

HRTEM evidence for the process and mechanism of saponite-to-chlorite conversion through corrensite

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ABSTRACT

To elucidate the process and mechanism of the prograde conversion of saponite to chlorite through corrensite, the microstructures of a series of chlorite-smectite (C-S) mixed-layer samples from Kamikita, northern Japan were examined by high-resolution transmission electron microscopy using both lattice and structure imaging. Corrensite grows epitaxially as domains of 5–20 nm thick mainly within homogeneous saponite domains, without forming randomly interstratified C-S. Then, chlorite domains grow outside homogeneous corrensite domains without forming randomly interstratified C-S or chlorite-corrensite (C-Co), and finally are predominant. An atomic resolution image suggests that corrensite essentially consists of the 1 *M* stacking of alternating chloritic and smectitic layers. The structure and occurrence suggest corrensite is mineralogically a unique species. Comparison of the stacking vectors of corrensite along [001] to those of chlorite reveals that the stacking sequence is not inherited during the process from corrensite to chlorite. We rarely observed layer terminations of the hydroxide sheets both in corrensite and chlorite domains, and the layer terminations that do exist can be explained as defects rather than the formation of corrensite or chlorite. Our data strongly suggest that the saponite-to-chlorite conversion series progresses stepwise from saponite to corrensite and from corrensite to chlorite, and that the dominant reaction mechanisms are dissolution and precipitation.