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Toarcian (late Early Jurassic) oceanic anoxic event and ammonoid/radiolarian biostratigraphic framework worldwide

Atsushi Matsuoka^{1*}, Kentaro Nakada¹

¹Niigata University

The Early Toarcian oceanic anoxic event (OAE) is regarded as one of the most large-scale oceanographic changes through the Phanerozoic. This phenomenon has been analyzed in detail mainly in Europe from various viewpoints. It is essential to establish biostratigraphic frameworks applicable to both neritic and pelagic environments to clarify the exact timing and spatial extent of the event. Recent progress in ammonoid and radiolarian biostratigraphy encompassing the Toarcian interval is overviewed.

Upper Pliensbachian-Toarcian ammonoid stratigraphy in East Asia is recently revised based on a detailed biostratigraphic re-examination in the Toyora Group, Yamagichi Prefecture. Six ammonoid zones are proposed as follows, in ascending order: the *Amaltheus stokesi* Assemblage Zone, the *Canavaria japonica* Zone, the *Paltarpites paltus* Zone, the *Dactylioceras helianthoides* Zone, the *Harpoceras inouei* Zone, and the *Pseudogrammoceras-Phlyseogrammoceas* Assemblage Zone. The base of the *Paltarpites paltus* Zone corresponds to the base of the Toarcian.

Global radiolarian zonation for the Pliensbachian, Toarcian and Aalenian is proposed as a result of international collaboration (Carter et al., 2010). Nine zones are set up for this interval. The Early Toarcian zone (*Eucyrtidiellum nagaiae* - *Praeparvicingula tlellensis* Zone) is recognized in the Queen Charlotte Islands (Canada), Slovenia, Oman and Japan.

Our analysis on the Pliensbachian-Toarcian stratigraphy of the Toyora Group reveals that the Early Toarcian OAE is not distinctive in the neritic environment of the eastern margin of Asia. On the other hand, a remarkable faunal turnover of radiolarians related to the OAE has been pointed out in pelagic chert sequences in the Panthalassa (Hori, 1997). A precise timing and magnitude of the OAE in the Panthalassa can be clarified by using the newly established radiolarian zonal scheme.

Keywords: Mesozoic, Jurassic, Toarcian oceanic anoxic event, ammonoid, radiolaria, biostratigraphy