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The Alpine Play—Incised Shoreface Systems in the Kingak Shale, National Petroleum Reserve in Alaska (NPRA)

Recent leasing and exploration drilling in NPRA have focused primarily on stratigraphic traps in the Jurassic-Lower Cretaceous Kingak Shale. This activity was stimulated by the 1994 discovery of the Alpine oil field (>400 mmbbl) on the northeastern boundary of NPRA. Key elements of Alpine-type accumulations include a high-gravity oil charge derived from a condensed section in Lower Jurassic strata and Upper Jurassic stratigraphic traps comprising lenticular, sharp-based shoreface sandstone sealed by condensed mudstone.

Late Jurassic sedimentation was influenced by pulses of uplift along the Barrow arch and by accommodation geometry inherited from a south-facing shelf margin in underlying Lower Jurassic strata. During Late Jurassic lowstands, dip-oriented valleys were incised into older strata in the low-accommodation northern area, broader estuaries and perhaps coastal embayments were incised into older strata along the coast, and offlapping marine strata were deposited southward at the shelf margin. During subsequent transgressions, coastal embayments, estuaries, and incised valleys were sites of wave winnowing and deposition of clean, bioturbated sand with excellent reservoir properties. During maximum transgression, condensed mud accumulated across the entire depositional surface, including both incised areas and interfluvies.

Reservoir-quality sandstones deposited in these incised systems rest on a sequence-bounding unconformity or ravinement surface, are sharp based, commonly contain a transgressive pebble lag, are blocky in character, and grade abruptly upward into condensed mudstones. The sandstones contain a pervasive Skolithos ichnofacies, including a locally abundant Macaronichnus assemblage, and few primary sedimentary structures are preserved. These characteristics suggest middle to upper shoreface deposition restricted to incised lows.