Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

BPT27-01 Room:101A Time:May 19 11:00-11:15

A unique condition for the SSF diversification and the phosphogenesis in the Early Cambrian in Chengjiang, South China

Tomohiko Sato[1*], Yukio Isozaki[1]

[1]Komaba, Univ. Tokyo

In the earliest Cambrian, a major diversification of small shelly fossils (SSFs) occurred as the first stage of the Cambrian Explosion. In order to clarify the precise location and environmental background of this event, we examined the detailed litho- and bio-stratigraphy of the SSF-enriched lowermost Cambrian in central Yunnan, South China.

In the Chengjiang area, ca. 40 m-thick lowermost Cambrian (the Zhongyicun Member of the Zhujiaqing Formation) is composed of interbedded phosphorite and limestone. Phosphorite is in fact composed of clastic grains with calcite matrix. This texture suggests that phosphate was primarily deposited in a relatively shallower setting than limestone, and eroded/transported into the depositional site of limestone as clastic grains. Primary phosphorite deposition likely occurred in an extremely shallow setting. At the Hongjiachong section, we subdivided the Zhongyicun Member into 5 units; i.e., Units A, B, C, D and E. Units A, D and E are mainly composed of phosphorite, whereas Units B and C of limestone. Units A, D and E were likely deposited in a site deeper than that of Units B and C. The depositional setting has likely changed from shallow to deep, and deep to shallow again. A unique sandstone bed occurs at the boundary of Units B and C. It is noteworthy that the sandstone truncated the bedding of the beds of Unit B. The sandstone is likely a turbidite bed that reached to the deeper part of basin intermittently. The SSFs occurred solely from this sandstone between Units B and C. As the SSFs occur in the same manner as phosphate clastics, they were also derived likewise from shallow environments.

At Hongjiachong, we identified 15 genera of SSFs from 10 horizons in the Zhongyicun Member, and recognized two distinct assemblages; one with *Anabarites* sp. and *Protohertzina* sp. from the bottom of Unit A, and the other with various mollusc shells, such as *Paracarinachites* sp. and *Ocruranus-Eohalobia* group from the sandstone and higher units. This assemblage shift, i.e., the major SSF diversification, occurred in the earliest Cambrian probably before that of the marker sandstone, i.e. during the deposition of Unit B of the lower half of the phosphorite-bearing sequence.

We speculate that phosphorites might have primarily deposited in a unique shallow-water environment where phosphorous-rich seawater was concentrated, such as a small restricted embayment, and that the SSF diversification possibly occurred in such extreme conditions.

Keywords: small shelly fossils, phosphorite, Cambrian, South China

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

BPT27-02 Room:101A Time:May 19 11:15-11:30

n-alkanes and isoprenoids extracted from the Ediacaran-Early Cambrian section in the Three Gorges area, South China

Kentaro Yamada[1*], Yuichiro Ueno[1], Keita Yamada[2], Naohiro Yoshida[2], Shigenori Maruyama[1]

[1]Earth & Planetary Sciences, TITech, [2]Environ. Chem. and Engr, TITech

The Ediacaran-Early Cambrian (635-509Ma) is one of the most important periods in the Earth life history. Almost all of eumetazoan phyla emerged and radiated during this period. Although it is expected that the eumetazoan evolution be influenced by the change of ecosystem including microbiota and geochemical cycle in the ocean, the detail is still ambiguous.

South China is the most suitable area for studying continuous biogeochemical change during the Ediacaran-Early Cambrian because there are less hiatus through the sequence.

Molecular fossils, which are organic compounds extracted from sedimentary rocks, are useful to reveal the microbiota and biogeochemistry, but the continuous change of molecular fossils composition during the Ediacaran-Early Cambrian in South China have not been reported.

In this study, the results of n-alkane and isoprenoid composition from 80 samples, and their compound specific carbon isotope ratios from 30 samples are reported. Dominant longer chain n-alkanes, and different carbon isotope ratios between pristane and phytane which were derived from the multiple phototroph communities, indicate the emergence of the stratified ocean and photic zone euxinia in the earliest Cambrian.

