

Examples of abrupt environmental change – ancient and modern – from a 2000 km transect across the Canadian Arctic Archipelago

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Four decades of fieldwork on the former Laurentide and Innuitian ice sheets in the Canadian Arctic Archipelago (CAA) have clarified their extent, chronology, and dynamics. The Laurentide and Innuitian ice sheets either approached or exceeded their all-time maximum during MIS 2, advancing seaward onto the polar continental shelf – possibly nourished by a split jet stream and buttressed by landfast sea ice. Ongoing seafloor mapping will clarify the offshore extent and chronology of these margins. New perspectives include: (1) the rapid and late MIS 2 buildup of both the northwest Laurentide and Innuitian ice sheets; (2) their primary ice divides and ice streams that delivered deep-draft icebergs that scoured the Arctic Ocean seafloor; (3) the role of former Antarctic-scale ice shelves during both the buildup and catastrophic breakup of land-based ice, notably in the western Arctic; (4) the chronology of deglaciation that includes an early phase of regional retreat closely aligned with MWP-1A followed by; (5) a Younger Dryas stabilization and readvance in the western CAA that serves as an analogue for potentially catastrophic, modern ice sheet collapse. A pan-archipelago sea level record spanning deglaciation to modern (>2000 ^{14}C dates) clearly delineates zones of modern emergence and submergence that complement the ice sheet history. Numerous examples of abrupt environmental change characterize Arctic Canada but perhaps the most overlooked is the ongoing demise of the Ellesmere Island Ice Shelf, the oldest sea ice in the Northern Hemisphere. Once used as a sledging platform by late 19th century explorers - when it covered 10 000 km² - it is now reduced to a few precarious fragments. Arctic environmental change now envelopes the full spectrum of the cryosphere (including glaciers, sea ice and permafrost) through to its ecology and human habitation. Perspectives based on long-term records of environmental variability are vital because they place modern change and their underlying processes in a meaningful context that should inform public policy (IPCC 2014).