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THE GEOLOGY AND DISCOVERY OF PRUDHOE BAY FIELD, EASTERN ARCTIC SLOPE, ALASKA

by

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ABSTRACT

The Prudhoe Bay Field is recognized as one of the largest oil fields in North America with estimated reserves of five to ten billion barrels. Reconstruction of the geologic history suggests that the combination of geologic controls on the field will be difficult to find duplicated elsewhere.

Hydrocarbons are present in Jurassic and Permo-Triassic sandstones and Pennsylvanian-Mississippian carbonate reservoirs. These strata, locally folded into a westerlyplunging, faulted anticlinal nose, are truncated by a pre-Cretaceous unconformity resulting in the subcropping of progressively older reservoirs to the northeast. Most of the hydrocarbons are trapped below the unconformity and are contained in the permo-Triassic Sadlerochit formation. This reservoir is present in the field area as a uniform wedge of alluvial-deltaic sandstone and conglomerate.

The pre-Cretaceous clastic reservoirs were derived from the ancient Beaufort Arch, north of the present coastline. In contrast, the unconformably overlying Cretaceous and Tertiary sandstone and marine shale were derived from uplifts on the steep south flank of the basin, near the present Brooks Range.

In 1944, during World War II, the U.S. Navy initiated the first extensive Arctic exploration program. This program was carried on for ten years at a cost of over \$55 million. Drilling was conducted principally in two areas, the Barrow High and the Arctic Foothills belt. The Umiat Field, located on a foothills anticline, was the largest oil discovery with estimated reserves of 20 to 100 million barrels in Cretaceous sandstones. The high finding costs experienced by the Navy tended to discourage industry exploration.

In 1963, several wells were drilled jointly by BP Exploration Company (Alaska) Inc. and Sinclair Oil and Gas Company, in an attempt to extend the Navy foothills Cretaceous play. BP-Sinclair and Union Oil Company of California each later drilled unsuccessful Paleozoic tests near the Arctic coast.

In 1964, Humble Oil and Refining Company joined Richfield Oil Corporation (now Atlantic Richfield) in evaluation of Federal acreage south of Prudhoe Bay. Regional seismic data and Federal leasing policy in existence at that time caused Humble to shift the exploration effort from the Federal acreage to the eastern Arctic coastal area. The major portion of the Prudhoe Bay structure was leased jointly by Humble and Richfield, and by BP at the State of Alaska Sale in July, 1965. The ARCO-Humble Prudhoe Bay No. 1 State was completed as the discovery well in June, 1968.