Metabasites from the Polish Part of the Andělská Hora Formation (Moravo-Silesian Zone): Geochemistry, Metamorphic History and Geotectonic Meaning

Wiesław KOZDRÓJ

Polish Geological Institute, Lower Silesian Branch, 53-122 Wrocław, Al. Jaworowa 19, Poland

A belt of metabasites (greenschists) 2.5 km long occurs in the vicinity of the Pokrzywna village (Opava Mts., Moravo-Silesian Zone). These volcanics appear as interlayers within the upper part of the Andělská Hora Formation (AH Fm.) composed of dark phyllites, metagreywackes and subordinate metaconglomerates (Sawicki, 1959). Přichystal (1981) considered them a possible northern prolongation of the Šternberk–Horní Benešov volcanic belt.

The AH Fm. is the oldest sequence of the Variscan flysch (Culm facies) in the Moravo-Silesian Zone but its precise age has not been established yet. It has been attributed Upper Frasnian – Tournaisian age (Dvořák, 1995), Middle Viséan age (Kumpera, 1983) or the uppermost Lower Viséan to lowermost Middle Viséan age (Otava et al., 1994; Hartley and Otava, 2001).

Metabasites of the AH Fm. lie conformably in metasediments, hence being mostly of synsedimentary – pyroclastic – origin. They are derived from layered, fine-grained tuffites, coherent, crystal tuffs and partly from lava flows. Subvolcanic rock (a sill?) several metres thick with preserved euhedral structure was found at only one locality.

During the Variscan convergence, basic extrusive rocks and the surrounding sediments were incorporated into an accretionary wedge and metamorphosed under greenschist-facies conditions (up to epidote blastesis in chlorite zone). A strong post-tectonic recrystallization of calcite is observed in all metabasites. The subvolcanic sill rock is impregnated by numerous hydrothermal ankerite blasts. Metamorphism was associated with folding and localized shearing along axial cleavage planes.

Despite the different types of primary rocks, all metabasites show similar geochemical signatures of the subalkaline, low-Ti tholeiitic basalts. Most of the investigated samples represent volcanic products derived from a transitional zone between within-plate (ocean island basalts) and N-MORB sources, comparable with enriched E-MORBs. Only one sample of lava flow clearly shows N-MORB affinities. The above observations point to the conclusion that the geotectonic conditions during sedimentation of the AH Fm. were still extensional, and oceanic plateau basalts were generated. This is consistent with the opinion of Přichystal (1993) who noticed that the character of volcanic activity in the Šternberk–Horní Benešov Belt in the Devonian to Lower Carboniferous was transitional, i.e., deviated from continental, alkaline, rift-related volcanism towards more mature, tholeiitic volcanism of the marine basin.

As a final remark, it can be concluded that E-MORB type volcanics of the AH Fm., although enclosed in "flysch-like series" – which should suggest rather orogenic tectonic setting – were actually influenced by no subduction processes.

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Alpine Tectonic Inversion – Principal Mechanism of the Variscan Basement Uplift and Exhumation in the Sudety Mts.

Wiesław KOZDRÓJ and Zbigniew CYMERMAN

Polish Geological Institute, Lower Silesian Branch, 53-122 Wrocław, Al. Jaworowa 19, Poland

The most important tectonic feature of the Sudety Mts. and the neighbouring areas (Fore-Sudetic Block, North Bohemian Basin) is their present tectonic style of horst and graben structures. The uplifted elements are very often built of crystalline rocks of the Variscan basement, while neighbouring depressions are composed of younger, epi-Variscan molasse or platform sediments. The youngest strata of the cover involved in the faulting processes are of Santonian age, thus pointing to the Sub-Hercynian – Laramide phases as the dominant orogenic movements. The final relief of Sudety Mts.