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Young Tertiary rotation of the megaunit Pelso and neighbour units of the West Carpathians.

DIONÝZ VASS[1], IGOR TÚNYI I[2]. & EMÖ MÁRTON[3]

[1] Geologická služba SR, Mlynská dolina 1, 817 04 Bratislava, Slovakia
[2] Geofyzikálny ústav SAV, Dúbravská cesta 1, 842 28 Bratislava, Slovakia
[3] Columbus u.17-23, H-1145 Budapest, Hungary

Abstract. The 80°counterclokwise (CCW) rotation of the remanent magnetism declination masured on 54 sites of the lower Miocene rocks in Southern Slovak depressions and in North Hungarian Central Range has been generated on the background of the Afrorabian and Euroasian lithospheric plates convergenc. The collision and subduction provoked the tectonic escape of the crustal and/or lithospheric fragments or terranes from the Alpine and Dinaric domain. The escape started in late Cretaceous and finished after Egerian and before late Eggenburgian (Early Miocene). The tectonic escape gave rise to the astenosphere and it was the reason of the crust upheaval, later on relieved by rifting. The relaxation of the lithosphere after a long compression and/or transtension gave way to the CCW rotation of the rock mass in two rotational events: during the late Ottnangian - early Karpathian, 18-17 Ma B.P. (50°CCW) and during the Early Badenian 16-15,5Ma B.P.(30°CCW). During the first event the Eastern part of the Pelso megablock rotated. The second event seized the whole Pelso unit (including the Transdanubicum).

Key words: declination rotation, West Carpathians, Pelso megablock, Early Miocene, tectonic escape, asthenosphere rise, crust upheaval, rifting.

Paleomagnetic investigations of 54 sites in the Southern Slovakian depressions and Northern Hungarian Central Range showed important counterclokwise (CCW) rotation which took place during the Early Miocene.

The driving force of the Tertiary tectonic developement in the Alpine-Carpathian-Pannonian (Alcapa) area was the convergence of the Afroarabian and Euroasian lithospheric plates (ZIEGLER 1988). The collision of the Bohemian Massife with the Apulian promontory forced the large crustal fragments to escape from the Alpine and Dinaric domain to the South -East, pushing them from behind. Simultaneously the roll-back effect of the subduction in front of rising Outer Carpathians operated as a pull in front of the escaping terranes (CSONTOS et al.,1992),(fig.1). The escaping terranes were joined latter in the Pelso megaunit, including the Transdanubicum, Mid-Hungarian mobile belt, Bükk and Gemericum (DANK & FÖLÖP 1990), (fig.2).

The escape was controlled by the strike-slip faults of a large lateral shear (several hundred kms), such as Gailtal - Balaton line, or Mid-Hungarian line and/or by faults with smaller lateral displacement - several tens kms - such the as Raaba, Diösjenö, Plešivec-Rapovce lines (Fig.2). The tectonic escape is well documented particularly by the lateral translation of the Late Permian to Late Triassic facial zones, showing the 500 km translation between the NW Dinarides and Bükk-Gemericum

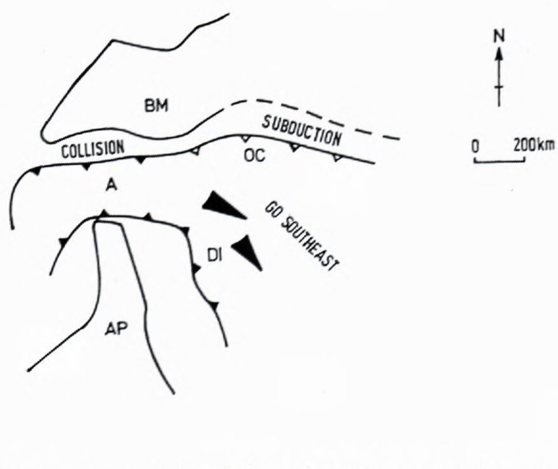

Fig.1 The convergence of the Afroarabian and Euroasian lithospheric plates caused the tectonic escape from the Alpine (A) and Dinaric (Di) domain.The convergence provoked the collision of the Apulian promontory (AP) with the Bohemian Massive (BM). The collision was an impulse of the tectonic escape pushing from behinde Alpine and Dinaric terranes escaping to the East. The subduction of the Polish Platform (PP) in front of the rising Outer Carpathians (OC) operated as suction, or pull in front of the escaping crustal and/or lithospheric fragments. (after LORENZ et al.,1993, modified)

