Na PARTITIONING BETWEEN CLINOPYROXENE AND ORTHOPYROXENE AT HIGH PRESSURE

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Compositions of clinopyroxene and orthopyroxene were studied from experiments at 20-50 kbar and 1100-1500°C in the systems Na_2O-CaO-MgO-Al_2O_3-SiO_2 and Na_2O-CaO-MgO-Al_2O_3-SiO_2-Cr_2O_3 with variable Na/Ca ratio in the presence of carbonate-silicate melts. Oxide mixtures or synthetic end-members of pyroxene solid solutions were used as starting materials. Carbon dioxide was introduced with sodium carbonate. The material was loaded into platinum capsules, which were then welded. Experiments were carried out on piston cylinder and belt apparatuses using solid cell assemblies of natural polycrystalline CaF_2. The duration of experiments varied from one to fourteen days. The experimental products were studied on a JEOL 8900 electron microprobe. All the investigations were performed in the Institute of Mineralogy, J.-W. Goethe University, Frankfurt am Main, Germany.

The content of Na_2O varied considerably in both clinopyroxene (from 0.1 to 6.0 wt %) and orthopyroxene (from 0 to 1 wt %). The investigation of concentration profiles of contacting clino- and orthopyroxenes on the basis of the reversal experiment approach allowed us to conclude that the partition coefficient of Na_2O between clinopyroxene and orthopyroxene was sensitive to temperature and changed from about 2 at 1500°C to 7.5 at 1100°C. No pressure or compositional dependence of the partition coefficient was established.

The results can be used at the analysis of physicochemical conditions of natural mineral formation. For instance, coexisting inclusions of clinopyroxene and orthopyroxene in diamond crystals sometimes yield unusually high apparent partition coefficient of Na_2O, up to 40 [1-4]. Such a discrepancy can indicate that these minerals were not in equilibrium and were trapped under different physicochemical conditions by a single diamond crystal. This suggests a complicated crystallization history of some diamonds accompanied by changes in physicochemical conditions and, probably, addition or removal of alkali-rich material, i.e., mantle metasomatism.

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