Geologic Controls on the Stratigraphic Architecture of the Denver Formation, Denver Basin, Colorado

Charles R. Nelson
Blackrock Resources, LLC, Golden, CO.

The Denver Formation is a latest Cretaceous and early Paleocene terrestrial stratigraphic interval in the Denver Basin. Two striking features of this formation's stratigraphic architecture are vertical bulk compositional variation and rhythmic lithologic stacking. These two features can be used to informally divide this formation into three distinct depositional-environment subunits that are defined based on the absence or presence of coal seams and their temporal spacing periodicities. These subunit classifications are illustrated using the lithology of the Kiowa core (Raynolds and Johnson, 2002) and the palynostratigraphic, paleomagnetic, and radiogenic-isotope based age-depth scale constructed for this core (Hicks et al., 2003). The coal seams in the Denver Formation interval of the Kiowa core are finger-print type lithologic evidence that stable, wetland hydrological conditions periodically existed during sediment deposition. These coal seams exhibit average temporal spacing of ~20 k.y., ~40 k.y., and ~100 k.y. or whole integer multiples of these periodicities. These temporal intervals correspond to Milankovitch-type orbital precession, obliquity, and eccentricity climate cycle intervals, respectively. Periodic Milankovitch-type orbital climate forcing of wetland hydrological conditions is the only geologic-processmodel hypothesis with appropriate temporal spacing expectations that can account for the stratigraphic architecture pattern exhibited by the coal seams in the Denver Formation. Milankovitch-type orbital climate cycles are commonly observed in the stratigraphic architecture of marine and lacustrine sedimentary intervals. The analysis results for the Denver Formation indicate that Milankovitch-type orbital climate forcing can also be an important geologic control on the stratigraphic architecture of terrestrial sedimentary intervals.