

アンモノイドにおける殻形態と殻の厚さの関係

Relationship between conch geometry and shell thickness in ammonoids

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Ammonoids had a conch with chambered phragmocone that served as a buoyancy apparatus as in extant nautilus or spirulas. If ammonoids were nektonic or nektobenthic animals, weight saving may have been critical for their locomotion. The relative density of the ammonoid body depends on conch geometry as well as shell thickness. If the conch geometry is such that its surface area to volume ratio is high, a large amount of calcium carbonate is required to form such a conch. An effective way to avoid overweight in ammonoids is to control shell formation such that more inefficient shape with a high surface-area to volume ratio is correlated with thinner shell thickness. In the present study, the relationship between conch geometry and shell thickness was examined in a total of 87 ammonoid species ranging in age from Devonian to Cretaceous. Specific surface was computed for theoretical models of ammonoid shell morphology with various values of Raupian parameter to assess how efficient each shape is to save the body weight. The values of the Raupian parameters were examined for each growth stage of the specimens examined and the specific surface of the model defined by the parameter values was calculated for each whorl. The relative shell thickness was measured for actual specimens as the cross-sectional area of shell material divided by the perimeter of the whorl cross section standardized by the conch diameter. As a result of morphometric analysis, a significant negative correlation was found between the specific surface and relative shell thickness; that is, the species with inefficient shell shapes tend to form whorls that are made of a thin material. The result suggests that density control was critical for ammonoids and conch geometry was important for their hydrostatic properties.

キーワード：アンモノイド、比表面積、殻の厚さ

Keywords: ammonoids, specific surface, shell thickness

大分県玖珠盆地中新統野上層産淡水魚類化石の重要性と意義 -カワムツの起源と古生物地理を例に-

The significance of the Middle Pleistocene freshwater fishes from the Nogami Formation in Kyushu, Japan based on the study of phylogeny and paleobiogeography of the genus *Nipponocypris*

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中部更新統野上層は珪藻土を主体とする湖成層で、更新世の淡水魚類化石が産出することで知られており、これまでサケ科のビワマス類似種 (*Oncorhynchus masou* subsp.), コイ科のニゴイとコウライニゴイの中間型 (*Hemibarbus barbus* x *labeo*), カワムツ類似種 (*Zacco* cf. *Z. temminckii* = *Nipponocypris* sp.), タナゴ属の一種 (*Acheilognathus* sp.), ハゼ科のヨシノボリ (*Rhinogobius brunneus*) とゴクラクハゼ (*R. similis*) の3科5属6種が報告がされている。また、ほぼ全身が保存された化石が多数産出しており、現生種との骨学的比較が可能で、標本数も多いことから本魚類化石群は日本列島ならびに東アジアの淡水魚類の起源と変遷を考える上で重要である。本研究ではこれらのうちコイ科のカワムツ類似種と現生ハス類に関して系統分類学的研究ならびに古生物地理について検討を行った。

ハス類(*opsariichthys*)は日本列島や台湾のほか、東南アジア、中国、朝鮮半島、ロシアの大陸側にも生息している東アジア固有のコイ科魚類である。ハス類はハス属 (*Opsariichthys*), オイカワ属 (*Zacco*), カワムツ属 (*Nipponocypris*), タイワンアカハラ属 (*Candidia*), *Parazacco*属の5属からなり、化石は大分県の玖珠盆地野上層、石川県の中新統、中国の下部始新統Buxin層などから報告されている。

カワムツ類似種 (*Zacco* cf. *Z. temminckii*) と現生ハス類を比較したところ、背鰭骨格とウェーベル氏器官との間の上神経棘数が8つであること、背鰭の最初の3つの軟条が不分岐で分節しないこと、主鰓蓋骨後縁部が凹むこと、椎骨数が42-44であることなどの組み合わせからオイカワ属 (*Zacco*) ではなく、カワムツ属 (*Nipponocypris*) に属することが判明した。

カワムツ属はカワムツのほかにヌマムツ、コウライカワムツが知られている。これらの現生種を含んだ国内外の現生ハス類の5属9種を用いた分岐分析および系統地理学的解析を行った。その結果、玖珠盆地産カワムツ類似種は現生カワムツと姉妹関係にあることが推定された。このことは現生カワムツの祖先が遅くとも中期更新世には東アジアで分化していたことを示すものと考えられる。また、中期更新世のカワムツ類似種の存在は朝鮮半島と日本列島に分布するカワムツの起源が日本である可能性を示しており、カワムツが中期更新世以降に分布を広げた可能性を示している。このことは同様の分布域を示すオヤニラミなど他の日本の現生淡水魚類の起源と分化を考える上で重要である。

