Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

BPT25-01 Room:202 Time:May 24 14:15-14:30

Stem and crown evolution: United grand theory of life evolution

MARUYAMA, Shigenori[1*] ; EBISUZAKI, Toshikazu[2]

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

Evolutional theories have long been discussed since 19th century. One of the most famous theory of evolution was proposed by Darwin about 150 years ago. Since then, Gould's punctuated equilibrium theory, Kimura's neutral evolution etc were proposed and recently molecular biology is rapidly developing. However, there is discrepancies in proposed phylogenic trees due to theoretical differences to analyze. So, we tried to implicate the evolution of history from synthetic paleogeographic map based on geological evidences including fossil data.

As a result, we propose there are two significant patterns of evolution through Earth history. One is stem evolution which occur at continental rift where atomic bomb magma erupt to accelerate the birth of new species by mutation. The other pattern is crown evolution that progress when continents collide after species were evolved in isolated environment such as places on fragmented continents. At the same time of those patterns of evolution, fluctuation happened in the Universe five huge impact on life history which is mass extinction. Activities such as starburst and collision between solar system and a dark nebula was the trigger to cause mass extinction and subsequent rebirth of another ecosystem on the Earth.

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BPT25-02 Room:202 Time:May 24 14:30-14:45

What is main marine primary producer during the Cretaceous OAEs?: Evidences from marine kerogens.

ANDO, Takuto[1*] ; SAWADA, Ken[1] ; TAKASHIMA, Reishi[2] ; NISHI, Hiroshi[2]

[1]Faculty of Science, Hokkaido University, [2]Tohoku University Museum, Tohoku University

The mid-Cretaceous oceanic anoxic events (OAEs) are important to understand extremely greenhouse world. It is thought that enhanced marine productivity caused the global anoxia, although coccolithophorid and dinoflagellate productivity were diminished during the OAEs. Distinct algal biomarkers such as 2-methyl hopanoid and isorenieratane in the OAE levels indicate high activities of cyanobacteria and green sulfur bacteria, although detection of these biomarkers was limited. Amorphous organic matter (AOM) and very small palynomorph such as acritarchs are main components of OM in black shale but they were removed at the time of palynomorph analysis with size fractionation. In the present study, we analyzed kerogen including AOM and small acritarchs by fluorescent microscope and pyrolysis/thermochemolysis method to reconstruct variation in primary producers during OAEs.

Black shales were collected from the Goguel (OAE1a), Jacob, Kilian, Paquier (OAE1b), Breistroffer (OAE1d) and Thomel (OAE2) levels in SE France. These crushed samples were extracted with ultrasonication and their residues were sequentially treated by acids in a water bath shaker (Sawada et al., 2012). AOM classified into NFA (non-fluorescent AOM; wood origin), WFA (weakly fluorescent AOM; marine plankton origin) and FA (fluorescent AOM; cuticle or palynomorph origin), and acritarchs divided into five groups (sphaeromorph, pteromorph, acanthomorph, netromorph, polygonomorph). We analyzed pyrolysis and thermochemolysis of kerogen by using GC-MS equipped a Curie-point pyrolyzer.

