

Development and prospective of stalagmite paleoclimatology

Akihiro Kano^{1*}

¹SCS Kyushu University

Stalagmites are forefront archives of terrestrial paleoclimates during late Pleistocene and Holocene, which have advantages in precise dating by U-series methods and lamina counting. Oxygen isotopic age-profiles from the caves in south China have provided the standard paleoclimatic records that reveal the change in intensity of the summer Asian Monsoon. Stalagmite studies in Japan have just started recently. Our research group, for instance, has revealed that 1) oxygen isotopic profile in Hiroshima Prefecture conforms the Chinese profile in the deglaciation period, and that 2) the Holocene oxygen isotopic profile in Niigata Prefecture may indicate intensity of East Asian winter Monsoon. Such case studies have been published from around the world. While, studies on interpretation of geochemical proxies are still ongoing. The stalagmite records cannot quantitatively evaluate temperature and rainfall changes because a complex of processes in the atmosphere, the soil layer, and the cave controls stable isotope values and trace element contents in a stalagmite. The stalagmite oxygen isotope value changes with rainfall intensity, rainfall seasonality, temperature, and evaporation of water, whereas the carbon isotope value reflects drip rate of the water on a stalagmite, vegetation types, and soil moisture. Another important effect is prior calcite precipitation, a degree of calcite precipitation from the water before dripping on a stalagmite, which largely influences to the carbon isotope value and the trace element contents. Despite of complexity of the processes, the prominent synchronicity appears among the stalagmite records from different regions. This was found for some climatic events and supported the climatic teleconnection in the Northern Hemisphere. The age-profile of the isotopic and chemical proxies certainly involves paleoclimatic information. Novel techniques in the stalagmite paleoclimatology will be developed to separate the effects from temperature and from rainfall amount to the oxygen isotope value.

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