

Massive soil erosion and the Late Devonian mass extinction

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The Late Devonian mass extinction was characterized by stepwise extinctions of marine organisms during the spread of vascular land plants. Algeo and co-authors hypothesized that the spread of vascular land plants resulted in increased pedogenic weathering rates and the flux of soil-derived nutrients to marine ecosystems leading to the mass extinction. However, since presentation of that hypothesis in 1995, no evidence of massive soil erosion has been reported. Here we show that massive soil erosion occurred rapidly in the latest Frasnian, which marks the culmination of the stepwise Late Devonian mass extinction and sea level rise. The evidence includes maxima in organic geochemical indicators of soil erosion and vascular land plants in the top of the Frasnian composed of mudstone in a shallow marine sequence from Belgium. The Late Devonian is a unique period marked by massive soil production in flood plains by vascular land plants and massive sediment yield in uninhabited hinterland by rapid physical weathering before development of seeds in the Famennian, resulting in the massive accumulation of soil and sediments on plains. Therefore, similar events have not occurred after the Devonian. We hypothesize that flooding due to global sea-level rise eroded the massive soil and sediments, providing abundant nutrients and a massive mud supply to marine ecosystems, which resulted in highly selective decimation of shallow-water sedentary organisms.

Keywords: Devonian, mass extinction, soil, sea level, vascular land plants