Kerogens in the Goguel (OAE1a) samples are mainly comprised of WFA, and percentages of WFA (WFA%) are slightly higher in black shale samples. Green algal phycoma-like acritarchs, sphaeromorph, are abundant in the Goguel level, especially acme phase of OAE1a. Anoxia during the OAE1a might be related to high production of green algae. Terrestrial NFA are main components in all OAE1b samples, although WFA are higher in black shale samples of the Kilian and Paquier levels. These data show both enhanced marine production and excess terrestrial input led anoxia during the OAE1b. Sphaeromorph are also observed from black shales samples of OAE1b level s. In addition, percentages of long-spine type acanthomorph are higher in the Paquier level. The WFA% values are remarkably higher in the OAE1d and 2 samples, especially black shales of OAE2 (80-90%), which suggest that enhanced productivity during the OAE1d and OAE2. Netromorph, which has each spine in bipolar, is observed in only OAE1d samples. Sphaeromorph decrease but acanthomorph increase with decreasing WFA% values in the Trough interval (cooling phase) of the OAE2 level. 2-methyl hopane and a large amount of branched alkanes are detected by pyrolysis/thermochemolysis analysis from the OAE1a and OAE1b samples, respectively. These pyrolysis results are consistent with those of free biomarkers. Branched alkanes were characteristically detected as pyrolysate of WFA in accumulated layers of the Paquier level, and the relative abundances of these compounds correlated with free tail-to-tail isoprenoid concentration. These tail-to-tail isoprenoids are presumably derived from lycopanoid skeleton of marine phytoplankton such as green algae, which is supported by the results of kerogen.

Keywords: Oceanic Anoxic Events (OAEs), kerogen, acritarch, palynofacies, pyrolysis, thermochemolysis

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BPT25-03 Room:202 Time:May 24 14:45-15:00

Paleotemperature, productivity and shell size of Hedbergella delrioensis in the Cretaceous thermal maximum

MORIYA, Kazuyoshi[1*] ; TSUTSUI, Keita[1]

[1]Dep. Earth Sciences, Sch. Education, Waseda Univ.

Planktic foraminifers, experienced two major diversity crises at the Cretaceous/Paleogene boundary and the Eocene/Oligocene boundary, have emerged in late Jurassic and repeatedly flourished in these 100 myr Earth history (e.g. Norris, 1991). Among them, the Cretaceous foraminifers diversified in the greenhouse interval. Morphologies of some Cretaceous species are very unique, and never reappeared after the K/Pg boundary (Norris, 1991). Its diversity has widely been discussed in relation with oceanic anoxic events in the mid-Cretaceous (e.g. Leckie et al., 2002).

On the other hand, size distribution within a modern planktic foraminiferal community, and intra-species size variation are known to respond to abiotic properties, such as temperature and salinity, and productivity (Bijma et al., 1990a, 1990b; Schmidt et al., 2004). However, the size distribution of the Cretaceous foraminifers has not been widely analyzed so far. We discuss the intra-species size variation of the mid-Cretaceous planktic foraminifer, *Hedbergella delrioensis*, and environmental qualities; paleotemperature, salinity and productivity.

Pelagic sediments used for this study were recovered in ODP Leg 207 at Demerara Rise, the equatorial Atlantic. Samples were washed through a sieve with 64μm opening. Approximately 100 individuals of *H. delrioensis* were picked from particles larger than 125 μm. The largest linear dimension of each individual was measured, and the stratigraphic variation of average size was described. Since TEX_{86} and carbon and oxygen isotope composition of planktic foraminifers have already been analyzed by Forster et al. (2007) and Moriya et al., (2007), stratigraphic variations of these proxies were discussed with the size distribution. Average size of *H. delrioensis* co-varies with the productivity estimated from the carbon isotope composition. Considering that the paleotemperature and salinity had been unchanged in the interval analyzed, it is expected that the size of *H. delrioensis* responded to the local productivity.

Bijma, J. et al. (1990) Jour Foram Res. 20, 117-127.
Bijma, J. et al. (1990) Jour Foram Res. 20, 95-116.
Forster, A. et al. (2007) Geology. 35, 919-922.
Leckie, R. M., et al. (2002) Paleoceanography. 17, 10.1029/2001PA000623.
Moriya, K. et al. (2007) Geology. 35, 615-618.
Norris, R. D. (1991) Paleobiology. 17, 388-399.
Schmidt, D. N. et al. (2004) Mar Micropaleontol. 50, 319-338.

