*AN OVERVIEW OF HIGH LATITUDE DEPOSITIONAL SYSTEMS

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It is axiomatic that a better understanding of depositional systems and analogs leads to better inputs for geological models and better assessment of risk for plays and prospects in hydrocarbon exploration. Depositional environments - clastics and carbonates, fine- and coarse-grained, continental, marginal marine and deep marine - show latitudinal variations, which are sometimes extreme. Most familiar facies models derive from temperate and, to a lesser extent, tropical examples. By comparison, depositional analogs from higher latitudes are sparser in number and more poorly understood. Numerous processes are amplified and/or diminished at higher latitudes, producing variations in stratigraphic architecture from more familiar depositional "norms." With exploration increasingly moving to Arctic basins and seeking targets originally deposited in higher latitude settings, understanding these and other latitudinal variations in depositional systems and analogs will lead to better inputs for geological models and better assessment of risk for reservoir, source and seal deposits.

Whereas overt glacial effects, both from erosion and depositional processes, are mostly limited to icehouse conditions, and are limited in applicability to conventional hydrocarbon exploration, recent discoveries of gas hydrates in association with permafrost make better understanding of the stratigraphic architecture developed during Cenozoic icehouse conditions equally desirable.

Some higher latitude process variations operate during both greenhouse and icehouse conditions. Extremes of seasonality result in temperature and insolation effects on fauna and flora, as well as short runoff seasons and strong fluvial discharge seasonality. Seasonal ice has profound direct and indirect effects, including limitation of wave fetch and influences on coastal systems, brine rejection density currents, overflow conditions at river mouths, as well as enhanced potential for hyperpycnal flows. Rafting of sediments during sea-ice breakup also provides an additional mechanism for transport of terrestrial material into deeper water. Coriolis effects range from zero at the equator to a maximum at the poles, with consequent effects on geostrophic currents, as well as deltaic and estuarine sediment plumes. Types, occurrences, and effects of storms are strongly dependent on latitude. Tide-influenced coastal sedimentary facies are likely to be volumetrically less significant, at least under highstand conditions. Generally reduced semi-diurnal tides at high latitudes may diminish the importance of tides as a sedimentary agent at higher, and especially polar latitudes. However, topographic effects can dominate the response of coastal areas to tidal forcing and some of the highest tide ranges and tidal currents are found in the Canadian arctic.

The Cenozoic icehouse is characterized by extreme and high frequency eustatic sea level changes. In glaciated regions, glacio-isostatic effects lead to very rapid local relative sea level changes while ice sheet melting provides extreme fluvial and sediment discharge. This can make standard sequence stratigraphic interpretation difficult. For example, incised valleys can be formed by either catastrophic glacial discharge events, isostatic uplift, rapid relative sea level fall or a combination of these processes.

Continental shelves that were exposed for extended periods during lowstands to annual average temperatures below 0^{C} are subject to downwards permafrost aggradation to hundreds of metres. The temperature profiles of such shelves intersect the gas hydrate stability zone at shallow depths. Complex thermal histories related to sea level, sediment supply and climatic fluctuations result in freeze-thaw cycles, differential subsidence (thermokarst), complex fracturing and fluid migration. Melting of permafrost at the shelf edge may influence slope stability.