700

DECIPHERING THE EVERGREEN OR DECIDUOUS HABIT OF CRETACEOUS POLAR CONIFERS AND THEIR IMPACT ON GLOBAL CLIMATE

J. E. Francis[1], B. M. Harland[1], D. J. Beerling[2], S. J Brentnall[2], C. P. Osborne[2], P. J. Valdes[3]

[1]University of Leeds, Leeds, United Kingdom, [2]University of Sheffield, Sheffield, United Kingdom, [3]University of Bristol, Bristol, United Kingdom

For most of the geological past high latitude regions, including Antarctica, were covered with dark green forests. These forests would have significantly modified both polar and global climates due to their low albedo and their effect on the land-surface heat budget and hydrological cycle. 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, but this has previously been difficult to determine from fossil material. A new technique has been developed to determine the length of time that conifers retained their leaves, based on analysis of cell dimensions and tree ring characteristics in fossil wood. The technique, called the ring markedness index, has been developed using living conifers and then applied to fossil conifers of mid-Cretaceous age from the polar regions. Analysis of fossil woods from the Arctic and Antarctica indicates that polar forests were composed of a mix of evergreen and deciduous trees, although Antarctic forests were predominantly evergreen. This conflicts with the long-held view that polar conifers would have been deciduous in order to survive the long dark days of winter. The fossil analyses validate outputs from the Sheffield University Conifer Model, a vegetation model developed to provide a more accurate representation of past polar vegetation. With the inclusion of polar vegetation, global climate models more realistically simulate past greenhouse worlds with warm climates in Antarctica.