A global compilation of glacial ^{10}Be and ^{26}Al exposure age data

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Abstract

Cosmogenic dating of glacial landforms and deposits has become a key tool in paleoglaciology and it represents perhaps the most common usage of cosmogenic nuclide analysis within geosciences. Cosmogenic analysis has been used for defining the timing of past glaciations, constraining the amount of glacial erosion, and estimating durations of burial under non-erosive ice. The number of published glacial ^{10}Be and ^{26}Al measurements grew slowly during the 1990s, but has after year 2000 increased rapidly. Over the same time, there have been major development of methods for cosmogenic nuclide measurement and exposure age calculation, and an exposure age published some years back in time will often be different from the exposure age calculated today based on just the same data but using updated exposure age models. To enable smooth recalculation of glacial exposure ages and reuse of published data, I have compiled a global database of published glacial ^{10}Be and ^{26}Al exposure age data (Figure 1). The database contains necessary data for exposure age calculation for more than 10800 ^{10}Be measurements and more than 1600 ^{26}Al measurements (April 2016). The source of the data is recorded (e.g. corrected data mistakes) and all samples have been organized in groups representing distinct units (e.g. one moraine ridge). An analysis of the sample group exposure age clustering shows that a disturbingly large amount of the sample groups include scattered exposure ages that must be explained by prior and/or incomplete exposure. The time-span with the most well-clustered exposure age groups coincide with the last deglaciation post-dating the global LGM, and beyond 25-30 ka the fraction of well-clustered exposure age groups rapidly drops to very low numbers. Comparing boulder and bedrock exposure ages from the same locations, there is some overweight for younger boulders resting on older bedrock, indicating that bedrock samples are more prone to be affected by prior exposure and/or boulder samples more prone to be affected by incomplete exposure. Of the samples that have both ^{10}Be and ^{26}Al data, 53% have concentrations that coincide within uncertainties with a simple exposure history, 7% fall clearly in the forbidden zone (too high ^{26}Al/^{10}Be ratio), and 40% have a clear burial signal (reduced ^{26}Al/^{10}Be ratio). The data from Antarctica stick out with a large number of long exposure and long burial duration samples.

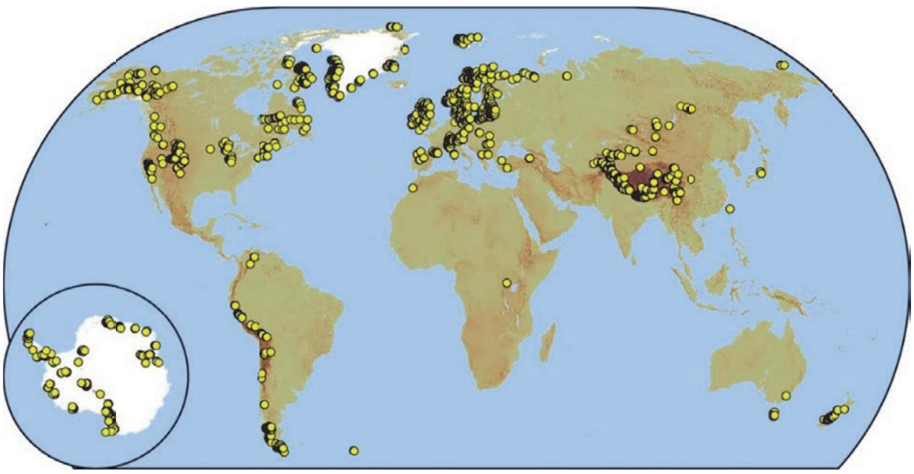

Figure 1. *Spatial distribution of glacial ^{10}Be and ^{26}Al samples in the global compilation.*