Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS01-20 会場:302 時間:5 月 22 日 11:00-11:15

層状チャートの堆積リズムに記録された天文学的周期とその古気候学・古天文学的意義
Astronomical cycle recorded in the bedded chert: Implications for the paleoclimatology and astronomy

池田 昌之[1*], 多田 隆治[1], 烏田 明典[1], 山本 信治[1]
IKEDA, Masayuki[1*], TADA, Ryuji[1], KARASUDA, Akinori[1], YAMAMOTO, Shinji[1]

[1] 東京大学地球惑星科学専攻
[1]Department of Earth and Planetary Sciences, the University of Tokyo

Astronomical forcing is one of the main drivers of climate change. The astronomical cycles recorded as sedimentary rhythms provide a clue to understanding the dynamics of Earth surface system and Solar system. Here we used the bedded chert sequence of Inuyama, central Japan, of which rhythms were proven to be of astronomical origin (Ikeda et al., 2010), to decode the astronomical cycle of approximately 65 myr. long spanning from the Early Triassic to Early Jurassic. The sedimentary rhythms of bedded chert were reflected by the variation in the biogenic silica and terrigenous burial rates on pelagic deep sea floor. The variation in the chert bed thickness was reflected by the biogenic silica burial rate during one precession cycle, which should be proportional to the variations in the dissolved silica input to the ocean, mainly through silicate weathering in Pangea. According to the geochemical modeling studies, a possible major controlling factor of the global silicate weathering intensity could have been the orbitally controlled summer monsoon intensity in low latitude Pangea (e.g. Kutzubach, 1981; Donnadieu et al., 2008). Therefore, the variations in the orbitally-controlled summer monsoon intensity in low latitude Pangea should have had close association with variations in the biogenic silica burial rate in the form of bedded chert during the early Mesozoic.

The long-period astronomical cycles of bedded chert could record the chaotic behavior of Solar system. Wavelet analysis of the chert bed thickness time series revealed the presence of approximately 2-Myr cycle whose periodicity varied between ˜ 1.5- and ˜ 2.4-Myr. According to the astronomical modeling studies, the 2-Myr eccentricity cycles may not necessarily have kept constant periodicities observed today (ca. 2.4-Myr periodicity), but their periodicities may have changed through time due to the chaotic behavior of solar planets, mainly Earth-Mars secular resonance (Laskar et al., 1990, 2004). Our results on the frequency transitions of the approximately 2-Myr cycle are the first geologic evidence for the chaotic transitions of Earth-Mars secular resonance. These transition patterns of approximately 2-Myr cyclicity will provide new constraints on orbital models. Exact timing and mode of transition will be discussed.

キーワード: チャート, 太陽系, カオス, ミランコビッチ, モンスーン, シリカ
Keywords: chert, solar system, chaos, Milankovtich, monsoon, silica