Geochemically anomalous olivine-poor nephelinite of Říp Hill, Czech Republic

Geochemicky anomální olivínem chudý nefelinit z Řípu (Czech summary)

(9 text - figs.)

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Dedicated to the memory of Professor František Ulrich

Sodalite olivine-poor nephelinite of Říp Hill substantially differs both from olivine nephelinite and olivine-free nephelinite of the Cenozoic volcanic province of the Bohemian Massif. Říp Hill represents an erosion-resistant neck 25.6 Ma in age located in the Teplá-Barrandian terrane block in contrast to the České středohoří Mts. volcanic complex in the Saxothuringian terrane. The very low Mg-value (48.5), low contents of compatible elements as Cr (79 ppm), Ni (31), Co (32), Sc (21) and lack of mantle-type xenoliths gives evidence of differentiation of primary mantle magma. Anomalous enrichment in incompatible elements particularly in ΣREE (650 ppm), U (3.6), Th (15.6), Nb (154), Ta (12.1), is associated with late magmatic crystallization (mostly of apatite, Ti-magnetite ± hauyne). $^{87}Sr/^{86}Sr$ (0.7036–0.7038) and $^{143}Nd/^{144}Nd$ (0.51278) ratios of the olivine-poor nephelinite are consistent with HIMU OIB from a sublithospheric source; ε^{t}_{Nd} (+3.4) value implies an depleted mantle source. Olivine-poor nephelinite could be derived from carbonated nephelinite magma with high $CO_2/H_2O + CO_2$ volatile fraction resulting in high viscosity and thus stopping of magma associated with differentiation and contamination in crustal reservoir during its ascent to the surface. Such magma could be associated with high explosive pyroclast-rich volcano of maar or stratovolcano type. The olivine-poor nephelinite of Říp Hill reveals common features in mineral paragenesis and chemical composition of minerals such as clinopyroxene, (Mg, Al, Ti)-magnetite, barite, ankerite with carbonate-bearing alkaline ultramafic lamprophyres in the vicinity. This fact suggests their mutual genetic association within the Říp Hill volcanic centre.

Key words: Bohemian Massif, Říp Hill, olivine-poor nephelinite, geochemistry, age, Sr, Nd isotopes

Introduction

Říp Hill is situated in the Labe river lowland of central Bohemia. It represents an eroded volcanic neck (459 m a.s.l.) rising up to 240 m above the surrounding plain (220–280 m a.s.l.). This plain is formed by sediments of the Bohemian Cretaceous Basin covering the epi-Variscan platform of the Bohemian Massif. The Cretaceous sediments are underlain by claystones of the Carboniferous Roudnice Basin. There are many publications dealing with the interpretation of volcanological position of Říp Hill (Zahálka 1923, Ulrich 1941, Žebera – Mikula 1982, Kašpar *in* Škoda 1983, Kopecký 1983, 1987–1988), however, only scarce relevant geochemical data exist on volcanic rocks forming the hill.

Geological setting

The origin of Říp Hill neck is associated with the activity of the young (Upper Cretaceous–Quaternary) volcanism of the Bohemian Massif, forming the young Central European volcanic province (Wimmenauer 1974). Kopecký (1987–1988) supposed immediate association of Říp Hill with the southern marginal fault of the Labe tectono-volcanic zone (NW–SE), near its intersection with the deep-seated Litoměřice Fault – master fault of the Ohře Rift (ENE–WSW), see Fig. 1. Detailed local tectonic information on Říp Hill was given by Zahálka (1923) and Ulrich (1941). These authors linked structural position of Říp Hill with the crossing of fault systems WNW–ESE and NNE–SSW, forming the narrow „Rovné grove block" with vertical displacement about 13 m. Three problematic occurrences of volcanic products including volcaniclastic material described by Zahálka (1923) within 1 km of Říp Hill, are no more accessible. Petrologically similar olivine-free nephelinitic to olivine-poor nephelinitic rocks occur in the central Bohemian region primarily at Kopeč Hill near Odolena Voda, Chloumek Hill near Chloumek, Špičák Hill near Štětí, Slánská hora Hill at Slaný (Fig. 1), Vinařická hora Hill near Kladno, Horní Zimoř, Šibenec Hill near Mšeno etc., though only single olivine nephelinite – Jenišovická hůrka Hill at Jenišovice, cf. Fig. 1.

Olivine-poor nephelinites (and analcimites), frequently containing minerals of the sodalite group ± amphibole and/or biotite are typically developed in the central part (between Mělník and Doksy) of the Bohemian Cretaceous Basin (Shrbený 1992). Analcimites originated mostly by late magmatic alteration of primary foiditic rocks.

The southern marginal fault of the Labe tectono-volcanic zone is accompanied by several mineral springs (e.g. Roudnice nad Labem). The long fibrous calcite sin-