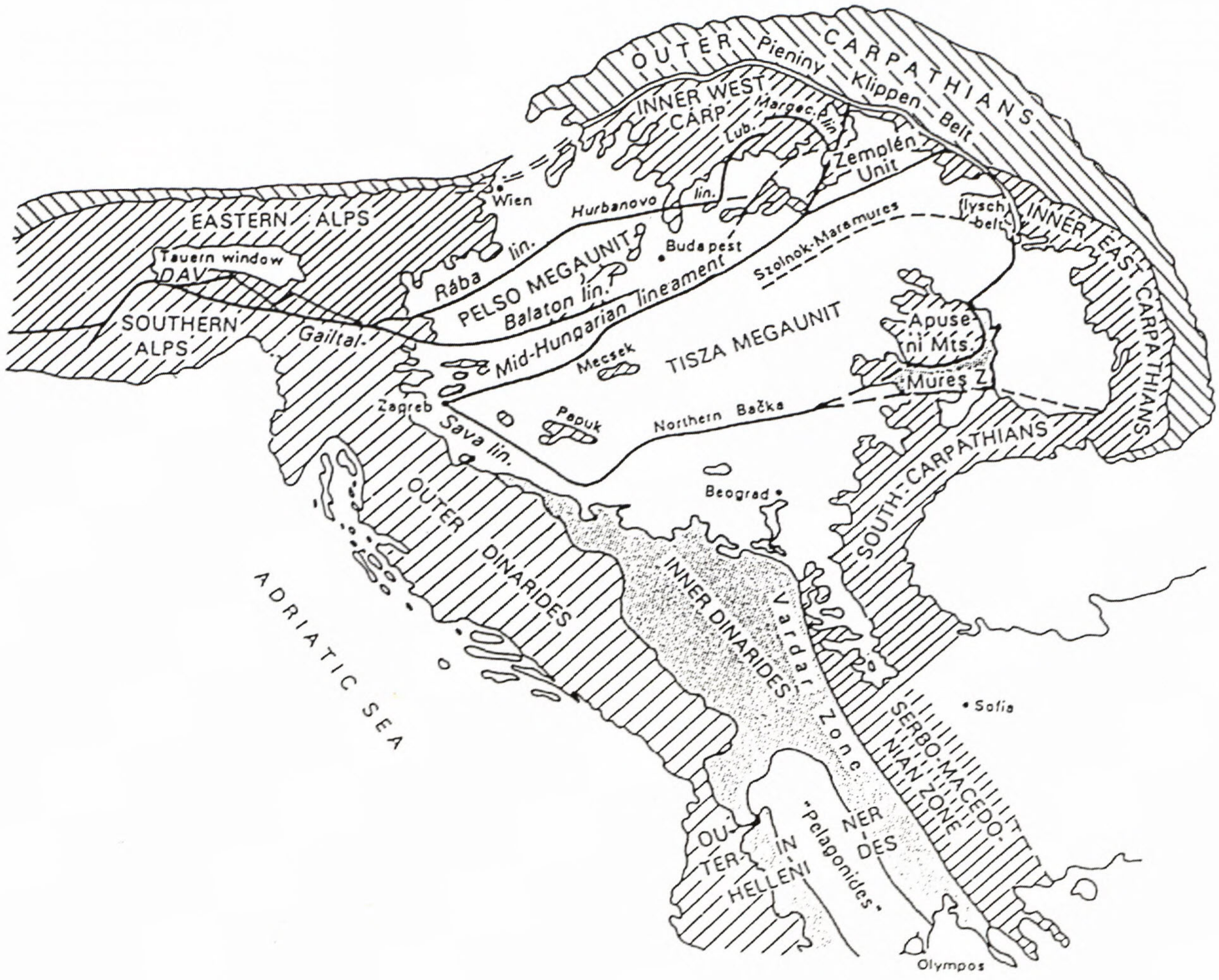

Fig.2 The Pelso megaunit composed of several individual terranes having the facial zones amputated by strike - slip faults. The continuation of the facial zones may be found in Southern Alps and NW Dinarides (after HAAS *et al.,1995).*

