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One microplate - three orogens: Alps, Dinarides, Apennines and the role of the Adriatic plate

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The motion of the Adriatic microplate with respect to the Eurasian and African plates is responsible for the Mesozoic to present tectonic evolution of the Alps, Carpathians, the Dinarides and Hellenides as well as the Apennines. The classical approach for reconstructing plate motions is to assume that tectonic plates are rigid, then apply Euler's theorem to describe their rotation on an ideally spherical Earth by stepwise restorations of magnetic anomalies and fracture zones in oceanic basins. However, this approach is inadequate for reconstructing the motion of Mediterranean microplates like Adria, which, at present, is surrounded by convergent margins and whose oceanic portions have by now been entirely subducted. Most constraints on the motion of the Adriatic microplate come either from palaeomagnetics or from shortening estimates in the Alps, i.e. its northern margin. This approach renders plate tectonic reconstructions prone to numerous errors, yielding inadmissible misfits in the Ionian Sea between southern Italy and northern Greece. At the same time, Adria's western and eastern margins in the Apennines and in the Dinarides have hitherto not been appropriately considered for improving constraints on the motion of Adria. This presentation presents new results of ongoing collaborative research that aims at improving the relative motion path for the Adriatic microplate for the Cenozoic by additionally quantifying and restoring the amount of shortening and extension in a set of geophysical-geological transects from the Tyrrhenian Sea, the Apennines and the Dinarides. Already now, our approach yields an improved motion path for the Adriatic microplate for the last 20 Ma, which minimizes misfits in previous reconstructions.

The currently largest challenge in our reconstructions is to reconcile amount and age of shortening in the Dinarides fold-and-thrust belt. For one thing, we see good agreement between the cross-sectional length of subducted material (c. 135 km, estimated from p-wave tomographic models) and shortening in the external carbonate platform of the Dinarides thrust belt (c. 127 km, from balanced cross sections). However, most of the thrust belt shortening is of Palaeogene age, which is difficult to bring into agreement with the fact that most of the subduction observed in tomographic models is most likely of Neogene age. This suggests that a substantial amount of Neogene crustal shortening must have been accommodated in the internal parts of the Dinarides fold-and-thrust belt rather than along its front. More field studies are therefore badly needed to obtain a better understanding of the timing of individual faults and their role during the Neogene evolution of the NE margin of the Adriatic plate.