

BPT002-03

Room:201B

Time:May 25 09:00-09:15

Age models of stalagmite from Shimochibaru cave in Kume Island, using radiocarbon dating

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Speleothem is a unique archive of past climate and has been used for paleoclimate studies. Advancement of analytical chemistry using mass spectrometry enable us to establish the record of past precipitation, temperature, and vegetations of various terrestrial regions. The most commonly used measure of radiometric age determination is Uranium series dating which can establish high precision age models. Although radiocarbon dating is powerful tool to determine the past climate events up to 50,000 years ago recorded in geological samples, nature of speleothem deposition processes make this method to be difficult to apply. It is so called dead carbon effect that groundwater dissolve much older carbon (ie. no radiocarbon) before it precipitates as speleothems other than ambient atmospheric CO₂. However several previous studies have attempted to correct this effect and an example from Bahama using coupled measurements of radiocarbon and U-series dating reveal constant contribution of dead carbon for the last 50,000 years (Beck et al., 2001), yet few studies reported using this strategy. In this study, we measured more than 30 of AMS (Accelerator Mass Spectrometry) radiocarbon dates for 2 speleothems collected from Kume Island in Okinawa, Japan. All the radiocarbon ages are stratigraphically in order and no age reversals were observed. Several newly formed speleothems on cave floor suggested that approximately 20 percent dead carbon contamination shift radiocarbon concentrations in speleothems as is consistent with Bahama and other records reported from similar geological settings. Corrected radiocarbon ages suggested that two speleothems preserve early to mid Holocene records. It will be therefore useful for studies of past Monsoon reconstructions since the period overlapped with the time when Monsoon activities were stronger than today according to Chinese cave records (eg., Wang et al., 2005). We conclude that systematic radiocarbon dating can be utilized as reliable age determination tools if the dead carbon content corrections are properly applied.

Keywords: stalagmite, radiocarbon age, dating, Kume Island