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# A new continuous 10Be record for the last 5000 years measured on ice chips from a borehole in East Antarctica

## Content

10Be concentrations measured from ice cores are key records for the reconstruction of long-term changes in solar activity and geomagnetic field intensity. Furthermore, 10Be records have additional applications for the dating of ice cores via the global cosmic ray signal, and studies of snow accumulation rates and atmospheric transport and deposition. Here, we present a new long-term 10Be record from ice chips recovered in austral summer 2017/2018 from Little Dome C, close to Dome Concordia station in East Antarctica and the location of the Beyond-EPICA drilling. The new ice chips were drilled by the so-called Rapid Access Isotope Drill method recently developed by the British Antarctic Survey [1]. This new drilling method is based on an auger enclosed in a barrel that quickly collects ice chips instead of recovering a fully intact ice core. The drill design allowed for about 461 m of ice to be drilled in Antarctica in only 104 hours and the chips are suitable for stable water isotope and 10Be analysis. This opens up the prospect of fast recovery of samples for a continuous 10Be record not necessarily connected to a large and costly ice core project.
Our new 10Be record covers the upper 161 meters of ice chips encompassing the last 5000 years. We prepared and measured the ice chip samples using the optimized method demonstrated in our recent publication [2]. The resulting 10Be concentration record agrees well with the 10Be concentrations in the GRIP ice core and the EDML ice core. Our new 10Be record also agrees with the global 14C production rate inferred from IntCal20 and thus reflects predominantly the atmospheric production signal of 10Be. Understanding the remaining differences should help us to improve the reconstruction of long-term changes in solar activity, which still contains significant uncertainties. We improved the initial timescale of the ice chips via synchronizing changes in the 10Be concentration to changes in the global 14C production rate. In addition, we observed insignificant mixing among the ice chip samples during the process of drilling and retrieving the ice. We highlight the advantages the new ice chip samples for assessing the long-term changes in 10Be deposition at different ice core sites.

[1] J. Rix, R. Mulvaney, J. Hong, D.A.N. Ashurst, Development of the British Antarctic Survey Rapid Access Isotope Drill, J. Glaciol. 65 (2019) 288–298. https://doi.org/10.1017/jog.2019.9.
[2] L. Nguyen, C.I. Paleari, S. Müller, M. Christl, F. Mekhaldi, P. Gautschi, R. Mulvaney, J. Rix, R. Muscheler, The potential for a continuous 10Be record measured on ice chips from a borehole, Results in Geochemistry. 5 (2021) 100012. https://doi.org/10.1016/j.ringeo.2021.100012.

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