



## **Timing and pacing of the Late Devonian mass extinction event regulated by eccentricity and obliquity**

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The Late Devonian envelops one of Earth's big five mass extinction events at the Frasnian–Famennian boundary (374 Ma). Environmental change across the extinction affected Devonian reef-builders, besides many other forms of marine life. Yet, it remains unclear which cause-and-effect chains led to the extinction, mainly because Devonian stratigraphy is poorly resolved. During this talk, I will present a global orbitally-calibrated chronology across this momentous interval, integrating cyclostratigraphy and high-precision radio-isotopic dates.

Our timescale stipulates that 600 kyr separate the lower and upper Kellwasser positive  $\delta^{13}\text{C}$  excursions. In the Steinbruch Schmidt section (Germany), the black argillaceous interval of the Lower and Upper Kellwasser last respectively 80 and 110 kyr, but the  $\delta^{13}\text{C}$  excursions are more extended in space and time. The UKE carbon isotope excursion is paced by obliquity and is therein similar to Mesozoic intervals of environmental upheaval, like the Cretaceous Ocean-Anoxic-Event-2 (OAE-2). This obliquity signature implies coincidence with a minimum of the 2.4-Myr eccentricity cycle and highlights the decisive role of astronomically-forced “Milankovitch” climate change in timing and pacing the Late Devonian mass extinction. To conclude, I will comment on the new set of questions that can be assessed thanks to this high-resolution timescale. One can, for example, identify time-lags between different proxies and therewith differentiate between the responses to astronomical forcing of different components of the Earth's system. Indeed, we report a delay of about 100 kyr between the  $\delta^{13}\text{C}$  and the Ti/Al ratios, reflecting the slow response of carbon reservoirs to astronomical forcing.