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Power spectra analysis proves the presence of Milankovitch periodicity in the Miocene depositional systems of the Vienna Basin

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Due to extensive hydrocarbon exploration, thousands of wells penetrated Middle and Upper Miocene sediments in the Vienna Basin. A quite characteristic succession of marls and sands was soon used as a marker-system for the correlation of wells. During the last years, these patterns, being most obvious in geophysical data-logs, have been discussed by Harzhauser & Piller (2004) and Harzhauser et al. (2004) to be triggered by astronomical forcing. Based on the approximate duration of the represented stages, a strong influence by the 100-kyr eccentricity band was proposed. These cycles are reflected by a succession of coarsening upward sequences with serrated funnel-bell-shaped curves. Major transgressions are reflected as shale line intervals of up to 40 m thickness. The interpretation of theses recurring patterns as expression of astronomical forcing was supported by the highly reminiscent patterns observed in well-logs of the Styrian Basin. This first approach, however, was simply based on the graphic interpretation of the logs.

To overcome this problem the OMV Exploration and Production GmbH provided a complete data-set of two representative wells. We tested our hypotheses now based on the geophysical raw-data of the 2200 m long sedimentary interval of the OMV-well Niedersulz 9 in the northern Vienna Basin. Analysis of long-term trends in the studied records and their visual inspection does not permit a reliable detection of the frequencies and phase relations between proxy records and astronomical forcing. In order to

verify it, Power Spectral analysis and Gaussian band-pass filtering methodologies are applied in the depth domain to the electric data of well Niedersulz 9.

The Blackman-Tukey (BT) method was applied using the AnalySeries program (Paillard et al., 1996). The BT method is based on the standard Fourier transform and requires evenly spaced time series. Therefore interpolation of unevenly spaced data sets is necessary before BT spectral analysis can be performed and hence this procedure may bias statistical results. In detail, spectral analysis were performed in the depth domain on the total electric record and on three discrete intervals, which were selected on the basis of visual inspection of their characteristic cycle patterns. These spectra (confidence interval $>$95%) revealed a prominent peak at 102 meters, which is in good confidence with the discussed 100-kyr cycles and a peak at about 500 meters (not clearly present in all spectra) corresponding to 400-kyr cycles.

Gaussian band-pass filtering procedures were applied to extract selected long and short-eccentricity frequency from the original signal which are successively compared with the same harmonic component recognized in the astronomical curve of Laskar et al. (2004).

Due to the lack of any independent dated biohorizons and/or magnetostratigraphic intervals recognized along the studied record, these correlations cannot be tuned within the wells. Unfortunately, no core-material is available for paleomagnetic-studies and, thus, an absolute age of the cycles cannot be applied. This dilemma shows the need for a new scientific drilling project in the Vienna Basin, which then might turn out as key-area for the timing of Paratethyan events.

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