Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SGL44-02 Room:421 Time:May 2 14:30-14:45

Chronology of Brunhes-Matuyama geomagnetic polarity transition recoreded in sediments and climate change

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Channell et al. (2010) suggested that the midpoint of the M-B boundary lies at 773.1 ka, ~7 kyr younger than the previously accepted astrochronological age for this polarity reversal (780-781 ka). Their results are based on the five high-resolution Matuyama-Brunhes polarity transition records from the North Atlantic placed on isotope age models produced by correlation of the d18O record to an ice volume model. They further inferred that the 40Ar/39Ar Fish Canyon sanidine (FCs) standard age that best fits the astrochronological ages is 27.93 Ma, which is younger than the two recently proposed FCs ages of 28.201 +- 0.046 Ma (Kuiper et al., 2008) and 28.305 +- 0.036 Ma (Rene et al., 2010). However, recent study by Ganerod et al. (2011) suggested an age of 28.393+-0.194 Ma for FCs based on paired 40Ar/39Ar and 206Pb-238U radiometric dating supporting the calibrations of Kuiper et al. (2008) and Renne et al. (2010). Furthermore, recent study by Rivera et al. (2011) suggested an age of 28.172+-0.028 Ma for FCs based on cross-calibration with an astronomically tuned age of A1 tephra sanidines in the studied sequence of Faneromeni section in Crete. The discrepancy is significant that needs to be investigated carefully especially in terms of climate system involved.

On the other hand, the age model for relative paleointensity stack PISO-1500 (Channell et al., 2009) is based on IODP U1308 from North Atlantic. Channell et al. (2008) developed the age model for U1308 by correlating the benthic oxygen isotope curve with LR04 oxygen isotope stack (Lisiecki&Raymo, 2005). LR04 stack is known as oxygen isotope stack for benthic foraminifarra, whose age model is dependent on ice volume model with a certain time lag. Caballero-Gill et al. (2012) developed an absolute age model based on U-Th dating for stalagmites from China and correlated the oxygen isotope curve with that on planctonic foraminiferra for a deep-sea core from South China Sea. On the basis of the radiometrically calibrated chronology, they estimated that the time constant of the ice sheet is 5.4 kyr at the precession band and 10.4 kyr at the obliquity band. These values are significantly shorter than the single 17 kyr time constant originally estimated by Imbrie et al. (1984), based primarily on the timing of terminations I and II and the 15 kyr time constant used by Lisiecki and Raymo (2005) for LR04 stack.

In the presentation, the chronology of Brunhes-Matuyama geomagnetic polarity transition will be further discussed in relation to the chronology of 10Be records of EPICA Dome C (Dreyfus et al., 2008).

Keywords: Brunhes-Matuyama polarity transition, chronology, sediment, oxygen isotope, ice sheet, astronomical calibration