ORIGIN OF THE POWDER RIVER BASIN COALS: A CONTROVERSY REVISITED

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ABSTRACT OF ORAL PRESENTATION

The Powder River Basin Paleocene and Eocene rocks contain what may be the greatest collection of thick, aerially extensive, low–ash/sulfur coals in the world. The extraordinary thicknesses range up to 200 feet (60 m) and commonly are between 50 to 100 feet thick (15–30 m). These laterally extensive coals are often measured in hundreds of square miles with at least two, the Big George and the Wyodak, encompassing nearly a thousand square miles in area. The low ash (2–7%) and sulfur (0.5–1.5%) content add to their uniqueness. The rank is subbituminous with a BTU value up to 13,000.

Identifying the nature and characteristics of the wetlands that generated these incredible coals has been a great puzzle for geologists over the years. What wetland environments stay constant for the tens of thousands of years necessary to produce enough peat to account for a coal bed 200 feet thick? How are such environments protected from clastic input in order to generate the low ash and sulfur characteristics? How can they be so laterally extensive, and why are they commonly elongate in a north–south direction?

A variety of general wetland models have been proposed ranging from the fluvial back-swamp to interdeltaic lobes to a lacustrine/swamp interaction. Each has its strong points and drawbacks, and attempts to find exact modern analogs have failed.. These models will be presented and examined. Although usually ignored as a wetland type, the lacustrine/swamp complex has a spectacular example in the Pantanal of Brazil's Mato Grosso State. This is the world's largest wetland and covers over 56,000 square miles—an area larger than the state of Florida! I favor this lacustrine/swamp model and feel that with the addition of tectonic activity similar to that in the Powder River Basin, the Okefenokee Swamp would be a very close modern analog, even to the size.

It seems that in the current literature, anyone describing the origin of very low ash and sulfur coals automatically envokes the "raised bog" as the wetland of choice. I have serious problems with this concept. It is indeed true that raised bogs do produce low ash and sulfur coals, but does that mean all low ash and sulfur coals MUST be from a raised bog? I think not, but the band wagon syndrome seems to be operating. A careful analysis of characteristics, processes and products of a raised bog begins to leave doubt about using is as a mechanism for satisfying all the necessary characteristics of Powder River Basin coals. This is especially true of the thickness of the coals.

Careful study of these coals and their enveloping sedimentary packages can lead to a better understanding of the paleogeographic and tectonic history of the Powder River Basin. Petrographic analysis of the coals themselves reveals many characteristics of the paleoclimate as well as the burial/erosion history of the basin.

The coals of the Lake de Smet and Sheridan–Decker areas share the characteristics of the other Powder River Basin coals, and their origin then must share a common explanation.

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Figure 1. Modern pictoral representation of evolutionary sequence (A–B–C) from swamp condition to lake environment.