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Stratigraphy and palaeoclimate of Spitsbergen, Svalbard, during the Early Cretaceous

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During the Early Cretaceous, Spitsbergen was located at a palaeolatitude of ∼60°N. Abundant fossil wood derived from conifer forests, dinosaur trackways, enigmatic deposits such as glendonites, and stable isotope data from the Early Cretaceous formations of Spitsbergen suggest that the climate at that time was much more dynamic than the traditional view of "invariant greenhouse" conditions on Earth.

The Early Cretaceous succession in central Spitsbergen comprises a regressive-transgressive mega-cycle. This is made up of the deep water to wave-dominated, Berriasian-Hauterivian Rurikfjellet Formation; the deltaic, Barremian Helvetiafjellet Formation; and the coastal to deep water, Aptian-Albian Carolinefjellet Formation. An erosion surface marks the base of the Helvetiafjellet Formation. Two regions with excellently exposed Early Cretaceous strata were chosen for study in this project: the Festningen section, on the north-western side of Isfjorden; and outcrops found along Adventdalen, near Longyearbyen, ∼40km northeast of Festningen.
We present the data collected in July 2015 from the Adventdalen area, and compare and correlate it with sedimentological and geochemical data collected from the Festningen succession in 2014. The Festningen section records a full sequence from the Berriasian to the Aptian, whereas the Longyearbyen sections record Aptian-Albian deposition.

We use carbon isotope stratigraphy to constrain the Barremian-Aptian boundary in the previously only indirectly-dated Helvetiafjellet Formation, and to identify other major global climatic and carbon cycle perturbations in the Early Cretaceous. We are thus able to correlate this succession with other successions globally. We combine this δ13C(terrestrial) data with sedimentological and petrological data to elucidate the origins of enigmatic glendonites found in both regions. Glendonites are thought to be associated with cold-water (and therefore also cold-climate) conditions, although their mode of origin is poorly understood. Through detailed petrological and geochemical study, and by contextualising the glendonites sedimentologically, we consider their origins and diagenetic history, and evaluate their usefulness as cold-climate indicators (e.g. after Kemper, 1987).