Holocene Antarctic subglacial weathering and ice-sheet history reconstructed using the $^{10}Be/^{9}Be$ ratios of lake Maruwan Oike sediments

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Glaciers play an important role in the climate system via freshwater storage and the transportation of various materials from the continents to the oceans. Enhanced discharge of the former during melting events can influence global sea-level, while enhanced silicate weathering resulting from the latter can drive a reduction in atmospheric CO_2. Although these processes are known to be important through geological time, temporal changes in chemical weathering intensity and meltwater flux for the East Antarctic Ice Sheet (EAIS) are not well understood. During the last deglaciation, the EAIS retreated significantly (*1, 2*), forming isolated basins via glacio-hydro-isostatic adjustment (GIA) related crustal uplift. Sediment accumulated in these lakes provide a unique record of subglacial weathering and ice-sheet history throughout deglaciations when global temperatures and pCO_2most notably rose.

Meteoric ^{10}Be is produced in the atmosphere by cosmic rays and delivered to the Earth and ocean surface via dust and precipitation. In Antarctica, these sources of ^{10}Be become locked up in ice sheets and are subsequently released to the continental shelf during periods of melting and freshwater discharge (*3*), where they adhere to suspended particles in the water column and subsequently accumulate on the basin floor (*4, 5*). Stable ^{9}Be is present in silicate rocks and is released during subglacial weathering (*5*), with little simultaneous release of ^{10}Be (*4*), and transported to the oceans via meltwater outflow. When Be is incorporated into the authigenic phase of marine sediments, the $^{10}Be/^{9}Be$ reflects that of the overlying water column (*6*), which in turn reflects the relative dominance of freshwater flux and/or subglacial weathering.

Here, we present authigenic $^{10}Be/^{9}Be$ ratios for a sedimentary core from Lake Maruwan Oike situated at the head of the Rundvåg glacier in the Lützow-Holm Bay area of East Antarctica. Sedimentary material from L. Maruwan Oike provides an ~6,000 year record of subglacial weathering and nutrient input from the nearby glacier (*7*). Authigenic $^{10}Be/^{9}Be$ records reflect variations in freshwater flux and subglacial weathering and indicate several periods of enhanced melting of the Rundvåg glacier. This study provides further constraints on EAIS fluctuations during the Holocene and offers an insight into the behaviour of beryllium in high-latitude subglacial-marine systems.

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Keywords: Beryllium, Holocene, Antarctica, Weathering, Glacier

