1984 Symposium on the Geology of Rocky Mountain Coal
Proceedings: North Dakota Geological Society, Bismarck, North Dakota 58502

PREDICTABLE CYCLICITY IN CRETACEOUS COAL DEPOSITIONAL SYSTEMS

by

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Extended Abstract. Cretaceous coals of the Western Interior of North America are primarily associated with depositional systems representing delta plain, strand plain, lagoonal, and coastal wetland environments. Their occurrence in these facies has suggested that the major controls on Cretaceous coal deposition are a combination of independently varying tectonic, sedimentologic, eustatic, and climatic factors. These complex interactions seemingly allow little predictability in the occurrence of Cretaceous coal deposits that might stimulate models for exploration and development. Integration of very detailed stratigraphic studies of coal-bearing sequences with high-resolution event stratigraphy in nearby Cretaceous marine facies, however, allows precise dating and environmental analysis of coal forming events, and calculation of their individual durations and rates of change. These studies show that most major Cretaceous coal deposits are associated with repetitive, predictable sedimentary sequences, that is third- to fifth-order cyclothems. Third-order cyclothems are mainly symmetrical sedimentary sequences which represent 7-10 Ma tectonoeustatic fluctuations in which coal deposits are primarily formed in association with stacked delta (progradational) sequences during stabilization of sea level at peak transgression and peak regression, as well as

during slow regressional phases. Fourth-order cyclothems are mainly represented by single progradational sequences which are asymmetrical, preserving the regressive hemicyclothem, in many cases capped by delta or strand plain sediments and coal deposits, and overridden by the transgressive disconformity of the next fourth-order cyclothem. Radiometric and biostratigraphic data suggest that these individual progradational sequences have durations of approximately 100,000 years; individual progradational sequences of the Dakota and Ferron Sandstones (Cenomanian-Turonian) of Utah are excellent examples. An example of fifth-order cyclicity is found in the 1-3-meter thick, stacked regressive cyclothems of the coal-bearing Albian Bear River Formation in southwestern Wyoming. These may reflect alternating dry and wet conditions in response to 21,000-42,000 year Milankovitch climate cycles. These are expressed up-section as brackish mollusk calcarenites, calcarenitic claystone, clay shale, carbonaceous shale, and coal sequences; each of these even contains smaller cycles reflected by the fauna. Recognition of these cycles provides a strong predictive tool for the location and assessment of coal resources, and interpretation of their depositional setting.