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Ammonoid faunal changes during late Early Jurassic (Late Pliensbachian-Toarcian) and Early Toarcian Oceanic Anoxic Event

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The time-interval of late Early Jurassic (Late Pliensbachian to Toarcian) has been characterized by some paleoceanographic events, especially represented by the Early Toarcian Oceanic Anoxic Event (OAE). The ammonoid faunas in the Northern Hemisphere were affected by these paleoenvironmental changes in this period. A dramatic diversity crisis of the ammonoid assemblages, biostratigraphically corresponded to the Exaratum Standard Subzone (middle Early Toarcian), was mainly recognized in the Submediterranean province including Apennines (central Italy), Subbetic (southern Spain) and High-Atlas (Morocco). This extinction event was considered to be caused by the coeval Early Toarcian OAE. The effects of this OAE have been also reported in North American Cordillera, North Tibet and pelagic areas (West Panthalassa and West Tethys). In contrast, a diversity fall at the Pliensbachian/Toarcian (P/T) boundary, which was characteristic in the extinction of Amaltheidae, the typical Boreal element in Late Pliensbachian, has been mainly distinguished in the Northwest European province, such as England, Paris Basin (northern France) and the Causses Basin (southern France). Moreover, an abrupt warming on the basis of the oxygen isotope fluctuation and the low stand of eustatic sea level analyzed by the Sr isotope ratio were also distinguishable around the P/T boundary through the Northwest European and the Mediterranean provinces.

In this study, a diversity fall of ammonoid assemblage from the Toyora Group is identified in the Paltarpites paltus Zone which is compared to the lower part of the Tenuicostatum Standard Zone, earliest Toarcian. This diversity crisis is characterized by the extinction of Harpoceratinae, and the survival of only a species of pandemic Arieticeratinae. Moreover, this event is stratigraphically corresponded to the anomalies of trace element concentrations (including V, Ni, Ba and Co), rare earth element (Ce) and carbon isotope fluctuation. Consequently, the ammonoid diversity crisis in the Paltarpites paltus Zone is perhaps reflected by the oxygen-deplete marine condition in East Asia, biostratigraphically earlier than the European Early Toarcian OAE. In contrast, some ammonoid bio-events during late Early Jurassic time are also recognizable in Japanese assemblages from the Toyora Group, the Early to Middle Jurassic epicontinental clastic sediments in southwest Japan, and the Kuruma Group, the Early Jurassic continental shelf deposits exposed in central Japan. A turnover from the Boreal fauna composed of Amaltheidae to the Tethyan fauna dominated by Arieticeratinae (Hildoceratidae) is distinguished mainly in the Kuruma Group during the Apyrenum Standard Subzone (latest Pliensbachian). This faunal change is chronologically discordant for the comparable faunal turnover in the almost equal paleolatitudinal areas of the Northwest European province, which is corresponded to the P/T boundary. The turnover recognized in the latest Pliensbachian ammonoid fauna from Japan seems to be mainly affected by the regression during latest Pliensbachian (Spinatum Standard Zone) to earliest Toarcian (Tenuicostatum Standard Zone), in addition to the starting of the warming event. The data of ammonoid faunal transition in East Asia enables to contribute to the discussion of global ammonoid paleobiogeography in late Early Jurassic time.

Keywords: late Early Jurassic, ammonoid, Early Toarcian Oceanic Anoxic Event (OAE), extinction, paleobiogeography