Keywords: molecular fossil, carbon isotope ratio, Ediacaran-Early Cambrian, South China

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

BPT27-03 Room:101A Time:May 19 11:30-11:45

Litho-, bio-, and C-Sr isotope stratigraphy of the Middle Permian carbonates in central Sichuan, South China

Takumi Futamori[1], Yukio Isozaki[1*], Tomomi Kani[2], Atsushi Suzuki[3], Toyoho Ishimura[3]

[1]Department of Earth Science & Astronomy, The University of Tokyo, [2]Faculty of Science, Kumamoto University, [3]AIST Geological Survey of Japan

We analyzed the stratigraphy of the Wordian to Capitanian (Middle-Upper Guadalupian, Permian) shallow marine cabonate (Maokou Formation) in the Ebian area of central Sichuan, South China, using samples from outcrop and drilled core. Fusulines and conodonts confirmed that the studied section ranges from lower Wordian to mid-Capitanian. Owing to depositional gap beneath the limestone conglomerate, the horizon of the end-Guadalupian extinction is missing. Nonetheless, we detected a nearly 20 m-thick interval characterized by extremely high positive values of stable carbon isotope ratio of carbonate ($>$ 5 permil) in the Capitanian. This is the first confirmation of the similar signal proposed from paleo-atoll carbonates in Japan (Kamura event). This suggests the appearance of cool climate in the later half of the Capitanianon a global scale, in good accordance with the global sea-level drop and ubiquitous hiatus on the top the Maokou Fm throughout South China (except the Penglaitan section).

Keywords: Permian, Maokou Formation, South China, Kamura event, mass extinction, Guadalupian

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

BPT27-04 Room:101A Time:May 19 11:45-12:00

Active anaerobic respiration in an anoxic ocean prior to the end-Guadalupian (Permian) extinction

Masafumi Saitoh[1*], Yuichiro Ueno[1], Manabu Nishizawa[2], Katsumi Shozugawa[3], Tetsuya Kawamura[1], Ken Takai[2], Naohiro Yoshida[4], Motoyuki Matsuo[3], Jianxin Yao[5], Zhansheng Ji[5], Yukio Isozaki[3]

[1]Graduate School of Science and Engineering, Tokyo Institute of Technology, [2]Japan Agency for Marine-Earth Science and Technology, [3]Graduate School of Arts and Sciences, The University of Tokyo, [4]Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology, [5]Chinese Academy of Geological Science

We present nitrogen and sulfur isotope (d15N and d34S) records of Guadalupian-Lopingian (Middle-Upper Permian) shelf-carbonates in northern Sichuan, China, to examine oceanographic changes around the end-Guadalupian extinction. d15N values of organic matter are remarkably high in the topmost part of the Guadalupian Maokou Formation, suggesting active denitrification in the Capitanian (Late Guadalupian) ocean. On the other hand, distinctly low and constant d34S values of pyrites in the topmost Maokou Formation suggest vigorous sulfate reduction in the water column. Active anaerobic respiration is in accordance with the emergence of oxygen-depleted waters and with the occurrence of anomalous carbonate precipitates on the relatively deep disphotic slope/basin in northwestern South China. Enhanced sulfate reduction in the water column implies that a sulfidic condition may have developed on the continental margin, at least locally, prior to the extinction. The emergence of a sulfidic water mass is supported by the abundant occurrence of small framboidal pyrites and by the extremely high proportions of pyrite Fe to highly reactive Fe (FeP/FeHR) in the rocks shown by 57Fe Mossbauer spectroscopic analysis. A development of a sulfidic water mass on the disphotic slope/basin may have influenced on the end-Guadalupian extinction through upwelling of the harmful waters along the continental margin.

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

BPT27-05 Room:101A Time:May 19 12:00-12:15

The Guadalupian (Permian) minimum of seawater 87Sr/86Sr

Tomomi Kani[1*], ISOZAKI, Yukio[2], KOFUKUDA, Daisuke[2], FUTAMORI, Takumi[2], HISANABE, Chihiro[1]

[1]Department of Earth and Environmental Sciences, Kumamoto University, [2]Department of Earth Science & Astronomy, The University of Tokyo

