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Seasonal variation of dead carbon fraction in dripwater in the Ryugashi Cave, Shizuoka Prefecture, Japan

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Stalagmite is a cave deposit precipitated from dripwater. Dripwater contains some dead carbon derived from carbonate-dissolved CO_2 through interaction with cave bedrock limestone, which will make the ^{14}C ages of the stalagmite older, and so a correction of the dead carbon fraction (DCF) is needed for ^{14}C dating of stalagmites. In this study, we investigated seasonal variation in ^{14}C in dripwater in the Ryugashi Cave, Shizuoka Prefecture, to examine the DCF stability in a stalagmite. The results show that ^{14}C concentration in dripwater was different depending on the site in the Ryugashi Cave, and that the ^{14}C showed similar seasonal variations at all sites: lower in fall and winter, while higher in spring and summer, though the extent of the seasonal variations was different by site. The ^{14}C concentration in dripwater tended to be higher (DCF tends to be lower) in dripwater with lower drip rate, indicating that the ^{14}C in dripwater was correlated with the drip rate, and also correlated with rainfall amount around the Ryugashi Cave.

A growing stalagmite collected from a site in the Ryugashi Cave showed a roughly constant DCF (around 12%) compared with the ^{14}C with the IntCal13 calibration curve, though the DCF was slightly fluctuated in detail. The results indicate that high-resolution ^{14}C measurement can be performed on stalagmites in the Ryugashi Cave, and further that the DCF fluctuation observed for stalagmites could give information on change of paleo-rainfall amount. Based on the scenario that the increase in rainfall amount brings the increase in drip rate of dripwater, followed by the increase in soil-derived carbon fraction in dripwater, further followed by the ^{14}C increase (DCF decrease) in dripwater, the reconstruction of precipitation could be performed using DCF variation in a stalagmite.

Keywords: dripwater, stalagmite, radiocarbon