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The end of subduction and collision: an integrated study of the youngest tectonic evolution of the SE-Carpathians

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The combined analysis of new data from different fields (seismic tomography, refraction seismics, gravity modelling, isostasy analysis, river network structure) reveals new insights into the tectonic evolution of the SE-Carpathians during Neogene and Quaternary times. Miocene subduction was followed by ("soft") continental collision accompanied by slab steepening. Negative buoyancy of the subducting lithosphere caused basin subsidence in the upper plate, resulting in the development of the Transylvanian basin. Later, steepening and delamination brought the slab into its present-day nearly vertical position beneath the outer parts of the south-eastern corner of the Carpathians. Results from high-resolution seismic tomography reveal a near-vertical high-velocity body with NE-SW orientation in the upper part (70-200 km) and N-S orientation in the lower part (200-370 km). These different orientations indicate a change in subduction retreat direction caused by oblique collision of the Intra-Carpathian block with the European foreland. This oblique collision together with differences in the lithospheric thickness and rheology of the foreland is the reason, why different stages of isostatic balance were reached in different regions of the SE-Carpathians. Analysis of free-air anomaly profiles through different sections of the mountain belt shows that isostatic balance is only reached in a few regions while others are characterized by a positive surplus. These differences are accompanied by differences in the arrangement of the river networks indicating that the regions are in different stages of continental collision with uplift in the one region and subsidence in the other one.

High-resolution seismic tomography shows a subdivision of the slab in a seismically active NE-part and an aseismic SW-part. This can be explained by slab detachment of

the SW-part, while the NE-part is still (partly) attached so that slab-pull induced stress accumulations lead to intermediate-depth seismicity (70-180 km).

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