Effects of composition and structure on dissolution mechanisms of micas and chlorites

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Weathering of sheet silicates is important for soil environments. Dissolution experiments of these minerals in laboratory provide us much information on natural weathering.

Dissolution experiments of sheet silicates with different compositions and structures have been carried out in a single-pass flow system at pH 3 and pH 4.8 to understand differences in dissolution mechanisms. The minerals used in this experiments were trioctahedral micas (biotite, phlogopite), dioctahedral mica (muscovite) and three chlorites (clinochlore, chamosite-a and chamosite-b). Biotite and chamosite contain more Fe in the structures than phlogopite and clinochlore.

From the results, preferential release of interlayer cations (K for micas and Mg for chlorites) was observed in all experiments and Fe was the most stable element except in the experiment of biotite. Chamosites contain Fe in their interlayer regions but there were no preferential release of this ion. The release rate of each cation in pH 3 was faster than that in pH 4.8 except cations in the interlayer regions. Probably Na ions in the solution at pH4.8 promote the release of interlayer cations.

XRD results showed the appearance of 12Åpeak in the XRD patterns of biotite and clinochlore. The appearance of this peak suggests Na ions entered the interlayer regions of these minerals.

These results suggest that the differences of structure and composition affect the release mechanisms of interlayer regions and expansion of the interlayer regions affects the bulk dissolution mechanisms.