Mineralogical and Rb-Sr Isotope Studies of Low-Temperature Diagenesis of Lower Cambrian Clays of the Baltic Paleobasin of North Estonia

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Abstract: X-ray diffraction (XRD), Rb-Sr isotope analysis, transmission electron microscopy (TEM), energy-dispersive X-ray spectroscopy (EDS), and Fourier transform infrared (FTIR) methods were used to study diagenetic illite and illite-smectite (I-S) in Lower Cambrian unlithified clays of shallow depth of burial in the northern part of the intercratonic Baltic paleosedimentary basin of the East-European Platform. The studies focused on the <0.06-μm size fraction of the clay. This fraction consists of a highly illitic illite-smectite (I-S) and a poorly crystalline illite (PCI), with some traces of Fe-rich chlorite also present. Rb-Sr isotopic data for the <0.06-μm size fractions suggest that the illitic I-S and PCI have different formation ages. No precise isotopic ages were derived directly owing to the composite illite mineralogy and retention of radiogenic Sr. This retention occurred because of imperfect isotopic homogenization at low water/rock ratios. The age of burial diagenesis is proposed to coincide with the time of maximum burial depth, which was achieved during the Middle to Late Devonian and continued until Permian-Triassic erosion. Because of the shallow depth of burial (<2 km), diagenesis was probably a low-temperature (<50 °C transformation process. The resident time of 100 – 150 million years at maximum burial had a major influence in the process.

Key Words: Baltic Paleosedimentary Basin • Cambrian • Low-Temperature Diagenesis • Illitization

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