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Evidence of Volcanism in the Middle Triassic Reifling Limestones of the Hronikum Unit

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Introduction

Tuffaceous material present in Middle Triassic limestones is generally known. Volcanoclastic intercalations occurr in basinal facies represented mainly by Reifling limestones. In Middle Triassic successions in Alps these volcanoclastic horizons are more common and known under the name “Pierta verde”. In Western Carpathians similar rocks occur in Turnaicum and Silicikum. First occurrence in Hronikum is known from hte Polish part of Západné Tatry mountains (Kozsowska at al. 1998). The present paper describes the first occurrence in Hronikum in Slovak territory.

Geological setting

Locality is situated in the Chočské vrchy mountains on western slope of Veľký Choč, ca 1.5 km NE from Valaská Dubová village. In the surroundings, two tectonic units are present: upper part of the Krížna nappe (Neocomian and Poruba Member) and lowermost slice of the Choč nappe (Gutenstein limestones and dolomites, Ramsau dolomites, Reifling limestones).

Tuffaceous material forms intercalations in Reifling limestones, varying in thickness between 1 and 20 cm. Original volcanic material is strongly argillitized and calcitized, with phantomatic structures of vitroclastic and blastofelsitic fragments.

Fig. 1. Distribution of Midlle Triasic tuffaceous intercalations in pelagic limestones of the West Carpathians.

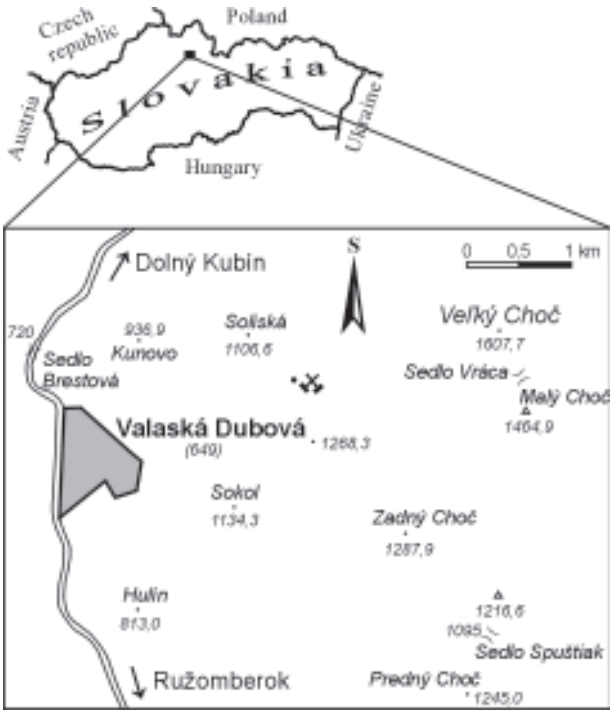

Fig. 2. Map of the study areas.

Grain size is under 0.3 mm. Among primary minerals were identified quartz, apatite, biotite. Feldspars are not present, since they were decomposed to clay minerals and calcite. Secondary minerals are represented by hematite and more abundant pyrite. Clay minerals such as illite, chlorite and corrensite were identified by means of XRD. It is worthy to note that these intercalations are absolutely free of fossils - on the contrary to host limestones. This locality exhibits close similarities to occurrences in southern Carpathian units, rock is nearly identical with its Silicic and Turnaic equivalents.

"Pietra verde" rocks in Reifling Formation of Northern Calcareous Alps are composed predominantly of pyroclastic material. Besides that in Middle Triassic sequences of Southern Alps there also occur ignimbrites and volcanic effusives. The onset of volcanism was in Late Anisian, main phase in the Ladinian. In Central and Eastern Carnian Alps most characteristic are Late Anisian ignimbrites and submarine lava flows reworked to basal breccias. Stratigraphic frame in this case is Late Anisian – – mostly Illyrian, to lesser extent in Fassanian. Similar character show volcanogenic sequences in Transdanubian range (Bakony) and Bükkicum where besides pyroclastics also volcanic efusives are present. In Alps as well as in Bükkicum the volcanism operated in two phases:

1. Late Anisian – Early Ladinian acidic volcanism with strong explosive behaviour
2. Late Ladinian to Middle Carnian effusions of alkaline basalts (of the plateau type) in Bükk mountains, connected with extensional tectonics

Based on the type of magma it was concluded, that volcanism in Bükkicum was related to Paleotethyan subduction zone where Bükkicum and Turnaicum represent southern continental margin of Meliaticum with intensive island arc volcanism (Hovorka 1996).

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Composition and Origin of Triassic Potassium-Rich. Rhyolites of the Silicicum Superunit, Western Carpathians, Central Slovakia

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Triassic acid volcanic rocks of the Drienok and Muráň nappes formerly known as "melaphyres" and quarz porphyries (Zorkovský 1959a, 1959b, Slavkay 1965) belong to tectonically uppermost Alpine nappe structure in the Western Carpathians overlaying the Veporicum, Hronicum and Gemericum Superunits, which is known as Silicicum Superunit. Our investigated rocks were defined as potassium-rich rhyolites, enriched in K (4.9–8.7 wt.% K_2O), Si (72.8–76.7 wt % $Si0_2$), and depleted in Ti (0.08–0.30 wt % TiO_2), Mg (0.09–1.03 wt.% MgO), and especially in Ca (0.03–1.06 wt.% CaO), Na (0.19–1.98 wt.% Na_20) and P (0.01–0.11 wt% P_20_5). Trace element geochemistry shows slight enrichment in Rb, Zr, Y and depletion in Sr, Ba, and V, as well as elevated Rb/Sr and Ga/AI ratios which are typical for alkaline-rich (A-type) post-orogenic and anorogenic silicic magmatic suites (cf. Whalen et al. 1987).

Zircon typology (Pupin 1980) indicates a hot and dry magma environment (mainly P_4, P_5 subtypes and D types). Estimated temperature of zircon crystallization from typograms (800–900 ± 50 °C) corresponds to high zircon saturation temperature (Watson and Harrison 1983), where T = 820–845 °C. BSE shows slightly oscillatory zoning of zircon, locally with small inherited(?) oval cores. EMPA reveals Hf contents analogous to the continental crustal granite zircon: 1.0–1.7 wt% HfO_2 (cf. Pupin 1992). Contents of Y are slightly elevated: 0.4–1.0 wt. % Y_2O_3, concentrations of other elements (e.g., P, U, Th, REE) are below detection limit of the EMPA (< 0.10 wt.%). Profiles across zircon crystals do not show distinct variations between Zr, Hf and Y or systematic Hf enrichment in rims of zircon crystals.

Studied volcanic rocks close to Poniky village show specific and very similar character with the other occurrences of Triassic volcanites, especially in the Muraň nappe (Veľká Stožka, Telgárt). Moreover, A-type leucogranites of the Hrončok type in the Veporic unit show also Triassic age, as resulted from U-Pb zircon dating (Putiš et al. 2000).

Rhyolites were produced in the continental carbonate platform environment of the shallow epicontinental sea, by anatexis of probably lower crustal acid material. In the Tatricum and Veporicum Superunits, the crust was thick enough to prevent the magma from reaching the surface. Consequently, volcanism occurred only in the Silicicum Superunit area with relatively thinner continental crust, in the vicinity of the Meliata-Hallstatt oceanic through.

Chemical composition of feldspars, rock major and trace elements, zircon chemistry and typology study, reveal alkaline character and crustal origin of the Silicicum rhyolites. All these data indicate the extension regime of continental rifting during