The Guadalupian (Permian) $^{87}Sr/^{86}Sr$ ratio of surface seawater recorded the unique Permian minimum ($<$0.7070) interval, , the lowest in the Phanerozoic. Two mid-superoceanic carbonate sections in Japan, i.e. Akasaka and Kamura, recorded extremely low $^{87}Sr/^{86}Sr$ values for nearly 5 million years during the Capitanian (Late Guadalupian; ca. 265-260 Ma) (Kani et al., 2008; 2013). We newly found out the same signal for the first time at the Shizipo section in central Sichuan, South China (Futamori et al., 2013). This confirms that the minimum $^{87}Sr/^{86}Sr$ interval started already in the late Wordian (Middle Guadalupian). After the long-term late Guadalupian minimum, for more than 5 m. y., the seawater Sr isotope values increased in the most rapid manner during the Late Permian. This rapid increase can be explained either by the deglaciation or by the Pangean rifting. The regime likely shifted to a warmer climate that removed ice covers from continents and increased the erosion/weathering rate. With respect to the Pangean rifting, the continental doming by plume impingement might intensify erosion/weathering of surface of continent. The continental rifting with new drainage systems likely increased decisively the radiogenic continental flux to superocean.

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

BPT27-06 Room:101A Time:May 19 12:15-12:30

Meteorite impact, volcanism, and radiolarian faunal turnover recorded in the Upper Triassic bedded chert in Japan

Tetsuji Onoue[1*], Honami Sato[2], Tatsuo Nozaki[3], Junichiro Kuroda[3], Katsuhiko Suzuki[3]

[1]Kagoshima University, [2]Kyushu University, [3]JAMSTEC

The Late Triassic was characterized by several marine and terrestrial biotic turnover events prior to the end-Triassic mass extinction. The causes of the end-Triassic mass extinction and Norian to Rhaetian biotic turnover events are still the subject of active debate. Catastrophic processes such as widespread eruption of the Central Atlantic Magmatic Province (CAMP) flood basalts and extraterrestrial impacts have been proposed to account for the biotic turnover events. We report a marine osmium (Os) isotope record reconstructed from an Upper Triassic chert succession in Japan, which accumulated on the paleo-Pacific deep seafloor. Os isotope data exhibit an abrupt and marked negative excursion from an initial Os isotope ratio of ˜0.456 to unradiogenic values of ˜0.126 in in a claystone layer within the middle Norian (˜215 Ma), indicating the input of meteorite-derived Os into seawater. A gradual decrease in 187Os/188Os ratios during the Rhaetian (201-210 Ma) is considered to have been closely linked with the CAMP volcanic event.

An analysis of radiolarians does not show a mass extinction event across the impact ejecta layer and during the CAMP volcanic phase. However, a significant faunal turnover occurred ˜1 Myr after the impact event. Biostratigraphic analysis shows that 20 radiolarian species became extinct at this level and the extinction rate is estimated to be 83%. It is possible that the impact may have triggered the extinction of these 20 species, though the direct cause of their extinction remains uncertain.

Keywords: Triassic, Radiolaria, Meteorite impact, Volcanism, Chert

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

BPT27-07 Room:101A Time:May 19 12:30-12:44

Stem evolution and Crown evolution; Role of atomic bomb magma

Shigenori Maruyama[1*], Toshikazu Ebisuzaki[2]

[1]Earth-Life Science Insitute, Tokyo Institute of Technology, [2]RIKEN

When we see the history of life and its evolution, there are some points to focus as follows. (A) Paleogeographic constraints on the birth of metazoan which occurred on a rift system back to 750 Ma after the Sturtian Snowball Earth and before Marinoan Snowball Earth. (B) Metazoans evolved in the South China block that was isolated in paleo-Pacific Ocean. (C) Rapidly diversified animals suddenly evolved in a rift system on the Gondwana margin. These three-step evolutions can be related to:(1) stem evolution in a rift system within supercontinent Rodinia (ca. 750Ma), (2) migration in a Paleo-Pacific Ocean during Ediacaran radiation (635-560Ma) and (3) crown evolution to diversify the life forms into 35 phyla of metazoans after the collision-amalgamation docking with Gondwana by 540Ma.

For evolution of life, supply of nutrients is necessary. There are 3 kinds of rock types which can be candidates as source of nutrients, e.g. granite, anorthosite (KREEP) and carbonatite. Among them, carbonatite plays unique role, functioning like atomic bomb magma to cause local mass extinction, and resultant promotion of genome mutation by internal radiation through food chains.