

Radiolarian biostratigraphy from Middle Miocene to Late Pleistocene in the Japan Sea-IODP Exp.346-

*Shin-ichi Kamikuri¹, Takuya Itaki², Isao Motoyama³, Kenji M. Matsuzaki⁴

1. Faculty of Education, Ibaraki University, 2. AIST, Geological Survey of Japa, 3. Department of Earth and Environmental Sciences, Yamagata University, 4. Department of Earth and Planetary Science, Graduate School of Science, the University of Tokyo

In the Integrated Ocean Drilling Program (IODP) Exp. 346, sampling by drilling was conducted at seven sites (U1422–U1427 and U1430) in the Japan Sea. Radiolarians in moderately well preserved states were found in most samples throughout the sequence in varying abundance. Forty-one radiolarian datum events were identified in this study, and the radiolarian zonation that best divides the middle Miocene to Pleistocene sequences with updated ages of radiolarian datum events estimated based on the geomagnetic polarity time scale (GTS) 2012 was applied to the sedimentary sequences in the Japan Sea. Here, four new radiolarian zones are proposed for the Quaternary of the Japan Sea, and one zone is slightly revised to adjust for differences among other zones. The sequences collected at the sites extended from the Pleistocene *Ceratospyris borealis* Zone to progressively deeper zones as follows: Site U1427, four zones to the Pleistocene *Schizodiscus japonicus*; Site U1422, six zones to the late Pliocene *Hexacantium parviakitaense* Zone; Sites U1423, U1424 and U1426, eight zones to the early Pliocene *Larcopyle pylomaticus* Zone; and Sites U1425 and U1430, fourteen zones to the middle Miocene *Eucyrtidium inflatum* Zone. The absence or extremely rare occurrence of *Stylatractus universus* and *E. matuyamai* indicates that *S. universus* lived in the deep water of the northwestern Pacific and had not been able to migrate into the Japan Sea across the Tsugaru Strait since the Pliocene.

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