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WHEN the colloidal material in the upland soils of the western part of the Corn Belt is examined by the common techniques of clay mineralogy, a general similarity in mineralogical makeup is evident. Clays of the montmorillonite and illite groups are the dominant inorganic exchange materials. In view of the study by Ross and Hendricks (10) of the montmorillonite group of clays, it seems likely that important variations may occur among the montmorillonite clays found in soils. A method which would indicate differences within this group of clays might furnish information which would help in interpreting soil properties.

One possibility for obtaining information of this type was suggested by Cornet (3). In his work the ammonium ions held in interlattice positions could apparently be separated from those held on edges and outer surfaces of the montmorillonite clay particles. This separation was made possible by a stepwise volatilization of the adsorbed ammonia when ammonium saturated clays were heated.

The experiments reported here were initiated to determine whether or not other volatile cations such as amines or other nitrogen bases were volatilized from the exchange complex upon heating in a manner similar to that found by Cornet for ammonia. It seemed probable that the energy changes incident to volatilization of these ions might be of sufficient magnitude to permit the reaction to be followed by the procedures commonly used in the differential thermal analysis of clays.

THERMAL DECOMPOSITION OF THE PIPERIDINE SALTS OF DIFFERENT MONTMORILLONITE CLAYS

One of the first organic bases studied in the thermal decomposition reactions was piperidine. It was selected because it fits into interlattice positions of montmorillonite type clays (6), and also because it is a strong base. The piperidine salts of a number of montmorillonite type clays were prepared by titrating the acid clay to a pH of about 7.5 with a .1 N water solution of piperidine. The clays used were supplied to this laboratory through the courtesy of Drs. C. S. Ross and S. B. Hendricks, and were selected to give a range in composition within the montmorillonite group.

The piperidine treated clays were dried on a steam chest and ground to pass a 60-mesh screen. They were then subjected to differential thermal analyses as described by other authors (11). A linear heating rate of 12.5° per minute was maintained and all temperatures and temperature differences were determined with Chromel Alumel thermocouples. The difference thermocouple was connected to a Leeds and Northrup 2420 C Galvanometer having a 0.022 micro amperes per mm sensitivity. Calcined A1$_2$O$_3$ was used as a reference material. The thermograms obtained were reproducible.

The differential thermal diagrams of six piperidine treated clays, as well as the differential thermal diagrams of samples of the acid clays are shown in Fig. 1. The acid clays were stored over a saturated solution of CaCl$_2$ before analysis. It is apparent from the predominant thermal reactions of the treated clays were exothermic, indicating a combustion of the adsorbed cation. It is also evident that reaction took place in a stepwise manner, exhibiting exothermic activity, with a marked tendency for the reaction to subside during the intervals between peaks. All of the clays showed a marked exothermic peak at $300^\circ$ to $350^\circ$ C followed by one or more peaks at higher temperatures. The temperatures at these later peaks occur seem to be related to the composition of the clays. The clay from Smith County, Miss. (1B), and that from Amaragosa, Calif. (1A), have been reported (10) as being typical magnesium montmorillonites. The piperidine treated clays exhibited exothermic reactions at $700^\circ$ C.