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Evidence for global climatic change in the wake of the end-Permian biotic crisis: The Olenekian – Smithian/ Spathian boundary - event

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Palynological data, global ammonoid distribution patterns and carbon isotopes show a major turnover in the marine and terrestrial ecosystems during the Early Triassic (Galfetti et al., in press). This change occurring at the Smithian/Spathian boundary (SSB) had major consequences for the delayed recovery of the marine, and to a minor degree, of the terrestrial ecosystems in the wake of the end-Permian biotic crisis. Boreal areas, with continuous and rapid sedimentation in marine environments, yield the best preserved and best dated archives documenting the recovery of terrestrial floras during the Early Triassic. Here we assess from a paleoecological point of view the palynological record of the Early Triassic ammonoid dated sections from shallow cores of the Barents Sea (Vigran et al. 1998). Grouped into 10 ecologically relevant categories we document a distinct turnover at the SSB from hygrophyte-dominated to xerophyte-dominated assemblages. The reestablishment of highly diverse plant ecosystems from the early Spathian onward, including the rise of woody gymnosperms and decline of the formerly dominating lycopods, is interpreted as an effect of a major climate change. Around the SSB global distribution patterns of ammonoid faunas show a major turnover associated with a severe extinction phase at the end–Smithian, followed by an extreme radiation from the early Spathian onward. Modeling of ammonoid paleobiogeographic distribution suggests that the resulting pattern can be used as a proxy for sea surface temperatures (SST). Thus, the end-Smithian appears as a time of a warm and equable climate as expressed by an al-

most flat pole-to-equator SST gradient. In contrast, the steep Spathian SST gradient suggests latitudinally differentiated climatic conditions. The concurrent turnovers in palynological assemblages and ammonoid distribution patterns and diversity coincide with one of the most important carbon cycle perturbation following the end-Permian mass extinction. This anomaly is characterized by a prominent positive carbon isotope excursion ($\delta^{13}C_{carb}$) known from Tethyan marine rocks. A new high paleolatitude record (Spitsbergen) measured from bulk organic matter ($\delta^{13}C_{org}$) shows the global significance of this shift and is compatible with the major climatic change, as inferred from the mentioned biotic events. Causes for this drastic climate change and the global carbon cycle perturbation are still cryptical. However, we propose that they were triggered by a massive end-Smithian CO_2 injection, most likely originating from the Siberian igneous province.

References

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Galfetti et al. (in press) The Smithian/Spathian boundary event: Evidence for global climatic change in the wake of the end-Permian biotic crisis. Geology