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

MIS30-01 Room:201A Time:May 25 13:45-14:00

Ecological and morphological analysis of radiolarians based on laboratory culture and X-ray micro-CT technology

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Living radiolarian researches have provided us with fundamental data on radiolarian ecology including feeding behavior, symbiosis, and parasitism. These researches together with detailed morphological analysis are expected to expand our understandings of past pelagic environments. Detailed observations of feeding behavior of laboratory cultured radiolarian specimens make it possible to understand the relationship between skeletal morphology and feeding behavior. Four types of feeding strategy well correspond to skeletal morphology in extant radiolarian taxa. High diversity of radiolarian skeletal morphology is partly related to having a variation in feeding strategies. The wide variation in feeding behavior means that radiolarians occupy several kinds of ecological niches in marine environments. We can infer feeding behavior of extinct radiolarian group based on their skeletal morphology. Once we recognize the role of radiolarians in food web in the modem ocean environments, we can apply it to reconstruct marine ecosystem in the past. Fluctuation in morphological diversity of radiolarian skeletons is well documented in fossil records. This fluctuation can be interpreted as change in the number of ecological niches in the marine eco-system through time. Recently developed X-ray micro-CT and layered manufacturing technology is essential for detailed morphological analysis of radiolarian skeletons.

Keywords: radiolaria, laboratory culture, X ray micro-CT technology, detailed morphological analysis, pelagic realm

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First record of Late Jurassic radiolarians from eastern Heilongjiang Province, NE China

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The early study of the Nadanhada geology began in 1930s by Japanese geologists (Yabe and Ohki, 1957). In 1957 Chinese and Russian scientists made joint geological research in the Ussuri River region, and confirmed the occurrence of Upper Triassic, Lower and Middle Jurassic rocks on the basis of fossil evidence (Wang, 1959), and they came to the conclusion that the Mesozoic mobile belt developed from a geosyncline in the northeastern continental margin of East Asia.

Based on fossil records of Late Palaeozoic fusulinids the Nadanhada Range was considered as a Palaeozoic geosyncline which extends from the northeast Sikhote-Alin region (Li et al., 1979). But the sporadical and irregular distribution of rock formations with various age fossils (Carboniferous and Permian fusulinids in limestone, Triassic conodonts in bedded chert, Triassic, Early and Middle Jurassic radiolarians in bedded chert and siliceous shale and Late Jurassic to Early Cretaceous bivales, a *Buchia* fauna), strongly suggest the melange characters of the Nadanhada geology. It together with the Mino and Western Sikhote-Alin terranes formed a single superterrane before the opening of the Japan Sea (Kojima, 1989).

Recent studies showed that the Dajiashan Formation, cropping out in the Zhenbaodao-Dajiashan area, southern Nadanhada Terrane, yields a middle-late Early Cretaceous *Aucellina* Fauna (Wang et al., 1995). Furthermore, the purported Early Jurassic ammonites of the Dajiashan Formation (Li, 1996) are also similar to those of the *Pseudohoploceras* ammonite fauna from the Lower Cretaceous Longzhaogou Group. All these sparked an interest in restudying the palaeontology and biostratigraphy of the Dajiashan Formation and its underlying deposits.

Well preserved Middle-Late Jurassic radiolarian faunas are encountered in four samples from the black mudstone of the Dalingqiao Formation, which was originally dated to Late Triassic-Early Jurassic by the Gological Survey of Heilongjiang Province of China. These radiolarian faunas consist of 45 species and subspecies in 28 genera and are assigned to two radiolarian zones, i.e. the Middle Jurassic (late Bathonian to early Callovian) *Striatojaponocapsa conexa* Zone and the Late Jurassic (Kimmeridgian) *Hsuum maxwelli* Zone. The new fossil record of Late Jurassic radiolarians makes it possible to reconstruct the geological history of the Nadanhada Range in northeastern China.

Keywords: radiolarians, biostratigraphy, Middle Jurassic, Late Jurassic, Eastern Heilongjiang Province, China

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MIS30-03 Room:201A Time:May 25 14:15-14:30

Temporal and spatial variation in growth rates of Fe-Mn crusts from the #5 Takuyo Smt using osmium isotope compositions

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A ferromanganese crust (Fe-Mn crust) records geochemical information of ambient seawater and is known as a useful material for deciphering the paleocean environmental changes throughout the Cenozoic period (e.g., Klemm et al., 2005; Burton, 2006). Based on the osmium (Os) isotope stratigraphy, recent studies proposed that a growth rate of the Fe-Mn crust was changed significantly and that its variation in the growth rate was attributable to global ocean environmental changes (Klemm et al., 2005; Li et al., 2008; Meng et al., 2008). However, due to the lack of detailed studies constraining the temporal and spatial variations in the growth rate of Fe-Mn crusts, the linkage between their growth rates and marine conditions is still poorly understood.

