
Hydrothermal Synthesis of Corrensite: A Study of the Transformation of Saponite to Corrensite

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Abstract: Hydrothermal synthesis experiments were conducted to study the transition from smectite to corrensite. A mixture of oxides with the bulk composition of corrensite— $\text{Na}_{0.4}(\text{Si}_{6.4}\text{Al}_{1.6})(\text{Mg}_{7.8}\text{Al}_{1.2})\text{-O}_{20}(\text{OH})_{10}$ —was sealed in platinum capsules with 29–37 wt. % water. One set of samples was treated in cold-seal vessels at 500° C and 2 kbar for durations of 2, 3, 6, 12, and 24 h; the other set was treated at 350° C and 2 kbar for periods of 12 to 89 d. X-ray diffraction patterns (XRD) of oriented aggregates from treated products were obtained from ethylene glycol-solvated and air-dried preparations. Samples were also heated to 350° C either in a calibrated muffle furnace, removed and quickly placed in a nitrogen filled chamber on the diffractometer, or were heated at 350° C by using a calibrated heating stage mounted on the diffractometer.

Initial mineral assemblages at both temperatures contained only saponite and serpentine. In experiments at 500° C, saponite transformed to corrensite within 6 h; in experiments at 350° C, the transformation occurred as early as 22 d. Increased experiment times at both temperatures produced increasing amounts of well-crystallized corrensite, as indicated by several well-defined XRD peaks. No evidence of a randomly interstratified chlorite-smectite (C-S) precursor to corrensite was found. The identification of pure smectite, as opposed to highly-expanded randomly interstratified C-S, was possible only when clays were dehydrated on a heating stage on the diffractometer.

These results call for a new examination of hydrothermally-altered basalt that has been reported to contain randomly interstratified C-S as an intermediate step in the reaction of smectite to corrensite or chlorite. These results also strengthen the view held by increasing numbers of investigators that corrensite should be regarded as a single phase, not as a mixed-layered phyllosilicate.

Key Words: Chlorite • Corrensite • Hydrothermal Synthesis • Randomly Interstratified Chlorite-Smectite • Saponite • X-ray Diffraction

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