Keywords: Cretaceous, planktic foraminifer, shell size, paleotemperature, productivity

Japan Geoscience Union Meeting 2015
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BPT25-04 Room:202 Time:May 24 15:00-15:15

Durophagous predation on scaphitid ammonoids in the Late Cretaceous Western Interior Seaway of North America

TAKEDA, Yusuke[1*] ; TANABE, Kazushige[2] ; SASAKI, Takenori[2] ; LANDMAN, Neil H.[3]

[1]Department Earth and Planetary Science, The University of Tokyo, [2]The University Museum, the University of Tokyo, [3]American Museum of Natural History

The study of the evolution of predator-prey interactions has contributed much to our understanding of the ecological background of biodiversity change through geological time, because they represent a driving force of natural selection. This study is the first to report a trend of predation intensity on scaphitid ammonoids from the Turonian to the Maastrichtian (Late Cretaceous) on the basis of analysis of ventral shell breakage in large samples from the U.S. Western Interior Province. Analysis of 835 adult specimens revealed ventral shell breakage in 50 specimens. In most of the damaged specimens, the breakage occurred in a preferred position at the rear part of the body chamber. Ventral breakage is rare in the Turonian specimens, whereas it is common in the Campanian and Maastrichtian specimens. The shell diameter of adult scaphitid ammonoids tends to increase with time. The position of the breakage and the absence of repairs indicate that the ventral breakage resulted from lethal predation. Based on the incidence of breakage and the size and shape of the breaks, possible predators include fish, reptiles, and cephalopods such as *Placenticeras*, *Eutrephoceras*, and coleoids. Our statistical analysis of ventral shell breakage indicates that the incidence of lethal predation increased in conjunction with an increase in adult shell size, suggesting that the body size of the prey was an important factor in predator?prey interactions. In addition, the predatory damage is more extensive in larger adults.

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BPT25-05 Room:202 Time:May 24 15:15-15:30

Origin and rapid dispersal of oceanic dolphins (Odontoceti: Cetartiodactyla) based on the oldest fossil record.

HIRAMOTO, Jun[1*] ; KOHNO, Naoki[2]

[1]University of Tsukuba, [2]National Museum of Nature and Science and University of Tsukuba, Japan

Oceanic dolphins (Delphinidae), such as killer whales, pilot whales and bottlenose dolphins, comprise approximately 36 extant species in 17 ˜19 genera, which makes them the most speciose group of cetaceans inhabiting the modern ocean. Despite their current diversity, the fossil record of delphinids is very limited, and it remains unclear how and when they first originated. Molecular clock analyses date the divergence of delphinids from other delphinoids (porpoises, belugas and narwhals) to the Early or Middle Miocene (about 23 ˜14 Ma). By contrast, the so far ”oldest” extinct taxon confidently referred to the group - *Eodelphinus kabatensis* from Hokkaido - is no older than Late Miocene (about 9 Ma). Thus, there is a considerable gap between the estimated time of origin as inferred from molecular data and the fossil record, respectively.

Here, we re-examine the extinct dolphin *Sinanodelphis izumidaensis* Makiyama, 1936, which is known from a relatively well-preserved skull and associated partial skeleton from the Middle Miocene Bessho Formation (approximately 13. 6˜11. 8 Ma), Nagano Prefecture, central Japan. Although initially described as a delphinid, later studies classified this species as Delphinoidea *incertae sedis* because of a lack of diagnostic characters and the incomplete preparation and limited accessibility of the holotype (the latter has been designated as a Natural Monument of Nagano Prefecture). For our analysis, we studied both the holotype (via direct observation and CT scanning) and two undescribed specimens (previously reported as Delphinoidea fam., gen. et sp. indet.) that were recovered from nearly the same locality and horizon. All of the specimens are similar in terms of general skull proportions, in having numerous, small teeth, and in having markedly asymmetrical external bony nares, indicating that they likely belong to the same species.

