# Sub-Milankovitch cycles in Paratethyan sediments

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Detecting Milankovitch cycles in sedimentary successions became state-of-the-art in geosciences. Most studies, however, neglect significant signals on a millennial to centennial scale. During the last years, several well-logs in the Vienna Basin and the North Alpine Foreland Basin have been analysed in terms of Milankovitch cycles. All studies reveal a distinct signal at the 100 ky eccentricity cycle. Marine deposits of the Paratethys are also prone to document the 40 ky obliquity signal which is much weaker in lacustrine deposits of Lake Pannon. The advantage of this method in the Paratethyan realm is to arrive at a best-fit age-model for the successions which usually lack any absolute datings.

Based on geophysical data and high-resolution analysis of palyno-assemblages and ostracod faunas, we present two examples of clear sub-Milankovitch cyclicity in marine and lacustrine deposits of the Central Paratethys area. As the first example deep water marls of the middle Burdigalian Hall Formation were studied, that formed in the North Alpine Foreland Basin. The second example is dealing with clay and silty deposits of the lacustrine Bzenec Formation, which formed in the Late Miocene Lake Pannon in the Vienna Basin. Both exhibit clearly Milankovitch cycles, which are used as reference systems. Whilst the marine marls are characterised by very distinct 10 ky cycles, the lake deposits exhibit a more complex array of cycles roughly corresponding to 250, 500, 625, and 2000 years. Interestingly, the lacustrine cycles are best reflected by magnetic susceptibility whereas the gamma-log does not reflect these small cycles. Moreover, the ostracod signal documents a cycle different from the geophysical one. This documents the importance of an integrated analysis combining biota and geophysics to detect the full range of cycles.

The successful examples are opposed by a 1.8 km long succession of late Burdigalian age in the Austrian Korneuburg Basin. In contrast to the Hall Fm and the Bzenec Fm, these deposits formed

in a rapidly subsiding estuary which was mainly influenced by eustatic sea-level changes reflected by a very distinct 21 ky signal. Despite comparable sedimentation rates, this record does not show any sub-Milankovitch signals. This may point to a limitation of the possibility to detect such cycles in coastal settings with rapid environmental shifts and heavy bioturbation. Although such limitations exist, we consider it promising to focus on high frequency rhythms in sedimentary successions. Even, if a the correlation with astronomical target curves remains speculative due to the lack of absolute datings, this method is an enormous leap in the calculation of sedimentation and subsidence rates.

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