

## Alaska's North Slope: Petroleum Exploration History and Future Potential

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The North Slope of Alaska consists of the foothills and Arctic coastal plain north of the Brooks Range. It extends some 1000 km in an east-west direction from the Canadian border to Cape Lisburne and varies in width from 30 to 300 km. The contiguous continental shelf extends a further 100 km northward beneath the the Arctic Ocean. The region is geologically complex and contains multiple proven source rocks and reservoirs in successive passive margin, rift and foreland basin sequences spanning the Palaeozoic to Tertiary. Hydrocarbons are found in both extensional and compressional structures as well as stratigraphic traps.

Initial geological exploration of the North Slope was undertaken by the USGS in the early part of the 20<sup>th</sup> century and lead to the establishment in 1923 of Naval Petroleum Reserve No.4 (now called NPRA) covering the western part of the region. Between 1944 and 1953 the U.S. Navy drilled 81 mostly shallow wells in NPR-4 which discovered a nine small oil and gas fields, one of which was developed to supply gas to the community of Barrow. In 1960 Congress created the Arctic Wildlife Range, which was expanded in 1980 to become the Arctic National Wildlife Refuge (ANWR) and covers the eastern part of the region. With ANWR closed to petroleum development and the continued existence of NPR-4, industry exploration was confined to the "middle ground" between the two. Seismic acquisition began in 1962 and ultimately lead to the discovery of the giant Prudhoe Bay and Kuparuk River oilfields in 1968 and 1969 respectively. The U.S. Navy and USGS undertook a second exploration program in the NPRA between 1974-1982 which saw the drilling of 28 exploration wells and six development wells in the Barrow gas field. Continued industry exploration of the middle ground and latterly in the NPRA has resulted in seven producing oilfield units, three others not yet producing and at least 27 other hydrocarbon accumulations.

To date the area has produced about 15 billion barrels of oil; remaining reserves are 7 billion bbl of oil and 35 TCF of gas. Recent estimates of the mean undiscovered resources of the North Slope by the USGS and MMS are 50 billion bbl of oil and NGL plus 227 TCF of gas. Oil is exported via the Trans-Alaska Pipeline System (TAPS) but as yet there is no gas export pipeline.

Future exploration of the North Slope is likely to focus on (1) subtle stratigraphic traps identified through 3D seismic attribute studies, (2) large Tertiary aged structural features offshore and possibly in the 1002 part of ANWR, (3) the shallow multi-billion barrel viscous oil accumulations below the permafrost, and, pending the construction of a gas export pipeline, (4) anticlinal traps along the Brooks Range foothills and (5) possibly gas hydrates.