We performed phylogenetic analysis based on 84 species (all odontocetes) and 278 morphological characters, with the archaeocetes *Georgiacetus* and *Zygorhiza* used as out-group. Our results identify *S. izumidaensis* as one of the earliest diverging members of crown Delphinidae. This placement extends the fossil record of delphinids to ca. 14 ˜12 Ma, only slightly younger than - and therefore in agreement with - the youngest molecular divergence dates. A further, as yet undescribed fossil delphinid apparently also occurs in the Middle or Late Miocene (13. 6 ˜10. 3 Ma) of California. Together, *S. izumidaensis* and the Californian material demonstrate that delphinids may have inhabited both sides of the North Pacific as little as 1 Ma after their presumed time of origin. This, in turn, may be indicated that dolphins underwent a phase of rapid geographical dispersal early during their evolutionary history.

Keywords: Sinanodelphis izumidaensis, Delphinidae, Middle Miocene, Bessho and Aoki Formation

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BPT25-06 Room:202 Time:May 24 15:30-15:45

Benthic-pelagic coupling in Pliocene ocean: Geochemical and micropaleontologic evidence in the ichnofossil Phymatoderma

IZUMI, Kentaro[1*]

[1]Center for Environmental Biology and Ecosystem Studies, NIES

Numerous studies have revealed the evidence of benthic-pelagic coupling in various ocean areas. In terms of marine benthos, it is well known that feeding, growth and reproduction are generally synchronized with the seasonal input of phytodetritus to the sea-floor. However, compared to examples of modern organisms, little is known about the evidence of the ancient benthic-pelagic coupling. Thus, the present study carried out the geochemical and microscopic analyses of the fecal pellet-filled ichnofossil *Phymatoderma* from the Pliocene deep-sea strata. The aim of this study is to assess whether benthic-pelagic coupling functioned in the ancient ocean, with special attention to the temporal relationship between phytodetritus input and deposit feeding by the trace-maker. Elemental analysis revealed that Ca, which is probably derived from the calcareous microfossils, is significantly accumulated in the tuffaceous pellets. Because the CaO content of the pelletal infill are generally similar to that of the host siltstones, it may be concluded that the recognized Ca accumulation in pellets does not reflect diagenetic alteration. SEM observations showed the presence of various types of microfossils (i.e., coccoliths, diatoms, planktonic foraminifera, radiolaria) within the pelletal infill of *Phymatoderma*. In addition, excreted tuffaceous fecal pellets are occasionally found to be composed exclusively of coccoliths. Considering all these lines of evidence, it is most likely that the deposit-feeding by the *Phymatoderma*-producer was synchronized with an episodic (probably seasonal) coccolithophore bloom deposition on the deep-sea floor. The reconstructed feeding strategy may have facilitated the effective uptake of freshly deposited phytodetritus. This interpretation is quite reasonable because such a mode of feeding has been commonly recognized in the case of deep-sea deposit-feeding macro and megabenthos. In summary, this study provides geologic evidence for benthic-pelagic coupling in the Pliocene ocean.

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BPT25-P01 Room:Convention Hall Time:May 24 18:15-19:30

A remain of a gigantic oviraptorosaurian (Dinosauria: Theropoda) from the Upper Cretaceous of the Gobi Desert

TSUIHIJI, Takanobu[1*] ; WATABE, Mahito[2] ; BARSBOLD, Rinchen[3] ; TSOGTBAATAR, Khishigjav[3]

[1]The University of Tokyo, [2]Osaka City University, [3]Mongolian Paleontological Center

A large, isolated symphyseal region of fused contralateral dentaries belonging to a caenagnathid oviraptorosaurian was found in the lower Upper Cretaceous Bays Shire Formation cropping out at Tsagaan Teg in the Mongolian Gobi Desert. This specimen is comparable in size and morphology to the gigantic caenagnathid *Gigantoraptor erlianensis* known from the Iren Dabasu Formation in China, and may be closely related to the latter species. The occurrence of the specimen of a possible affinity with *G. erlianensis* in the Bays Shire Formation is consistent with the hypothesized correlation between the Bayn Shire and Iren Dabasu formations proposed based on vertebrate fossils, especially turtles.

