Precessional and half-precessional climate forcing of Mid-Devonian monsoon-like dynamics

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A Devonian magnetic susceptibility (MS) record obtained on limestones ranging from the Uppermost-Eifelian to the Lower-Givetian and located on the southern border of the Dinant Synclinorium in Belgium, was selected for time-series analysis. In these carbonate ramp and platform deposits, spectral analyses highlight persistent high-frequency cycles in both, the MS-signal and the microfacies curve, reflecting environmental and climate changes. These meter-scale variations in the MS-signal are interpreted as changes in the flux of magnetic minerals towards the marine system, most likely controlled by monsoon rainfall-intensity. By combining chrono- and biostratigraphic information with theoretical knowledge of sedimentation rates in different depositional environments, these cycles are interpreted as astronomically driven (precession-dominated). It is hypothesized that during precession maxima the trans-equatorial pressure gradient reaches a maximum and intensifies monsoonal circulation. The consequent increased moisture transport towards the continent leads to enhanced precipitation and runoff, which in turn leads to an increased flux of detrital material (including magnetic minerals responsible for the MS-signal) towards the marine system. Moreover, this unique high-resolution climate signal reveals half-precessional cycles. These cycles suggest the important response of intense monsoonal systems to periodic changes in the strength of low-latitude (equatorial) insolation.