Reservoir Geology and Development History of the Grayling Gas Sands Reservoir, McArthur River Field, Trading Bay Unit, Cook Inlet, Alaska

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The Grayling Gas Sands (GGS) reservoir of the McArthur River Field (MRF) (Chevron 48.8%, operator, and Marathon 51.2%), is the third largest gas field in the Cook Inlet, Alaska with an OGIP of 1.35-1.80 TCF and a cumulative gas production of 1.14 TCF and 568 MBW. The GGS, also referred to as the Middle Kenai Gas Pool, produces normally pressured, unassociated dry gas from a 7,000+ foot thick sequence of forearc basin stacked fluvial sands of the Tertiary Tyonek Formation. The GGS overlies older Tertiary and middle Jurassic oil reservoirs of the MRF. The MRF was discovered in December 1965, and initial GGS gas production began in 1968, peaking at 225 MMSCFPD in November, 1997. Current production capacity is approximately 75 MMSCFGPD from 20 active sales gas wells on the Steelhead Platform, and two active fuel gas wells on the Grayling Platform. The GGS is trapped by structural and stratigraphic components associated with a NNE-SSW fault propagated anticline. GGS gas is considered biogenetic, sourced from numerous interbedded, often laterally continuous sub-bituminous to bituminous coal beds. Drive mechanisms for the GGS are natural depletion and aquifer drive. Forty gas pay sands comprise the GGS, most of which have independent original gas-water-contacts. The originally normally pressured reservoir sands are differentially depleted due to over 40 years of production. Seismic data across the main MRF structure is typically poor due to the presence of shallow gas charged unconsolidated sediments which slow and diffuse seismic energy. Over 200 gas and oil wells drilled from the four MRF offshore platforms provide for a varied, but relatively robust well data set. The feldspathic litharenite to litharenite sands and conglomeratic sands comprising the GGS reflect the influence of a magmatic arc to the west, and a complex of accreted mélange and turbidite metasediments to the east. Controls on reservoir quality include grain size, sorting, clay and detrital mud content, degree of cementation and dissolution, degree of compaction, and grain fracturing. Core porosity ranges from 15 to over 30%, and permeability from less than ten to hundreds of millidarcies. Fresh water sensitive authigenic montmorillonite (smectite), and potentially mobile kaolinite are common. GGS reservoir lithofacies are highly cyclical, characterized by stacked fining upwards fluvial cycles tens of feet thick. A basal channel facies often rest with a sharp contact on underlying fine clastics or coal. On a field scale many of the GGS sands are laterally discontinuous, often thinning onto the crest of the field suggesting that the MRF structure was likely active during GGS deposition. The mature GGS reservoir is undergoing a renewed phase of development with drilling of high step wells to access isolated fluvial sands, infill wells targeting prematurely abandoned zones, and single-zone horizontal wells.