DEEP TECTONICS OF THE CENTRAL CARPATHIAN DEPRESSION (SE POLAND): EXAMPLES OF GEOLOGICAL REINTERPRETATION OF MAGNETOTELLURIC SOUNDINGS AND SEISMIC PROFILES

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Introduction

The structural position of the Central Carpathian Depression (CCD) (Tołwiński 1932) is determined by a wide belt of exposures of thick, detrital, synorogenic sediments ranging in age from the Upper Oligocene to the Lower Miocene and representing the younger members of the Menilite-Krosno Series of diachronous facial boundaries (Jucha 1969). In the SE part of the Polish Outer Carpathians, maximum thicknesses of these sediments were observed in strongly folded structural depressions of both the Silesian and the Skole units bordered by overthrusts and outcrops of older sedimentary formations (Lower Paleogene-Cretaceous) having diverse lithologies (Książkiewicz 1977).

Methods

The new models of consolidated basement of the CCD were based upon the reinterpreted results of several hundreds of magnetotelluric soundings carried on by the PBG Geophysical Exploration Ltd. in Warszawa, Poland with the MT-1 system developed by Stefaniuk (2001, 2006). The implementation of modified methodology of seismic survey by the Geofizyka Kraków Inc. after 1994 (Czerwińska 2013), particularly the advanced seismic data processing procedures applying the ProMAX system (e.g. Marecik et al. 2008) enabled the researchers to improve the dynamics and resolution of seismic imaging (Kuśmierek & Baran 2008). The new interpretation of geological structure of the CCD exemplified below is based upon the integration of detailed geological maps and drilling data with the reprocessed seismic sections.

Results

You may add figures or tables. The results of geological reinterpretation of magnetotelluric soundings enabled us to identify deep faults displacing both the Precambrian and the Meso-paleozoic formations underlying the allochthonous series of the Outer Carpathian thrust-and-fold belt, which do not appear at the bottom surfaces of thrust folds of flysch nappes. Based upon diverse geometry of high-resistivity horizon correlated with the top surface of metamorphosed Precambrian basement (e.g. Stefaniuk & Kuśmierek 1986, Kuśmierek & Ney 1988, Ryłko & Tomaś 1995, Stefaniuk 2001), the tectonic sutures were disclosed: shallow (i.e. decollements of the nappes) and deep (i.e. relatively younger, subvertical structures) (Kuśmierek 2010). These sutures are dislocated by deep, S-N- and SW-NE-trending, transversal, oblique-slip faults, which are reflected in the sedimentary cover by changes in directions of folds and overthrusts. Deeply buried depressions of Precambrian basement bordered by subvertical tectonic sutures and accompanied by extremal differences in rock resistivity (at the range of some hundreds of ohmmeters; Stefaniuk et al. 2009) were interpreted as underthrusted and then rotated fragments of Precambrian basement (Konečný et al. 2002), synchronous with the deposition of synorogenic sediments in the Late Oligocene-Early Miocene. The most complicated tectonics of folds and overthrusts is associated with the internal zones of synclinoria overlapped onto the rotated, subvertical tectonic sutures generating the extreme horizontal tectonic displacements (Kuśmierek 1990). Such zones are characterized by systems of stacked, deeply rooted thrust folds (documented by drillings) propagating into the subsurface zone as asymmetric, plastic deformations of

synorogenic sediments of diverse thicknesses in the fold limbs. Disharmonic style of shallow tectonics reveals divergence of fold vergences and local back thrusts generated during the final stage of tectonic compression, as e.g. specific detachments showing flattened arches geometry identified for the first time by the authors.

Conclusions

The new models of deep tectonics of the CCD based upon the geological reinterpretation of magnetotelluric soundings and seismic sections confirmed the results of gravimetric modelings (Stefaniuk et al. 2009). Integrated interpretation of the models of Precambrian basement and sedimentary cover of the Outer Carpathian thrust-and-fold belt suggests the common scenario of their geodynamic evolution despite different tectonic styles.

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