High-resolution Holocene records of a stalagmite from maritime Japan

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In East Asia, the climatic factor for the lowered meteoric water $\delta^{18}O$ during mid-Holocene than the last glacial period is still controversial. Previous interpretations on stalagmite $\delta^{18}O$ were recently re-examined with new records from the maritime Japan, in eastern part of the Asian monsoon region beyond the influence from Indian summer monsoon (Mori et al. 2018). However, their stalagmite presented limited records in the Holocene section because of low growth rate. Here, we report another stalagmite from the same cave (Kiriana cave in Mie Prefecture), which provides high-resolution records of stable isotopes and trace element during Holocene.

The ages of the 34-cm-long stalagmite were determined at 17 horizons through Uranium-Thorium dating method at the National Taiwan University. Stable isotopes were measured at 0.2-mm intervals using an isotope ratio mass spectrometer (Thermo Finnigan DeltaPlus) connected with an on-line gas separation and introduction system (GASBENCH II) at the Kyushu University. Trace element analysis was performed with inductivity coupled plasma optical emission spectrometer (iCAP7200, Thermo Fisher Scientific) at the Hiroshima University.

The stalagmite $\delta^{18}O$ displays similar temporal patterns with the Chinese records but exhibits much smaller amplitude of $\delta^{18}O$ than the Chinese records. This result supports the idea of Mori et al. (2018) that the stalagmite $\delta^{18}O$ record from this cave is a superimposed signal of variations in air temperature and seawater $\delta^{18}O$, rather than the hydroclimatic control on meteoric water $\delta^{18}O$. On the other hand, $\delta^{13}C$ of the stalagmite has more than 2‰ shift from mid- to late-Holocene with ~1‰ excursions in millennial timescale. The variation synchronized with Mg/Ca suggests that the $\delta^{13}C$ change is largely affected by prior calcite precipitation (PCP) from the infiltrating water in the karst bedrock, which generally increases under a dry condition. Supposing that $\delta^{13}C$ record of this stalagmite reflects PCP induced by precipitation change, we propose that precipitation or EASM variability is recorded more clearly in $\delta^{13}C$ rather than $\delta^{18}O$ of stalagmite in maritime Japan.

Keywords: Stalagmite, Stable isotope, Trace element, East Asian summer monsoon, Holocene

