

Article

Milankovitch Cyclicity In Late Triassic Continental Sediments From The Newark Basin From Singular Spectrum Analysis Of Natural Gamma Ray Logs

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ABSTRACT Milankovitch climate cyclicity based on sediment facies analysis (Olsen & Kent, 1996: *Paleogeogr., Paleoclimat., Paleoecol.*) of the 915 m-long Titusville core drilled in the Jurassic/Triassic Newark basin was quantitatively evaluated using standard downhole logs such as natural gamma-ray (NGR). The source of the NGR was analyzed with discrete gamma-ray spectral analysis on the core, which showed that the natural radioactivity was mainly due to potassium except for the peaks near carbonaceous shales which reflect uranium concentrations due to diagenesis. The uranium peaks were removed and the data processed using the singular spectrum analysis (SSA) technique to filter noise. The significance of the results were tested against an auto regressive (AR1) "red" noise spectrum. The filtered signal shows a beautifully modulated waveform. After scaling the depth record to time based on a simple linear interpolation to the prominent 404 ky eccentricity cycle, as was done by Olsen and Kent (1996) and Kent and Olsen (1999: *J. Geophys. Res.*), the only statistically significant frequencies have periods of approx. 20 ky and the signal has a strong modulation with periodicities of around 100 and, of course, the tuning target of 404ky. This is in accordance with astronomical theory and confirms previous results based on the sedimentological analysis, adding more detail especially in those intervals where the lithological variation is very subtle. However, the average periodicity of the precessional cycle is found to be approx. 23 ky, which is longer than expected and in apparent disagreement with the predictions of the astronomical theory. The same result was obtained with Fourier analysis of the sediment facies data by Olsen and Kent (1996). This discrepancy requires further analysis but might be due to systematic blurring of the sedimentary response to weak precession cyclicity during eccentricity minima. Nevertheless, it is clear that the continuous downhole logs provide a source of information complementary to sediment facies analysis for astronomical calibration of the geomagnetic polarity record in the Newark basin cores (Kent & Olsen, 1999).



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