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Minimum Age and Evolution of the Buried Ice in Beacon Valley, Antarctica, Derived from In Situ Cosmogenic Noble Gases

Peter Oberholzer (oberholzer@erdw.ethz.ch)[1], **Heinrich Baur** (baur@erdw.ethz.ch)[1], **George H Denton** (debbies@maine.edu)[3], **David R Marchant** (marchant@bu.edu)[3], **Jörg M. Schäfer** (schaefer@erdw.ethz.ch)[1], **Christian Schlüchter** (schlüchter@geo.unibech)[4], **Rainer Wieler** (wieler@erdw.ethz.ch)[1] & **Adam Lewis**[2]

[1] ETH Zürich, Isotope Geochemistry and Mineral Resources, Sonneggstrasse 5, 8092 Zürich, Switzerland
[2] Department of Geological Sciences and Institute for Quaternary Studies, University of Maine, Orono, ME 04469, USA
[3] Department of Earth Sciences, Boston University, 675 Commonwealth Avenue, Boston, MA 02215, USA
[4] Geologisches Institut, Universität Bern, Baltzerstrasse 1, 3012 Bern, Switzerland

Beacon Valley in the Dry Valleys region, Antarctica, is a key area for paleoclimatic and paleoglaciological investigations in Antarctica. On one hand, Taylor Glacier, a large outlet glacier of the East Antarctic Ice Sheet (EAIS) enters the mouth of Beacon Valley, which therefore records every increase in EAIS volume. On the other hand, Beacon Valley contains a unique glaciological puzzle: The valley floor is covered by large remnants of glacier ice overlain by till. This ice represents a sensitive indicator of climate warming (Sugden et al., 1995). Currently, age and evolution of the valley floor and the underlying ice are intensively discussed. Van der Wateren and Hindmarsh (1995) calculated sublimation rates of more than 100 m/Ma, implying a Late Pliocene age for the buried ice and the overlying till. In strong contrast, in situ volcanic ashes in wedges in the till are dated to be older than 8 Ma (Sugden et al., 1995), a figure interpreted as a minimum age for the buried ice. Recently, Schäfer et al. (2000) determined ^{3}He and ^{21}Ne exposure ages of boulders from the top of the till as well as from within the ice. The oldest surface sample yielded a minimum age of 2.3 Ma. We present here an extended surface exposure dating study of additional eleven rock samples, eight of them from the surface of the till, lying up to 500 metres apart, the rest buried by till and ice. Our goal is to extend the pilot study to a investigation representative of the entire Beacon Valley floor. We are determining minimum ages of the surface samples and maximum sublimation rates of the ice. The results shed light on the reworking dynamics of the ice and thus the evolution of the valley floor. Noble gases ^{3}He and ^{21}Ne were extracted from pyroxene separates by applying the stepwise heating procedure described by Schäfer et al. (2000). We use both the conventional Baur-Signer ion source and a novel ion source yielding a sensitivity increase of about a factor of hundred (Baur, 1999). Preliminary results give minimum ages of 3 Ma for the surface boulders. All three buried samples show significantly lower cosmogenic noble gas concentrations than expected from the present shielding by overlying ice and till. This implies a stronger shielding in the past which can be best explained with a higher ice level in Beacon Valley since the Mid-Pliocene. All these results confirm the findings of Sudgen et al. (1995) and Schäfer et al. (2000) that the ice has been deposited many million years ago and imply exceedingly low sublimation rates. No ice collapse occurred, contradicting Webb et al. (1984) who propose a deglaciation of the area during the Pliocene.

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