W155-003 **Room: 101A** **Time: May 29 9:26-9:39**

Phasing of orbital forcing and Antarctic climate over the past 470,000 years from an extended Dome Fuji O2/N2 chronology

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Climate variations over the last million years are characterized by orbital periodicities of ˜100, ˜41 and ˜23 ky. While 23- and 41-ky components are understood as linear climatic responses to forcings by precession and obliquity, respectively, the 100-ky cycle cannot be explained as a linear response to eccentricity. It has been suggested that the 100-ky cycle is caused by skipping of higher frequency beats which results in the bundling of either 4 or 5 precession cycles (Raymo, 1997, Paleoceanography), or 2 or 3 obliquity cycles (Huybers and Wunsch, 2005, Nature), each grouping resulting in an average ˜100 ky periodicity. Another type of hypotheses proposes that primary forcing to create the 100-ky glacial cycle is atmospheric CO2 (e.g. Shackleton, 2000, Science).

In order to investigate the roles of orbital and greenhouse-gas forcings on climate, one needs a paleoclimate chronology with an accuracy better than ˜2 ky (˜1/10 of precession cycle). Recently, Kawamura et al. (2007, Nature) established such an Antarctic ice-core chronology for the past 360 ky through orbital tuning of O2/N2 ratio of trapped air in the Dome Fuji and Vostok ice cores with local summer insolation (Dome Fuji data available from http://www.ncdc.noaa.gov/paleo/icecore/antarctica/domefuji/domefuji.html). The O2/N2 chronology permits comparisons between Antarctic climate, atmospheric greenhouse gas and insolation variations, thus providing a possible way to separate the respective contributions.

Here we extend the O2/N2 chronology back to 470 ky ago using the second Dome Fuji ice core (which recently reached 3,035 m depth or ˜720 ky), in order to cover Marine Isotope Stage 11 and Termination V. The accuracy of the extended part of the chronology is better than 2 ky even for the period with small precession amplitude (i.e. small O2/N2 variation), owing to substantial improvement in data precision (by a factor of more than 3 over the previous data). The onset of Antarctic warming for the last five Terminations is found to occur within the rising phase of summer insolation at high northern latitudes. Furthermore, null hypotheses that the last five Terminations are not paced by precession can be rejected at 5 % significance level, while null hypothesis for obliquity cannot be rejected, with high statistical power. Antarctic cooling at the last four glacial inceptions appears to be in phase with the decline of northern summer insolation and obliquity, but earlier than atmospheric CO2 decrease by a few millennia. These results are consistent with the classic Milankovitch theory that high northern latitude summer insolation is the primary pacemaker of the late Pleistocene glacial cycles. Important questions that should be explored by climate/ocean/ice sheet models are the mechanisms by which (1) the 100-ky glacial cycle is shaped by precession forcing and (2) northern climate signal is transferred to Antarctica without changing CO2 concentration.