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The Moho in the Eastern Alps - new insights from recent 3D refraction experiments

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The Alps are the result of a long and ongoing tectonic evolution, initiated coevally with the opening of the Atlantic Ocean in the early Jurassic. Alpine evolution was very complex, involving several stages, and has been better investigated and understood in the western parts of the orogen compared to the eastern segment. Information on the Moho below the eastern Alps is mainly limited to data obtained from several refraction lines from the 1970's and a seismic reflection profile from the late 1990's.

In 2000 and 2002, Central Europe was covered by two very large-scale 3D seismic refraction experiments: CELEBRATION 2000 and ALP 2002. In this study, we concentrate on the data subset from the Eastern Alpine region and its transition to the surrounding tectonic provinces (Bohemian Massif, Carpathians, Pannonian domain and Dinarides). This includes the transition from the head-on collision between the European and Apulian plates in the central part of the Eastern Alps, the extrusion of the Eastern Alps into the Pannonian domain and the transition of the Eastern Alps into the Dinarides.

The data from the new experiments have been processed with different 3D inversion algorithms and with interactive ray tracing approaches along selected profiles. In all cases, pictures of the P-wave velocity structure of the crust and upper mantle have been obtained. The results are in general agreement with former models, but reveal more details and important additional features.

The Moho is fragmented and overall very variable in depth and reflectance. 3 different parts have been identified, with depths ranging between 28 and 52 km. Evidence for the subduction of the European plate towards the S can be interpreted between 13° and 16° longitude, as well as subduction of the Apulian plate towards the ENE. Therefore,

both the European and the Apulian plates underthrust a "Pannonian microplate" which is bordered by the Tisza plate further south. Within this constellation, the deepest point of the Moho now coincides with the observed gravity minimum at the location of the Tauern Window; this was not the case on previous Moho maps.

The velocity pattern shows higher Moho velocities correlating with the Apulian plate. Furthermore, a 100 km broad zone of lower Moho velocities, W-E oriented around 48.5° latitude, has also been interpreted.

The lack of velocity information in most parts of the lower crust may lead to slightly distorted Moho depths. Therefore, further research should take advantage of additional geophysical information (e.g. gravimetric and magnetic data) to find better constraints on the velocity of the lower crust.