Occurrence and Petrographic Characteristics of Paleosols in the Lower Waseca Formation, Saskatchewan

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Abstract

Paleosols are soils that developed on past landscapes. The purpose of this project is to identify, describe and classify paleosols in the Mannville Group in Saskatchewan cores to determine paleoenvironmental conditions in the Lower Cretaceous. Key criteria used to identify the paleosols in this study include lack of depositional sedimentary structures (e.g., bedding, cross-bedding, etc.), root related features (mainly rootlets), boundaries (wavy, irregular, tonguing), colours, evidence of organic matter, grain size, soil structures/cracks, and staining. Paleosol units can be identified on wireline logs due to the gamma ray and density neutron signatures of the coal beds present within the paleosols, although the bottom half of the paleosol has no defining wireline signature itself. The Waseca Formation of the Mannville Group contains the best preserved paleosols out of the 19 cores chosen for study. These paleosols are all topped with a coal unit, and underlain by a fine sandstone layer with an abundance of rootlets (5-20%). The sandstone units are generally massive and light gray (2.5Y7-1). Some of the cores have an additional dark gray (2.5Y4/1) fine sandstone layer underneath the coal and above the light gray unit. Two cores, 111/03-06-050-23W3 and 111/03-06-050-23W3, were selected for detailed study. Thin section sampling and point counting of the paleosols selected for detailed study show the rocks to be a sandstone wacke with a decrease in organics from top to bottom of the paleosol control section. The paleosols exhibit clay coating, alteration to clay grains and infilled pores by clays indicative of subaerial exposure and pedogenic processes. The sub-coal parts of the paleosol have medium sorting, subrounded to subangular grains, and consist of fine to very fine sand sized grains. SEM/EDS data revealed kaolinite clays dominate the matrix and coat grains. Further study includes XRD on the clays, and organic analysis of the coals to better characterize these paleosols. To date the data suggest the paleosols evolved into an organic soil, due to the large amount of organics that accumulated on the surface which are preserved as a layer of coal.

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