Morphology and sedimentology of raised-beach sequences as a proxy indicator of past sea-ice intensity, Canadian Arctic Archipelago

DOMINIQUE ST. HILAIRE[1], TREVOR BELL[1], AND DONALD L. FORBES[2]
1. Department of Geography, Memorial University of Newfoundland, St. John's, NL, A1B 3X9 Canada ¶ 2. Geological Survey of Canada, Natural Resources Canada, Bedford Institute of Oceanography, 1 Challenger Drive (PO Box 1006), Dartmouth, NS, B2Y 4A2 Canada

Growing concern about the state of Arctic sea-ice has been highlighted in the recently published ACIA report (2005). The alarming trends of decreasing sea-ice extent and thickness in the Arctic Ocean stress the need for comprehensive studies of past sea-ice variability. The primary goal of this study is to investigate whether raised beach sequences, preserved on the emergent coastline of the central Canadian Arctic, contain a proxy record of past sea-ice intensity. The research approach is to compare variations in beach morphology and sedimentology with a proxy record of sea ice intensity derived from driftwood and whalebone occurrences on emerged beaches. It is hypothesized that periods of reduced sea ice intensity and increased open water would expose shorelines to higher and more prolonged wave energy, leading to better developed beach berms. More specifically then, the study will: a) document variability in beach morphology and sedimentology as a function of age and b) assess the extent to which variations in

Atlantic Geology, 2008, Volume 44, Number 1

wave energy between the periods of more or less open water have a recognizable expression in the preserved beaches.

Three study sites on Lowther Island, Nunavut, were selected based on a combination of the following characteristics: (1) a well-constrained postglacial emergence history, which allows beach age to be derived from beach elevation; (2) a coastal system that is relatively simple in terms of sediment supply, configuration, and energy regime; (3) coincidence with ongoing modern beach monitoring by the Geological Survey of Canada; and (4) representation of modern sea ice intensity regimes. Methodology includes: remote sensing using airphotos and high-resolution satellite imagery; ground surveys using RTK GPS to map modern and relict beaches; analysis of sediments on beach ridges of varying age; and GIS.

Lowther Island has experienced isostatic uplift for more than 9000 yr (9 ka) leading to the development of extensive raised-beach sequences. Preliminary results from three study sites on Lowther Island suggest a regional pattern in raised-beach morphology. Series of massive and well-developed single-crested beaches are intercalated with numerous and closely spaced beaches of smaller amplitude and often multi-crested. Well-developed beaches are located between 0 and 2, 5 and 7, and 9 and 11 metres of elevation. These elevations correspond to the modern period, 1.25 to 1.75 ka BP and 2.25 to 2.5 ka BP, respectively. These ages do not necessarily correspond to periods of light sea-ice as interpreted from the distribution of driftwood and whalebone.