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Temperate rainforests near the South Pole during peak Cretaceous warmth

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The mid-Cretaceous was one of the warmest intervals of the past 140 million years (Myr) driven by atmospheric CO₂ levels around 1000 ppmv. In the near absence of proximal geological records from south of the Antarctic Circle, it remains disputed whether polar ice could exist under such environmental conditions. Here we present results from a unique sedimentary sequence recovered from the West Antarctic shelf. This by far southernmost Cretaceous record contains an intact ~3 m-long network of *in-situ* fossil roots. The roots are embedded in a mudstone matrix bearing diverse pollen and spores, indicative of a temperate lowland rainforest environment at a palaeolatitude of ~82°S during the Turonian–Santonian (93–83 Myr). A climate model simulation shows that the reconstructed temperate climate at this high latitude requires a combination of both atmospheric CO₂ contents of 1120–1680 ppmv and a vegetated land surface without major Antarctic glaciation, highlighting the important cooling effect exerted by ice albedo in high-CO₂ climate worlds.

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