

Regeneration of Little Ice Age bryophytes emerging from a polar glacier with implications of totipotency in extreme environments

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Across the Canadian Arctic Archipelago, widespread ice retreat during the 20th century has sharply accelerated since 2004. In Sverdrup Pass, central Ellesmere Island, rapid glacier retreat is exposing intact plant communities whose radiocarbon dates demonstrate entombment during the Little Ice Age (1550–1850 AD). The exhumed bryophyte assemblages have exceptional structural integrity (i.e., setae, stem structures, leaf hair points) and have remarkable species richness (60 of 144 extant taxa in Sverdrup Pass). Although the populations are often discolored (blackened), some have developed green stem apices or lateral branches suggesting *in vivo* regrowth. To test their biological viability, Little Ice Age populations emerging from the ice margin were collected for *in vitro* growth experiments. Our results include a unique successful regeneration of subglacial bryophytes following 400 y of ice entombment. This finding demonstrates the totipotent capacity of bryophytes, the ability of a cell to dedifferentiate into a meristematic state (analogous to stem cells) and develop a new plant. In polar ecosystems, regrowth of bryophyte tissue buried by ice for 400 y significantly expands our understanding of their role in recolonization of polar landscapes (past or present). Regeneration of subglacial bryophytes broadens the concept of Ice Age refugia, traditionally confined to survival of land plants to sites above and beyond glacier margins. Our results emphasize the unrecognized resilience of bryophytes, which are commonly overlooked *vis-a-vis* their contribution to the establishment, colonization, and maintenance of polar terrestrial ecosystems.