

# CLAYS and CLAY MINERALS

at a glance

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Scientific Contributions

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Short Notes

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History of The Clay Minerals Society by Richards A. Rowland

Preparation of sodium-degraded mica by J. M. Marques and A. D. Scott

Report of the Nomenclature Committee (1966-67) of The Clay Minerals Society  
by G. W. Brindley, S. W. Bailey, G. T. Faust, S. A. Forman, and C. I. Rich

## THE USE OF CLAY IN POULTRY FEED

J. H. Quisenberry

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Dietary supplements (bentonite and kaolinite) have been used as binding and lubricating agents in the production of pelleted feeds for chickens. The high-swelling and water absorbing capacity of some bentonites make them attractive dietary additives for control of wet droppings in caged layers. In addition, experiments show that layers fed on these diets exhibit significant increases in body weight, egg size, and life expectancy even though their total caloric intake is less than that of the control group. Dietary kaolin improves caloric efficiency even more than bentonite but without apparent effect upon growth or carcass quality. Kaolins of smaller particle size are superior to those of larger size in improving caloric efficiency. The effective kaolins are estimated to be worth approximately two calories of metabolizable energy per gram. The major beneficial effect appears to be due to a slowing down of the rate of feed passage through the intestinal tract.

components of the system. It was found that the montmorillonite clay particles curled around the boehmite which had been adsorbed on the basal surfaces of the montmorillonite.

## GLAUCONITE PELLETS: SIMILAR X-RAY PATTERNS FROM INDIVIDUAL PELLETS OF LOBATE AND VERMIFORM MORPHOLOGY

M. Tapper and D. S. Fanning

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Glaucconite pellets of vermiform and lobate morphology occur together in Eocene geologic formations in Maryland. Morphologically, the vermiform pellets appear to be identical to those that have previously been called "altered biotite". In this sections these pellets do show a well defined micaceous morphology with the layers running across the worm-like pellets. Some zones in these pellets appear to be "crystals" that are up to  $30 \times 70 \mu$  and nearly rectangular in cross section. Externally, the lobate pellets have many rounded lobes and are similar to one of the shapes that Burst has called free-form. In thin section under crossed nicols these pellets have a grainy appearance, indicating that the lobate pellets are composed of many small zones each about  $5-20 \mu$  across. Within these zones the mineral glauconite has a single orientation, but the zones are not lined up with each other to give the gross micaceous appearance that is associated with the vermiform pellets. Random powder X-ray diffraction patterns of individual vermiform and lobate pellets are nearly identical. In addition to X-ray diffraction patterns, the  $K_2O$  content and CEC of the pellets indicate that interstratified expanded layers are present. The probability that both kinds of pellets obtained their morphology before or during, rather than after, the time they became glauconite (mineralogically) suggests that the proper environment may form glauconite from a variety of starting materials.

## A MORPHOLOGICAL STUDY OF SELECTED SYNTHETIC CLAYS BY ELECTRON MICROSCOPY

Doris C. Warren and James L. McAtee, Jr.

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The morphology of synthetic montmorillonite and hectorite has been studied using electron microscopy and X-ray diffraction techniques. Interstratified montmorillonite-mica particles may be identified in these specimens by electron microscopy and electron diffraction techniques. Magnesium-substituted samples were found to exhibit an increasing amount of curling with increasing magnesium content, except for the end-member magnesium clay. Synthetic hectorite clays do not necessarily have the same morphology as natural hectorite clays. A study was made also of the morphology of a series of samples obtained from a study of kinetics of crystallization. Boehmite and montmorillonite were the basic

**ABSORPTION OF PYRIMIDINES, PURINES, AND NUCLEOSIDES BY Li-, Na-, Mg-, AND Ca-MONTMORILLONITE (CLAY-ORGANIC STUDIES XII)**

