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Isotopic composition of the air trapped in the Berkner Island Ice Core (δ^{15}N, $\delta^{18}O_{atm}$, δ^{40}Ar) over the last glacial period and the deglaciation (50-6 kyrs)

E. Capron (1), A. Landais (1), V. Masson-Delmotte (1), J.-M. Barnola (2), R. Mulvaney (3)

(1) Laboratoire des Sciences du Climat et de l'Environnement, CEA CNRS-UVSQ, Gif-sur-Yvette, France, (2) Laboratoire de Glaciologie et de Géophysique de l'Environnement, CNRS, Grenoble, France, (3) British Antarctic Survey, Natural Environnement Council, Cambridge, England, United Kingdom (emilie.capron@lsce.ipsl.fr / Phone : 0169082702)

A 947 m deep ice core has been extracted from Berkner Island (78.36S, 45.43W, 950 m elevation) through a collaborative project between UK and France to bring new climatic insights on the West Antarctic region near the Weddell Sea, a region close to the Antarctic bottom water formation where the ice sheet is very sensitive to climate changes. This site is characterized by a mean surface temperature of –26˚C and an accumulation rate of 13.5 $g^{-1}.cm^{-2}.yr^{-1}$ which allows obtaining a high resolution climatic record of the last glacial cycle.

We performed measurements of the isotopic composition of the air trapped in bubbles in the ice (δ^{15}N, $\delta^{18}O_{atm}$, δ^{40}Ar) over the end of the last glacial period and the deglaciation. The $\delta^{18}O_{atm}$ profile, a pure atmospheric signal reflecting global ice sheet volume and biosphere productivity, brings new tie points for the establishment of the Berkner ice core chronology. The δ^{15}N signal is expected to give local information on the evolution of the firn structure. Our record reveals a high variability of δ^{15}N in Berkner Island during the last glacial period. Such variability in the δ^{15}N profile has never been measured in other Antarctic ice cores and we show that classical firn densification models are unable to predict either the trend or the scattering of this record. We question the firn physic integrated in models and the possibility to insert additional

components into densification models (convective zone, nature of the snow).

Even though the δD record does not show any indication for local rapid temperature change, we performed δ^{40}Ar measurements to test the hypothesis of a thermal effect on the isotopic fractionation which could induce such strong variability in the δ^{15}N profile.

The coastal localisation and altitude changes over the deglaciation of Berkner Island make difficult the use of δD data to estimate local accumulation changes. Considering that, we show that a possible way to reconcile model's outputs and measurements is to question the forcing parameters of the model (temperature and accumulation deduced from δD profile).