Keywords: Mongolia, Gobi Desert, Oviraptorosauria, Cretaceous, Dinosauria

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BPT25-P02 Room:Convention Hall Time:May 24 18:15-19:30

Desmostylian phylogenetic relationship revisited

MATSUI, Kumiko[1*]

[1]Department of Earth and Planetary Science, University of Tokyo

Desmostylia is an extinct clade of marine mammals. They belong to Tethytheria or possibly Perissodactyla. They lived in North Pacific Rim from earliest Oligocene to earliest Late Miocene and are already extinct at the order level. Traditionally, Desmostylia has been divided into two families, Desmostylidae and Paleoparadoxiidae, based on their teeth morphology, with the former including 4 or 5 genera (*Ashoroa*, *Cornwallius*, *Kronotherium*, *"Vanderhoofius"*, and *Desmostylus*) and the latter 4 genera (*Behemotops*, *Archaeoparadoxia*, *Paleoparadoxia*, *Neoparadoxia*). Although the phylogenetic relationships within Desmostylia have been mostly unclear, two hypotheses were proposed: either both Desmostylidae and Paleoparadoxiidae are monophyletic groups, or Paleoparadoxiidae comprise paraphyletic outgroups for Desmostylidae. One factor contributing to such difference in the hypothesis was the lack of well-preserved specimens that can be used as suitable outgroups for phylogenetic analyses. Cooper et al. (2014), however, described a well-preserved skull of *Anthracobne* that is considered as an appropriate outgroup of Desmostylia. In this study, at first, I ran analyses on data matrices on the desmostylian interrelationship published in previous studies to examine reproducibility of the results, i.e., whether or not tree topologies reported in these studies could be recovered. Second, I analyzed the Desmostylian relationship by newly adding *Anthracobne* as an out-group to such data sets after examining the accuracy of their character coding. Phylogenetic analysis was conducted with equally weighted parsimony using TNT v. 1.1 (Goloboff et al. 2008). One thousand replicates of tree bisection reconnection branch swapping were run holding ten trees per replicate with all zero-lengths branches collapsed. For this analysis, published data sets were combined and revised to include 5 species of Desmostylia and 5 species of Paleoparadoxiidae. A whole data matrix including both cranial and postcranial characters and a culled matrix including cranial characters only were separately analyzed. In this analysis, analyses on both the whole and culled data sets resulted in Paleoparadoxiidae forming paraphyletic, successive outgroups for the monophyletic Desmostylidae. This result provides a phylogenetic framework for discussing various aspects of Desmostylian evolution.

Reference

Cooper et al. (2014). Anthracobunids from the Middle Eocene of India and Pakistan Are Stem Perissodactyls. PLoS One 9(10): e109232.

Goloboff et al. (2008). TNT, a free program for phylogenetic analysis. Cladistics 24: 1-13.

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BPT25-P03 Room:Convention Hall Time:May 24 18:15-19:30

Avian wing loading and aspect ratio correlate with track

TANAKA, Ikuko[1*]

[1]Graduate School of Science, Kobe University

Avian have two completely different styles of locomotion, flight and bipedal walking, and use them properly depending on situations. Avian track shapes are divided into three groups corresponding to habitat types, suggesting bipedal walking is controlled by habitats. Is flight, another locomotion type, controlled the same? To investigate it, we obtained data of wing shapes and bodyweights from modern birds, and examined if they showed similar groupings related to habitats. Multiple regression analyses reveal that wing loadings and wing aspect ratios for birds in each group defined by track shapes exhibit separate clusters that do not overlap with each other. This result shows that wings are also divided into three groups corresponding to habitat types, the same with track shapes. Thus, habitats unambiguously affect avian flight as well as walking. Past avian wings are seldom remained as fossils, whereas past avian tracks are often preserved fossilized. The correspondence relation between wing aspect ratio/wing loading and track shapes may constrain the past avian flight ecology and behavior from fossilized track records.

