GC2024-PERM015

A cyclostratigraphic study of the Katav Formation, (Upper Riphean, Southern Urals)

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Geochronological data are lacking for many Precambrian sedimentary sequences. In this case, cyclostratigraphy has proved invaluable in identifying periodicity in the stratigraphic record and therefore can constrain reversal frequency absent an absolute time scale. Cyclostratigraphy is based on the recognition of astronomically forced climatic changes in sedimentary strata. In paleomagnetism, the orbital cycles can be teased out of magnetic susceptibility (MS) variations in both terrestrial and marine sediments. Assuming that the magnetization of the limestones of the Katav Formation is synchronous with the time of its formation, an attempt was made to estimate the duration of accumulation of the studied strata. MS variations from an updated collection of samples in the upper part of the Yuryuzan section were used to detect orbital cyclicity. A cyclostratigraphic analysis was performed using Acycle software (https://github.com/mingsongli/acycle). The section was sampled for MS measurements in parallel with paleomagnetic sampling at 0.2 m intervals. This allowed us to identify only cycles that could presumably be interpreted as cycles of large and small eccentricities. For a more reliable interpretation in order to reveal the influence of cycles of small eccentricity, nutation, and precession, we additionally sampled a 14.25 m thick section in the upper part of the section every 0.05 m. Our combined approach to section sampling allowed us to identify the expected influence of all four Milankovitch cycles commonly used in interpretation. Spectral analysis of the MS series of the upper part (69.8 m) of the Yuryuzan section allowed us to identify the expected Milankovitch cycles and estimate the duration of sedimentation within the studied part of the section. According to our estimates, 69.8 m of the section accumulated over ~3.4 Ma, which gives an average sedimentation rate of ~20.5 m/Ma. This result does not contradict the current understanding of sedimentation rates in a shallow marine basin under a relatively stable tectonic regime. An assessment of variable sedimentation rates along the section was also made using a sliding stratigraphic window. Cycles with similar, but slightly different, periodicities are the result of different sedimentation rates (with values ranging between ~8 and ~ 31 m/Ma). The results obtained allow us to estimate the frequency of geomagnetic reversals and can be used to estimate the duration of transient processes.

This work was supported by the Russian Science Foundation, grant No. 23-27-00018.