Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

APE33-P12 Room:Convention Hall Time:May 24 17:15-18:30

Carbon and Oxygen Isotopic Variation over the Last 1000 Years of a Stalagmite from West Java, Indonesia

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Equatorial region are important because of driving global atmosphere circulation. Though climate changes during the past few millennia have been reconstructed using stalagmites and lake sediment recently, there are only a few high resolution (especially annual- to centennial-scale) paleoclimate records in equatorial region. Stalagmites provide continuous paleoclimate records in land and are dated accurately by U-Th dating. For that reason many studies use oxygen and carbon isotope ratios of stalagmites as paleoprecipitation proxies (e.g. Zhang et al., 2008; Jex et al., 2011).

This study aims to reconstruct variation of past precipitation in Asian equatorial region by analyzing carbon and oxygen isotope ratios (d13C, d18O) from the annually laminated stalagmite CIAW15a, which is obtained from Ciawitali Cave in West Java, Indonesia. Watanabe et al. (2010) reveals d13C and d18O of CIAW15a is affected by kinetic fractionation occurring in the cave and proposes the possible process that d13C and d18O of CIAW15a record variation in local precipitation amount through kinetic process in the cave. Based on the previous study, this study did the following things:

(1)d13C and d18O time series of CIAW15a are compared with instrumental precipitation data and evaluated as proxies to reconstruct past precipitation.

(2)Annual d13C and d18O are analyzed along the growth axis following Izutani (2010), and precipitation before instrumental observation is reconstructed.

d13C and d18O are dated using the average thickness of the uppermost 106 layers. We compared temporal variation between precipitation data and isotopic data of the stalagmite CIAW15a dated using the average thickness of 44.8 micrometer. There are significant negative correlations. Further analysis reveals that d13C and d18O of CIAW15a have high correlations with precipitation amount in rainy season (December-April).

SOI (Southern Oscillation Index), which is an index of ENSO (El Nino/Southern Oscillation), shows no significant correlation with d13C and d18O of CIAW15a. In this region ENSO has high correlation with precipitation in dry season (June-October), while d13C and d18O reflect precipitation amount in rainy season (December-April). Therefore, it supposes that ENSO was not recorded clearly in d13C and d18O variation.

Annual d13C and d18O of CIAW15a were analyzed over the last 1000 years. d13C and d18O are dated using U-Th age model. d13C and d18O variations are synchronous in 10-30 year order during the last 600 years, indicating that they reflect kinetic processes in the cave relating to variation of local precipitation amount. Higher d18O (d13C) of CIAW15a in AD 1425-1625 and 1760-1800 are consistent within age error with periods of droughts recorded in lake sediment from East Java (Rodysill et al., 2012; Crausbay et al., 2006).