Keywords: ornithology, wing morphology, flight ecology, avian locomotion, multiple regression analysis, paleobiology

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BPT25-P04 Room:Convention Hall Time:May 24 18:15-19:30

Implication of peculiar internal fracturing in fossil nautiloids

KARASAWA, Tomoki[1*] ; MAEDA, Haruyoshi[2]

[1]Graduate school of Science, Kyoto University, [2]The Kyushu University Museum

Extinct Miocene nautiloid *Aturia cubaensis* from Uchiura Group (Fukui Prefecture) shows internal septa fragmentation though the outer wall is intact. Similar broken nautiloids fossils with intact outer walls and fragmented septa have been reported since 1980s and were interpreted as 'implosion', the fragmentation by increasing ambient water pressure during a dead shell sinks. In these *A. cubaensis*, however, sipluncles are filled with mud and mangled. This indicates this fragmentation occurred after a burial of the empty shell.

Septal fragmentation occurs at adapically half from a last septum. Intact air chambers are filled with grayish white mudstone though a fossil matrix is dark gray mudstone. Former is composed of matrix-supported and high porosity (about 25 - 35 %) and latter is grain-supported and low porosity (below 20 %). On the other hand, porosity of mudstone infilling of the siphuncle has usually high (more than 40 %). Especially it is highest at the collapse boundary between intact air chambers and fragmented septa (up to 70 %). In addition, clay minerals concentrates in the siphuncle near the collapse boundary. These lines suggest that the siphuncle-infilling soaks up the water in air chambers in diagenesis. This depressurizes insides of air chambers and thus makes considerable pressure difference between inside and outside of a buried nautilus shell, and finally septa collapse.

This internal fragmentation has not been found from ammonoids. Deformation of ammonoids occurs in outer walls mainly and can be explained by simple compactional process except for dissolution. This suggests difference of strength of structure between shells of nautiloids and ammonoids. Detailed taphonomic analysis could be a clue to structural mechanics of cephalopods shells.

Keywords: taphonomy, nautiloid, Miocene, diagenesis

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Chemotaxonomic fingerprints of alkenones and alkenoates in sediments of Lake Naga-ike on the Skarvsnes, Antarctica

NAKAMURA, Hideto[1*] ; TAKEDA, Mayumi[1] ; SAWADA, Ken[1] ; TAKANO, Yoshinori[2]

[1]Hokkaido Univ., [2]JAMSTEC

Long chain alkenones and alkenoates are widely distributed in marine sediments and their extent of unsaturation (U^{K}_{37}, $U^{K'}_{37}$) is extensively used for reconstruction of paleo sea surface temperature. Alkenones and related compounds have also been detected in various lakes, although there is a wide variation in alkenone compositions and the temperature calibrations between individual settings. These variations probably reflect the difference in alkenone producing species (strains) in lakes. Indeed, recent DNA analysis revealed that multiple lineages of the order Isochrysidales are distributed among alkenone containing lakes, and is considered to be engaged in the alkenone production (2-3). Culture based investigation on temperature calibrations suggested the significant variation of calibrations among Isochrysidaceae species (*Isochrysis galbana* (4), *Pseudoisochrysis paradoxa* (5) and *Chrysotila lamellosa* (6)). Therefore, taxonomic identification of alkenone producers is essential to the proper selection of calibrations and thus lead to better application of alkenone paleothermometer in lakes.

