

The last glacial-interglacial cycle, western Spitsbergen, Svalbard archipelago

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Despite an interest in the Quaternary history of the Svalbard archipelago that has spanned most of this century, the timing and extent of glacial activity across the archipelago remains controversial for the Weichselian prior to c. 13 ka B.P.; our knowledge of environmental change over the last 150 ka throughout the Arctic is fragmentary and equivocal. Lacking an independent geochronology, even deposits of the last inter-

glacial are rarely identifiable, and the number, duration and timing of glacial advances within the Weichselian are debated.

We have studied a remarkably well exposed series of superimposed glacial and marine sediment found in coastal cliffs at Brøggerhalvøya, west Spitsbergen, that contains what we believe to be the most complete record of environmental change for the last glacial/interglacial cycle yet reported from the Sval-

SITE 15: COMPOSITE STRATIGRAPHY

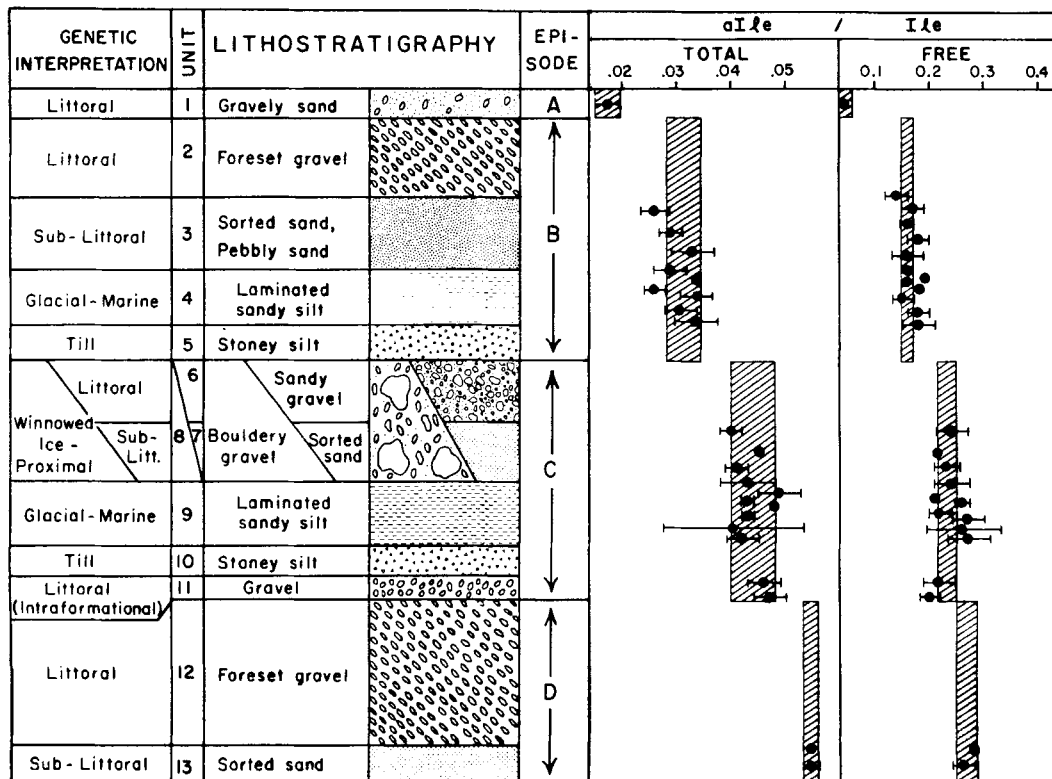


Fig. 1. Schematic outline of composite stratigraphy of Site 15.

bard archipelago. The sections contain a sequence of four emergence cycles (episodes D, C, B and A) related to glacial-isostatic depression and subsequent recovery of the crust; tills are found in episodes C and B. The lithostratigraphy, biostratigraphy and geochronology and the paleoenvironmental interpretations are presented by Miller et al. (unpublished).

The oldest sediments are sparse sublittoral sands and a thick sequence of overlying foreset-bedded littoral sediments of episode D. They are mostly non-fossiliferous, and are interpreted to represent emergence following a pre-Weichselian deglaciation.

Glacial-marine and sublittoral sands that overlie a thin till unit within episode C contain a diverse and abundant fauna that require marine conditions more favourable than during the Holocene. We define this interval as the Kjærsvika Interglacial. Based on foraminiferal assemblages, sedimentology and geochronology (radiocarbon, amino acids and uranium-series disequilibrium) we conclude that the Kjærsvika Interglacial occurred during isotope substage 5e. During the marine transgression following episode C deglaciation, relative sea level reached 70 to 80 m a.s.l.

Episode B deglaciation occurred late in isotope stage 5 (c. 80 ± 10 ka ago), and was followed by a marine transgression to about 50 m a.s.l. The associated foraminifera, mollusca and vertebrate fauna require seasonally ice-free conditions similar to those of the Holocene, but less ameliorated than the Kjærsvika Interglacial. These data, coupled with surface water conditions

in the adjacent Fram Strait (Lehman & Gard unpublished), require a significant influx of Atlantic water into the northern Norwegian/Greenland Sea late in isotope stage 5. This flux of Atlantic water, augmented by a local summer insolation maximum (Berger 1978), resulted in shallow marine conditions similar to those of the Holocene.

During episodes B and C glacial activity began with a local advance, followed by an extensive regional advance, the latter probably less extensive than the former.

There is no evidence for major glacial activity during the Middle Weichselian (isotope stages 4 and 3), and we conclude that ice margins were not significantly different from those of the Late Weichselian, although the depositional record of this interval is scant. The extent of ice at the Late Weichselian maximum was less extensive than either of the two preceding advances. The last deglaciation (episode A) began prior to 13 ka B.P. Oceanic/atmospheric circulation patterns conducive to large scale glaciation of western Spitsbergen remain obscure, but the patterns dominating during isotope stages 4, 3, 2 and 1 did not produce a major glacial advance along this coast.

References

- Berger, A. L. 1978: Long term variations of caloric insolation resulting from the Earth's orbital elements. *Quaternary Research* 9, 139–167.