and 450 km between the Southern Alps and Transdanu-bicum (KÁZMER & KOVÁCS 1985, HAAS et al.,1995). The Central Western Carpathian units were also affected by the forces causing the tectonic escape, however, the facial zones of the Alps and Central Western Carpathi-ans do not show such a large disruption, but their lenght was several times multiplied (HAAS et al.,1995).

The tectonic escape started after the Cretaceous folding in the Alps, it was accelerated after the pre-Oligocene folding and finished after the Egerian in the earliest Miocene. Of course, the escape was not a uniform motion. The Gemeric terrane approached the Central Western Carpathians in the Late Eocene (clastic material coming fromum Gemeric is present in the Central Carpathian Paleogene (MARSCHALKO 1968). On the other side the Slovanian and Buda Paleogene, were disrupted by a dextral strike-slip on the Gailtal-Balaton line with lateral translation of approx. 300 km after the Egerian (after the earliest Miocene).

The large shifting of the crustal and/or lithospheric fragments, if sufficiently rapid, caused in the mantle a horizontal stress gradient activating the flow of the ductil astenospheric mass. The mantle material escaped from the area of large crustal loading to an area of lesser isostatic pressure. Convectional currents are generated in the astenosphere. The astenosphere activated in this way was rising. Conductive heating from the mantle plume, heat transfer from the magma generation and convective heating forced the lithosphere to thin (ALLAN & ALLAN 1992). If the heat fluxes from the lithosphere were large enough, relatively rapid thinning of the lithosphere would cause isostatic uplift of the lithosphere including the surface of the crust (SENGÖR & BURKE 1978, BAKER & MORGAN 1981, MORGAN & BAKER 1983, TURCOTTE 1983, KEEN 1985, fide ALLEN & ALLEN 1992).

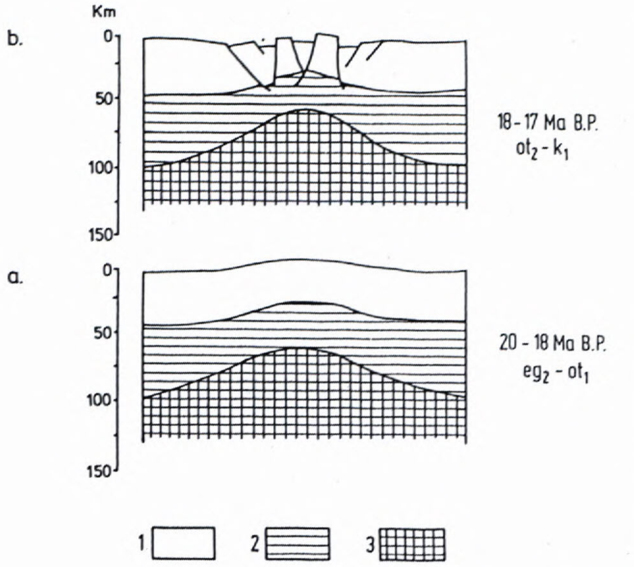

Fig. 3 Two phases of the rifting provoked by the rising astenospehere in the Pannonian realm after the tectonic escape of the Pelso megaunit from the Alpine-Dinaric domain.

3a The astenosphere rise as result of the isostatic instability caused by lateral shifting of the escaping crustal and/or lithospheric fragments cca 20-18Ma B.P. The astenosphere rise provoked an uphaeval of the crust in Pannonian realm.

