

静岡県竜ヶ岩洞石筍の放射性炭素年代測定 Radiocarbon dating of stalagmites from the Ryugashi Cave, Shizuoka

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Stalagmites are cave deposits precipitated from drip water. Drip water consists of carbon derived from soil CO₂, which has atmospheric ¹⁴C values in isotopic equilibrium with atmosphere, and carbonate-dissolved CO₂, which has ¹⁴C-free (dead) carbon through interaction with cave host bedrock. As a result, drip water contains a percentage of dead carbon, which will make the ¹⁴C ages of the stalagmite older. Therefore, a correction of the dead carbon fraction is needed for ¹⁴C dating of stalagmites. In recent years, young stalagmites of 10-20 ka have been ¹⁴C dated by comparing the ¹⁴C on samples of known calendar age with the tree ring record of atmospheric ¹⁴C during a period of overlap (Hoffmann *et al.*, 2010; Southon *et al.*, 2012). This procedure involves the implicit assumption that dead carbon fraction in stalagmite remained constant through its growth time. In this study, therefore, we examined dead carbon fraction in two stalagmites from the Ryugashi Cave in Hamamatsu, Shizuoka by investigating seasonal variation in ¹⁴C concentrations of drip water coupled with soil CO₂, atmospheric CO₂, and host limestone, in order to reveal possibility of accurate and precise ¹⁴C dating on stalagmite in Japan.

The drip water samples showed ¹⁴C of 1130 BP to 980 BP and $\delta^{13}\text{C}$ of -10.1 ‰ to -9.1 ‰, which are lower in fall and winter, and higher in spring and summer, and have the annual means of ¹⁴C of 1025±140 BP and $\delta^{13}\text{C}$ of -9.4±0.4 ‰. The RYGS12 stalagmite of 7 cm in length showed 945±30 BP at its top and 2150±40 BP at its bottom, and had a growth rate of about 60 μm/yr. The calibrated age of RYGS12 was estimated by comparing the ¹⁴C with the IntCal13 calibration curve, resulting that the stalagmite had a constant dead carbon fraction through its growth time and gives ¹⁴C ages of 1050 years older than the true age. The carbon isotopic fractionation between drip water and stalagmite was negligible. The results indicate that high-resolution ¹⁴C measurement can be performed on stalagmites in the Ryugashi Cave.

The RYGS12 sample showed rapid decrease of $\delta^{13}\text{C}$ from -8.3 ‰ to -11.8 ‰ at around AD1450. The decrease suggests an increase of soil input to the stalagmite, since soil CO₂ has low $\delta^{13}\text{C}$ of -22.0 ‰. It is reported that there was a great earthquake of magnitude 8.6 (Meio earthquake) accompanied by a catastrophic tsunami in this study area in AD1498. Therefore, the $\delta^{13}\text{C}$ decrease might be caused by the Meio earthquake. In the presentation, we will present ¹⁴C result on another stalagmite sample RYG08 of 30 cm in length.

キーワード: 石筍, 放射性炭素年代, 炭素同位体比, 酸素同位体比

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