

**SEDIMENTOLOGICAL EVOLUTION OF THE MISSISSIPPIAN KEKIKTUK FORMATION,
SAGAVANIRKTOK DELTA AREA, NORTH SLOPE, ALASKA**

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ABSTRACT

The reservoir interval in the Endicott field, located under the delta of the Sagavanirktok River east of Prudhoe Bay, is the Mississippian Kekiktuk Formation. The rocks are quartzose, and lithofacies and sequence analysis of core material shows that the Kekiktuk in that area can be subdivided into three sedimentologically distinct intervals, each of which reflects a different fluvial depositional environment. The lowermost interval (Zone 1) rests directly on metamorphic basement, and comprises interbedded coal, mudstones, siltstones, and fine-grained sandstones. These rocks were deposited in a very low lying swamp plain containing local lakes and sluggish, highly sinuous streams. Zone 1 is overlain sharply by Zone 2, which comprises medium- to coarse-grained, multistory sandstones which were deposited within an unconstrained braided river system. The braid plain contained both ephemeral and permanent lakes, and periodic gravity flows deposited coarser sediment into the latter. That sequence passes gradationally upwards into Zone 3, which is composed of coarse-, medium-, and fine-grained sandstones, as well as siltstones, mudstones, and coals. The lower part of Zone 3 is dominated by upward-fining sandstone sequences, interpreted as channel bars deposited within a moderately sinuous fluvial system. They pass gradationally upwards into other, distinctly upward-fining sequences which differ in having higher proportions of siltstone, mudstone, and coal. Those rocks were deposited in a more highly sinuous (meandering) fluvial environment. The rocks grade upwards into shallow marine sediments of the Kayak/Itkilyariak Formations. The vertical sequence within the Kekiktuk in this area permits an interpretation of the structural history of the basin during Kekiktuk times.

FACIES ANALYSIS AND CORRELATION IN THE LISBURNE DEVELOPMENT AREA, PRUDHOE BAY, ALASKA

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ABSTRACT

The Lisburne Group is a widespread group of predominantly shallow marine carbonate rocks, largely Mississippian and Pennsylvanian in age, underlying much of Alaska's North Slope. Near Prudhoe Bay, it is divided into two formations, with the Wahoo overlying the Alaph.

Oil was discovered in the Lisburne with the drilling of the Prudhoe Bay State #1 well in 1968. An active delineation program during 1983-84, and detailed geological/geophysical studies have demonstrated the viability of the Lisburne reservoir.

Log interpretation for lithology is difficult in the Lisburne, and good core control is essential. A computerized data base has been established containing foot-by-foot descriptions for more than 5,000 feet (1,500 m) of core. We have developed a lithofacies classification based on sediment texture, grain size and type, and dolomite content.

The upper portion of the Wahoo has received the most attention and is best understood at this time. The most distinctive features of logs in the Lisburne interval are the so-called "shale" marker beds. These are readily correlatable across the reservoir area, and have been used as time lines to divide the Wahoo into a set of detailed subzones. The major marker beds represent distinct breaks in sedimentation. Between these breaks, lithology varies both laterally and vertically. Detailed subzones have allowed us to map individual "slices" of the reservoir, and to have confidence in overall reservoir continuity. Whereas matrix porosity appears to contain most of the hydrocarbons, fracture porosity is important for the interconnection of porous intervals and for productivity of the reservoir.