3b The transition of the crustal rise into tectonic collapse: the begining of the rifting in proper sense, cca 18-17Ma B.P.

1 crust	*Ma B.P.*	*millions years before present*
2 upper mantle	*k*	*Karpathian*
3 astenosphere	*ot*	*Ottnangian*
	eg	*Eggenburgian*

The conditions of astenosphere activation were fulfilled by the Tertiary tectonic escape in the Alcapa region. The heat flux es from the activated astenosphere warmed in relatively short time the crust which began to rise (first step of the active rifting in the sense of SENGÖR and BURKE 1978 and others fide ALLEN & ALLEN 1992), (Fig.3). The first manifestation of crust upheaval in the Pannonian area 20 Ma B.P. was the sea regression and disapearance of the Fiľakovo/Pétervásara marine basin (VASS 1995). The sea regression was followed by exclusively continental sedimentation. The crust heating was signalised also by the generation of crustal magmas giving rise to areal acid volcanism in the Pannonian area (PANTÓ et al., 1966, SZABÓ et al., 1992, LEXA et al.,1993).

From the begining of the tectonic escape (at least from the begining of are Oligocene aprox 36 Ma B.P. till the crust upheaval (20-19 Ma B.P.), the whole escaping area was under the influence of compressional, transpressional and/or transtensional forces (fig.4). In the late Ottnangian (aprox.17 Ma B.P.), these forces were replaced by extensional ones, caused by the acceleration of the crust extension reflected in the first manifestation of tectonic collapse or rifting itself (the second step of active rifting). Evidence of this is the sea transgression into the Bántapusta and Borsod areas (KOKAY in PAPP et al., 1973, BOHN-HAVAS 1985) and the sea excursions into the Novohrad/Nógrad Basin (N. Hungary - S. Slovakia, VASS et al.,1987). The stress relaxation and the areal extension, well proved by structural measurements (VASS et al.,1993, FODOR in MARTON & FODOR 1995) gave space for the CCW rotation. The rotation exhibits two phases (Fig.4): the First 50°CCW during the Late Ottnangian - early Karpathian (18-17 Ma B.P.) and the second during the early Badenian (16-15,5Ma).

The rotation may be explained by two models:

1. The whole or a large part of the megaunit Pelso rotated (Fig.5). The rotation moved the megaunit at least 500 kms to the North. Such a model is supported by the shallow paleomagnetic inclination (i.e. rocks acquired the remanent magnetisation in the areas closer to the Equator as they are situated at present. The rotation covers 2,5Ma and the rate of movement was aprox 2cm/year, which is comparable with recent crustal dynamics. The rotation assumed the crust or the elastic lithosphere, but not the deeper litosphere and risen astenosphere. Because of this evidence the continuation of rifting is missing in the rotated terranes. To the contrary, they were permanently rising from the Middle Badenian till present. Crustal extension and rifting during the Middle Miocene occured in the area abandoned by the rotated Pelso megaunit

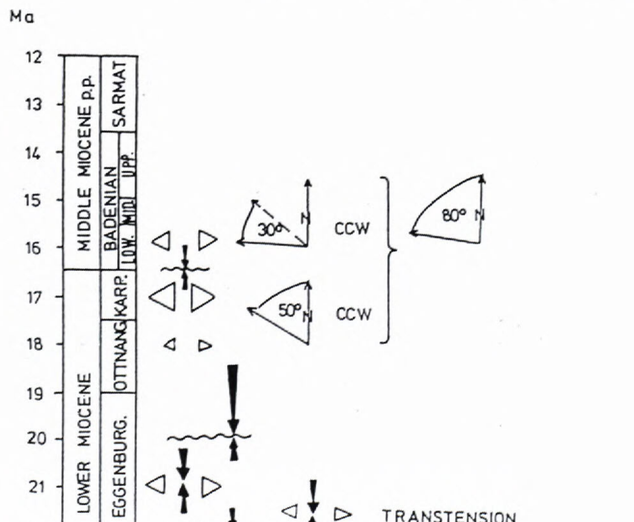

Fig. 4 The time-table of the paleostress and the rotations events during the early Miocene in the South Slovakian depressions and North Hungarian Central Range.