G. E. Lailach, T. D. Thompson, and G. W.

Brindley

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The absorption of biologically important purines, pyrimidines, and nucleosides by Li-, Na-, Mg-, and Ca-montmorillonite has been studied in aqueous solutions over a range of pH values 2–12. The initial organic concentrations were about 1 m.molar. The ratio clay to organic compounds was such that only up to 25 per cent of the exchange capacity could be saturated by organic cations, but, depending on conditions, up to 100 per cent of the available organic material was absorbed. Of the nineteen compounds studied, only thymine, uracil, and their nucleosides were not absorbed under the experimental conditions. Absorption occurs primarily as a cation exchange reaction under acid conditions and varies with the basicity of the compounds, their aromatic or non-aromatic character, and the possible extent of their van der Waals interaction with the silicate layers. Nucleosides generally are less strongly absorbed than their purines or pyrimidines because their non-planar structure permits less van der Waals interaction; their absorption is influenced by the differences in swelling behavior of montmorillonite with mono- and divalent cations.

**ABSORPTION OF PYRIMIDINES, PURINES, AND NUCLEOSIDES BY Co-, Ni-, Cu-, and Fe(III)-MONTMORILLONITE (CLAY-ORGANIC STUDIES XIII)**

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Absorptions of purine and pyrimidine derivatives by Co- and Ni-montmorillonite at pH < 6, and by Cu-montmorillonite at pH < 3 are similar to their absorption by Ca-montmorillonite and take place primarily by a cation exchange process. In the weakly acidic to weakly alkaline range, absorption is due to complex formation with the inorganic cations, and decrease in the order Cu > Ni > Co > Ca. Adenine, 7-methyladenine, hypoxanthine, and purine are strongly absorbed, 9-methyladenine, 6-chloropurine, and cytosine are weakly absorbed, and thymine and uracil are not absorbed. At pH < 5, the nucleosides are absorbed by Co-, Ni-, and Cu-montmorillonite in approximately the same manner as by Ca-montmorillonite, but at pH > 6 their absorptions decrease in the order Cu > Ni > Co > Ca. Fe(III)-montmorillonite behaves quite differently from the other montmorillonites studied. With purines and pyrimidines, there is strong absorption from pH 3 to pH 7–8; with the nucleosides, the absorption varies considerably with the compounds considered decreasing

in the order adenosine > cytidine > guanosine > inosine.

**HETEROGENEITY OF MONTMORILLONITE SURFACE AND ITS EFFECT ON THE NATURE OF HYDROXY-ALUMINUM INTERLAYERS**

Pa Ho Hsu

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A specimen montmorillonite (Arizona bentonite) was treated with hydroxy-aluminum solutions of various basicity. The cation exchange sites of this clay were found not to be homogeneous in their strength of retaining hydroxy-aluminum polymers; this strength varied from very weak, with which the Al polymers were only loosely held, to very strong, with which stable interlayer Al-clay complexes were formed. When a large amount of clay was treated with a small amount of solution, the polymers were held only in positions of strong affinity; the polymers were difficult to extract with neutral salt solutions and did not change to crystalline Al(OH)<sub>3</sub> during prolonged aging. When a small amount of clay was treated with a large amount of solution, the exchange sites were completely occupied by polymers; a portion of these polymers was easily extractable with neutral salt solutions and, during aging, changed to Al(OH)<sub>3</sub>. This contrast is significant in any attempt to compare results obtained under different experimental conditions and to correlate laboratory experimentation with the occurrence of gibbsite and interlayer Al-clay complexes in nature.

**CATION EQUILIBRIA STUDIES ON FRACTIONATED NATURAL CLAYS**

Walter Fertl and F. W. Jessen

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Various fractions, ranging in size from 50 to 0.05 μ, of natural bentonitic clays from Mexico and Wyoming, occurring as heterogeneous or multicomponent cationic system, were studied under specific equilibrium conditions of salt concentrations in the range found in many drilling fluids and formation waters. Because most reservoir sands contain some clay, cation exchange processes are of great importance in both drilling and production operations. It is important that neither invading mud filtrate nor injection waters upset the natural existing equilibria because bentonitic clays respond to such environmental variation by base exchange reactions that may affect formation permeability and productivity or injectivity indices. Glass electrodes were utilized in the study and particular emphasis was placed on developing an electrode sensitive to divalent cations. A tektite electrode, made of thin slices of glass similar to natural tektite in composition, was found to have specific sensitivity to divalent cations.