Heats of Compression of Clay-Water Mixtures*

B. D. Kay† and Philip F. Low

Department of Agronomy, Purdue University, Lafayette, Indiana 47907, U. S. A.

* Journal paper no. 5531, Purdue University, Agricultural Experiment Station.

† Present address: Department of Land Resource Science, University of Guelph, Guelph, Ontario, Canada.

Abstract: Heats of compression of glass bead-water and clay-water mixtures were determined from the peak heights of the thermograms produced when these mixtures were subjected to pressure in a Calvet differential microcalorimeter. It is known that the heat of compression is directly proportional to the peak height. When the latter quantity was plotted against the pressure applied to any mixture, two intersecting straight lines were obtained. The change in slope at the point of intersection was interpreted as being the result of a pressure-induced higher-order phase transition in the water.

The differential peak height, ϵ was defined as the rate of change of peak height with pressure/g of water present in the mixture. Hence, it is directly proportional to the rate of change of the heat of compression with pressure/g of water. Values of ϵ were determined for both glass bead-water and clay-water mixtures containing different proportions of solids. It was found that ϵ remained nearly constant with increasing proportions of glass beads, whereas, it varied in a non-uniform way with increasing proportions of clay. Also, its values in the clay-water mixtures were relatively high. Calculations showed that the difference in ϵ values for the two mixtures could not be ascribed to the exchangeable cations associated with the clay particles. Consequently, it was ascribed to the effect of the particle surfaces on the structure of the vicinal water.

Clays and Clay Minerals; September 1975 v. 23; no. 4; p. 266-271; DOI: 10.1346/CCMN.1975.0230402

Clay Minerals Society (www.clays.org)