THE BAKKEN FORMATION IN THE WILLISTON BASIN OF WESTERN CANADA

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A suite of geological maps of the Bakken Formation (Upper Devonian-Lower Carboniferous) have been compiled in preparation for a study of its source rock potential. The maps display the extent, thickness and present structure of both the formation and its three members. Additional sheets indicating hydrocarbon shows and formation fluid characteristics are also available. A suite of illustrative cross-sections accompanies the maps.

The Bakken Formation is a thin unit exhibiting subdued changes in thickness, which generally conform to the regional structure of the basin. In the region of the Alberta-Saskatchewan border the combination of rapid thickness variations of the middle sandstone member and the pattern of pre-Cretaceous erosion produces a more complex geometry. Similar, but more local thickness variations of the middle sandstone member occur in the Rocanville-Virden area.

Local structural anomalies attributable to either salt solution collapse (Hummingbird, Saskatchewan) or meteorite impact (Hartney, Manitoba) are highlighted by the maps.

NATURE AND ORIGIN OF OOIDS AND PISOLITES OF THE MISSION CANYON FORMATION (MISSISSIPPIAN), WILLISTON BASIN, NORTH DAKOTA

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The ooids and pisolites in the Mission Canyon Formation (Mississippian) of North Dakota are dominated by a radially (normal) fibrous substructure. Scanning electron microscope and petrographic studies show a depositional origin for the radially fibrous substructure. Three types of ooids and pisolites with this substructure are common in the Mission Canyon: complete (unbroken), broken and recoated (1-4 stages), and composite (containing a complex nucleus). Depositional and diagenetic features associated with these ooids and pisolites are; (1) a range of fabrics from wackestone to grainstone; (2) fenestral, peloidal carbonates interbedded with and containig the ooids and pisolites; (3) cyanobacterial mats; (4) oncolites; (5) fibrous crusts; (6) restricted-marine organisms (ostracode and algae dominated); (7) desiccation cracks and tepee structures; (8) intraformational micro-erosional surfaces; (9) internal sediments; (10) fibrous and bladed isopachous cement.

The radially fibrous substructure of the ooids and pisolites point to formation in low energy environments. The associated depositional and diagenetic features indicate that a storm affected, tidal flat environment existed. Therefore, the ooids and pisolites probably formed in hypersaline pools on the tidal flats. Periodic storm surges agitated the pools and caused breakage of ooids and pisolites. Quiescent periods allowed renewed grain growth with the addition of radially fibrous coatings. Multi-staged growth textures show the periodic effects of storm surges until final deposition.

A facies mosaic was formed by several subenvironments (hypersaline pools, tepee structures, and cyanobacterial mats) on the tidal flat. Lateral migration of these subenvironments with burial produced the complex vertical succession of lithologies seen in core. This model differs from those of others who placed the ooids and pisolites, and associated lithologies, into parallel, linear, facies belts and called upon complex, transgressive-regressive, sea level changes to form the same lithologic successions.

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