

Age synchronization between an Antarctic ice core and Northern Hemisphere marine cores: with special focus on MIS 11

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Investigation of the roles of different forcings (e.g. orbital variations and greenhouse gases) on climate and sea level requires a paleoclimate chronology with high accuracy. Such a chronology for the past 360 ky was constructed through orbital tuning of O₂/N₂ ratio of trapped air in the Dome Fuji and Vostok ice cores with local summer insolation (Kawamura et al., 2007). We extend the O₂/N₂ chronology back to ~500 kyr by analyzing the second Dome Fuji ice core, and find the duration of 11 ka, 5 ka, 9 ka, and 20 ka for MIS 5e, 7e, 9e and 11c interglacial periods in Antarctica, with similar variations in atmospheric CO₂. The termination timings are consistent with the rising phase of Northern Hemisphere summer insolation.

Marine sediment cores from northern North Atlantic contain millennial-scale signatures in various proxy records (e.g. SST, IRD), including abrupt climatic shifts and bipolar seesaw. Based on the bipolar correlation of millennial-scale events, it is possible to transfer our accurate chronology to marine cores from the North Atlantic. As a first attempt, we correlate the planktonic d₁₈O and IRD records from the marine core ODP 980 with the ice-core d₁₈O and CH₄ around MIS 11. We find that the durations of interglacial plateaus of planktonic d₁₈O (proxy for sea surface environments) and benthic d₁₈O (proxy for ice volume and deep-sea temperature) for MIS 11c are 20 and 15 ka, respectively, which are significantly shorter than originally suggested. These durations are similar to that of Antarctic climate and atmospheric CO₂. However, the onsets of interglacial levels in ODP980 for MIS 11 are significantly later than those in Antarctic d₁₈O and atmospheric CO₂ (by as much as ~10 ka), suggesting very long duration (more than one precession cycle) for the complete deglaciation and northern high-latitude warming for Termination V. Atmospheric CO₂ may have been the critical forcing for this termination. The long duration of Termination V is consistent with our new ice sheet simulations (extended from the work of Abe-Ouchi et al., 2013) in which an ice-sheet/climate model is forced by insolation and CO₂ variations. In the presentation, comparisons for other interglacial periods will also be reported.

Keywords: Antarctic ice core, Marine core, Chronology, Glacial-interglacial cycles