SEISMIC STRUCTURE OF THE EASTERN ALPS: EVIDENCE FOR A "PANNONIAN" MICROPLATE

M. BEHM, E. BRUECKL, W. CHWATAL & H. THYBO

CELEBRATION 2000 Working Group & ALP 2002 Working Group

Experiment

CELEBRATION 2000 and ALP 2002 conducted two large 3D seismic refraction field campaigns which target the lithospheric structure of Central Europe. This study applies data from both experiments (CELEBRATION 2000, 3rd deployment: 55 shots and 844 receivers; ALP 2002: 39 shots and 947 receivers) together with additional vintage data from older projects (Figure 1).

We study the Eastern Alps and their transition to the surrounding tectonic provinces, (Bohemian Massif, Carpathians, Pannonian domain and Dinarides). The investigation area 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 Eastern Alps into the Pannonian domain and the transition of the Eastern Alps to the Dinarides.

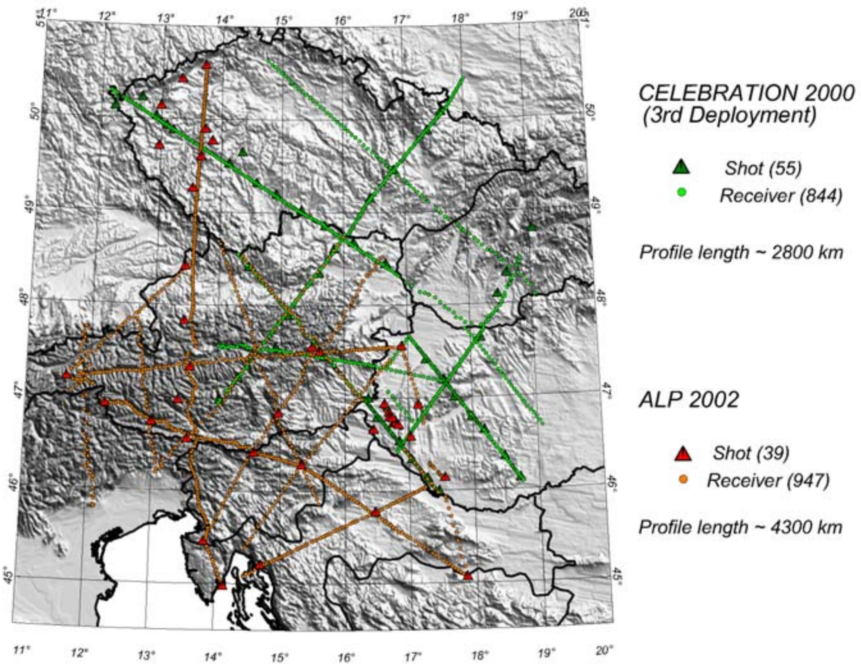

Figure 1:
Field geometry of the 3rd deployment of CELEBRATION 2000 and ALP 2002

Methodology

A 3D model of the P-wave velocity of the crust has been derived by combining the results of regional 1D diving wave inversions of CMP stacked seismic traces (Brueckl et al, 2003). This model was further refined by 3D first arrival traveltime tomography. Both times only Pg-information was used.

Depth to the Moho has been determined by combination of two methods, starting with a delay-time inversion of refractions from the upper mantle (Pn). Again stacked data were used , and the model got refined by single trace traveltime picks. Additionally, standard CMP stacking of wide-angle reflections was performed. These stacked traces were searched for reliable wide-angle reflections from the Moho (PmP-phases). Finally this reflection model and the delay-time model were merged and migrated to a yield one image of the Moho.

