The European Alps, Carpathians and Dinarides: evolution of a complexly deformed orogenic system and attempts of quantitative restorations of Neogene plate motions

Kamil Ustaszewski, National Taiwan University

The European Alps, Carpathians and Dinarides are parts of the much larger system of Circum-Mediterranean orogens. They form a topographically continuous, but highly curved orogenic belt, which bifurcates and encircles the Pannonian Basin, a large Miocene back-arc basin. Their continuous topographic expression might suggest coherent geological structures along-strike. In reality, however, this orogenic system is characterised by rather dramatic along-strike changes in terms of age of deformation, which affected the involved tectonic units since the Mesozoic. Owing to this long-lasting and multiple orogenic history, its parts are now compositionally heterogeneous and exhibit even opposing structural facing. A detailed geological synthesis shows that plate tectonic motions since the Early Neogene alone account for a high degree of complexity.

A map-view restoration of tectonic units in the Alps, Carpathians and Dinarides reveals the plate tectonic configuration before the onset of Miocene to recent deformations. Estimates of shortening and extension from the entire system allow to semi-quantitatively restoring the translations and rotations of tectonic units. The restoration shows that the Neogene north-south convergence between the European and Adriatic plates alone amounts to c. 200 km at a latitude of 14ºE, but increasing further to the southeast into the Adriatic Sea. The displacement of the Adriatic Plate indenter led to a change in subduction polarity along a transect through the easternmost Alps and to substantial Neogene shortening in the eastern Southern Alps and the external Dinarides. While slab-pull and rollback of oceanic lithosphere subducted beneath the Carpathians triggered back-arc extension in the Pannonian Basin and much of the concomitant folding and thrusting in the Carpathians, the rotational displacement of the Adriatic Plate indenter provided a second important driving force for the severe Neogene modifications of the Alpine-Carpathian-Dinaridic orogenic system.