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GEOMORPHIC INDICATORS OF SEDIMENT TRANSPORT IN THE MCMURDO DRY VALLEYS, ANTARCTICA

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The McMurdo Dry Valleys of Antarctica have a hyper-arid, cold, polar desert climate today, which results in some of the lowest erosion rates on Earth. Though the erosion rates are very low, the downslope transportation of sediments is evident. One indication of sediment mobility is the characteristic sediment convergence above and divergence below boulders that are lodged in the hillslope.

This results in a measurable bulge of sediment above boulders, and a corresponding cavity, or lack of sediment, below boulders.

To determine and quantify the processes involved in downslope sediment transportation in the Dry Valleys we use a finite difference sediment transport model based on the local slope dependent transport rate. To guide our modelling effort, we made detailed topographic surveys in the field at 25 centimeter increments around boulders with the characteristic build up of material around them. Model results fit the observed profiles well, and we can use the model to calculate the minimum volume of sediment that was mobilized to create the bulge and cavity. We are exploring the potential role of thermal contraction and expansion in a moisture-free soil as a process that promotes the downslope movement of a matrix. To determine spatial patterns in sediment transport rates, hundreds of boulders were surveyed on 12 hillslopes.

Previous research suggests that a polar desert climate has persisted in the Dry Valleys for millions of years, and that sediment erosion and transportation rates remained low during this time. Very little is known about how a landscape can remain stable for millions of years. Our goal is to understand and determine the processes and rates of sediment transport in a polar desert climate. This will aid us in resolving the apparent contradiction between suggested landscape stability and the observed indicators of the downslope movement of sediments.