ASTRONOMICAL CALIBRATION OF THE FAMENNIAN (UPPER DEVONIAN) TIME SCALE

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The Late Devonian was affected by major, irreversible changes including two of the most severe biodiversity crises in Earth's history, the so-called Kellwasser and Hangenberg Events (respectively near the Frasnian – Famennian (F-F) and the Devonian – Carboniferous (D-C) boundaries). Currently, hypotheses for the Late Devonian extinctions include sea-level fluctuations and regression, climate cooling, ocean anoxia, massive volcanism and/or bolide impact. Unfortunately, testing these hypotheses is impaired by a lack of sufficient temporal resolution in paleobiological, tectonic and proxy climate records. Recent advances in astronomical calibration have improved the accuracy of the Frasnian time scale and part of the Famennian. However, the time duration of the Famennian Stage remains poorly constrained. During the Late Devonian, an epieric sea in North-America mid-continent occupied the Illinois Basin where a complete Late Frasnian – Early Carboniferous succession of deep-shelf deposits was archived. A record of this sequence is captured in three overlapping cores (H-30, Sullivan Slough and H-32). The H-30 core section spans the F-F boundary; the Sullivan Slough section spans almost all of the Famennian and the H-32 section sampled spans the D-C boundary. To have the best chance of capturing Milankovitch cycles, 2200 rock samples were collected at minimum 5-cm-interval across the entire sequence. Magnetic susceptibility (*MS*) was measured on each sample and the preservation of climatic information into the signal was verified through geochemical analyses. To estimate the duration of the Famennian stage, we applied multiple spectral techniques and tuned the *MS* signal using the highly stable 405 k.y. cycle for Sullivan Slough and the obliquity cycle (34.4 k.y.; Waltham, 2015) for the H-30 and H-32 cores. Based on the correlation between the cores and the tuning, we constructed a Famennian astronomical time scale, which indicates a duration of 13.3 m.y. An uncertainty of ± 0.5 m.y. was calculated to assess the errors raising from the stratigraphic position of the F-F and D-C boundaries, and the 405 k.y. cycle counting error. Our estimate duration is very close to the GTS-2012 duration (Becker, 2012) interpolated from the high-resolution (U/Pb) radiometric ages available for the uppermost Devonian.

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