A late Cenozoic glacial history of the central Transantarctic Mountains, Antarctica using ^{3}He, ^{21}Ne, and ^{10}Be surface exposure ages

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Ice-free areas at high elevation in the central Transantarctic Mountains (TAM) preserve moraines and drift deposits that delineate the former thickness and extent of the East Antarctic Ice Sheet (EAIS). ~30 existing cosmogenic-nuclide exposure ages from scattered locations in the TAM indicate that some moraines and drift sheets are 5 Ma or older, implying that these features were deposited during warm periods of the Miocene and Pliocene, when the EAIS is hypothesized to have been smaller than present. To evaluate this, we have measured >350 ^{3}He, ^{10}Be, and ^{21}Ne exposure ages from glacially transported clasts on distinct ice-marginal landforms at Roberts and Otway Massifs, which abut the EAIS. The majority of these data comprise ^{3}He measurements on pyroxene extracted from Ferrar dolerite clasts and prepared using an HF etching method adapted from Bromley *et al.* [1] that improves measurement throughput and reproducibility. We address the common problem of scatter in exposure ages due to cosmogenic-nuclide inheritance by (i) measuring large numbers of exposure ages, including ~10 from each landform, and (ii) resampling and averaging approaches based on statistical criteria and field observations of boulder characteristics and geomorphic context.

Moraines at both Roberts Massif and Otway Massif are open-work boulder belts characteristic of deposition by cold-based ice, which is consistent with present climate and glaciological conditions. Apparent exposure ages at these sites range from ~9 ka to 14 Ma, with individual moraine ages as old as ~8 Ma, which shows that these landforms record glacial events in the central TAM since the mid-Miocene. We also use the ^{10}Be/^{21}Ne nuclide pair to constrain erosion rates of Beacon Sandstone boulders to < 3.5 cm/Ma, a testament to the long-term stability of this landscape. Our glacial chronology, combined with geomorphic mapping and calculated erosion rates, point to cold-based glaciation in the central TAM since at least ~8 Ma. Further, we show that the EAIS in this region was of similar thickness or thicker than present for long periods since ~14 Ma, including parts of the Pliocene and Miocene.

[1] Bromley et al. (2014) *Quat. Geochronol.* **23,** 1-8.