

CLAYS and CLAY MINERALS

at a glance

Volume 21

December 1973

Scientific Contributions
Note
News

429-488
489
491

ON THE MECHANISM OF THE ADSORPTION OF TRACE COPPER BY BENTONITE

H. F. Steger

429

The adsorption of trace quantities of Cu (3.89×10^{-6} to 3.00×10^{-4} M) by a bentonite clay from calcium acetate solution was studied over the range of pH 4.27-5.87. The data were fitted to an existing adsorption equation and the 'best' values of the adsorption parameters were calculated. The proton, cupric ion and mono (hydroxy) cupric complex were found to be the adsorbed species. The adsorption sites are of two types. It has been postulated that the majority of sites are lattice hydroxyl groups located at crystal defects and edges. The remainder arise from organic matter adsorbed by the clay and are the more important in the adsorption of Cu at very low metal concentration and at pH <5.4. The implication of the results on the potential use of bentonite clay to remove trace amounts of Cu from mine waste waters is considered briefly.

poise drilling mud can be attributed to concomitant variation in seven interrelated compositional properties. Sequential analysis shows that <0.2 μm clay content is the most important contributor to variation in yield. The remaining variables (total clay content, exchangeable Na, exchangeable Ca + Mg, Fe^{2+} and Fe^{3+} contents, and CEC) contribute little additional precision to the regression analysis when <0.2 μm clay content is included in the equation.

BENTONITE CHARACTERISTICS FROM DEPOSITS NEAR ROSALIND, ALBERTA

D. W. Scafe

437

Two bentonite deposits having average thicknesses of 10 and 4 ft are exposed within nonmarine strata of Late Cretaceous age along the Battle River near Rosalind, Alberta. They are characterized by scarcity of >44 μm and variable 44-2 μm and <2 μm contents. Material >44 μm in size in excess of 2 per cent is primarily attributable to secondary calcite, and <2 μm content may be related to the amount of 44-2 μm material that has altered diagenetically from volcanic glass to montmorillonite. Rhyodacite was the probable composition of the parent ash; therefore, the high iron content in one deposit is probably due to diagenesis. The blocking effect of iron on exchange sites can explain differences in exchangeable Na and Ca in different deposits. High exchangeable Na found in finer subdivisions of fractionated clay can be explained by increased purity of the bentonite.

Multiple regression analysis of the analytical data shows that 48 per cent of the variation in yield (bbl/T.) of 15 centi-

CLAY MINERALOGY OF SOME SILTY SOILS OF THE INNER COASTAL PLAINS OF MISSISSIPPI

V. E. Nash and R. C. Glenn

451

The chemical and mineralogical properties of six soils previously believed to be developed from coastal plain sediments were found to be significantly influenced by thin loess overlays and admixtures. The study included two profiles each of the Atwood, Lucedale and Savannah series. Atwood formed primarily in deep loess over coastal plain sediments, Lucedale showed definite loess influence to a depth of 10 in. and possible mixing to a greater depth, whereas the Savannah indicated the presence of slight loess to a depth of 20 in. Both the Atwood and Lucedale soils are well drained, whereas Savannah is moderately well drained and contains a fragipan.

The mineralogy of the coarse clay (2-0.2 μm) appeared to be the most diagnostic feature indicating genetic differences among the soils. Montmorillonite in this clay fraction was most abundant in Atwood, diminished in Lucedale and occurred only in trace amounts in Savannah. In both the Atwood and Lucedale soils very little montmorillonite was found at depths of 35 in. where coastal plain influence apparently predominates. Conversely, aluminous vermiculite-chlorite intergrade minerals were least abundant in Atwood, increased in Lucedale and occurred in greatest amounts in Savannah.

Accompanying these changes in mineralogy were corresponding changes in the chemical properties. Although no consistent differences in Ca and Mg content were found between the Atwood and Lucedale soils, both Atwood and Lucedale were much higher in exchangeable Ca and Mg than Savannah. Soil pH and base saturation increased in the order, Savannah, Lucedale and Atwood.

**MAGNETIC BEHAVIOR OF SOME BIOTITE
SAMPLES FROM WEST THRACE,
N.E. GREECE**

T. Anagnostopoulos, M. Calamitou and C. Sideris 459

The magnetic behavior of some biotite samples, from volcanic rocks of W. Thrace area, N.E. Greece, was studied in the temperature range from 85 to 270°K and compared with the chemical composition. The magnetization of the samples depends linearly on the applied field, and the magnetic susceptibility obeys the Curie law, showing a typical paramagnetic behavior which is due to Fe²⁺, Fe³⁺ and Mn²⁺. The effective magnetic moment was calculated from the structural formulas of the samples and deviation from the experimental values is discussed.

**THE CRYSTAL STRUCTURE OF THE
DIOCTAHEDRAL MICA 2M₂ DETERMINED
BY HIGH VOLTAGE ELECTRON DIFFRACTION**

A. P. Zhoukhlstov, B. B. Zvyagin, S. V. Soboleva and A. F. Fedotov 465

The structure of a dioctahedral 2M₂ mica was defined by high voltage electron diffraction. The cell parameters are: $a = 8.965$, $b = 5.175$, $c = 20.31$ Å, $\beta = 100^\circ 40'$, $Z = 4$, space group C2/c. Despite the peculiar character of the layer disposition ($\sigma_4 \sigma_5 \sigma_4 \sigma_5$), the oxygens of the layers are packed according to the cubic law. Consequently, the interlayer cations *K* have a trigonal prismatic coordination. The angle of tetrahedral twist is 11° 20'. The interatomic distances T-O indicate ordered replacements of Al for Si.

**AN ULTRAVIOLET SPECTROSCOPIC METHOD
FOR MONITORING SURFACE ACIDITY OF
CLAY MINERALS UNDER VARYING
WATER CONTENT**

George W. Bailey and S. W. Karickhoff 471

The ability of a clay mineral surface to function as an acid is not represented by bulk pH measurements. A method

using u.v. analysis and organic indicators has been developed to monitor surface acidity. The u.v. organic indicator method enables sensitive *in situ* quantification of surface-induced protonation in wet or dry clay systems. The clay preparation procedure used yields reproducible acidic behavior.

**MICA-DERIVED VERMICULITES AS
UNSTABLE INTERMEDIATES**

J. A. Kittrick 479

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 pH₄SiO₄ and high Mg²⁺. 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.