Extraction of the sedimentary cycles and application of cyclostratigraphy to the Middle Miocene Onnagawa Formation in Yashima District, Akita Prefecture, Japan

*Jumpei Yoshioka[1], Ryuji Tada[1,3], Kenji Marc Raymond Matsuzaki[2], Toshihiro Tada[1], Aki Sakuma[1], Yusuke Umemiya[1], Shunsuke Kurokawa

1. Department of Earth and Planetary Science, the University of Tokyo, 2. Atmosphere and Ocean Research Institute, the University of Tokyo, 3. Yunnan University

Middle Miocene (16.0-11.6Ma) is the time of the second of the three cooling steps during Cenozoic. In this cooling event, siliceous sediments with high organic contents were widely deposited along the North Pacific rim because of high productivity and/or preservation of diatoms. In the northern Japan Sea, those sediments are known as the Onnagawa Formation. It was reported that siliceous rocks in the Onnagawa Fm. showed meter-scale rhythmical bedding reflecting fluctuations in productivity of diatoms and flux of detrital materials. Furthermore, it was also reported that parts of highly siliceous rocks in the Onnagawa Fm. showed centimeter-scale black bands. However, the age and the cause of their occurrence has not been understood.

In this study, we tried to construct a high-resolution and precise age model of the Onnagawa Fm. in the Yashima District by applying cyclostratigraphy to the m-scale rhythmical bedding, that is attributable to the fluctuation of biogenic silica content.

Firstly, a ca. 130m-long continuous composite columnar section was constructed by correlation of 6 sections. This composite columnar section is divided into 5 lithological units, cyclic alternations of marl and interbedded mudstone (Unit A), mudstone with cyclic siliceous rocks intercalations (Unit B), siliceous-mudstone with muddy-porcelanite intercalations (Unit C), bedded muddy-porcelanite with cm-scale black bands (Unit D) and siliceous-mudstone and hard siliceous-mudstone alternations (Unit E).

“Silica rank”, which is defined as degree of siliceousness and divided into 5 grades based on hardness of the siliceous rocks observed in the field and confirmed by XRD analysis, was determined every 10cm for Unit B, Unit C and Unit D. It showed obvious m-scale cyclicities. The silica rank variation for Unit B and Unit C was obviously different from that for Unit D, and it is considered that this difference may reflect either the change in the sedimentation rate or the change in response of sedimentation mechanism to the orbital forcing that results in the lithological change. In order to construct an age model, the silica rank was tuned to $\delta^{18}O$ of benthic foraminifera with age constraints given by microfossil biostratigraphy.

Keywords: the Onnagawa Fm., Miocene, silica rank, cyclostratigraphy

