

Evaluation of chemical composition of conodont fossils in pelagic sedimentary rocks for application to reconstruction of paleo-seawater condition

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Conodont fossils are one of the best materials for reconstruction of paleo-seawater information. They are tooth-like phosphatic organs of the extinct group of marine animals Conodonta and generally preserves chemical information of paleo-seawater better than other carbonate fossils. Their chemical and isotope compositions have been used for paleo-environmental reconstruction; for example, their REE patterns and strontium isotopes ($^{87}\text{Sr}/^{86}\text{Sr}$) are used for estimation of paleo-redox conditions and paleo-weathering intensities, respectively. All of the prior researches on chemical composition of conodont fossils have focused on fossils from shallow marine carbonate rocks. However, geochemical researches on conodont fossils from pelagic deep-sea sediments have not been conducted so far. Herein, this study aims to evaluate the chemical composition of conodont fossils from pelagic deep-sea sedimentary rocks and establish methods of paleo-environmental reconstruction using the conodont fossils.

We collected pelagic deep-sea sedimentary rocks (chert and siliceous claystone) ranging from the Lower to Upper Triassic pelagic deep-sea strata from the Inuyama area, Aichi Prefecture, Central Japan. Collected samples were cracked parallel to the bedding planes into small “chips” and conodonts were found on the surface of these “chips” by careful observation under a stereoscopic microscope. In this method, any acid such as HF acid is not used in order to avoid elemental leaching during the extraction procedure. Conodont specimens were embedded in 1-inch diameter Petropoxy 154 resin, then polished on their surface with diamond paste (#60000).

Elemental mapping analysis of major elements by Electron Probe Micro Analyzers (EPMA) on the polished fossil specimens revealed their major components are Ca, P and F (24:14:5 in molar ratio), suggesting that they preserve their initial main elemental composition of apatite. The cathodoluminescence (CL) images and elemental mapping of minor elements by EPMA indicate that REEs were concentrated in $\sim 10\ \mu\text{m}$ -thick apatite layers at the outer margins of cracks and albid crowns of all analyzed conodonts. The results of laser ablation inductively coupled mass spectrometry (LA-ICP-MS) also indicate the existence of REE-rich layers at the rims of conodont albid crown and cracks. Some parts of the REE-concentrated layers shows euhedral shape implying that they are probably authigenic apatite precipitation after deposition of fossils. The REE concentrated layers are considered to be the main host of conodont REEs.

Values of Ce-anomaly (Ce/Ce^*) of the conodont fossils from the studied sections showed a stratigraphic variation through Lower to Upper Triassic, which is consistent with the shift of anoxic to oxic paleo-seafloor conditions previously reported by geochemical analysis of whole rock from the same section. Formation of Mn oxide at oxic seafloor-condition can explain positive Ce-anomalies of the variation (Takahashi et al., 2015; Fujisaki et al., 2016). In addition, Y/Ho of all conodont samples were 25~30 which is the value of terrigenous sediments. These results imply that, under anoxic condition, conodont fossils record REEs of terrigenous sediments, and under oxic condition they record those of terrigenous sediments and Mn-oxides.

Measured $^{87}\text{Sr}/^{86}\text{Sr}$ of conodont fossils using laser ablation multi collector inductively coupled plasma mass spectrometry (LA-MC-ICP-MS) were slightly higher than sea-water values predicted from shallow marine bioapatite, probably because of the spectral interferences caused by REEs absorbed on

conodont fossils analyzed in this study.

Keywords: conodont, chert