A Mount Sopris portable well logger was calibrated for gamma-gamma density and neutron porosity in dry geophysical-type boreholes in unfrozen materials. Since the hydrogen index of ice is less than that of water, the response of the neutron porosity for 100% ice reads as approximately 72% porosity. Thus, by cross plotting gamma-gamma density vs. neutron porosity, we can determine if the soils are frozen and estimate the unfrozen water contact.

Using this crossplotting technique, we believed that the hydrogen indices of natural gas hydrates, detected in oil wells on the North Slope of Alaska, provide a sufficient contrast with those of water and/or ice to provide a method of quantitative evaluation of hydrates in situ.

Logs of a hole drilled through a buried, artificial-ground ice mass showed that the natural gamma-log count rate decreases significantly in the vicinity of the ice, indicating that the natural gamma log could prove useful for detecting and delineating massive ice.

Calibrated logs were also used to estimate potential thaw consolidation and to follow seasonal variations in moisture content and bulk density.


Late-Stage High-Angle Faulting, Eastern Doonerak Window, Central Brooks Range, Alaska

The three deformation phases are recognized in the eastern Doonerak window. From oldest to youngest, they are (1) an isoclinal folding characterized by pervasive axial-planar dextral cleavage, (2) formation of kink bands and chevron-style folds of the slaty cleavage, and (3) development of gentle flexures with associated crenulation cleavage or close-spaced joint planes. First- and second-phase structures are related to thrust faulting. High-angle faulting may be related to third-phase deformation.

Most of these high-angle faults strike west to northwest, are subvertical, and exhibit slickenside striations that plunge gently west. Another set of high-angle faults strikes northeasterly and contains two generations of slickenside striations, a younger subhorizontal set and an older subvertical set. These perpendicular slip directions support the existence of two separate stress regimes: (1) a north-trending principal compressive stress axis, ε1, and (2) a west-trending ε2.

Structural analysis of several west-northwest-trending high-angle faults and associated extensional fractures demonstrates a stress regime with ε1 plunging gently west-northwest. This regime is incompatible with north-directed thrusting and supports a separate late-stage deformational event. Two possible interpretations are that the high-angle faulting is (1) related to west-northwest thrusting or (2) is a separate phase of deformation involving significant east-west compression.


Reconnaissance Oxygen Isotope Study of Gold-Bearing Quartz Veins Within Metasedimentary Rocks of Valdez Group, Alaska

A reconnaissance oxygen-isotope study of gold-bearing quartz veins within the metasedimentary rocks of the Valdez Group from around Prince William Sound was conducted to examine the variations and similarities within and between the different gold districts, and to investigate the origin of the ore-forming solutions. Analyses were made of mineralized samples from mines and prospects in the Port Valdez, Port Wells, Girdwood, Hope-Sunrise, and Moose Pass gold districts.

In the Hope-Sunrise district the δ18O values of the gold-bearing veins are relatively constant, ranging from +16.0‰ to +16.7‰, whereas in the Port Valdez district, the vein values are more variable (+10.9‰ to +17.0‰). Implying variations in temperature or fluid compositions. Within individual mines, the δ18O values are constant within 0.1‰ along strike in continuous veins, and vary by a maximum of 0.2‰ between bands of quartz in ribbon vein samples.

Petrographic and fluid inclusion data suggest a temperature of approximately 325°C for formation of the mineralized quartz veins. Calculated δ18O values for fluids in equilibrium with the veins range from +8.6‰ to +12.2‰. A quartz separate from an altered quartz diorite intrusion at the Rough Tough mine in the Port Valdez district has a δ18O value of +14.0‰; fluid in equilibrium with the intrusive at a reasonable temperature