

CLAYS and CLAY MINERALS

of a glance

Volume 18

August 1970

Scientific Contributions

127-181

News

183

FACTORS AFFECTING POTASSIUM FIXATION AND CATION EXCHANGE CAPACITIES OF SOIL VERMICULITE CLAYS

Isaac Barshad and Fawzy M. Kishk

127

Soil vermiculite clays of varying tetrahedral and octahedral composition and cation exchange capacity (CEC) were examined for their ability to fix K^+ in both the *wet* and *dry* states. Fixation capacity, expressed as a per cent of the CEC, in the wet state was fairly high for most samples but it was enhanced greatly upon drying the K saturated samples. This enhancement indicated that each sample contained a number of vermiculite species with different CECs.

The vermiculite clays, as a group, exhibited a much higher *fixation capacity* at a much lower CEC than those of the coarse grained vermiculites. This enhanced fixation is believed due to the dioctahedral nature of the vermiculite clays in contrast to the trioctahedral nature of the coarse grained vermiculites. In samples of nearly equal CECs only those containing Al^{3+} in tetrahedral positions exhibited an enhanced *fixation* capacity in the dry state but not in the wet state.

It was remarkable to find that the state of oxidation of crystal structure iron strongly affected the *fixation* and the CEC. Reduction of Fe^{3+} to Fe^{2+} caused a *decrease* in *fixation* even though the CEC increased as a result of this change. Conversely these reactions and their effects were found to be reversible.

The variation in the orientation of the dipole of the hydroxyl ion in the octahedral layer with respect to the cleavage plane of the crystal is believed to be responsible for some of the noted differences.

STRETCHING FREQUENCIES OF STRUCTURAL HYDROXYLS OF HECTORITE AND K-DEPLETED PHLOGOPITE AS INFLUENCED BY INTERLAYER CATION AND HYDRATION

J. Chaussidon

139

The frequencies of structural OH stretching vibrations in swelling trioctahedral minerals such as hectorite or K-

depleted phlogopite depend on the ionic form and hydration of the sample. The trioctahedral structure is evidently a suitable case for the observation of spectral changes, since hydroxyl groups are in conditions of high reactivity with the surrounding medium. These changes are attributed to the field which originates either from the cations or the residual water molecules, and the joint analysis of spectroscopic and X-ray diffraction data permits an interpretation that frequencies quoted for unaltered mica are only perturbed frequencies.

DIFFERENTIAL RELEASE OF POTASSIUM FROM INTERSTRATIFIED MICA CLAY MINERALS AS RELATED TO PROBABLE DIFFERENCES IN THEIR MICA LAYER COMPONENTS

G. J. Ross and H. Kodama

151

Release of potassium by extraction with solutions containing sodium tetraphenyl boron or by leaching with 0.1 N barium chloride seemed to be related to the nature of the mica layers in the interstratified minerals studied. The rate of potassium release was lower when the calculated Si/Al^IV ratio of the mica component layers resembled muscovite and higher when this ratio was intermediate between muscovite and pyrophyllite. This supported a recent hypothesis that the composition and structure of the mica component layers may vary in different interstratified minerals of similar total chemical composition.

EXTRACTION OF INTERLAYER K FROM PHLOGOPITE SPECIFIC EFFECTS OF CATIONS, ROLE OF Na AND H CONCENTRATIONS IN EXTRACTION SOLUTIONS

J. Mamy

157

The accurate optical observation of alteration fringes developing in phlogopite flakes, shows that the morphology of the fringes is specific for some cations, such as Na, Mg and Ca, replacing K.

A careful chemical study of the exchange kinetics of interlayer K shows that, beside the classical effect of blocking the exchange reaction with cations such as K, Rb, Cs, NH₄, it is possible to induce an increase of the rate of K exchange when adding to a concentrated solution of one cation, a very small amount of other cation such as Na or H. The effects of mixtures such as Ca-Na and Ca-H are reported here in detail. Attention is drawn to the decisive part played by the impurities which may be contained in the reagents used.

Whole rock chemical analyses show no systematic variation with depth except for a decrease in calcium and magnesium caused by solution of carbonate. In contrast, potassium increases progressively with depth in the clay-size fraction, indicating a redistribution of potassium within the rock. Detrital illite (mica) seems to break down with increasing depth, thereby supplying potassium for interlayer fixation in illite/montmorillonite as the proportion of illite layers increases. The diagenetic reaction is independent of the geologic age of the sediments and of stratigraphic boundaries. Temperature seems to be more important than pressure in governing the reaction.

BURIAL DIAGENESIS IN GULF COAST PELITIC SEDIMENTS

Ed Perry and John Hower

165

Subsurface samples of shales ranging in age from Pleistocene to Eocene obtained from five Gulf Coast oil wells were examined mineralogically and chemically to determine the nature and extent of burial diagenesis in pelitic sediments. Illite/montmorillonite dominates the mineralogy and undergoes a monotonic decrease in expandability from about 80 to a limit of 20 per cent montmorillonite layers with increasing depth. The interstratification changes from random to ordered at about 35 per cent expanded layers. Discrete illite and kaolinite phases are ubiquitous and judged detrital. The discrete illite (mica) content of the whole rock decreases with depth, while the kaolinite shows no systematic variation. Chlorite occurs in appreciable amounts in only one well and there only in samples from the shallow water facies. This chlorite is also considered detrital.

A METHOD FOR PREPARING PELLETED CLAY SAMPLES OF SEMI-MICRO QUANTITY FOR DIFFERENTIAL THERMAL ANALYSIS

Pei-lin Tien and Maynard P. Bauleke

179

A semi-micro quantity (10–15 mg) sample of clay is pressed into a 3mm diameter pellet for differential thermal analysis (DTA) in a STONE-TRACOR ring microsample holder. The pellet is transferred to the sample holder dish with a vacuum tweezers. Platinum sample dishes are also handled by vacuum tweezers to avoid denting the dishes or damaging the thermocouple wires. The DTA curves obtained by the pellet method are highly reproducible. The resolution and sensitivity of reaction peaks are equivalent to or better than those produced by a large sample (200 mg) packed into a nickel block holder.