The last deglaciation in Antarctica: Insights on the amplitude and timing of a two step event

by P. Ciais[1], R. Vaikmae[2], J. Jouzel[1,3], J. R. Petit[3] and M. Stievenard[1]

[1] *Laboratoire de Modelisation du Climat et de l'Environnement, Centre d'Etudes de Saclay, Gif sur Yvette, France*
[2] *Institute of Geology, Estonian Academy of Sciences, Tallin, Estonia*
[3] *Laboratoire de Glaciologie et de Geophysique de l'Environnement, Univ. de Grenoble, St Martin d'Heres, France*

Recent ice cores GRIP and GISP-2 in central Greenland have shown that temperature increased rapidly at the onset of the Bølling interval (14.5 ka BP), remained warm during the Allerød, and returned to full glacial cold during the Younger Dryas, which terminated abruptly at 11.6 ka BP (Alley et al., 1993; Johnsen et al., 1993). This characteristic sequence is well recognized in Western Europe as well as in the North Atlantic basin. Recent results suggest that it could also be extended throughout the Northern Hemisphere. However, there is little evidence for a Younger Dryas style event in the Southern Hemisphere.

The existing East Antarctic deep ice cores were not sampled specifically to study the Last Deglaciation. Their dating was no better than 10% over that period, hindering any detailed comparison with the Northern Hemisphere. However, the cores of Vostok and Dome C have shown that the deglacial warming is a two-step event, interrupted in the middle by a cold reversal (ACR) (Jouzel et al., 1987; Jouzel et al., 1991). A new core obtained at Dome B in East Antarctica is sampled for isotopes with a greater resolution and fully confirms the shape of the ACR previously recognized at Dome C and Vostok. Besides, recent work makes it possible to date more accurately (± 5%) the Byrd ice core in West Antarctica (Hammer et al., 1994). The new dating gives an age of 14.6 ka for the drastic collapse in aeolian dust deposition observed at Byrd. Because the collapse in aeolian dust is a well recognized marker in all Antarctic cores (Jouzel et al., 1991; Petit et al., 1990), it can be used to adjust the dating of Dome B and other east Antarctic cores (Fig. 1). New insights on the Last Deglaciation in Antarctica are obtained (Jouzel et al., 1994).

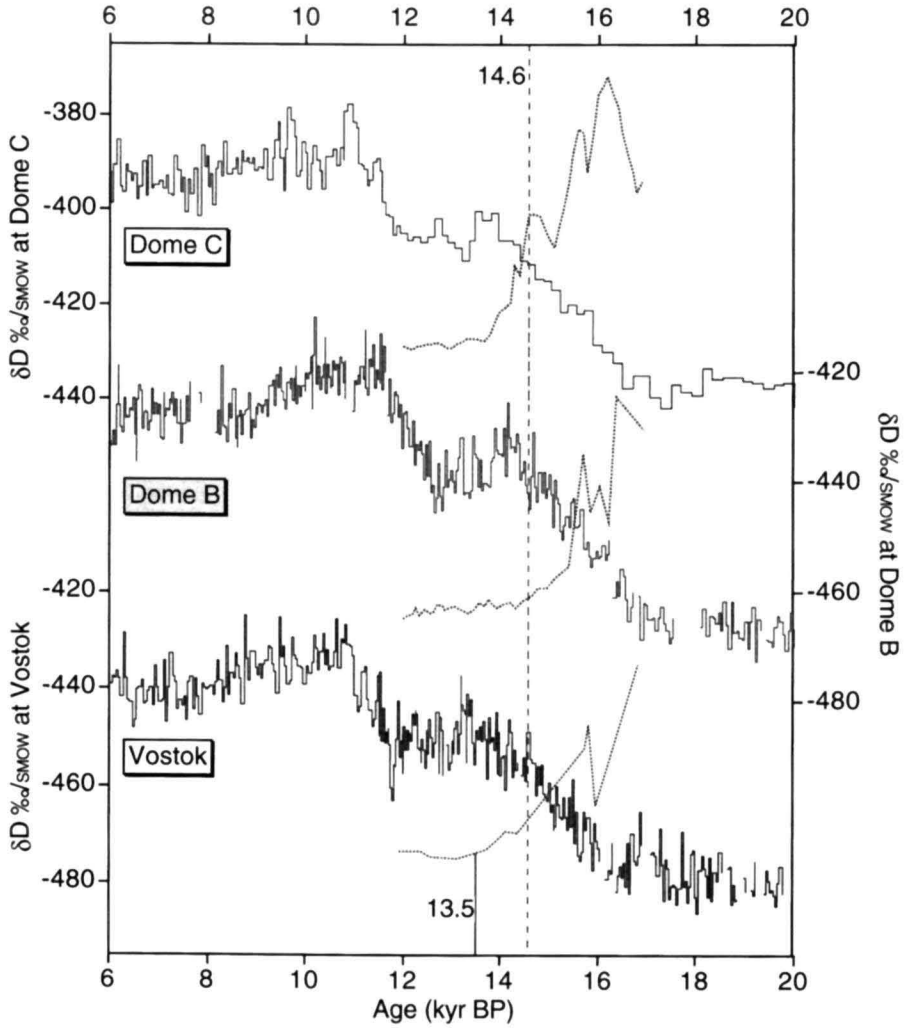

Fig. 1. Isotopic profiles vs age for Dome B and other Antarctic cores. δD is given for Dome C, Dome B and Vostok. Note the collapse of dust deposition (stippled lines), an event recognized everywhere in Antarctica.

PHASING OF THE ANTARCTIC DEGLACIATION

In Antarctica, the first deglacial warming starts at around 17 ka BP, hence before the main warming in Greenland. The onset of the ACR in Antarctica coincides with the progressive cooling trend of the Allerød in the north. However, the ACR may terminate approximately 1 ka before the Younger Dryas in Greenland. This latter finding yet has to be confirmed using north-south correlations of gasses trapped in air bubbles. Unlike the Younger Dryas in Greenland cores, the ACR does not end up abruptly.

CLIMATE CHANGE DURING THE ANTARCTIC DEGLACIATION

In Antarctica, the first deglacial warming is smaller than the Bølling warming in Greenland. By 14.6 ka BP, the antarctic warming is only about 65% of that corresponding to full glacial-Holocene changes. The ACR cooler interval is not as pronounced as the Younger Dryas cooling in Greenland (minus 3°C instead of minus 7°C). The terminal deglacial warming in Antarctica culminates into an Early Holocene Optimum which is not clearly observed in Greenland.

The aeolian deposition of continental dust collapses over Antarctica at 14.6 ka BP and there is no further re-increase during the ACR. This can be interpreted as a shut down of the Argentina continental shelf as a source of dust, under the sea level rise associated to Melt Water Peak One.

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