# Using magnesium isotopes to understand chemical weathering in permafrost environments

Nicolas Cuozzo*, Ronald Sletten, Yan Hu, Fang-Zhen Teng

University of Washington, Department of Earth and Space Sciences, Seattle WA 98195 (*e-mail: ncuozzo@uw.edu)

Mg isotopic composition is reported in thawed ice from a 30-meter ice-cemented sediment core collected in Beacon Valley, Antarctica, documenting rock-water interactions in permafrost. Chemical dissolution is apparent in the top 7 meters of the core, where the core's chemical and physical composition abruptly changes and then remains stable down to the bottom of the core at 30 meters. The Mg isotopic values in the upper 7 meters illustrate that Mg is sourced from two end members with distinct isotopic compositions: (1) marine aerosols that are captured by snowfall on glaciers and released by glacial melt ($\delta Mg^{26}$ = -1.02 ± 0.06‰), and (2) dissolution of Ferrar dolerite ($\delta Mg^{26}$ = -0.22 ± 0.07‰). Mg accumulated in the permafrost has isotopic values intermediate between the two end members, and shows up to 60-70% of Mg in the permafrost ice is sourced from dolerite dissolution. Compared with the lower 7-30 meters, the upper 7-meters are characterized by strong seasonal temperature fluctuations, with higher soluble salt concentrations, pH values, rock-ice ratios, and a seasonally higher percentage of unfrozen water. Below 7 meters, the Mg isotopic values fall within the range of the marine aerosol end member and show little to no dissolution. However, some fractionation may occur as Mg salts precipitate when the soil freezes and excludes soluble ions. These results provide a first look at in-situ weathering processes and rates in permafrost soils in hyper-arid polar deserts.