

A revised chronology of the Dome Fuji ice core from O_2/N_2 of trapped air

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Accurate ice core chronology is essential to examine the sequences, durations and phasing of climatic records. A chronology for the Dome Fuji (DF) ice core (DFO-2006, for 340 kyr BP) was constructed by synchronizing variations in O_2/N_2 of occluded air with local summer insolation, with stated 2σ error of about 2 kyr (Kawamura et al., 2007). However, it was found that DFO-2006 at ~100 kyr BP and ~129 kyr BP (end of Termination II) are older by ~3 kyr and ~2 kyr, respectively, than U-Th radiometric dating of Chinese speleothems with stated 2σ error of <1 kyr (Cheng et al., 2009; Fujita et al., 2015). Poor quality of the O_2/N_2 data due to diffusive gas loss during core storage in “warm” freezer (-25 °C) may be responsible for the discrepancies. Also, large noise in the O_2/N_2 data between 220 and 230 kyr BP hampered its use for constraining the time scale, thus the O_2/N_2 data from the Vostok ice core was used for the chronological tie points at 221.2 and 230.8 kyr BP in DFO-2006. Here we re-analyzed O_2/N_2 to improve the DF chronology before 80 kyr BP, using the samples stored at -50 °C. After careful tests, we found that ~1-cm-thick surface layer must be removed to eliminate the effect of gas loss for ~20 years. With our new O_2/N_2 data, the DF chronology was revised with the tuning technique of Kawamura et al. (2007). The new DF chronology between 80 and 165 kyr BP agrees with the speleothem chronology within 1.2 kyr. In particular, the DF age at the end of Termination II agrees with the speleothem chronology and the AICC2012 ice core chronology within ~1 kyr. The results suggest that O_2/N_2 in the DF core faithfully records local summer insolation, and that the revised chronology greatly improved from DFO-2006. We will extend the O_2/N_2 record further back in time and show the new data in the presentation.

Keywords: Ice core, Dome Fuji, O_2/N_2 , chronology