A PETROLEUM SYSTEM MODEL FOR GAS HYDRATE DEPOSITS IN NORTHERN ALASKA

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ABSTRACT
Gas hydrate deposits are common on the North Slope of Alaska around Prudhoe Bay, however the extent of these deposits is unknown outside of this area. As part of a United States Geological Survey (USGS) and the Bureau of Land Management (BLM) gas hydrate research collaboration, well cutting and mud gas samples have been collected and analyzed from mainly industry-drilled wells on the Alaska North Slope for the purpose of prospecting for gas hydrate deposits. On the Alaska North Slope, gas hydrates are now recognized as an element within a petroleum systems approach or TPS (Total Petroleum System). Since 1979, 35 wells have been samples from as far west as Wainwright to Prudhoe Bay in the east. Geochemical studies of known gas hydrate occurrences on the North Slope have shown a link between gas hydrate and more deeply buried conventional oil and gas deposits. Hydrocarbon gases migrate from depth and charge the reservoir rock within the gas hydrate stability zone. It is likely gases migrated into conventional traps as free gas, and were later converted to gas hydrate in response to climate cooling concurrent with permafrost formation. Gas hydrate is known to occur in one of the sampled wells, likely present in 22 others based gas geochemistry and inferred by equivocal gas geochemistry in 11 wells, and absent in one well. Gas migration routes are common in the North Slope and include faults and widespread, continuous, shallowly dipping permeable sand sections that are potentially in communication with deeper oil and gas sources. The application of this model with the geochemical evidence suggests that gas hydrate deposits may be widespread across the North Slope of Alaska.

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