Integrated geophysical modeling of 2D/3D data in the Western Carpathians

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SUMMARY

We present crustal and lithosphere studies within Slovakia with magnetotelluric (MT) method, which were combined with other geophysical data.
The first part of research was focused on interpretation of MT measurements along the 2T seismic profile, which from north to south crosses all the basic tectonic units of the Outer and Inner Western Carpathians. The 3D MT model from data distributed along the 2T profile gives a qualitatively new information about physical properties of the crust along the profile and in its immediate vicinity. The new phenomena are highlighted in the 3D MT model, such as whole crustal conductivity zones at the boundary of physically contrasting blocks, namely the Carpathian conductivity zone (CCZ), the Pohorelá shear zone and the Zdychava fault zone. These identify major crustal blocks and structures typical for the Western Capathians. In comparison to older 2D model we see a significant difference, particularly in the case of the interpreted CCZ, which was not visible in the older 2D model. We assume that it reflects significant fault zones at the European Platform and Inner Western Carpathian junction. The model´s resolution and precision were supported by the integrated geophysical modelling, based on the crustal joint inversion with gravity data and geophysical-petrological thermally-self consistent mantle modelling.
Three MT profiles were modelled, which are distributed across the CCZ, farther to the East from the area of 2T profile. The dominant features are mostly middle-crust wide conductive zones, which are revealed on all profiles, although not always in the same position. Such structures have no equivalent in other profiles in central (2T) or western Slovakia, The only exception is the southern part of 2T profile, which was interpreted as a young crust alternated by volcanic activity or hydrothermal fluids. The conductive zones on our three profiles are also genetically young and we associate them with Neoalpine tectonic processes in the Neogene.
Further we continue with studies of dynamic processes at the contact of the Outer and Inner Carpathians. In a series of works, we focused on MT models across the Klippen Belt (KB) and the goal of these studies was to compare the deeper structures of the KB in its western and eastern sections. In the western section the tectonics is dominated by the Flysch Belt (FB), which overthrusts the KB. On the other hand, in the eastern section the situation is opposite - the KB is thrusted on the FB. By later processes the southern part of KB was cut off by steep faults. The contrasting tectonic style of the western and eastern sections of KB reflects the different kinematics of the Inner Western Carpathians (IWC) and the European Platform (EP) collision in the western and eastern part. While in the western part the transpression tectonics dominated, in the eastern part there were frontal thrusts on the EP. Only then the transpression movements along the BP began.

Keywords: magnetotelluric, tectonics, the Western Carpathians