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Millennial scale climate variability during Devonian greenhouse times

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Sub-Milankovitch cycles (also called millennial cycles) are pervasive through geological time, but their origin, mostly during Greenhouse period remains strongly discussed. To better understand these cycles during a Greenhouse climatic system, two intervals of hemipelagic carbonate from the Devonian section of Pod Barrandovem in Czech Republic were sampled at high resolution (every cm). Variations in Ti content (X-Ray Fluorescence) are interpreted as climate-controlled changes in detrital input and this allows to get insight into the mechanism leading to the occurrence of these Millennial scale cycles. This section has been the focus of a cyclostratigraphic study, permitting to transform our two high resolution records from the distance domain into the time domain. From this time-calibrated Ti signal, spectral analysis reveals clear obliquity and precession cycles, confirming the established astrochronology. Besides obliquity and precession, clear spectral peaks also occur in the high-frequency part of the power spectrum, i.e. millennial-scale cycles, at 2-3, 6-8 and 10-12 kyr periods. The 6-8 and 10-12 kyr cycles are further studied through bi-coherence spectra and they seem to be related to a combination of tones Milankovitch cycles. The shortest cycles (2-3 kyr cycles) seems to be a common and stable feature during geological history in very different settings classically explained through solar forcing.