Clasts of Volcanic rocks from the Visean conglomerates in the Drahany Culm: evidence for a volcanic arc on the eastern margin of Bohemian Massif

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The Visean siliciclastic sediments – Drahany Culm facies – form the eastern continuation of the Rhenohercynian Zone of the European Variscan Belt (Dallmayer et al. 1995, Franke 2001). Volcanism played an important role in the formation of Carboniferous basins in the western Europe. Volcano-sedimentary basins containing marine graywackes associated with volcanism of Famennian to Late Visean age are known in the Southern Vosges and Schwarzwald. Older, acid and low-K calc-alkaline volcanic rocks were dated at 345 ± 2 Ma, and younger, ignimbritic and high-K rhyolites at 340 ± 2 Ma. Intermediate to felsic volcanic rocks exhibit low content of Nb, and enrichment in incompatible trace elements. The volcanism reported here is interpreted as arc magmatism (Eisele et al. 2000, Schaltegger et al. 1996).

The Drahany Culm represents typical flysch development with intracalations of graywackes, siltstones and conglomerates. Three formations were distinguished in this area. They are from the west to the east and from bottom to top: Protivanov Fm., Rozstání Fm. and Myslejovice Fm. It comprises rocks representing lower crust (high-grade rocks – granulite), middle crust (amphibole to muscovite bearing granites, biotite and biotite-muscovite bearing migmatites, gneisses and durbachites) and upper crust (volcanics sedimentary rocks and low – grade rocks such as phylites, Kotková et al. 2002). The spectrum of the volcanic rocks found in the conglomerates is very broad. The suite of andesite-dacite-ryolite was distinguished from the petrological point of view. The felsic rocks prevail over intermediate and mafic types. The structural variation with granophyres, aphyric, ophitic and porphyric lavas, tuffs and ignimbrites indicate complex volcanic to subvolcanic environment that correspond probably to stratovolcanic type of eruption.

The volcanic rocks from the older formations are calc-alkaline, whereas pebbles from the younger conglomerates are enriched in potassium and even ultrapotassic trachytes were found in the youngest members of the sedimentary sequence. The pebbles of volcanic rocks show the high content of LILE along with low concentrations of HFS, especially Nb, Ta, Ti, and suggests that the volcanites originated in a volcanic arc environment. Ultrapotasic trachytes show similar mineralogy, geochemistry, and age (343 ± 7 Ma by K-Ar method) as the pebbles of durbachites (Kotková and Parrish 2000). Therefore, we interpreted the ultrapotassic trachytes as the volcanic equivalents of durbachites.

Pebbles of volcanic rocks from Drahany Culm can be interpreted as a product of volcanic arc, because of their lithology (andesites to ryolites), geochemistry (calc-alkaline rock enriched in LILE and depleted in HFSE) and structural development (volcanic, subvolcanic and plutonic types). The evolution from calc-alkaline types to the high-K and even ultrapotassic types suggest that the volcanic arc was probably situated on the continental crust. Because the majority of clastic material in sediments of the Drahany Culm was denuded from Moldanubicum, we can speculate that the arc originated on the Moldanubian crust as a consequence of subduction of the Brunovistulicum plate. Very high exhumation rates of 4,8 mm/yr documented by Kotková and Parrish (2000) could be responsible for complete erosion of the arc.

Carboniferous volcanism of the Drahany Culm on the eastern part of Variscan Belt (Rhenohercynian Zone) display broad similarities with those from the western Europe (Southern Vosges and Schwarzwald). Our results indicate that the Carboniferous volcanism was widespread along the whole Rhenohercynian zone and not restricted to its western part only.

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