Investigations on the physical behavior of inorganic soil colloids have provided some interesting data concerning the properties of these colloids when saturated with various cations. One of the outstanding results of these studies was the striking similarity in the properties of Ca- and H-saturated systems. Since common observation, as well as certain field studies, have shown that the addition of lime to the soil improves its physical properties, it was difficult to understand the similar behavior of Ca- and H-clays. The suggestion immediately arises that these beneficial effects are produced by Ca-saturated organic colloids. Such a suggestion follows from a priori reasoning that organic matter in soils is usually associated with a high calcium content and that such soils generally have a very good structure. It was necessary, therefore, to study the colloidal properties of organic matter in order to clarify the problem.

Organic colloids were extracted from well-decomposed peat by the method of Waksman, electrodialyzed, saturated with various cations and studied from the points of view of adsorption, hydration, flocculation, and reversibility following desiccation. A condensed summary of the experimental results is given in Table 1. These data may be briefly summarized as follows:

1. The migration velocity of humus saturated with various cations decreased in the order: Li = Na > K > H > Ca > Ba.

2. The viscosity of the various systems followed the order: Ba > Ca > H > Na > Li > K. The higher viscosity of the Ba-, Ca-, and H-systems was due to flocculation effects.

3. Humus systems that were saturated with Li, Na, and K ions were completely dispersed and flocculated with difficulty. More than twice the symmetry concentration of HCl, BaCl₂, and CaCl₂ were required to produce significant flocculation. They could not be flocculated by dehydration with methyl alcohol.

4. At symmetry concentration the flocculating power of various cations followed the order: H ≥ Ba ≥ Ca > Mg > = Li. The Mg ion acted like a monovalent cation relative to flocculation.

5. The energy of adsorption and release of the several cations studied was of the same order of magnitude as in colloidal Putnam clay. The adsorption of these cations at symmetry concentration on H-humus was as follows: Th+++ > La+++ > Ba++ > Ca++ > Mg++ > K+ > Na+ > Li+. The relatively high energy of adsorption and low flocculating power of the Mg ion with respect to organic matter suggests a possible explanation of the formation of solonetz soils. Mg-humates would be mobile, especially in the presence of small amounts of alkali cations.

6. The reversibility of dehydrated Ca- and H-humate is very low. The percentage reversibility of Ca-humus was four times that of H-humus in a ten-day period. K-humus was completely reversible in two days.

These results suggest the following general conclusions concerning the colloidal properties of soil organic matter:

1. Colloidal humus behaves like a high-hydrated suspensoid. Hydration has major importance in the stability of humus sols. The high hydration of humus places it between colloidal clay and bentonite with respect to most of its properties.

2. The relatively high energy of adsorption and low flocculating power of organic matter with respect to organic matter suggests a possible explanation of the formation of solonetz soils. Mg-humates would be mobile, especially in the presence of small amounts of alkali cations.

3. The higher reversibility of dehydrated Ca-humus as compared with H-humus points out the possibility of the migration of organic matter to relatively great depths in pedocal soils. Since Ca- and H-saturated humus have similar properties relative to flocculation and since Ca-humates are more reversible in water than the corresponding flays terns, it would seem that the importance of calcium in the nutrition of plants and production of vegetation is a more significant factor in organic matter accumulation than has hitherto been recognized.