A New Geological Map of Northwest Ellesmere Island (Sverdrup Basin): Hvitland Peninsula

MAYR, ULRICH, BENITO BEAUCHAMP, and J. CHRISTOPHER HARRISON, Geological Survey of Canada, Calgary, AB

Helicopter-assisted and Polar Continental Shelf Project-supported field work on Hvitland Peninsula, NW Ellesmere Island, carried from a base camp at the north shore of Otto Fiord, was conducted during the summer of 1991, 1992, 1994 and 1996. The area is situated at the northeastern margin of the Sverdrup Basin. The field work revolved around two main activities: 1) the stratigraphic analysis of the Carboniferous and Permian succession; and 2) the mapping and structural interpretation of the bedrock. The project involved various GSC officers, university graduate students and their professors, and industry experts, including a number of specialists from Norwegian oil companies.

The map area straddles a region of upper Paleozoic facies changes. The eastern part is underlain by platform carbonates, whereas the western part is underlain by basin mudrocks. Large reefs occur along the front between the basinal and platformal rocks. The new map contains about fifteen upper Paleozoic map units, five of these are newly defined.

Three distinct structural regions can be distinguished. The southeastern part features thrust-imbricated panels, arranged in triangle-zone structures riding on an evaporite décollement. This belt is gradational with a thrust belt to the north rooted in an isotropic lower Paleozoic basement. Both thrust belts plunge southwest into a less deformed area comprising short thrusts and strike-slip faults rooted in basement or evaporites.

The map area is significant because of the hydrocarbon potential of similar rocks in the subsurface of the Sverdrup Basin and the mineral potential (lead-zinc) of the platform carbonates. Parts of the Upper Paleozoic succession on Hvitland Peninsula lies within the oil-window of organic matter maturation. Large carbonate reefs, some reaching over 1 km in thickness, occur widely along the paleo shelf-edge. Similar reefs in the Western Arctic, as well as in the Barents Sea and Timan-Pechora basins of Europe are associated with major hydrocarbon potential.

Complex Alluvial Paleosols in the Lower Cretaceous Mill Creek Formation, southwestern Alberta: Micromorphological Features and Significance as Paleoenvironmental Indicators

MCCARTHY, PAUL J., The University of Western Ontario, London, ON; I. PETER MARTINI, University of Guelph, Guelph, ON; and DALE A. LECKIE, Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada, Calgary, AB

To deduce a record of middle Cretaceous palaeoclimatic history, an understanding of the genesis of paleosols is important. Field observations are often not sufficient for such a genetic interpretation of paleosols, partly because fossil soils are usually either truncated or they form parts of thick aggradational pedocomplexes within alluvial successions. Under such conditions micromorphology provides information critical to an understanding of past environmental conditions.

Thick alluvial successions of the Mill Creek Formation contain abundant evidence of pedogenesis, but few well-developed paleosol profiles, and therefore, provide an ideal case study in which to demonstrate the usefulness of micromorphological data for paleoenvironmental interpretation. The micromorphological features of greatest interpretive value are types of clay coatings and ferruginous segregations, structure and fabric. Of lesser value are pappules, evidence of bioactivity and concretions. While individual features can provide some paleoenvironmental information, the most useful information comes from the relationships of features to one another (parageneses) and assemblages of features. The presence of illuvial clay requires that water percolated through the soil and that the soil periodically dried out so that the translocated clay was retained. Dark reddish clay coatings indicate clay illuviation under freely-drained conditions, while pale-yellow and silty day coatings suggest illuviation under poorly-drained and saturated soil conditions respectively. The presence of iron depletion coatings, iron nodules and quasisferrites indicates these units were at least periodically saturated, and the occurrence of multiple, overlapping phases within single thin sections demonstrates that redox conditions fluctuated, strongly suggesting development in the vadose zone. Recent soils containing similar assemblages of features are found in warm temperate areas of North America and Europe with seasonal climates and mean annual temperatures in the range 9-15 °C and mean annual precipitation from 850-1500 mm. Variability in soil moisture conditions is attributed to changing geomorphic conditions rather than to regional climate change.