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ICE SHEET DYNAMICS AND LANDSCAPE STABILITY IN THE DRY VALLEYS OF ANTARCTICA

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The Dry Valleys of Antarctica have proven to be a critical location for understanding past ice sheet dynamics, landscape stability and climate history. In large part the existing understanding of their geologic history is based on dating, mapping, and stratigraphic relations of glacial deposits, colluvial sediment, and in situ volcanic ashes. In many cases, however, these age constraints provide only limiting ages for glacial advances, or loose limits to rates of erosion or sediment transport. Existing cosmogenic-nuclide surface exposure ages from many parts of the Dry Valleys are in general younger than the age of surface deposits inferred from stratigraphic relations, presumably due to some combination of surface erosion or past ice cover, both of which would serve to reduce the apparent exposure age. Here we report both measurements of multiple cosmogenic nuclides from surface deposits, which help to detect long periods of past ice cover, and measurements of the changes in nuclide concentration with depth below the surface of the deposit, which help to understand rates of soil mixing, soil transport, and landscape evolution. For example, beryllium-10 and aluminium-26 measurements from the surface of an avalanche deposit that contains 8.5 Ma volcanic ash (cf. Marchant et al., 1993) yield an apparent exposure age of only 0.4 Ma. However, measurements of the subsurface nuclide concentrations, when taken together with the stratigraphic and geomorphic situation of the site, show that the age of the ash does not conflict with the apparent exposure age when slow erosion of the deposit (ca. 1.5 m/Ma) since deposition is taken into account. Similar examples from other sites allow us to shed light on the apparent conflict between the stratigraphic evidence for great antiquity of the landscape and the relatively young apparent exposure ages for some surfaces, as well as to better understand rates of erosion, sediment transport, and landscape evolution.