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Long-period astronomical cycles form Triassic-Jurassic bedded chert sequence and Newark Supergroup

Masayuki Ikeda[1*], Paul E. Olsen[2], Ryuji Tada[1], Akinori Karasuda[1]

[1]DEPS, Univ. of Tokyo, [2]LDEO, Columbia University

Attention has historically focused on the 20, 40, 100, and 405 ky Milankovitch periods, but long-period cycles of up to several million years are present in the orbital solutions through Phanerozoic. These long-period astronomical cycles have been occasionally recognized in sedimentary records, and may imply associated changes in global

climate. Astronomical theory predicts that the long-period astronomical cycles may not have had constant periodicities because of the chaotic behavior of the planets (Lasker et al., 2004). It is possible that geological records preserve the evolution in frequency of long-period astronomical cycles in the past (Olsen & Kent, 1999; Ikeda et al., 2010a). To explore the evolution of long-period astronomical cycles, bedded chert sequence and lacustrine Newark Supergroup have been used to construct an astronomical time scale of approximately 30 m.y. duration from the Late Triassic to Early Jurassic that shows a hierarchy of the sedimentary rhythms of astronomical cycle origin including all of the main precession-related periods (Ikeda et al., 2010b; Olsen and Kent, 1986, 1999). Wavelet analysis of the 405-kyr tuned record revealed the presence of approximately 2 m.y. cycle whose periodicity was modulated between ˜ 1.6- and ˜ 2.4 m.y.. The timing of frequency modulations and dominant frequency of the approximately 2 m.y.. cycle are synchronized with the two sequences. Our results of frequency modulation of approximately 2 m.y. cycles can provide new constraints for orbital models and the cyclostratigraphic template for establishing a high-resolution chronostratigraphy.

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