

## **Depositional Setting and Potential Reservoir Facies in the Nanushuk Formation (Albian-Cenomanian), Brookian Topset Play, North Slope, Alaska**

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### **ABSTRACT**

The Nanushuk Formation is a thick fluvial-deltaic-shelf succession that crops out in the foothills north of the Brooks Range and is present in the subsurface throughout the NPRA and state lands immediately to the east, up to a maximum progradational shelf edge approximately 30 miles east of the Colville River. Nanushuk strata comprise prominent topsets visible on seismic lines that pass basinward (east) to clinoform reflectors in slope strata of the Torok Formation. Large rivers with headwaters west of the present-day North Slope flowed eastward, down the axis of a foreland basin, and built an extensive delta complex and shelf. Smaller, steeper gradient rivers, with headwaters in the ancestral Brooks Range, flowed north and northeastward and built deltas on the south side of the basin. Six facies associations are recognized in Nanushuk cores from wells in the eastern NPRA and in outcrops to the south, including: 1. offshore mudstones with minor interbedded fine-grained sandstones; 2. shoreface-delta-front sandstones with minor interbedded mudstones; 3. distributary channel-fill sandstones; 4. bayfill-estuarine mudstones that envelop a variety of fine-grained sandy facies; 5. fluvial channel-fill sandstones; and 6. alluvial floodbasin mudstones. In the eastern NPRA and in outcrops to the south, the offshore and shoreface-delta-front associations are most common. Shoreface-delta-front deposits stack to form coarsening-upward parasequences from 30 feet to over 100 feet thick that are typically bounded by flooding surfaces; amalgamated parasequences with sand-on-sand contacts are common in shoreline proximal settings. Hummocky and swaley cross-stratification, wave ripple cross-lamination (and symmetrical ripple bedforms), mudstone rip-up clasts, and pebble-lined scours are abundant in this association. In the most proximal settings, some shoreface successions are overlain by bayfill-estuarine mudstones. Distributary channel-fill sandstones and bayfill-estuarine mudstones are present locally in the subsurface. The fluvial channel-fill and alluvial floodbasin associations are common in outcrop, but have not been recognized in cores from the eastern NRPA. The abundance of storm wave-generated structures in the shoreface-delta-front and offshore associations indicates powerful storm waves routinely affected Nanushuk deltas and the adjacent shelf in this part of the basin. Stacked shoreface-delta-front parasequences overlain by flooding surfaces and offshore mudstones, and in proximal settings, parasequences that pinch out updip in mudstones of the bayfill association, represent attractive reservoir targets. Sandstones of this association commonly display visible porosity in core. Toplap relations visible on seismic and sharp-based shoreface successions recognized in Nanushuk outcrops along the Colville River suggest the likely presence of shelf-edge deltas associated with forced regressions, adding to stratigraphic trap potential. Distributary channels encased in bayfill-estuarine mudstones are potentially attractive reservoir targets if effectively sealed updip.