Stable isotope and chemical compositions of carbonate ocelli and veins in Mesozoic lamprophyres of Hungary

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Abstract: Lamprophyres and carbonatites of late Cretaceous age occurring in Palaeozoic to Mesozoic granites and sedimentary rocks contain carbonate ocelli and veins which show alteration resulting in the formation of disseminated carbonate and clay minerals. Those bodies intruding granites contain calcite and dolomite whose carbon isotopic compositions (δ¹³C = -4.5‰) are within the primary mantle ranges, whereas the oxygen isotopic compositions (δ¹⁸O = 14‰) are well outside the ranges of primary carbonatites. Carbonate ocelli of the lamprophyres were formed by interactions of igneous fluids with xenoliths of sedimentary origin. Interactions with the magma have also changed the chemical composition of limestone xenoliths enclosed in the lamprophyres. Carbon isotopic compositions and calcite-dolomite solvus temperatures measured on calcite ocelli with dolomite rims point to both chemical and isotopic disequilibrium between calcite and dolomite despite apparent complete recrystallization of the original sedimentary material.

The isotopic compositions of calcite veins may be attributed to the effects of igneous fluids, exchange of fluids with sedimentary host rocks, oxidation of organic matter or possible degassing of magma and/or magmatic fluids. The former two processes produce calcites with sedimentary δ¹³C values and δ¹⁸O values down to 15.0‰, whereas the latter three factors may be responsible for a trend of δ¹³C shifts down to -9.0‰, and δ¹⁸O values up to 24.2‰.

Key-words: stable isotopes, carbonates, lamprophyres, thermometry.

Introduction

The stable isotope compositions of igneous carbonates have been extensively studied in order to determine primary mantle compositions and magmatic fractionation processes responsible for the variability of carbon and oxygen isotopic compositions (see Deines, 1989 for compilation). In contrast with a number of recent studies of carbonatites (e.g. Knudsen & Buchardt, 1991, Reid & Cooper, 1992), little data exist for carbonates in lamprophyres, despite their close genetic relationship with carbonatites (Bernard-Griffiths et al., 1991; Deines, 1989; Hubberten et al., 1988, etc.). Rock (1991) has compiled literature data on the stable isotopic compositions of carbonates in lamprophyres and has subdivided them into primary- and secondary-types. He also called attention to the importance of coupled microprobe/isotope studies in order to distinguish these two types.

Following the earlier work of Demény (1992), who determined the main carbonate types and stable isotopic distributions in lamprophyre suites.