Results

We determine a south-dipping European Moho to the west of 14°E, comparable to the results of the Transalp and NSF-20 projects further west. This indicates subduction of the European lithosphere under the Apulian plate in the central part of the Eastern Alps. East of 14°E the subduction of the European lithosphere may be under the **"Pannonian" microplate** located between the European and the Apulian plates. In the south the Mid-Hungarian Lineament divides this new plate and the Tisza unit. The boundaries to the European and Apulian plates are marked by steps in the Moho topography. There is strong lower crustal reflectivity at the suture between Europe and the Pannonian microplate. The existence of the Pannonian microplat Oligocene configura

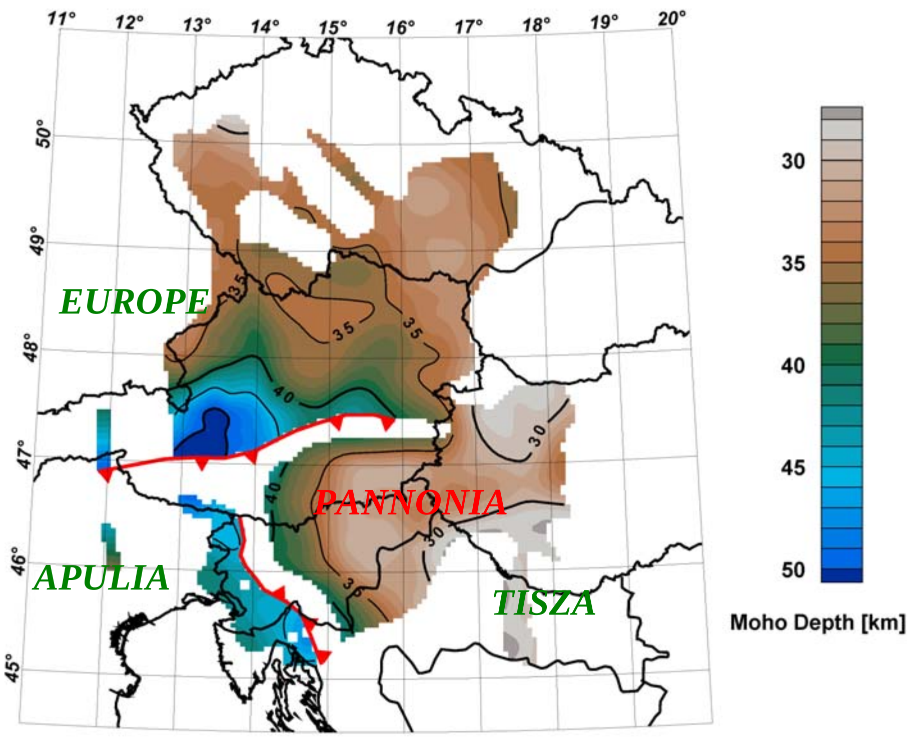

Figure 2:
Moho depth and plate positions determined by the CELEBRATION 2000, ALP 2002 and Transalp projects

Structure and Velocity

Upper crustal velocity anomalies correlate well with surface geology. Low velocities exist through the crust and uppermost mantle below the northern front of the Eastern Alps and near the Mid-Hungarian Lineament. The Istria region is characterized by very large velocities in the upper crust and in the uppermost mantle.

The lower crust is strongly reflective in a NW-SE striking zone between the Bohemian Massif and the Pannonian basin. In some parts this reflectivity even masks the PmP reflection. The upper crustal velocities at the Tauern window are not high, but higher velocities exist down to 10 km depth to the north of the Tauern window.

Escape/Extrusion

Our findings are in agreement with models of escape tectonics of the eastern Eastern Alps (e.g. Ratschbacher et al., 1991). Dipping structures in the velocity field of the upper crust may indicate normal faults. Also the Pannonian microplate and its boundaries to the European and Apulian plates can be related to the extrusion tectonics toward the Pannonian basin.

Conclusions

The application of 3D field and interpretation techniques for refraction and wide-angle reflection studies of the lithosphere gave insight into prominent structures of the Eastern Alps. A new **"Pannonian" microplate** was discovered and other significant structures were resolved. In the near future the 3D model presented here will be supplemented by 2D interactive ray tracing interpretations along individual lines. From these interpretations we expect more detailed and local information about the features we discovered so far.

References

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RATSCHBACHER, L., W. FRISCH, H.-G. LINZER, and O. MERLE, 1991. Lateral extrusion in the Eastern Alps, Part II: Structural analysis, Tectonics 7, 23-40