Mantle-crust interactions in the oceanic lithosphere: Constraints from minor and trace elements in olivine

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Minor and trace element compositions of olivines are used as probes into the melt-rock reaction processes occurring at the mantle-crust transitions in the oceanic lithosphere. We considered mantle and lower crustal sections from the Alpine Jurassic ophiolites. In particular, we analyzed olivines from plagioclase-impregnated harzburgites and replacive dunites (Fo 91-90 mol%), and olivines from olivine-rich troctolites, troctolites and olivine-gabbros (Fo 88-82 mol%). The olivines from the hazburgites most likely experienced re- equilibration with the impregnating melts, as indicated by Mn, Ti, Y and HREE variations and the low Na concentrations. The olivines from the dunites have: (i) Mn, Ni, Co and Ca compositions similar to the primitive (Fo 91-89) olivine phenocrysts in MORB [1], and (ii) relatively high Y and HREE contents indicating equilibrium with primitive MORB. We thus reinforce the hypothesis [2] that replacive dunites act as conduits for the extraction of MORB. The involvement of MORB-type melts in the formation of the dunites is substantiated by the spinel compositions (Cr# ~35, TiO_2 ~0.3 wt%). Notably, the concentrations of Mn, Ni and Co in the dunites olivines produce positive correlations, in agreement with a formation through melt-harzburgite reactions. The preservation of this geochemical inheritance indicates that the liquids migrating along the dunites may change their compositions in response to the dunite-forming reactions. The olivine-rich troctolites are considered to be hybrid rocks formed by interaction between an olivine-rich matrix and MORB-type melts. The olivine chemistry in these rocks is controlled by the composition of the infiltrating melts and provides little information about the nature of the olivine matrix. Fractional crystallization rules the compositions of the olivines from the troctolites. Furthermore, the olivines from the troctolites have higher Y and HREE, and lower Co than the olivines in olivine-gabbros. These variations show that the troctolite/olivine gabbro transition is partly constrained by melt-rock reaction processes.

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Solid - Liquid Equilibria of K_2SO_4-KBr-H_2O System at 373 K

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Massive high-salinity underground brines are frequently met in the exploitation of oil and gas resources. In particular, the underground gasfield brines in Western Sichuan Basin (China), are very rare liquid mineral resources in the world. The B, K, and Br contents of the brines are far beyond the lower grades of the comprehensive industrial utilization. The ternary system K_2SO_4-KBr-H_2O is a subsystem of the underground gasfield brines. The solid-liquid equilibria for the ternary system at 373 K were measured experimentally using the method of isothermal solution saturation. In the phase diagram of the ternary system K_2SO_4-KBr-H_2O at 373 K(Figure 1), there are one invariant point E and two univariant curves DE and CE. Equilibrium solids were KBr and K_2SO_4 in the studied ternary system. The crystallization area of K_2SO_4

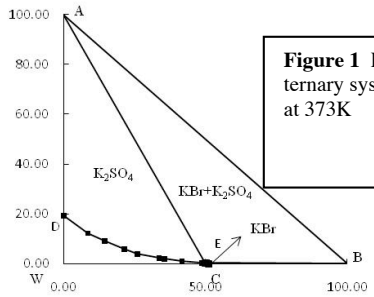

Figure 1 Phase diagram of the ternary system K_2SO_4-KBr-H_2O at 373K

(AED field) in the phase diagram is obviously bigger than that of KBr (BEC field).

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