Mineral replacement under the presence of trace H_2O: Jadeite ($NaAlSi_2O_6$)–spodumene ($LiAlSi_2O_6$) reaction at 700℃ and 2 GPa

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Mineral replacement is a fundamental reaction process involved in diagenesis, metamorphism and metasomatism. In order to determine the mechanism of mineral replacement without free H_2O fluid phase, a jadeite ($NaAlSi_2O_6$) crystal was placed in spodumene ($LiAlSi_2O_6$) powder and heated at 700℃ and 2 GPa for 72 h using a piston-cylinder apparatus. In the experiments, the natural single crystal of jadeite from the New Idria, California with a grain size of ~1W mm ×1D mm ×2H mm was placed in the platinum capsule with fine spodumene powder having particle sizes of several μm. Polished cross sections of the run products were investigated with a SEM–EDS. At the reaction interface, we found a thin porous layer ~100 μm in width having a composition of 90 mol% jadeite and 10 mol% spodumene component, instead of a smooth gradual compositional profile. This is interpreted as a result of dissolution and precipitation reaction rather than diffusive chemical exchange. Although free water was not added into the experimental system, the starting material of natural jadeite crystal contains trace hydrous components (OH or H_2O) of up to 1000 ppm as hydroxyl and fluid inclusions. The trace amount of hydrous components might have worked as a solvent. Our experimental data imply relatively rapid mineral replacement reaction may occur in a ‘wet’ subsolidus system.

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