# Linking Remotely Sensed Permafrost Features to Subsurface Structures, Gas Geochemistry and Gas Hydrates

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Methane hydrate (a crystalline solid in which water molecules form an ice-like framework that trap gas molecules) is an attractive energy resource because of its high energy density as compared to other naturally occurring forms of methane, and its relatively close proximity to the Earth's surface and seafloor. Methane hydrate distribution on the Alaska North Slope (ANS) Prudhoe Bay region is thought to be controlled by the availability of migrated thermogenic methane gas from depth. The Eileen Fault Zone intersects the pressure/temperature stability field of gas hydrates at 8,000 ft below the surface. If the Eileen fault does not completely seal, it would allow excess gases, including methane, from gas hydrate formation to continue to migrate towards the surface. A gas charged pingo, with comparable gas composition to gas hydrates found at depth, would be evidence that such migration has occurred. Using GIS techniques, subsurface geologic structures determined from geophysical data and geochemical samples of shallow permafrost have been integrated with processed remote sensing images of pingos. Initial results show no correlation between pingo alignment and the orientation of shallow subsurface faults, however with additional processing pingo alignment may be more apparent. Analysis of seismic data by the USGS at Milne Point, northwest of Prudhoe Bay, shows a gas chimney that correlates well with a lake and shallow faults in the area. Further analysis of the Milne Point data and incorporation of additional geochemical data from field work in August of 2005 will focus on understanding the interaction of faults and gas hydrates in the Prudhoe area. If such an association exists, migrating gases could be an indicator of subsurface gas hydrate formation, suggesting that some permafrost features in alignment could be possible surface indicators for subsurface processes.