

Stalagmite evidence for ^{18}O -depleted surface water of Japan Sea during the last glacial

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In East Asia monsoonal realm, stalagmites generally record lower $\delta^{18}\text{O}$ during warm humid interglacials and higher $\delta^{18}\text{O}$ in the cold dry glacials. Here, we present an unusual trend in stalagmite $\delta^{18}\text{O}$ between the last glacial interval and Holocene from Fukugaguchi Cave, Niigata Prefecture, where a major moisture source is the East Asian winter monsoon (EAWM) carrying vapor from the warm surface of the Japan Sea. The $\delta^{18}\text{O}$ profile of this stalagmite overall exhibits low $\delta^{18}\text{O}$ values; the mean sampled glacial $\delta^{18}\text{O}$ is distinctly lower than the mid-Holocene mean of another stalagmite (Sone et al., 2013) from the same cave. An interpretation assuming greater vapor transportation than mid-Holocene from the intensified EAWM during the last glacial contradicts marine carbonate records indicating that the entrance of the Tsushima Warm Current into the Japan Sea was interrupted because of lowered sea level. Additionally, our model indicates that the amount effect of winter meteoric water was insignificant. Low $\delta^{18}\text{O}$ in the stalagmite dated to glacial intervals in Fukugaguchi Cave most likely resulted from low-salinity and ^{18}O -depleted surface water, which developed in the isolated Japan Sea. This is the first terrestrial evidence indicating ^{18}O depletion and salinity of the Japan Sea surface water during the last glacial.

Keywords: stalagmite, East Asian winter monsoon, the last glacial period, Japan Sea