

Chemigraphic Analysis of Trioctahedral Smectite-to-Chlorite Conversion Series from the Ohyu Caldera, Japan

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Abstract: The chemical compositions of chlorite-smectite mixed-layered minerals (C/S) from the Ohyu caldera (Inoue, 1985) are analyzed using $M^+ \cdot 4Si \cdot 3R^{2+}$ diagrams. The assumed original saponite has the following composition:

$Si_{3.54}Al_{0.46}O_{10}Al_{0.175}Fe^{2+}_{1.385}Mg_{1.295}Mn_{0.02}(OH)_2M^{+}_{0.56}$. Random C/S minerals (100 to 80% expandable layers) are interpreted as an interstratification of the starting 2:1 smectite layer with a $Al_xR^{2+}_{3-x}$ interlayer. The 2:1 smectite layer charge remains constant but Ca, Na, K cations are replaced by a $Al-R^{2+}$ complex ion. The brucitic layer (produced by the polymerization of the complex ions) and the 2:1 smectite layer form a 14 Å non-expandable phase having a composition different from a true chlorite.

The true chlorite layers first appear in the ordered (corrensite) phase composed of a high charge saponite: $Si_{3.35}Al_{0.65}O_{10}R^{2+}_3(OH)_2M^{+}_{0.65}$ and an octahedral vacancy-free chlorite

$Si_{2.90}Al_{1.10}O_{10}Al_{1.10}R^{2+}_{4.90}(OH)_8$. The recrystallization of the original trioctahedral smectite into a high-charge saponite decreases the b-dimension difference with the chlorite component.

From these data, it is suggested that the trioctahedral smectite-to-chlorite conversion is controlled by three reactions: 1. fixation and polymerization of $Al-R^{2+}$ complex ions in the interlayer region of the original smectite producing a 14 Å non-expandable phase (the interlayering of this phase with the original smectite gives the randomly interstratified C/S mineral. 2. dissolution of these random mixed-layered minerals and precipitation of corrensite. 3. dissolution of corrensite and growth of Fe-rich chlorite.

Key Words: Chlorite/smectite mixed layer • Corrensite • Ohyu caldera • Smectite-to-chlorite conversion

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