account of the knowledge of the geological structure. As pointed out by him, the Carpathian Basin is divided by a huge fault line extending from Zagreb up to the Tokaj Mountains into two major units largely differring from each other in their geological features.

During the last 20 years that have elapsed since that time, about 1500 boreholes

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of different aim have been put down in the basin area and about 3000 on the mountain margins and several thousand km of seismic profiles have been measured. In the light of these results and of the progress achieved in stratigraphy, tectogenesis and plate tectonics, the ideas on the basin substratum have radically changed. The new results are reflected by the deep structure map on a scale of 1 : 500.000 which was completed in 1985 (Fülop et al.) (Fig. 1.).

The map provides additional evidence of the fact that the basement is divided into two major tectonic units showing considerable different geological features. The northwest Duna unit* has Alpine-Dinarid and West Carpathian connections as exhibited by its geological features.

The geohistory of the southeast, so called Tisza unit was, at least up to Miocene times, quite different from that of the northwest unit. It has direct connection with the Apuseni Mts., and its Permian—Triassic—Lower Jurassic development shows affinity with the European plate.

The two major tectonic units are divided by the "Central Hungarian Structure Zone" crossing the country in ENE-WSW direction. The continuity of the fault zone is locally interrupted by NE-SW trending young structural elements which locally resume the function of the main fault zone.

The opinions of the specialists dealing with the characteristics and geodynamic role of the Central Hungarian Structure Zone widely diverge because this megatectonic boundary changed functions several times during the Alpine geohistory. In the Jurassic it seems to have played primarily the role of microplate boundary. The northwest and southeast units now in contact, however, seem to have been emplaced in their juxtaposition probably as a result of a strike slip over several hundred km distance as late as during Paleogene time.

The two major tectonic units on either side of the Central Hungarian Structure Zone can be subdivided into further fractions.

The northwest part of the country, from the Austrian border as far as the Rába fault line following by and large the course of the river Rába, may be regarded as direct continuation of the Eastern Alps. In the Kőszeg- and Sopron Mountains and the basement of the Kisalföld (Little Hungarian Plain), the Mesozoic greenschist sequence of the Rechnitz window, Paleozoic meso- to epimetamorphic formations of the Lower and Upper Austroalpine nappe system, can be identified.

Between the Rába fault and the Balaton fault lines the Transdanubian Central Range unit is found. Partly in outcrop, partly buried in the subsurface of the basin, it is characterized by Upper Permian to Mesozoic terrigene carbonate sequences of S Alpine character unconformably overlying the Lower Paleozoic anchimetamorphic rocks underneath. Structurally, the unit seems to be quite simple, though, in the light of latest geophysical results, the presence of a large nappe structure cannot be precluded (Adám et al., 1985).

South of the Balaton fault which in the Paleogene may have been the path of sizeable horizontal dislocations, the Mid-Transdanubian unit can be singled out as a narrow zone extending up to the Central Hungarian Structure Zone. Rather poorly known, the imbricated marine Lower Paleozoic and carbonate-facies Mesozoic are akin to both the Transdanubian Central Range and the Bükk.

The most sophisticated geological-structural image is that shown by the North Hungarian Range. Alpinotype nappes composed of metamorphic rocks of different

* This denomination is a proposal, it is not generally accepted.

Fig. 1. Megatectonic units and depth of pre-Tertiary basement of Hungary.

grade are supposed to exist in the Bükk Mountains, their presence in the Aggtelek--Rudabánya Mountains have been proved. The Late Paleozoic carbonate sedimentation continues in the Triassic, being replaced, in the Jurassic by the formation of black shales of schistes lustrés type. The character of contact of these units with the Transdanubian Central Range is unknown.

Situated south of the Central Hungarian Structure Zone, the so-called Tisza unit has a substructure that is not uniform either. The folded-imbricated structure of the Mecsek and Villány Mountains is traceable farther northeast in the substructure of the Alföld (Great Hungarian Plain). A mesometamorphic basement of controversial age is overlain by Permo—Triassic deposits of Germanic type, Liassic beds of Gresten facies, to be followed by a Jurassic—Cretaceous carbonate sequence with a remarkable Early Cretaceous volcanism. The Békés unit in the southern Alföld (Great Hungarian Plain) exhibits the features of the Codru nappe system.

The Zemplén Mountains in the northeast corner of the country, with a view to its geological characteristics, is believed to belong to the Tisza unit.

The Mesozoic history of the Hungarian portion of the lithosphere is defined by the process of spreading and then the closure of the Tethys and the changes in spatial position it occupied within the Tethys system.

In Late Permian to Early Triassic time, the lithosphere portions known from Hungary lay at the western tip of a bay that belonged to the Panthalassa world ocean and that extended well into the Pangea continent. Having occupied positions that were different from today's these portions belonged to different paleogeographic units (Fig. 2.).

