Rotations of lithospheric fragments in the Carpathian – Pannonian Domain and the development of the Carpathian Chain and the Pannonian Basin in the Tertiary

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In the last decade, the paleomagnetic study in the Carpathian-Pannonian domain brought a large number of new data which show a variability of the Tertiary rotations in time and space mirroring the development of the Carpathian chain and Pannonian back-arc basin during the Neogene. The paleomagnetic results document the general CCW rotation of the northern, the Alcapa megatectonic unit, while indicate both CW and CCW rotations in the southern, the Tisza–Dacia megatectonic unit.

In the Western Carpathian region of the Alcapa microplate two CCW rotations were registered in the Tertiary. The older one (50–60°), after the Ottnangian (17.5 Ma), can be correlated with initial rifting of the back-arc area, associated with high subsidence rates above all in the Vienna Basin. During this time, the Early Styrian thrust of the Flysch Belt over the North European Platform was followed by development of continuous foredeep in front of the orogene (depocentres in the west). The second CCW rotation (30°), during the Early Badenian (15 Ma), can be correlated with tectonically controlled transgression, followed by accelerated subsidence in the Danube Basin and the Late Styrian thrust of the Western Carpathian Flysch Belt over the foredeep. There is paleomagnetic evidence to show that the final emplacement of the Western Carpathian region is older than 14.5 Ma.

In the Transcarpathian depression, in the Tokaj Mts. and in the Oas Mts. we know of a single CCW rotation (40–50°) which must have taken place in the Sarmatian (13–12 Ma). This rotation can be correlated with maximum subsidence in the East Slovakian Basin and accelerated subsidence in the foredeep at the Western–Eastern Carpathians boundary, followed by the last overthrusts of the Outer Carpathian Flysch Belt.

In the Transdanubiam Central Range a CCW rotation (30°) can be traced during the Eocene, mirroring the Paleogene development of the Southern Alps and Dinarids. A second CCW rotation (30°) occurred probably during the Early Badenian (15 Ma) which can be related to Danube Basin synrift development. The last CCW rotation (30°) is observed on Early Pannonian (11–9.5 Ma) rocks. Though the exact age of this rotation is not yet known, it may be tentatively related to the new rifting period in the back arc basin and to the development of compressive structures from the zone of Sava folds to the south-eastern front of Transdanubian Range.

In the southern, Tisza-Dacia megatectonic unit, the Tertiary paleomagnetic data complicated the picture of uniform CW rotations which had been based on Cretaceous paleomagnetic results. In the western part of the Tisza-Dacia unit, CCW rotations (about 50°) of Karpathian age (17.5 Ma) occur, probably connected to a left-lateral displacement at the northern margin of the Mecsek Mts. There are a few data indicating that the main body of the Mecsek rotated in the CW sense, but the timing is uncertain. In the eastern part of the megatectonic unit there is evidence for about 60° CW rotation between 14 and 12 Ma. This rotation can be correlated with the Late Styrian to Early Moldavian thrust of the Eastern Carpathian Flysch Belt over the foredeep and initial rifting stage (uplift?) of the Great Hungarian Plain. In the Transylvanian Basin increased subsidence took place.

In the SE margin of the Pannonian back arc basin, still in the Tisza megatectonic unit, CCW rotation (40°) was observed, which must have occurred after Pontian time (6 Ma) and was accompanied by rapid subsidence in the Drava and Sava Basins This youngest registered CCW rotation reflects compressive development of the Dinarids in the Pliocene.

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