Interstratification in Vermiculite

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Abstract: Vermiculite (Libby, Mont.) was ground in a Waring blender in a 1 m NaCl solution and, after removal of excess electrolyte, the clay fraction was separated by sedimentation. The clay was predominantly vermiculite: X-ray diffraction patterns of Ca-saturated and oriented specimens showed an intense and sharp 15 Å and a weak 25 Å diffraction maxima and their integral orders. The intensity of the 25 Å reflection, attributed to regularly interstratified layers of vermiculite (15 Å) and mica (10 Å), was less than 20% of the 15 Å peak.

Additions of varying amounts of potassium or cesium, ranging from 10% to 100% of exchange capacity, to Ca-saturated clay showed that the collapse of the vermiculite lattice proceeds through a 1:1 regular interstratification of a 15 Å and a 10 Å lattice. Successive additions increased the 25 Å diffraction peak at the expense of the 15 Å reflection until the entire sample was interstratified. Further additions of K (or Cs) reduced the intensity of the 25 Å reflection and produced a 10 Å reflection until the entire sample was collapsed to 10 Å and no 25 Å reflection was recorded. These observations point out that under certain environmental conditions, the diagenetic formation of micas from vermiculite may proceed through an interstratification of the two in a manner analogous to weathering of biotite to vermiculite through an interstratified stage.

One-dimensional Fourier synthesis from the intensities of the 00*l* diffraction maxima of the interstratified mixture was carried out. In addition, a mechanism for the formation of the interstratified mixture was postulated: the replacement of Ca by K (or Cs) in one layer reduces the effective negative charge on the adjacent layer. Consequently, the K cannot replace the Ca in this but replaces the Ca in the next layer forming the interstratified mixture.

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