Spore malformation, a terrestrial mass extinction and the definition of the Devonian-Carboniferous boundary

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Abstract

Malformed land plant spores are abundant at the terrestrial Devonian-Carboniferous boundary in East Greenland. These are exactly coincident with spore extinctions with the lost of major clades that had dominated Mid and Late Devonian spore floras. These extinctions occur within the deepest, largest and most stable stratified lake within the East Greenland Devonian and Carboniferous succession. It is evident that this malformation results from the maturing spores being damaged by UV-B radiation whilst in the sporangium but before the protective spore wall was deposited. Alternative hypotheses of UV-B damage or poisoning during major eruptions is precluded by the absence of an Hg anomaly.
Now that we understand why the plants became extinct we can use this as a significant marker to define the Devonian-Carboniferous boundary in terrestrial and marginal marine sediments. This extinction can be identified worldwide including at high palaeolatitude in Gondwana.
In 2022 there was the rare opportunity to return to East Greenland and the Devonian-Carboniferous boundary on Celsius Bjerg during an expedition to collect latest Devonian tetrapods. The D-C boundary lake was cored using a backpack drill to acquire a complete record through the extinction event. This material is now being analysed for palynology, δ13C, TOC and carbonate % together with SEM backscatter imagery of fabrics. This provides a much better understanding of the relationship between the extinctions and development of the lake during the intense monsoon climate that accompanied the collapse of the terminal Devonian glaciation.

Keywords: Devonian, Carboniferous boundary, spores, malformation, UV, B, Greenland

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