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Astronomical modulation of oxygenation conditions during the Telychian (Silurian) recorded in the Sommerodde-1 core from Bornholm Denmark.

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The Silurian (443.8-419.2 million years ago) is a period of important biodiversity changes, dynamic climate change, including strong sea level fluctuations and the development of low-oxygen conditions in the ocean[1-2-3]. To date the Silurian lacks in (cyclostratigraphic) age constraints and in understanding in the way astronomical cycles modulate the Silurian climate, which hinders our understanding of Silurian climate dynamics. To assess the role of astronomical cycles in the pacing of the Silurian climate, we study the imprint of astronomical cycles on the record of the Sommerode-1 core from Bornholm, Denmark (53.65-118.66m).The core contains a near continuous Telychian record including the SOCIE and Valgu carbon isotope excursions/events[4-5-6]. The core was scanned at University of Bremen/ MARUM (November 2021) using the Bruker M4 Tornado µXRF scanner, enabling for a high-resolution cyclostratigraphic and chemostratigraphic study of the Telychian.

XRF core measurements provided semi-quantitative element data, spaced at 0.5 mm, were converted into element concentrations (ppm) using a set of reference standards. A Principal Component Analysis simplified the variability in our dataset into 3 components. PC1 has high loadings for Al, Si, K, Ti, Fe and Co, and is interpreted as a detrital component. PC2 has high loadings for Ca and Mn, and is interpreted as an indicator of oxygenation conditions. PC3 has high loadings for S, indicative for the sulphides/dysoxic/anoxic conditions[-8-9].

Peaks for Mn at 69-85m and S at 85-104m, indicate that part of the core (69-85 m) was deposited under oxic conditions while another part of the core (85-104 m) was deposited under anoxic/dysoxic conditions. We note that the transition to oxic conditions at 90 m coincides with the Valgu isotopic event[4] while the SOCIE[4] (80-70 m) event occurs during oxic conditions. Spectral analysis (wavelet, MTM and Evolutive Harmonic Analysis (EHA)) on the 3 components reveals the imprints of long and short eccentricity, obliquity and precession. An EHA spectra of the detrital component was used to trace the long eccentricity in the depth domain which was used to infer

changes in sedimentation rates. The sedimentation rates are used to convert the record from the depth to time domain. Astronomical cycles filtered from the record in the time domain show that astronomical cycles exert a great control on the depositional record. Indicating the astronomical cycles modulated the Telychian climate which in term paced oxygenation conditions at the sea-floor.

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