Mica-Derived Vermiculites as Unstable Intermediates*

J. A. Kittrick†

Department of Agronomy and Soils, Washington State University, Pullman, Washington 99163, U.S.A.

* This investigation was supported in part by grant 16060 DGK from the Federal Water Pollution Control Administration and from the U.S. Department of the Interior in support of the State of Washington Water Research Center project A-042. Published as Scientific Paper No. 3965, College of Agriculture, Washington State University, Pullman, Washington 99163, U.S,A. Project No. 1885.

† Professor of Soils. Appreciation is expressed to Mr. E. W. Hope for his help in the experimental work.

Abstract: Stability determinations were made by solubility methods on two trioctahedral mica-derived vermiculites. The phlogopite-derived vermiculite was found to be unstable under acid solution conditions, where stabilities of montmorillonite, kaolinite and gibbsite had previously been determined. An attempt was next made to locate a possible montmorillonite-vermiculite-amorphous silica triple point. This triple point involved conditions of alkaline pH, high pH_4SiO_4 and high Mg^{2+}. These are conditions where phlogopite and biotite-derived vermiculites are most likely to control equilibria *if* they are stable minerals. The montmorillonite-vermiculite-amorphous silica samples went to the montmorillonite-magnesite-amorphous silica triple point, leaving no stability area whatsoever for the vermiculites. These large particle-size, trioctahedral, mica-derived vermiculites appear to be unstable under all conditions of room *T* and *P*.

Arguments are presented indicating that micas are unstable in almost all weathering environments. A hypothesis is proposed that mica-derived vermiculites result from the unique way in which unstable micas degrade in these environments. It is proposed that vermiculite derives from a series of reactions whose relative rates often result in an abundance of vermiculite. These relative reaction rates are slow for mica dissolution, rapid for *K* removal and other reactions pursuant to vermiculite formation, and slow for vermiculite dissolution. In chemical terms, mica-derived vermiculites may be considered fast-forming unstable intermediates.

Clays and Clay Minerals; December 1973 v. 21; no. 6; p. 479-488; DOI: 10.1346/CCMN.1973.0210608

Clay Minerals Society (www.clays.org)