

# CLAYS and CLAY MINERALS

at a glance

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## REGULARLY INTERSTRATIFIED CHLORITE-DIOCTAHEDRAL SMECTITE IN DIKE-INTRUDED SHALES, MONTANA

C. L. Blatter, H. E. Roberson and G. R. Thompson 207

Corrensite or 'corrensite-like' minerals occur in dike-intruded shales and siltstones of the Montana Group and Colorado Group (Early Cretaceous) in Western Montana. The  $< 1 \mu\text{m}$  size fraction of one specimen of this 'corrensite-like' material has been studied in detail. X-ray diffraction data and chemical analysis indicate that this specimen is a regular or nearly regular interstratification of chlorite and *dioctahedral* smectite. Also described are other samples, which contain corrensite and additional phases. These samples were taken at several localities where basic dikes have intruded these shales and siltstones.

## DETERMINATION OF THE CATION EXCHANGE CAPACITY OF CLAYS AND SOILS USING AN AMMONIA ELECTRODE

E. Busenberg and C. V. Clemency 213

The ammonia electrode serves as the basis of a simple, accurate method for determination of cation exchange capacity of small (*ca.* 50 mg) samples of clays. The technique is also capable of accurate measurement of CEC values on the order of 0.01 m-equiv/100 g if larger (*ca.* 500 mg) samples are used. The procedure, which requires saturation of the exchange sites with ammonium as in the usual methods, utilizes the electrode in the determination of ammonia released by treatment of the ammonium clay by strong base. For a Wyoming bentonite, the technique gave a CEC of 86 m-equiv/100 g with an S.D. (four determinations) of 0.83 m-equiv/100 mg. Duplicate runs on the same sample by the conventional Kjeldahl method gave results of 86.0 and 85.5 m-equiv/100 g.

## ELECTROCHEMICAL MODIFICATIONS IN KAOLINITE-GLOSS BEAD PLUGS

### MINERALOGICAL AND PHYSICO-CHEMICAL MODIFICATIONS

A. J. Sethi, A. J. Herbillon and J. J. Fripiat 219

Electrochemical treatment of kaolinite-glass bead plugs in the presence of water and  $\text{CaCl}_2$  solutions produces dissolution of the glass beads, corrosion of the anodes, and transport of the released elements toward the cathodic zone. In this area, new mineral phases (both amorphous and crystalline) are synthesized. Most of these new phases, and especially the calcium silicate hydrate (CSH-1), are well known to exhibit important cementing properties. The nature and the extent of the modifications brought about by the treatment are dependent on the nature of the electrodes, the pH and the ionic strength of the circulating electrolyte, and the duration of the treatment.

## ION-RICH SAPONITE (FERROUS AND FERRIC FORMS)

Norkiko Kohyama, Susumu Shimoda and Toshio Sudo 229

Clayey fragments colored deep bluish green are widely found in glassy rhyolitic tuffs at Oya, Tochigi Prefecture. In room-air the color changes to black or gray within one hour and finally to brown in a few weeks. The fragments are composed of an intimate mixture of two kinds of smectite: a ferrous iron-rich smectite (*IR*) with  $b_0 = 9.300 \text{ \AA}$ ; and an iron-poor smectite (*IP*) with  $b_0 = 9.030 \text{ \AA}$ . Microscopic examination shows a vesicular texture and that *IR* occurs at the core and *IP* at the marginal parts of each vesicle. Analysis by EPMA gave the following structural formulas: *IR*,  $(\text{Na}_{0.60}\text{K}_{0.04}\text{Ca}_{0.44})(\text{Mg}_{2.04}\text{Fe}_{3.98}^{2+}\text{Al}_{0.02})\text{-(Si}_{6.36}\text{Al}_{1.64}\text{O}_{20}(\text{OH})_4$ ; *IP*,  $(\text{Na}_{0.52}\text{K}_{0.08}\text{Ca}_{0.26})(\text{Mg}_{0.90}\text{Fe}_{0.95}^{2+}\text{Al}_{2.54})(\text{Si}_{7.66}\text{Al}_{0.34})\text{O}_{20}(\text{OH})_4$ . *IR* has a much larger amount of iron in trioctahedral sites than that found in any earlier

data. Acid-dissolution data, infrared absorption spectra, Eh-values, and DTA and TG curves are also given. Ferrous iron in the structure is easily oxidized in room air with loss of protons from the clay hydroxyls and with contraction of the lattice. We call the IR before and after oxidation the ferrous and ferric forms, respectively, of iron-rich saponite. They strongly suggest the existence of the iron-analogue of saponite. On exposed weathered surfaces in the field, brown fragments tend to be differentiated into two parts: one light yellow montmorillonite-beidellite; the other a brown incrustation due to hisingerite.

#### PHASE TRANSITIONS IN COMPLEXES OF NONTRONITE WITH *N*-ALKANOLS

G. Pfirmann, G. Lagaly and Armiu Weiss 239

The basal spacings of long chain *n*-alkanol complexes on nontronite saturated with Li<sup>+</sup>, K<sup>+</sup>, Mg<sup>2+</sup>, Ca<sup>2+</sup>, Sr<sup>2+</sup> and Ba<sup>2+</sup> were measured for temperatures increasing from -70 up to 130°C. With rising temperatures the complexes rearrange from a low temperature form into a high temperature form.

In the low temperature form the alkyl chains of the alkanol molecules form bilayers with their chain axes perpendicular to the silicate layers. The chains may not be in all cases in the planar all trans conformation but in special 'kink'-conformations.

The transition into the high temperature form is explained by cooperative transition from a form with a low number of 'jogs' to one with a high number of 'jogs' and 'kinks'.

#### EXCHANGEABLE CATION-STRUCTURAL PARAMETER RELATIONSHIPS IN MONTMORILLONITE

N. Lahav and Eshel Bresler 249

The interaction between 'unhydrated' cations (those not separated from the surface by a solvent sheath) in hole positions and the montmorillonite surface was analyzed theoretically by considering the main contributions to potential energy from the coulombic, hydration, van der Waals, induced dipole, and repulsive energies. The effects on these energy terms of the distance between the cation and the plane of basal oxygens, *h*, and of the angle of rotation of the silica tetrahedra,  $\theta$ , were investigated. Increase of  $\theta$  with *h* constant increases the absolute values of all but one of the energy terms. The hydration energy is an exception because it is probably independent of  $\theta$ . For a small cation, the increase in attraction energy is greater than the increase in repulsion when the value of  $\theta$  is sufficiently small. As  $\theta$  increases, the repulsive energy becomes more and more dominant until a minimum potential energy is reached. For large cations, this minimum can occur only above a certain value of *h*. Thus, the values of the potential energy minimum and of  $\theta$  at this minimum depend on the cation under study as well as on *h*. Since the concentration of unhydrated cations in a montmorillonite-water system increases with decreasing water content, it is concluded that  $\theta$  increases during the drying of homogeneous montmorillonite-water suspensions. This variation provides a partial explanation for the changes in *b*-dimension with water content observed by other investigators.