

Strontium isotopic signatures of the streams and lakes on James Ross Island, Antarctica

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The Antarctic Peninsula region as the the fastest warming site in the Southern Hemisphere experience not only accelerating retreat of glaciers but also the rate of rock weathering. In order to understand processes of chemical weathering we are using strontium isotopes ($^{87}\text{Sr}/^{86}\text{Sr}$).

Sampling on the James Ross Island was performed during the 2011 and 2012 field campaigns with respect to bedrock lithology, consisting of two main geological domains (palagonitized basalts and Mesozoic sediments).

Data for water samples from Torrent Valley and Brandy Bay (Phormidium Lake and Monolith Lake basins) fall within two isotopically distinct groups. Samples from Torrent Valley have less radiogenic $^{87}\text{Sr}/^{86}\text{Sr}$ ratios than samples from Brandy Bay. In Torrent Valley the $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of the stream profile from the glacier to the sea shore become less radiogenic with increasing distance from the glacier. Torrent Valley is dominated by volcanic rocks and the isotopic composition of waters is close to their previously published isotopic data (0.7033 ± 0.0002), thus implying major contribution of volcanic source of the Sr in the water.

Water samples collected within Phormidium Lake basin have $^{87}\text{Sr}/^{86}\text{Sr}$ ratios close to marine sediments (0.7085 ± 0.0006) which are in good agreement with the geological situation on site. There are significant isotopic variations in the stream data. Some of the small streams entering Phormidium Lake are more radiogenic and some are less radiogenic than the waters of the lake itself. The $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of the Phormidium Lake lies on the mixing line between the stream waters. Data for Monolith Lake basin show $^{87}\text{Sr}/^{86}\text{Sr}$ ratios as a mixture between marine sediments and volcanic rocks as volcanoclastic breccias are quite abundant at this site. Our results imply that key factor affecting chemical composition of water and nutrient availability is lithology of bedrock and the sea spray contribution is not significant, even in the close proximity to the sea shore. Use of Sr isotopes can discern the proportions of geological materials undergoing chemical weathering at James Ross Island.

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