

MIXED-LAYERED STRUCTURES IN VANADIUM CLAYS¹

By

JOHN C. HATHAWAY

U. S. Geological Survey, Beltsville, Maryland

EXTENDED ABSTRACT

A group of claylike silicates from zones of vanadium mineralization in the sandstone-type deposits of the Colorado Plateau have been examined by x-ray powder diffraction methods to determine their mineralogic composition. The materials studied were separated by water elutriation, bromoform separation, or both, and oriented aggregates as well as randomly oriented powders were prepared. A comparison of the x-ray diffractometer patterns of these specimens with roscoelite from Coloma, California (AMNH 13,565) shows that most of the nine samples examined differ from roscoelite in two important ways: by interstratification of mica layers with montmorillonite, and by variation in octahedral substitution of V for Al. The mixed layering of mica-montmorillonite is revealed by distinct changes in position and intensity of the first-order basal spacings on treatment with ethylene glycol and on heating of the samples to 400° C and 500° C. Variations in octahedral substitutions are inferred from variations in the intensity of the second-order basal spacings relative to the first and third orders. Low relative intensity of the second order is interpreted as indicative of high electron density in the octahedral positions caused by substitution of V for Al. One sample (ALB-34-54) from Placerville, Colorado, shows x-ray characteristics very similar to the roscoelite from California and a chemical composition which gives a sum of 1.969 for octahedrally coordinated cations, indicating that it is a dioctahedral mineral. Two samples from Rifle, Colorado, also show characteristics closely resembling roscoelite although one of these, from an oxidized zone, exhibits a relatively stronger second-order basal spacing, and the suggestion is made that the amount of vanadium substitution is less than in the Coloma, California, or the Placerville, Colorado, material. The rest of the samples show mixed layering to various degrees, with the first-order basal spacing of the untreated material ranging from 10.1 Å to 10.5 Å.

Chlorite is present in at least seven of the samples and is the dominant mineral in at least two of them. Only in the materials from Coloma, California, and Placerville, Colorado, was chlorite absent. The chlorites in two samples show mixed layering with expanding material, although one of these—from Thompson, Utah—may be more closely allied to vermiculite than to chlorite. This indeterminant sample differs considerably from the other materials examined in that the mixed-layered mica-montmorillonite as well as the vermiculitic (?) mineral do not survive heating to 500° C. The nonmixed-layered chlorites are characterized by almost equal intensities of the first four basal

¹ Full paper has been submitted for approval as a U.S. Geological Survey publication.

orders although they vary in their thermal stability, some being destroyed by heating to 500° C. These variations are presumably the result of differences in degree of crystallinity or particle size as well as in composition.