

Assessment of local diversity in Cretaceous ammonoids from the Yezo Group using individual taxonomic abundance

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Exploring global diversity change across the Phanerozoic has been an important part of paleontology in the past quarter-century. It is widely known that the diversity estimates are seriously biased by variation in the volume of paleontological data and there have been many debates on how to remove the sampling intensity biases. The taxonomic richness has been standardized by sampling proxies such as collection-based occurrences and the amount of rock records. On the other hand, use of the number of individuals observed in each taxon is limited to the studies on sample level diversity at the outcrops because those data are not available at the global level. An intermediate approach between at the global and sample levels is commonly found in the tabulation of number of species for a particular taxonomic group through a restricted geologic time interval at the local level. However, such a local database compiled in a traditional manner does not record any information on abundance of each species in most cases.

Here, we studied chronological change in species diversity of Cretaceous ammonoids from the Yezo Group exposed in central Hokkaido, Japan, using the diversity indices that take into account the abundance of each species. This study was based on the fossil collections collected from Soya, Nakagawa, Haboro, Kotambetsu, Obira, Mikasa, Oyubari or Hobetsu areas and stored at Shizuoka University, National Museum of Nature and Science, Tokyo, Nakagawa Museum of Natural History, Mikasa City Museum and Hobetsu Museum. The number of individuals was counted for each species for each stratigraphic unit from the Cenomanian to Maastrichtian. A total of 9,834 individuals of 266 species was identified and counted.

The patterns of diversity change estimated in the present analysis were considerably different among collections even when the same diversity index was adopted. A plausible reason of this discrepancy is the difference in relative species abundance observed among collections. The only exception is the Shannon-Weiner function which exhibited a consistent pattern of diversity change independent of which collection was utilized. This result suggests that the Shannon-Weiner function is the most robust against variation in relative species abundance. The diversity estimates based on species richness tended to be correlated with the proportion of the rare species to the total number of species. This result suggests that these diversity estimates are readily distorted by the impact of rare species.

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