キーワード：コイ科、更新世、野上層、淡水魚類、カワムツ属、ハス類

Keywords: Cyprinid fishes, Pleistocene, Nogami Formation, freshwater fishes, *Nipponocypris*, *opsariichthys*

Living Polycystine Radiolarian Vertical Distribution in Southern Japan

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Polycystine radiolarians are one of the planktic micro-organism (Protista), bearing siliceous test, widely distributed in the world ocean. Their geographic and vertical distributions have been investigated in many regions, such as tropical and equatorial area of the Atlantic Ocean, Gulf of Mexico, Western Equatorial Pacific and subarctic area of the Northwest Pacific. However, we have a lack of studies, which aim to clarify radiolarian vertical distributions in area influenced by the Kuroshio Current (Northwest Pacific). The Kuroshio Current (KC) is a western boundary current of the Pacific Ocean, which bifurcates from the northward flow of the North Pacific Equatorial Current, carrying warm and oligotrophic water to the northeastern Asia. The KC is well-known for be relatively thick (could reach few hundred meters of thickness depending on area) and thus have a consequent influence on the regional oceanography and distribution of marine organisms. Therefore, in this study, we propose to elucidate how the KC influence the radiolarian species vertical distribution analyzing plankton tow samples collected off southern Japan. We have investigated samples collected during the cruise KT08-10 of R/V Tansei-maru and cruise KS15-4 R/V Shinsei-maru in spring 2008 and 2015 respectively. During the KT08-10, plankton tow samples could be collected at five stations in the northern East China Sea (ECS), an area influenced by a branch of the KC the so-called Tsushima Warm Current, while during the KS15-04, plankton tows samples could be collected at three stations in the Kyushu Palao-Ridge, an area influenced by the KC. The deepest samples collected in ECS reach 700 m (near the seafloor of this area), while in the Kyushu Palao Ridge, we could collect samples until 3000 m. In both area, the surface water is characterized by subtropical species such as *Tetrapyle circularis* group and *Didymocyrtis tetrathalamus*. However, colonial radiolarians seem to be more abundant in the Kyushu Palao Ridge. The sub-surface of the ECS is characterized by high abundances of *Eucecryphalus* sp. (200-300 m). However, the abundances of this species are much lower in the Kyushu Paleo Ridge, inferring that a *Eucecryphalus* sp. likely suggest sub-surface water proper to the ECS. For these water depths (200-300 m), *Pterocorys carnitatum* dominate the assemblage in Kyushu Paleo Ridge. *Pterocorys* group is generally associated to the sub-surface of the North Pacific Subtropical Gyre, so we may speculate that in Kyushu Paleo Ridge we have some influence of the Subtropical Gyre. Intermediate to deep-water depths are characterized by relatively high abundances of *Cycladophora davisiana* in the Kyushu Paleo Ridge, while this species is absent in the ECS. Few factors may be considered such as the depth of the seafloor in the ECS, and provincialism.

Keywords: Radiolaria, Vertical Distribution, Kuroshio Current

北海道日高地方波恵川クジラ化石産出地点周辺の中新統の地質と珪質微化石層序

Geology and siliceous microfossil biostratigraphy of the Miocene formations near the whale fossil locality, Hae River, Hidaka district, Hokkaido

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A calcareous concretion containing whale bones was discovered as a float during the riparian works on the Hae River, Hidaka Town in 2005. Radiolarian and diatom assemblages recovered from the concretion indicate the *Lipmanella redondoensis* Zone and the *Rouxia californica* Zone, respectively, suggesting an age of 7.7 to 7.4 Ma. This age is concordant with the age range of the Nina Formation which is distributed near the locality of the concretion and was previously dated as ca. 10.1 to 3.5 Ma based on the diatom stratigraphy in the surrounding area. However, because of very few biostratigraphic data for the sedimentary rocks exposing along the Hae River, the location of the original home of the concretion is unknown. In order to detect the home locality, we surveyed geology along the river and analyzed diatom and radiolarian biostratigraphy for the sedimentary sequence. The Nina Formation exposing along the Hae River mainly consists of diatomaceous mudstone, sandy mudstone and sandstone. Many of the studied samples yielded common to abundant fossil diatoms that include various index species, *Denticulopsis praedimorpha*, *Denticulopsis dimorpha*, *Denticulopsis katayamae*, *Thalassionema schraderi* and *Neodenticula kamtschatica*. The occurrences of these species indicate that the Nina Formation encompasses the Middle Miocene through the Pliocene. However, we have not found diatom assemblages indicative of the *Rouxia californica* Zone from the studied samples, and, thus, the home locality of the whale fossil is still an unsolved question.

キーワード：珪藻、放散虫、鯨類化石

Keywords: Diatom, Radiolaria, whale fossil