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

MIS01-P01 Room:Convention Hall Time:May 22 15:30-16:45

Detailed stratigraphy across the Middle-Late Permian boundary in the Ebian area, Sichuan, South China

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The mass extinction across the Paleozoic-Mesozoic boundary (P-TB) occurred in two steps. The major change in biodiversity started around the Middle?Late Permian (Guadalupian?Lopingian) boundary (G-LB). The cause of extinction has not been unknown. In order to clarify the cause of the environmental changes and extinction around the G-LB, we examined detail stratigraphy of the upper Middle Permian rocks at Shizipo in central Sichuan, South China.

This section is composed of four units; the Maokou Formation ($>$ 100 m), Wangpo bed (ca. 1 m), mudstone (ca. 2 m) , the Emeishan basalt (several hundred meters), in ascending order. The Maokou Fm mainly consists of bioclastic limestone, with a thin limestone conglomerate at the top.

The sporadic occurrence of fusulines gives the Wordian to Capitanian age to the 70 m-thick Maokou Fm at the studied section. The sedimentary characteristics indicate that the Maokou Fm was deposited mostly in a relatively deep shelf setting. The limestone conglomerate at its top indicates their exposure above the sea-level that likely has resulted in unconformity. The Maokou Fm generally yields abundant bioclasts of shallow marine biota, whereas the mudstone between the Wanpo bed and the Emeishan basalt lack them. This likely recorded the decline in biodiversity around the G-LB. The mass extinction of the G-LB occurred clearly earlier than the eruption of Emeishan flood basalt. Thus the latter could not be the cause of the G=LB extinction.

Keywords: mass extinction

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The strontium isotope stratigraphy in the Wordian of the mid-oceanic paleo-atoll limestone at Takachiho in Japan

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In order to clarify the extinction-related environmental changes before the G-L boundary (Permian) event, we analyzed the paleo-atoll limestone derived from ancient mid-oceanic paleo-seamount at Takachiho, Miyazaki, Japan. Using the 60 m-thick drilled core samples, we described the litho-stratigraphy first, and determined the age by the fusuline biostratigraphy. 87Sr/86Sr ratios from 15 horizons concentrate in 0.7072 to 0.70735. 87Sr/86Sr ratio reached the minimum values (0.7068-0.7069) of the Phanerozoic during the Capitanian (late Guadalupian). This study confirmed for the first time that 87Sr/86Sr ratio stayed in relatively higher value during the Wordian (Neoschwagerina Zone) at least by the beginning of the Capitanian.

Keywords: mass extinction

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Mass independent fractionation by UV photolysis of optically thin SO_2

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Sulfur mass independent fractionation (S-MIF) of Archean sediment is regarded as a proxy of the atmosphere at that time. S-MIF is produced by photolysis of SO_2 in oxygen-free environment. However, the elementary reaction and the mechanisms of fractionation in the atmosphere are not fully understood. We present here a newly developed experimental setup to reveal the atmospheric photochemistry observed in the geological record. The photochemical system consists of a D_2 light-source, two gas chambers attached to a monochrometer and a UV detector designed to operate with no interference of atmospheric air. Here we present the first round of experiments of SO_2 photolysis conducted under SO_2 at low partial pressure ($<$5 Pa) and high amount of CO. The purpose of this experiment is to test a different experimental conditions from previously reported results where the environment of high pressure SO_2 is oxidative and optically thick. The optically thick condition of the past experiments causes self-shielding of SO_2, possibly resulting in unique S-MIF. But self-shielding may have not operated or not be important in the Archean atmosphere, because atmospheric SO_2 concentration unlikely exceeded over ppm level. Then, our experiment of SO_2 photolysis was conducted under the optically thin setting. Additionally, reducing atmosphere with a large amount of CO produces a stable amount of OCS (Ueno et al.,2009). Results demonstrated that OCS is produced by SO_2 photolysis under CO atmosphere. The product OCS shows clear MIF signature. We calculated fractionation factors of SO_2 photolysis (185-220 nm) and also the chemistry associated with SO_2 photoexcitation (250-320 nm) as an additional source of MIF. We discuss a source of MIF involving not only SO_2 photodissiaction but also the chemistry associated to the photoexited SO_2* species in relation to the MIF signal meaured on the geological record.

Keywords: Archean, ancient atmosphere, mass independent fractionation

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To find extraterrestrial material from deep-sea sediment of one hundred million years ago 6-2

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It is proposed that the encounter of dark clouds and supernova explosion caused extreme environmental change of the earth surface (the mass extinction and Snowball Earth), yet the evidence to verify it through geological record is scarcely reported. In this research, we aim to estimate the amount of descent cosmic dusts through the earth history (mainly Phanerozoic time). The best target to obtain cosmic dusts through ancient time is deep-sea deposits in the accretionary complex. We focus on the cosmic spherules which are one of the cosmic dusts. Especially, the shale beds, whose depositional rate is very slow, is suitable to estimate the rate of the cosmic spherule descent. It is generally thought that cosmic spherules are derived from in the solar system, but the amount of cosmic dusts descent has a correlation with the perturbation between our solar system and galaxy.

We target three areas of Inuyama, Gujo-hachiman and Llyen Peninsula (U.K.), which crop out the T/J boundary, the P/T and G/L boundary and the Marinoan Snowball Earth, respectively, and made detail geological map to sample bed-by-bed to pick up cosmic spherules from each shale-bed. To identify cosmic spherules from crushed sample, SEM-EDS analyses are applied for the observation of surface and cross-section of cosmic spherules.

We collected 74 shale samples from Inuyama, about 180 from Gujyo-hachiman and about 40 from UK and separated cosmic spherules from 101 shale samples. The results show that cosmic spherules are obtained in layers of Toarcian and T/J boundary and also found in nearly 167 Ma and 214 Ma layers corresponding to large impact events (Puchezh-Katunki and Manicouagan). But, cosmic spherules were not recovered from layers of P/T and G/L boundary in Gujyo-hachiman and Marinoan Snowball Earth in the UK, respectively. For the future, we try to pick up shale one by one (every 20 thousand years) and separate cosmic spherules and extrasolar materials which come from outside solar system.

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Exploring extrasolar dusts from ancient deep-sea sediment

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If our solar system encounters the dense molecular cloud and near explosion of supernovae, the flux of galactic cosmic ray and extrasolar dust into Earths atmosphere will increase and may cause an extreme environmental change (snowball earth and mass extinction). To investigate a causal connection between mass extinction events and encountering the molecular clouds we focus on the geological samples which record both ancient environmental change and cosmic dust, that is deep-sea sediment in a accretional complex on land. We collected more than 400 samples of thin shale interlayer between cherts in the Inuyama-area, which include T/J boundary and Toarcian anoxic event. If extrasolar dust particles are found from terrestrial sample, they would be similar to presolar grains. Thus we performed acid treatment to recover residual mass because most presolar grains are recovered as acid residue. Known types of presolar materials include carbonaceous phases such as nanodiamond, silicon carbide, graphite, and, probably, organic materials, as well as silicon nitride and oxide phases such as corundum, spinel, hibonite and silicate. We challenge the exploration of extrasolar dust particles from deep-sea sediment and will provide our preliminary results.

Keywords: mass extinction, extrasolar dusts, deep-sea sediment, accretionary complex