



Early Cretaceous vegetation and climate change at high latitude: palynological evidence from Isachsen Formation, Arctic Canada

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Understanding the behaviour of global climate during relatively warm periods in Earth's history, such as the Cretaceous Period, advances our overall understanding of the climate system and provides insight on drivers of climate change over geologic time. While it has been suggested that the Valanginian Age represents the first episode of Cretaceous greenhouse climate conditions with relatively equable warm temperatures, mounting evidence suggests that this time was relatively cool. A paucity of paleoclimate data currently exists for polar regions compared to mid- and low-latitudes and this is particularly true for the Canadian Arctic. There is also a lack of information about the terrestrial realm as most paleoclimate studies have been based on marine material. Here we present quantitative pollen and spore data obtained from the marginal marine and deltaic-fluvial Isachsen Formation of the Sverdrup Basin, Canadian Arctic, to better understand the long-term vegetation and climate history of polar regions during the warm but variable Early Cretaceous (Valanginian to Early Aptian). Detrended correspondence analysis of main pollen and spore taxa is used to derive three ecological groupings influenced by moisture and disturbance based on the botanical affinities of palynomorphs: 1) a mixed coniferous assemblage containing both lowland and upland components; 2) a conifer-filicopsid community that likely grew in dynamic lowland habitats; and, 3) a mature dry lowland community composed of Cheirolepidaceans. Stratigraphic changes in the relative abundance of pollen and spore taxa reflect climate variability in this polar region during the ~20 Mya history of the Isachsen Formation. The late Valanginian was relatively cool and moist and promoted lowland conifer-filicopsid communities. Warming in the Hauterivian resulted in the expansion coniferous communities in well-drained or arid hinterlands. A return to relatively cool and moist conditions in the Barremian resulted in the expansion of mixed lowland communities. Our paleoclimate inferences for this Canadian high latitude region are consistent with reconstructions from lower latitudes, suggesting at least hemispherical expression of Valanginian cooling and a subsequent warming event in the Hauterivian that influenced polar vegetation. This work demonstrates the utility of a multivariate statistical approach to palynology to provide insight into the composition and dynamics of ecosystems and climate of high latitude regions during the Early Cretaceous.