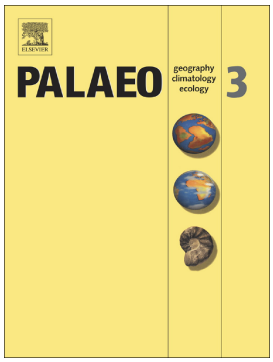

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Orbital control on cyclical primary productivity and benthic anoxia: astronomical tuning of the Telychian Stage (Early Silurian)

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Abstract

The identification of Milankovitch cycles and the establishment of a high-resolution astronomical time scale for the Palaeozoic represent a research frontier in cyclostratigraphy and astrochronology. A continuous core drilled through the Telychian Stage (Llandovery, Silurian) of the Pasłek Formation in the Baltic Basin (Poland) is characterized by repetitive centimetre-scale alternations of homogeneous greenish-grey mudstones and faintly laminated dark-grey-to-black mudstones. Such lithological rhythmicity reflects a cyclical variation in redox conditions at the sediment-water interface, and therefore was used to construct a floating astronomical time scale (ATS) for the Telychian Stage. The cyclostratigraphic analysis was performed on a 5 mm resolution greyscale scan based upon photographs of the slabbed core, with lower values associated with greenish-grey mudstones and higher values related to dark-grey-to-black mudstone facies. Spectral density estimation by means of the multitaper method (MTM) reveals significant peaks rising above the 95% red noise confidence level that we interpret as the 405-kyr long-eccentricity, short-eccentricity, obliquity and precession components. The MTM evolutive power spectral analysis (EPSA) shows a gradual increase in the velocity of sedimentation from 5.03 m/Myr in the lowermost interval to 5.48 m/Myr towards the uppermost part of the studied sequence. We postulate that the observed cycles reflect orbitally-driven climatic variations from stable wet conditions to monsoon-like high seasonal contrasts that affected weathering intensity,