To elucidate chemotaxonomic characteristics of the compositions of alkenone and related compounds, we have been cultured 9 strains covering all 3 genera (*Chrysotila*, *Isochrysis*, *Tisochrysis*) of the family Isochrysidaceae, and proposed that the lack of tetraunsaturated alkenones are common characteristic for genus *Tisochrysis* (7). In this study, cultured Isochrysidaceae strains as well as sediments of antarctic lake Naga-ike were examined further into the compositions of alkenones and alkenoates. We discuss chemotaxonomic feature of triunsaturated alkenone isomers and novel C_{38} alkenoate which could be identified by a recently-developed method (8) using gas chromatography column with dipole selective stationary phase. Isomer of triunsaturated alkenones have previously identified from high latitude lakes (BrayaSø, Toolik Lake), which are characterized by a significant proportion of triunsaturated isomers ranging C_{37}-C_{39}(8). Meanwhile, triunsaturated alkenone isomer detected from *C. lamellasa* were solely C_{38}. Occurrence of C_{38} triunsaturated isomers along with novel C_{38} alkenoate are proposed as characteristics of *C. lamellosa* in the family Isochrysidaceae.

Lake Naga-ike is a freshwater lake on the Skarvsnes, Antarctica, and biomarker analysis has been carried out by (9) revealing ca. 3000 yrs record of alkenone compositions. Examination of the sediment of Lake Naga-ike by a new method (8) revealed that the co-occurence of C_{38} triunsaturated alkenone isomers and novel C_{38} alienate, suggesting a possible contribution of *C. lamellosa*. By using a calibration obtained from a culture strain *C. lamellosa* calibration (6), paleotemperature are calculated to be 9.2-15 ℃ in surface sediments of Lake Naga-ike. The estimated temperatures are concordant with a summer temperature of lake waters observed in Naga-ike, while other known culture based calibrations estimated extremely-low temperatures. This result may afford collateral evidence for the occurrence of alkenone producer closely related to *C. lamellasa*.

1) Prahl, F. G. and Wakeham, S. G., 1987. Nature, 330, 367-369.
2) Theroux, S., et al., 2010. Earth Planet. Sci. Lett. 300, 311-320.
3) Toney, J. M., et al., 2010. Geochim. Cosmochim. Acta 74., 1563-1578.
4) Versteegh, G. J. M., et al., 2000. Org. Geochem. 32, 785-794.
5) Theroux, S., et al., 2013. Org. Geochem. 62, 68-73.
6) Nakamura, H., et al., 2014. Org. Geochem. 66, 90-97.
7) Nakamura, H., et al., 2014. JGS Annual Meeting 2014.
8) Longo, W. M. et al., 2013. Org. Geochem. 65, 94-102.
9) Sawada, K. et al., 2014, AGU Fall Meeting 2014, B21E-0093.

Keywords: alkenone, Haptophytes, chemotaxonomy, lake sediments, paleothermomater

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An index of morphological turnover across a chronological boundary

UBUKATA, Takao[1*]

[1]Kyoto University

Study on morphological diversity over geologic time has been conventionally based on the patterns of disparity change. Change in disparity across a mass extinction event is determined by the relationship between a temporary decrease in morphological variation and subsequent introduction of new variation after the event. In the case of a balanced relationship, the disparity remains constant throughout the interval, even if the morphology was totally changed. An alternative approach is an analysis of morphological turnover in which appearance patterns of morphospace occupation are compared between the adjacent geochronological units. However, conventional morphospace analyses have omitted abundance of each species. Here, I would introduce an index representing how drastically the pattern of morphospace occupation changes. The index takes into account the abundance of each species based on the collection-based occurrence data deposited in the Paleobiology Database. The analysis of the morphological turnover begins with depicting the landscape of the probability density of data in a morphospace for each chronological bin using multi-dimensional kernel density estimation. The similarity between a pair of the landscapes can be represented by a correlation coefficient of the probability density computed for each point in the multi-dimensional morphospace. The value of 1 minus the correlation coefficient is defined as an index of morphological turnover. This index is sensitive to change in morphospace occupation pattern.

Keywords: morphospace, disparity, mass extinction and recovery