Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

BPO020-12 Room: 301B Time: May 25 16:45-17:00

Dietary analysis of marine naticid and ampullospirine snails: evidence from stable carbon isotope composition.

Makiko Ishikawa[1*], Nanako O. Ogawa[2], Naohiko Ohkouchi[2], Tomoki Kase[3]

[1]JSPS Postdoctoral Fellow, Waseda Univ., [2]Biogeos, JAMSTEC, [3]National Museum of Nature and Science

Naticids are predatory marine snails that feed on prey mollusks by drilling shell. The remarkable increase of drilled shell during the late Mesozoic has been cited as important evidence for the " Mesozoic Marine Revolution" hypothesis (Vermeij, 1987). The history of naticid predation has long been controversial because the oldest body fossil is from the Early Jurassic, while the alleged oldest drill hole is from the Early Cretaceous. Previous works have shown that "naticids" recorded prior to the Early Cretaceous all belong to the almost extinct subfamily Ampullospirinae, and Cernina fluctuata, the sole survivor of Ampullospirinae, is an algal grazer and does not belong to family Naticidae based on observation of the soft anatomy and dietary (Kase and Ishikawa, 2003). The feeding strategy of extinct animals inferred from the sole extant species, however, may sometimes be controversial.
Isotope analysis is another approach to reconstructing diet of fossil organisms. Stable carbon and nitrogen isotope compositions of animal tissue are controlled by their diet and provides a clue to estimate the trophic level of the target animal in marine and freshwater food chain (e.g., Michener and Schell, 1994). Particularly, primary producers have their characteristic carbon isotope compositions, and the conservative transfer of compositions to the animal from its diet can be useful in tracing food webs (Michener and Schell, 1994). We investigate the trophic levels of ampullospirine Cerina fluctuata and naticid Polinices mammilla collected from the Philippines on the basis of the stable isotopic analyses to extend our knowledge on the history of naticid predation. We also analyze two potential primary food sources of C. fluctuata as well. One is Enhalus acoroide, abundant seagrass at the collecting site, and the other is Padina australis, a macroalga frequently found in the stomach of C. fluctuata (Kase and Ishikawa, 2003). The average $d^{13}C$ and $d^{15}N$ values were -7.1 and 4.7 per mil for an individual of C. fluctuata foot, respectively, and were 4.5 and 1.4 per mil higher than those of P. australis. In contrast, the $d^{13}C$ of E. acoroide leaf material was 0.6 per mil higher than that of C. fluctuata. These results are consistent with the previous observation that C. fluctuata mainly fed on macroalgae (Kase and Ishikawa, 2003). On the other hand, the average $d^{13}C$ and $d^{15}N$ values were -13.0 and 7.2 per mil for an individual of P. mammilla foot, respectively. The diet of the modern ampullospirine and naticids were clearly distinguished by the isotopic signatures of their soft parts. The stable carbon isotopic composition differs between the ampullospinine and naticids even in their shells. The compositions were -19.7 and -23.3 per mil in C. fluctuata and P. mammilla, respectively, and were well reflecting the value of their soft parts.
Calcified skeletal tissues have preservational potential of organic material synthesized at the time of calcification for much longer periods than body tissues (e.g., Kashiyama et al., 2008). Our results suggest that the method may be applicable to fossil shells to analyze ancient food webs.

Kase and Ishikawa (2003) Geology 23, 403-406.
Kashiyama et al. (in press) In: Proceedings of the 7th International Symposium of Cephalopod-Present and Past.
Michener and Schell (1994) In: Stable isotopes in ecology and environmental science. 138-157.

Vermeij (1987) In: Evolution and escalation: An ecological history of life. 527 p.