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The role of Fe–Ti-oxides in the study of lower crustal garnet granulite xenoliths from the Central Pannonian Basin

J. Dégi (1,2), R. Abart (2), K. Török (3)

(1) Eötvös University, Budapest, Hungary (degij@freemail.hu), (2) Freie Universtität Berlin, Berlin, Germany, (3) Eötvös Loránd Geophysical Institute of Hungary, Budapest, Hungary

Fe–Ti-oxides in lower crustal garnet granulite xenoliths (garnet–clinopyroxene–plagioclase ±orthopyroxene ±amphibole ±scapolite) from the Bakony-Balaton Highland Volcanic Field, Central Pannonian Basin, were studied by using high resolution analytical techniques and thermodynamic modeling. The xenoliths tell a complex story of the evolution of the lower crust during the extension of the Pannonian Basin. Fe–Ti-oxides were used to refine existing information.

During the Alpine orogenesis the formation of the garnet granulite, in equilibrium with homogeneous Fe–Ti-oxide phases, took place at peak metamorphic conditions between 1.0–1.6 GPa and 850–1050 ^{o}C. This was followed by the extension of the Pannonian Basin during the Miocene. The pressure and temperature changes are well documented by reactions of silicates. A significant change in the oxygen fugacity is also recorded by the exsolution of the originally homogeneous Fe–Ti-oxides to form magnetite and ilmenite lamellae. The exsolution lamellae are possibly the products of an interaction between migrating fluids and lower crustal material.

During the uplift, most of the xenoliths suffered alterations to some extent due to the interaction with the host basalt. This interaction is also shown by a magnetite overgrowth on the majority of Fe-Ti oxides. We studied the diffusion of Al and Ti from magnetite overgrowth into the magnetite and ilmenite lamellae, respectively. The first was described by one dimensional volume diffusion, while grain boundary diffusion has an important role in the second process besides 2D volume diffusion. Diffusion

modeling was used to determine the time spent in the basalt and especially the extent of thermal interaction between the xenolith and the host basalt in order to find xenoliths, of which silicate phases truly represent lower crustal conditions.

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