blades are recognizable with unaided eye, fine flakes of biotite are also present.

Fine-grained biotite-hornblende tonalites comprise two varieties: dark and light. The dark tonalite is rich in hornblende, apatite and titanite, which are not common in the light one. Both varieties contain plagioclase and quartz. Biotite and hornblende occur as aggregates. Contact between the two varieties is abrupt but embayed and irregular. Dykes of the light tonalite penetrate into the dark variety.

Medium-grained biotite-hornblende tonalites consist of plagioclase, hornblende, biotite, and quartz. Apatite and zircon are accesories. Aggregates are formed by hornblende surrounded by biotite. Two varieties of plagioclase are present: (1) large grains, up to 2 mm in size, characterized by complex zoning, and (2) small, scarcely zoned grains in the matrix, up to 0.5 mm in size.

Granites are fine-grained and consist of quartz, K-feldspar, plagioclase, muscovite and biotite. Apatite and zircon are accesories.

Biotite tonalites occur as rounded and angular enclaves in the granodiorites. Outer parts of the tonalite enclaves crystallized rapidly due to cooling. One centemetre thick chilled margins of non-porphyritic tonalite were formed around the enclaves. Such a relationship between the granodiorite and biotite tonalite indicates that the former one is older and both rocks can be referred to as a compound dyke sensu Fernandez and Barbarin (1991). The contacts between the granodiorites and biotite-hornblende tonalites were absent in the investigated drill cores. Mutual relationships between these rocks cannot be therefore determined. Granites are the youngest rock type, which crosscuts all other rocks in the form of dykes a few metres to several centimetres thick.

The analysis of borehole material allowed the discrimination of three distinct episodes of magmatic activity: the granodiorite injection, followed by tonalite and granite injections.

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Deep Structure and Geodynamics of the Carpathian Lithosphere Based on Geophysical Study

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Geophysical methods are the most important tool for the study of lithosphere and reconstruction of the geodynamic development of the Western Carpathians. Therefore, a complex geophysical interpretation of deep-seated structures confronted with the results obtained from other geophysical and geological disciplines can contribute to better understanding of the evolution of the Carpathian orogen structural pattern. The study of lithosphere is based mainly on application of deep-range geophysical methods, such as seismic refraction and reflection profiling, seismology, gravimetry, magnetotellurics, geothermics and magnetometry.

Integrated geophysical modeling was used for the specification of the lithosphere thickness map in the Carpathian region. This approach combines the surface heat flow, free-air (Bouguer) anomalies and topography (local isostasy) to determine the continental lithospheric thermal structure along transects running across the Western Carpathians, the Polish Platform, the Bohemian Massif and the Pannonian Basin. Beneath the central and eastern segments of the Western Carpathians, the thickness of the lithosphere increases to a maximum of 140–150 km. We interpret the lithospheric thickening as a small remnant of a subducted slab. Unlike the central and eastern segments of the Western Carpathians, a clear lithospheric thickening is not compatible with the data in the western segment of the Western Carpathians. The differences in lithospheric thickness in these two segments of the Western Carpathians can be explained by a different geodynamic evolution of these areas. Based on a critical analysis of earlier models, a new interpolation of former geophysical data and results of integrated modelling, we constructed a new map of lithosphere thickness in the region of the Carpathian–Pannonian Basin System.

An integration of the existing geophysical and geological data and knowledge of deep geological structure and geodynamics of the Western Carpathians was made on the basis of 2D density modelling. The method of modelling of lithospheric inhomogeneities was applied along the most important Western Carpathian deep seismic transects.

Crustal seismic structures along the CELEBRATION 2000 profiles CEL01, CEL04, CEL05, CEL06, CEL09 and CEL11 clearly indicate seismically anomalous zones within the crust and the uppermost part of the lower lithosphere beneath the Western Carpathians and the adjacent tectonic units.

The complicated structure of the Western Carpathian lithosphere with specific physical and rheological properties is a result of the youngest deep-seated processes in the orogen collisional zone and high thermal stage of the Pannonian back-arc basin system. The crust of the Western Carpathians and neighbouring areas has a complex pattern and is composed of fragments being formed during Neoalpine, Paleoalpine and Hercynian orogenic stages. Geophysical investigations are available to identify most of these crustal structures. In this study, we described particularly the structures of Neoalpine collision (slab detachment zone, compressional accretionary wedge of the Outer Western Carpathians – Flysch Belt, tensional structures and asthenospheric diapir as a result of back-arc extension), structures related to the Cretaceous thrust-stacking, subhorizontal reflection packages interpreted as tensional structures of various generations, underplated intra-Penninic (Oravic) continental ribbon, traces of Meliatic oceanic suture and northerly dipping reflection beam are interpreted as the boundaries of Hercynian lithotectonic units with opposite vergency to the Paleoalpine units.

West Bohemia/Vogtland Region in View of Local Seismic Signals

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Local WEBNET stations in the West Bohemia/Vogtland earthquake swarm region provide high-quality data permitting detailed analyses of phases contained in the seismograms. Seismograms of local earthquakes are very responsive to earthquake mechanisms. In addition to regular P and S waves, the seismograms display pronounced P- and S-wave reflections or S-wave splitting. Some of the reflections may correspond to the presence of fluid or molten medium within a short distance from the earthquake hypocentres, other reflections demonstrate the complex geological structure of the region, split phases can verify anisotropy of the Earth crust in this area.

Secondary phases as another phenomenon in seismic wave propagation (velocity ratio of P- and S- waves, wave back-azimuth) vary in time and space.

The aim of this contribution is to show space and time changes of some of the observed secondary phases in local West Bohemia seismograms and to infer some possible geological and tectonic interpretations of these phenomena. Consequently, we can discuss some processes acting during earthquake swarms in the West Bohemia/ Vogtland region and in the time intervals between swarm activity.

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