The lower Paleozoic, offshore Labrador, Canada: insights into the paleoenvironments and depositional realms from core and thin section analyses

NIKOLE BINGHAM-KOSLOWSKI AND TANNIS MCCARTNEY

Geological Survey of Canada (Atlantic), Bedford Institute of Oceanography, Dartmouth, Nova Scotia B2Y 4A2, Canada <nikole.bingham-koslowski@canada.ca>

Lower Paleozoic strata encountered in seven wells in the Hopedale Basin (offshore Labrador) are commonly associated with Cretaceous syn-rift structures. These strata are not laterally continuous, and inadequate biostratigraphic data prevents well-to-well correlation of the Paleozoic section. This study presents a detailed lithological analysis of Paleozoic conventional cores and associated thin sections from the Labrador margin, provides preliminary paleoenvironmental interpretations, and assesses whether lithological comparisons are sufficient for determining possible relationships between the Paleozoic strata of the margin in the absence of reliable age data.

Of the seven wells, conventional cores were collected from Paleozoic strata in (from north to south): Gudrid H-55, Roberval K-92, Indian Harbour M-52, and Freydis B-87. The lithology and paleontology of six cores and 43 thin sections from the four wells have been documented. The cores range from solid dolostone to predominantly limestone; the degree of diagenesis decreases southwards. The cores from Gudrid H-55 (core 1) and Roberval K-92 (cores 6 and 7) have been pervasively dolomitized, resulting in the destruction of any original fossil content. An unidentified hydrocarbon is observed within fractures and pore spaces of both Roberval K-92 cores. The Paleozoic rocks at Indian Harbour M-52 (core 1) consist of a fossiliferous wackestone having a microbial mud matrix that contains a significant amount of dolomite, including hydrothermal dolomite. Core 1 from Freydis B-87 represents the only siliciclastic Paleozoic rocks in the Hopedale Basin, and consists of interbedded mudstones, siltstones, sandstones, and carbonate units. Ichnofacies, sedimentary structures (ripple cross-laminations and planar laminations) and fossils from the carbonate sections are characteristic of a shallow marine depositional environment for this interval. A fossiliferous wackestone exhibiting preferential dolomitization of argillaceous stringers comprises core 2 from Freydis B-87.

Despite the similarities in the composition of the cores from Gudrid H-55 and Roberval K-92, the high degree of alteration prevents any direct correlation between these wells. The strata from Indian Harbour M-52 is comparable in lithology to core 2 from Freydis B-87, and shares a similar fossil suite characteristic of a low-energy, shallow marine environment (*Girvanella*, shell fragments, bivalves, brachiopods, crinoids, gastropods, sponge spicules, bryozoans, dasycladacean green algae, trilobites, and ostracods). This suggests that the two intervals can be correlated, although a biostratigraphic analysis is recommended to confirm this.

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