

Subsurface to Outcrop Correlation of Fluvial Architecture of the Lance Formation, Washakie Basin, Southern Wyoming

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The Maastrichtian Lance-Fox Hills-Lewis strata in the Washakie and Great Divide Basins of southern Wyoming accumulated a complete source-to-sink spread of coastal plain (Lance), shoreline and shelf (Fox Hills), and deepwater slope and submarine fan (Lewis) depositional systems. During system deposition, the Cretaceous Interior Seaway underwent its last transgression and regression cycle and the Laramide Orogeny began. Laramide total subsidence rates (>2km in 1.9 My) generally outpaced sediment flux into the basin so that the system became and remained a deepwater (>500m water depth) basin beyond the Lance-Fox hills shelf prism. A major consequence of the rapid subsidence and dramatic catchment area relief increase was that Lance coastal-plain deposits aggraded strongly and accumulated behind the generally rising trajectory of the Fox Hills shorelines.

The present study examines the process character, dimensions, and architecture of the fluvial systems in the main coastal-plain fairways that fed the shorelines, shelf, and deepwater systems of the basin. A prior 3-D subdivision of the basin succession (using 1000 wells) defined 15 distinct clinof orm units bounded by 16 maximum flooding surfaces. The clinof orms are cropping out on both sides of the basin, which allows the Lance Formation coastal-plain deposits, best exposed in clinof orms 11, 12, and 13, to be examined in both outcrops on the east side of the basin and in subsurface well data.

The tectonically active geologic setting resulted in an increased catchment area (Wind River Range, Granite Mountains, Rawlins Uplift, and Washakie and Great Divide Basins) relief, from lowland (100-500m) to mountainous (1000-3000m), and a large sediment supply, 4-16 x 10⁶ ton/y, and bypass of sand, 200-2000 ton/km²/y, directed through the Lance fluvial system to the marine basin during two stages of deposition (Carvajal and Steel, 2011). Measured sections in deposits of five distinct channels of clinof orm 12 suggest a low-sinuosity, braided river pattern. The mean river channel depths are between 6.3m – 7.9m and channel belt widths between 1,476m – 2,108m based on average cross strata set measurements. The dominant northwest to northeast paleocurrent trends in all the channels measured provide evidence of a possible easterly embayment and east to west supply to the fluvial Lance from the Rawlins and Sierra Madre Uplift.

Keywords: Washakie Basin, Lance Formation, fluvial