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Delta Front and Deep-Water Basin-Floor Deposition in the North American Interior Seaway: Lewis Shale, South-Central Wyoming

Core, electric log and outcrop data show the Lewis Formation of south-central Wyoming to consist of a thin, transgressive shale overlain by a much thicker interval of coarser delta-related clastics. The entire formation is up to 762 m (about 2500 ft) thick. Maximum westward and northward extent of the transgression, which occurred in south-central Wyoming during the *Baculites eliasi* interval (Maestrichtian, Late Cretaceous) of the Western Interior biostratigraphic zonation, was to areas of the Rock Springs and Wind River uplifts. The Lewis sea opened eastward into the main expanse of the North American Interior seaway. Shale of the lowermost Lewis is black, carbonaceous and bioturbated and shell debris is common. Depositional site of the lower Lewis interval was a shallow, oxygenated shelf.

In contrast, Lewis clastics above the transgressive interval were deposited largely in delta front, interdistributary and relatively deep-basin settings. The central basin floor changed from shallow water to sub-storm-wave depths, seemingly in response to eustatic sea level rise and to tectonic subsidence. This deepening occurred starting in *Baculites eliasi* to *B. grandis* time (Maestrichtian). Upper Lewis clastics are mostly related to distributary systems which entered the basin first from the northeast and later apparently from the south. Progradation direction of the northeast delta suggests significant uplift in the Wind River thrust area concurrently with Lewis sedimentation. Log cross-section patterns and core data indicate that the northeast delta fed sediment into a continually subsiding basin having significant and changing local relief. The northeastern delta system was active during the *Baculites*

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grandis to *B. clinolobatus* interval; the southern delta was important during *B. clinolobatus* time.

Many hydrocarbon-producing Lewis sandstones, including those at Wamsutter and Hay Reservoir fields, are thickly bedded and massive and some show fluid escape structures. These were likely deposited by high-density turbidity currents. Thinner sandstones are characterized by grading, Bouma sequences and sole markings. These were also deposited by sediment gravity flows. Much of the interbedded shale at Wamsutter field was slightly burrowed by a restricted fauna or is unburrowed indicating, respectively, dysaerobic and anaerobic conditions at time on the basin floor. Water depths were likely 150-200 m (about 500-650 ft) or more for these conditions. Depositional site for Lewis sandstones at Wamsutter field is inferred to have been in a delta-toe setting.