Abrupt warming at the onset of last deglaciation inferred from isotopic composition of fluid inclusions from a stalagmite in Okinawa

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Millennial scale abrupt climate changes have been occurred during the last deglaciation. Stalagmites is one of the most important archive to reconstruct terrestrial climate change in low- and mid-latitudes areas because of their high-accuracy of U-Th dating. However, interpretation of oxygen isotopic ratio ($\delta^{18}O_{ca}$) of calcite is not straightforward because it is controlled by two factors; $\delta^{18}O$ of dripwater and temperature at calcite formation.
Oxygen isotope ratio ($\delta^{18}O_{fi}$) and hydrogen isotopic ratio (δD_{fi}) of fluid-inclusions water preserve past isotopic ratios of drip water. Thus, they are useful to reconstruct not only the isotope composition of past rain water but also changes in temperature. In this study, we analyzed the $\delta^{18}O_{fi}$ and δD_{fi} in the fluid inclusions and the $\delta^{18}O_{ca}$ of a stalagmite. A stalagmite, HSN2, was collected in Hoshino cave in Minami Daito Island, Okinawa, Japan. The isotope compositions of fluid inclusion water were measured using a semi−automated version of our fluid inclusion analysis system (Uemura et al., 2016). The $\delta^{18}O_{ca}$ of calcite was measured using Gas-bench CF−IRMS (Delta V advantage). U-Th dates was measured at National Taiwan University. The stalagmite HSN 2 has grown continuously from about 21,800 to about 13,400 years before present, and thus covering a important transition period between the Last Glacial Maximum (LGM), Heinrich stadial 1 (H1), and Bølling-Allerød (BA). The temperature variation estimated from $\delta^{18}O_{fi}$ and $\delta^{18}O_{ca}$ shows significant increase in temperature from H1 to BA.

Keywords: stalagmite, fluid inclusions, stable isotope, last deglaciation

