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Comparing Cosmogenic Nuclide Studies in the Dry Valleys and the Terra Nova Bay Area: Is the Antiquity of the Dry Valleys' Block Unique in Antarctica?

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Long-term erosion of rock surfaces as well as glacial advances are driven by climate. Additional parameters influencing erosion are lithology, presence of sea salt, endolithic micro-organisms etc. In recent years, surface exposure age dating (SED) using in-situ produced cosmogenic nuclides has proven to be a powerful tool to clarify origin and long-term erosion of landscape surfaces. The ice free parts of Antarctica offer a unique laboratory for long-term SED and erosion studies, respectively, as surfaces are exposed over many million years and erosion is slow. Especially the Dry Valleys Block, Southern Victoria Land, has been intensively investigated. It is meanwhile mostly accepted that this part of the Transantarctic Mountains has undergone minimal uplift since at least Early Pliocene (e.g. (1), that the last overriding by the East Antarctic Ice Shield occurred earlier than 10 Ma ago (2-4), and that the high altitude surfaces have been eroded exceedingly slowly, by a few cm/Ma only (e.g. (5), (4)). However, there is considerable debate whether the Dry Valleys Block is representative for the entire Transantarctic Mountains or if this region is rather unique with respect to landscape formation and evolution, paleoclimate and tectonics. Recently, (1) reported absolute surface exposure ages of 11.2 Ma and 6.45 Ma in Northern and Central Victoria Land, respectively. They interpreted this age discrepancy to indicate distinct histories of deglaciation, valley downcutting and uplift for different blocks of the Transantarctic Mountains. To shed light on this conflict, we set up a surface exposure study in the Terra Nova Bay area, Northern Victoria Land. A suite of glacial features was sampled, starting with a relict surface on top of Mt. Keinath followed by glacial erratics deposited by outlet glaciers of the East Antarctic Ice Shield. Our goals are to test whether old, hardly eroded surfaces exist in the Terra Nova Bay region and to add new information about the oscillations of the East Antarctic Ice Shield by dating the advances of the respective outlet glaciers. Cosmogenic helium and neon is measured in quartz and olivine samples, quartz separates are additionally analysed for cosmogenic 10 Be. We compare the Terra Nova Bay results to the extensive Dry Valleys data set. First results indicate high minimum exposure ages for the relict surfaces on top of Mt. Keinath of 3.5 Ma and low maximum long-term erosion rates of 15 cm/Ma. The exposure age is based on the assumption of no erosion, which is not realistic for the analysed coarse grained granites from the deeply weathered landscape at Mt. Keinath. Therefore, the exposure age is likely to be significantly higher. These results extend the conclusion of long-term cold and hyperarid paleoclimate drawn for the Dry Valleys to at least entire Victoria Land.

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