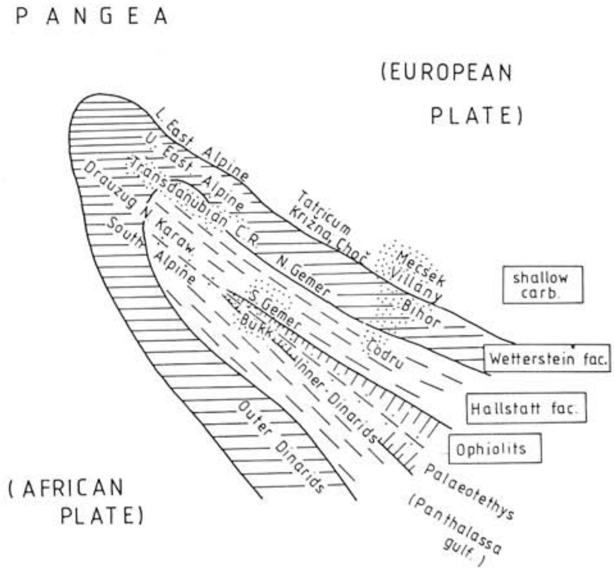

Fig. 2. General paleogeographic situation in the Mid-Triassic, showing position of the Hungarian units (dotted areas).

A marked change occurred in Mid-Triassic time, when the rifting that was responsible for the break-up of the Pangea reached the area of what is now Hungary.

The first stage of opening of the Tethys (or Paleotethys) came to a deadlock in earliest Carnian time and a stage of evolution characterized by platform-type carbonate sedimentation followed.

A new turning-point in tectogenetic evolution was the revival of rifting, the second stage of the Tethyan expansion in Liassic time. A radical change in the position of the Hungarian units, however, took place in Mid—Late Jurassic time, when a huge transform fault of a length of about 500 km that may be regarded as the first manifestation of the Central Hungarian Structure Zone came into being (Fig. 3.). The opening of the Pieniny zone and the rotation-driven dislocation of the Tisza unit created a situation in which the Transdanubian Central Range unit of African plate origin and the Tisza unit of European plate origin could get in an inverse position.

The Late Cretaceous situation was characterized by a double (northern and southern) flysch through-system sorrounded the afare-mentioned units (Fig. 4.).

The emplacement of both Tisza and Duna units as a result of sizeable horizontal dislocations of the units involved seems to have ended by Oligocene time (Fig. 5.).

The evolutionary stage from the Neogene up to the present has been characterized by further rotations high-amplitude uplifts and subsidences which have led to the present day pattern of the Carpathian Basin.

The intricate structural-geological picture just outlined will, of course, be modified and improved with the progress of research. The exploration of the Hungarian subbasins that are filled with young sediments locally attaining 6—7 thousand metres in thickness has been such a challenge to Hungarian geologists and geophysicists working in Carpathian realm as may be compared to the exploration of the ocean bottom in the 1960's.

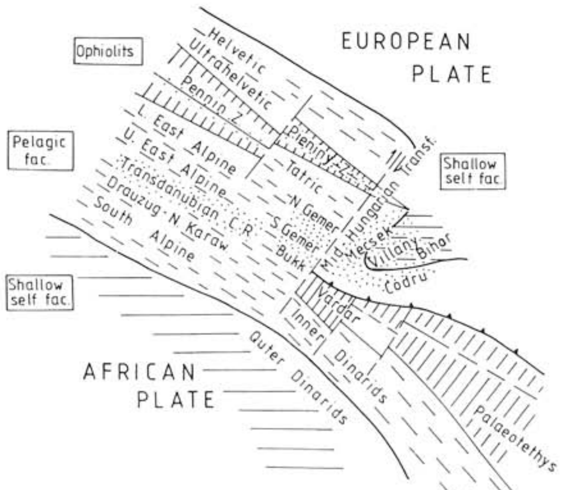

Fig. 3. Paleogeographic situation in the Mid—Late Jurassic.

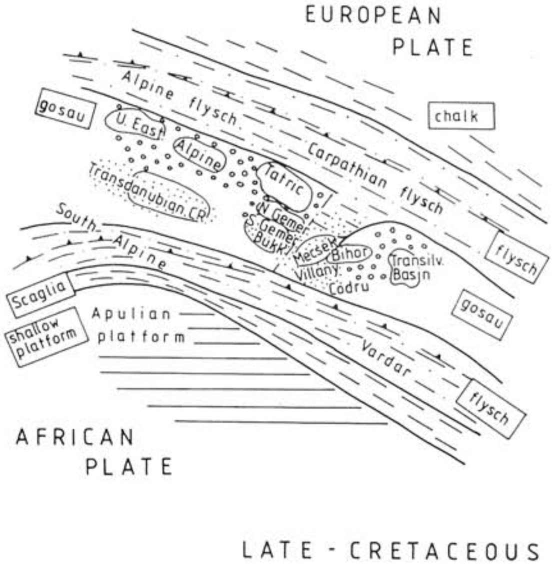

Fig. 4. Paleogeographic situation in the Late Cretaceous.

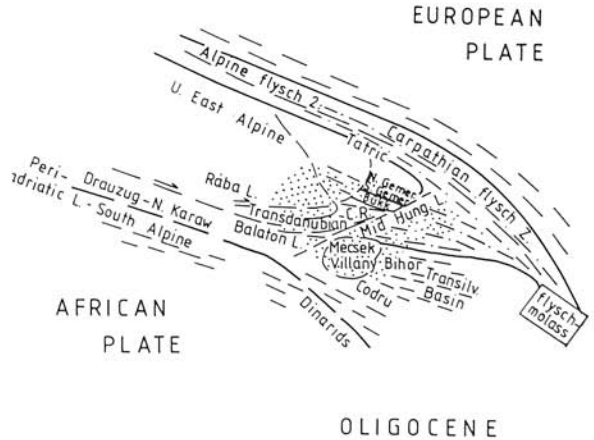

Fig. 5. Paleogeographic situation in the Oligocene.

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