Cretaceous polar forests: fossil data versus computer model predictions

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Climate models used to simulate past climates have commonly generated ice-covered polar regions. However, abundant fossil wood indicates that during the Cretaceous the polar regions were covered with dark dense forests. These forests would have significantly modified the climate on both regional and global scales due to their low albedo and their effect on the land-surface heat budget, the hydrological and carbon cycles. The deciduous or evergreen habit of the conifers and the length of time they held their leaves would have played an important part in this feedback.

A new method has been developed to determine the evergreen or deciduous habit of fossil polar conifers by quantitatively characterising the cell patterns within growth rings in fossil wood to determine how long the trees kept their leaves. Analysis of Cretaceous fossil wood from the Arctic (Canadian Arctic Archipelago and Svalbard) and the southern polar regions (Antarctica and Australia) indicates that the forests were composed of a mixture of both deciduous and evergreen conifers. These results have been compared to outputs of the Sheffield University Conifer Model, which models the growth of forests at high latitudes. The model predicts evergreen and deciduousness values similar to those seen within the fossil record. The Conifer Model will be coupled with regional and global climate models to examine the effect of forest vegetation in the polar regions during past greenhouse climates.