Early Cambrian Tidal Sedimentary Environments, Western Victoria Island, Arctic Canada

Andrew Durbano[1], Brian R. Pratt[1], Thomas Hadlari[2], and Keith Dewing[2]

[1]Department of Geological Sciences, University of Saskatchewan, Saskatoon, SK, Canada
2Geological Survey of Canada, Calgary, AB, Canada

Abstract

The currently unnamed early Cambrian (Series 2, Stage 4) sandstone unit of western Victoria Island offers a chance to explore the nature of the Cambrian transgression in Arctic Laurentia, of which little is currently known. Early Paleozoic rocks are widely distributed on Victoria Island but have only been mapped at a regional scale. A detailed study of the sedimentology of the unnamed sandstone unit (informally referred to as the siliciclastic unit) exposed around the head of Minto Inlet records deposition in a shallow-marine embayment on a passive margin.

Four facies associations are recognized: (1) outer embayment sand dune complex characterized by laterally continuous, tabular cross-bedded, medium- to coarse-grained sandstone; (2) inner embayment sand flat dominantly consisting of fine- to medium-grained bioturbated sandstone and fine- to medium-grained sandstone interbedded with laminated mudstone; (3) semi-restricted inner embayment sand flat characterized by laterally continuous, medium-grained oolitic ironstone and fine- to medium-grained bioturbated sandstone; and (4) offshore muddy shelf dominantly consisting of laminated mudstone with discontinuous seams of medium- to coarse sand. Bioturbation in the form of a typical early Cambrian suite of shallow-subtidal ichnofossils predominated in the two inner embayment settings, representing a low-diversity *Cruziana* ichnofacies. Oolitic ironstone horizons in the semi-restricted setting mark periods of low sedimentation rates when iron became concentrated and calcite was the primary cementing agent. Dunes are, for the most part, non-bioturbated or contain just few individual burrows belonging to *Skolithos*, representing the *Skolithos* ichnofacies. The mostly tabular, sheet-like geometry of the sandstones is attributed to sediment deposition under essentially uniform current speeds at consistent water depth conditions in a low-gradient setting. Paleocurrent measurements and thickness variation suggest that deposition was affected by undulating topography on the Proterozoic basement, as well as by syndepositional faulting in some areas. The embayment opened to the northwest where sandbars developed offshore; stratigraphic thinning towards both the south and northeast indicates the direction of the paleoshoreline. The Mount Clark Formation of the northern interior plains, Northwest Territories is correlative with the siliciclastic unit based on similarity of lithology (cross-bedded and bioturbated sandstones) and similar olenelloid trilobites. Documenting the unnamed sandstone helps write a missing chapter in the Cambrian stratigraphy of the Canadian Arctic Islands.