Here, we report the temporal and depth variations in the growth rate of Fe-Mn crusts on the basis of the Os isotope composition. Our samples were collected systematically from the Takuyo Daigo Seamount (#5 Takuyo Smt) by ROV Hyper Dolphin / RV Natsushima (NT09-02 Leg.2 cruise) with manipulator and underwater diamond saw. The Os isotope compositions of two Fe-Mn crust samples collected from 1440 and 2987 mbsl exhibit a similar trend and their values are almost the same as the seawater Os isotope record from present to 12 Ma, demonstrating that the growth rates of Fe-Mn crusts from the #5 Takuyo Smt are constant regardless of sea depth. This is consistent with the growth rate determined by the Be-10 dating method. However, in the older part (bottom part in the side of basement rock) of Fe-Mn crust collected from 1440 mbsl, the Os isotope compositions have a large deviation from the seawater Os isotope record. Moreover, the Fe-Mn crust collected from 2987 mbsl totally lacks the section older than 12 Ma. These results suggest that (1) the existence of the growth hiatus older than 12 Ma, recognized in the previous studies (Klemm et al., 2005; Li et al., 2008; Meng et al., 2008) or (2) the bottom part of Fe-Mn crust older than 12 Ma at 2987 mbsl was simply eroded and disappeared by land slide of the #5 Takuyo Smt.

The present study is the first attempt to comprehend the spatial/depth variation in the growth rate of Fe-Mn crusts using the Os isotope stratigraphy. It is turned out that the growth rate of Fe-Mn crusts collected from different depth is constant and sedimentary age determined by Os isotope composition is consistent with that of the Be-10 dating method. In the future research, we will conduct the Os isotope geochronology to various Fe-Mn crust samples from various localities and elucidate whether or not the growth hiatus is related with the global ocean environmental changes.

Keywords: osmium isotope, paleoceanography, ferromanganese crust, growth hiatus

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MIS30-04 Room:201A Time:May 25 14:30-14:45

Deciphering the chemical evolution of the Cenozoic seawater using ferromanganese crust

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We report the secular variation in the Os concentration and isotope ratio from the Middle Miocene to present using Fe-Mn crust samples collected from the Takuyo Daigo Seamount. Both the Os/Fe ratio and Os isotope ratio increased exponentially toward present. Based on the flux calculation using a simple box model, these increase tendencies can be almost explained by the increase of riverine Os flux to the ocean and the present seawater Os mass is estimated to be ca. 1.85 times the size of that in 10 Ma. Therefore, the seawater Os mass may not be constant through the Earth history and a Fe-Mn crust is one of the most appropriate materials to unravel the chemical evolution of the paleo-seawater.

Keywords: ferromanganese crust, seawater, chemical evolution, Os geochemistry, Takuyo Daigo Seamount, Pacific Ocean

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Linkage between Massive Volcanic Events and Global Extreme Climatic Events in the Cretaceous Period

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Causal linkages between massive volcanic events and extreme climatic events have long been discussed. However, little has been understood about the mechanisms of these linkages. Recent developments of heavy metal isotope analyses such as lead (Pb) and osmium (Os) enable us to reconstruct detailed volcanic events from marine sedimentary records. Based on these isotopic records, we have investigated temporal relationship between massive volcanic events associated with large igneous provinces (LIPs) and Mesozoic extreme events such as Triassic-Jurassic mass extinction, and mid-Cretaceous Oceanic Anoxic Events (OAEs). We present an overview of our recent works on 1) end-Triassic mass extinction (200 Ma), 2) Early Aptian OAE-1a (120 Ma) and 3) end-Cenomanian OAE-2 (94 Ma) and their linkages with Central Atlantic Magmatic Province, Ontong Java Plateau and Caribbean/Madagascar LIPs, respectively.

Marine sediments deposited across the early Aptian OAE-1a show two prominent negative shifts of seawater osmium isotopic ratios, suggesting duplicate inputs of unradiogenic osmium from the mantle. The lead isotopic record suggests that the main part of the Ontong Java Plateau was formed by deep submarine eruptions. On the other hand, marine sediments deposited across the end-Cenomanian OAE-2 interval indicate an abrupt shift of Pb isotopic ratios, suggesting an increased supply of volcanic Pb via subaerial eruption. Our data indicate strong consistency between magmatic events and extreme climatic events for both OAE-1a and OAE-2, although the eruption processes differ. A more precise discussion of the causal mechanisms between these events will be presented in the near future.