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Structure and Episodic Tectonic Evolution of the Lower Crustal Accretionary Wedge: from Deep Retro- to pro-Wedge Orogenic Fabrics

Radmila NAHODILOVÁ, Pavla ŠTÍPSKÁ, Karel SCHULMANN and Ondrej LEXA

Institute of Petrology and Structural Geology, Charles University, Albertov 6, 14200 Prague, Czech Republic

We reconstruct a cross-section (50 km – E-W) from the deepest part of the Moldanubian root zone represented by the Monotonous series to the west and Varied group to the east in the northern Waldviertel (valley of the German Thaya). In this section of the Moldanubian zone, the general orogenic fabric is traditionally interpreted in terms of a thin Gföhl gneiss and granulite klippen (relics of a lower crust nappe) overlying the middle crust sequences represented by the Monotonous series to the west and Varied series to the east (Fuchs, 1976a,b; Matte et al., 1991; Dallmayer et al., 1992).

The orogenic wedge structural pattern can be described as follows: The westerly Monotonous series metasediments show steep east dipping metamorphic fabrics. The adjacent western border of the Gföhl unit is represented by a sheet of ultrabasic rocks and amphibolites juxtaposed to strongly mylonitized Gföhl orthogneiss steeply dipping to the east. Towards the east the Gföhl gneiss becomes more anatectic and abruptly changes the dip direction to the west. The structural observations indicate that the west dipping anatectic fabrics overprint the east dipping ones. The western border of the Gföhl gneiss is limited by sheets of felsic kyanite-bearing granulites, mafic granulites showing the decompression textures of the assemblage clinopyroxene-garnet to orthopyroxene-plagioclase and kinzigites composed of sillimanite, garnet and hercynite. This thrust sheets occur in the hanging wall of the eastward Raabs volcanosedimentary unit which shows increasing degree of anatexis towards the east. The fabric of the Raabs unit is monotonously dipping to the west under intermediate angles. Locally, the main anatectic and isoclinaly folded fabric is refolded by late folds with east dipping axial surfaces.

This structural pattern is interpreted in terms of episodic evolution of a lower crustal accretionary wedge. Using the terminology by Ellis et al. (1999), the eastern part of this crustal scale structure represents pro-wedge side and its fabric is associated with westward underthrusting/subduction of the Brunovistulian foreland. We interpret the Gföhl unit as the deepest lower crustal part of the wedge symmetrically extruded over the mid-crustal units (uplifted central plug). The Monotonous series is seen as a retro-wedge behind the underthrusting zone. The retro-shearing along the border of the Monotonous unit (overlying rigid retro-lithosphere block) is responsible for the exhumation of the deepest part of the lower crust and upper mantle slivers. The pro-shearing affects the eastern part of the lower crust low-viscosity materials (granulites), which overthrust easterly located anatectic domain. The mineral assemblages of initially HP granulites indicate decompression and thrusting in relatively shallow crustal levels but still at very high temperatures. The extruding steep or intermediate dipping fabrics on the pro-wedge side are affected by late flat shear zones accommodating the gravitational collapse of the whole wedge structure. Therefore, the gravitational spreading on top of the extruded plug (Koyi, 2000) may be responsible for transition from vertical to horizontal fabrics in low-viskosity partially molten rocks of the Raabs and Gfohl unit.

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