Kaolinite, Smectite, and K-Rectorite in Bentonites: Relation to Coal Rank at Tulameen, British Columbia

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Abstract: The Tulameen coal field is part of an Eocene nonmarine basin which received extensive volcaniclastic sediments due to its location within an active magmatic arc. Bentonite partings in the coal originally consisted of glassy rhyolitic tephra with phenocrysts of sanidine, biotite, and quartz. During the initial alteration, which took place within the swamp or shortly after burial, glass was transformed to either smectite-cristobalite-clinoptilolite or to smectite-kaolinite. The formation of kaolinite depended on the degree of leaching of silica and alkalies in the swamp environment. Some beds are nearly 100% kaolinite and can be designated as tonsteins. The smectite shows no evidence of interlayering; the kaolinite is well ordered. During alteration, sodium, originally a component of the glass, was lost from the system.

A later thermal event, which affected only the southern part of the basin, metamorphosed the smectite to a regularly interstratified illite/smectite with 55% illite layers and rectorite-type superlattice (IS-type). The source of potassium was dissolution of sanidine. Vitrinite reflectance measurements of the coal suggest that the smectite was stable to 145 – 160 ° C, at which temperature it transformed to K-rectorite.

The absence of randomly interstratified intermediates, even in beds rich in potassium, suggests that the transformation of smectite to K-rectorite was controlled by a steep thermal gradient possibly resulting from local magmatism or circulating geothermal fluids.

Key Words: Bentonite • Coal rank • Kaolinite • Mixed layer • Rectorite • Smectite • Tonstein • Vitrinite • Zeolite

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