Integrated study of tectonic dislocation in the Western Carpathians

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SUMMARY

The knowledge of geological structures and dislocation mechanisms (e.g. faults) is important when investigating a number of solid earth questions such as seismic risk, slope deformation, radon emanation and provides important information about tectonic development of the area. Co-located geophysical (magnetotelluric-MT, gravimetric, and others) and structural mapping within the Western Carpathians has lead to development of new methodology to study dislocation within the DISLOCAT project.
Among the geophysical methods, MT provides very good results in terms of identification of faults, fracture structures and deeper suture zones based on mapping the 3D distribution of electrical conductivity, where conductive structures potentially allow fracture mapping of conductive fluids accumulated in the damaged zone in the brittle crust. Conductive minerals can also cause similar effects in fractures – typically an indication of paleo-fluids. These metallic-mineral phases precipitate from carbon rich fluids penetrate areas of shear-weakened crust, triggering chemical reactions resulting in mineralized veins and fissures.
One of the chosen areas is connected with dislocations in the High Tatras Mountains and its tectonic development in the area of the European Platform and Inner Western Carpathian junction. Which resulted in an extensive shear zone, creating a corridor for the sub-vertical outflow of mantle fluids leading to formation of the deep seated Carpathian conductivity anomaly (CCA). During recent years several short MT profiles were measured to map boundaries of the High Tatras Mts., which represent a crystalline intrusive complex covered by nappes of Mesozoic sedimentary rocks in the north and surrounded by a deformed sedimentary succession of the Central Carpathian Paleogene Basin. The preliminary conductivity and other geophysical models focus on the identification of the sub-Tatric fault and other similar discontinuities.
A second focus area is situated in southern Slovakia in the Gemericum unit region where the largest accumulation of ore in Slovakia occurs predominantly from hydrothermal vein type mineralization. We map mineralization zones and the Roznava fault in the southern part of this area. The geological units and fault positions were mapped by newly collected MT data where 3D modeling with topography has been used to avoid distortion from deep valleys in the area. The MT model was coupled with the map of Bouguer anomalies and magnetic data were modeled to show correlation of studied geological features and different geophysical parameters. These results will help to understand the direction, inclination, depth and thickness of the fault zone, structural parameters and development of structures over time.

Keywords: magnetotellurics, fault zones and dislocation, integrated modeling