Diagenesis of Clay Minerals from Lower Cretaceous Shales of North Eastern British Columbia*

A. E. Foscolos and H. Kodama

Institute of Sedimentary and Petroleum Geology, 3303 33 Street, Calgary, Alberta, Canada
Soil Research Institute, Department of Agriculture, Ottawa, Ontario, Canada

* Joint contribution, No. 475 (S.R.I.).

Abstract: Clay minerals from shale outcrops of the Lower Cretaceous Buckinghorse Formation (4250 ft thick) were investigated in order to assess their degree of diagenesis and their oil-generating potential. Crystallinity index, sharpness ratio, per cent of illite which is the 2*M* polymorph and presence of discrete minerals have been studied in the whole clay fraction, while the very fine clay fraction has been subjected to X-ray diffraction, differential thermal, thermogravimetric, differential thermogravimetric, i.r. spectroscopy, surface area and chemical analyses. With information derived from these studies and from published data, a classification scheme was devised which relates variation of clay mineralogy to diagenetic stages and burial depth.

Data on the <2 μm size fraction show that the crystallinity index decreases while the sharpness ratio and per cent of illite which is the 2*M* polymorph increase with burial depth. Results on the <0 · 08 μm fraction reveal that a three-component interstratified clay mineral exists. In addition, Fourier transform calculations and chemical and physicochemical analyses indicate that both the ratio of the amounts of non-hydrated clays (illite) to hydrated clays and the K_2O content of clays increase with burial depth: cation exchange capacity and surface area decrease with burial depth.

Based upon a classification scheme, which was devised by combining criteria and data derived from the studies of Weaver (1961a), Kubler (1966), Burst (1969) and Dunoyer de Seconzac (1970), the upper and middle parts of the formation (upper 3250 ft) fall within the middle stage of diagenesis whereas the lower part (1000 ft) is allocated to the beginning of late diagenesis. In terms of Burst's (1969) work, the upper 3250 ft are transitional between the stability and dehydration zones indicating that, prior to uplift, hydrocarbons may have been in the process of migration. The lower 10000 ft of the formation are in the restricted dehydration zone, indicating that hydrocarbon migration should have been completed.

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