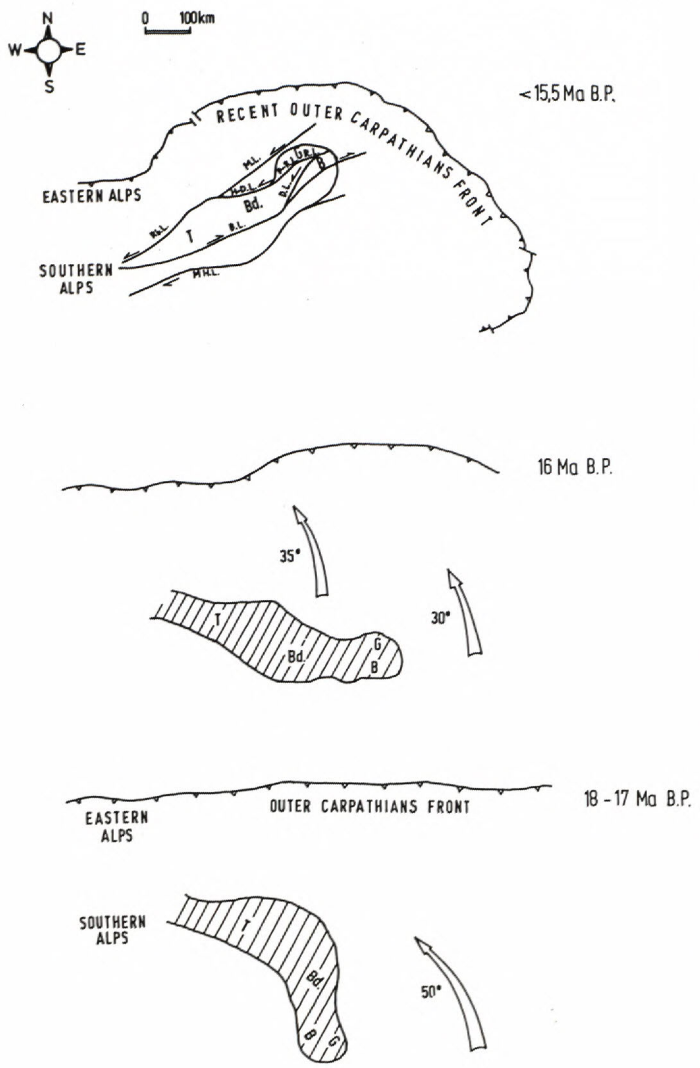

Fig. 5 Model of the whole Pelso megaunit rotation. The rotation took part when the Carpathian arc was formed B.L.-Balaton line, D.L.-Darnó line, H.-Dj.L-Hurbanovo-Diósjenő line, MH.L-Midhungarian line, M.L.-Muráň line, P.-R.L.-Plešivec-Rapovce line, R.L.-Rožňava line, Rb.L-Raaba line, T-Transdanubicum and Mid Hungarian mobil belt terranes, B-Bükk, G-Gemeric, Bd-unit between Transdanubicum and Bükk Mts. (Burda unit).

(area of Nagyalföld, area on the southern perifery of the Transdanubian Central Range and Nord Hungarian Central Range (comp. ROYDEN in ROYDEN & HORVÁTH et al.,1988).

2. The megaunit Pelso brought along its own basic tectonic structure in vertical (nappes), as wel as lateral (large wrench faults) from his Alpine-Dinaric home. The rotation took place afterwards as individual rotations of several blocks of smaller size confined by second-order crustal and or supercrustal faults oblique or perpendicular to the main wrench faults accomodating the tectonic escape before the rotation (comp. MÁRTON & FODOR 1995).

The rotations finished after the early Badenian, as the middle Badenian andesites in the area do not show any indications of the rotation (see for ex. ORLICKÝ et al.,1995).

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