

Spatial variability in McMurdo Dry Valleys snow and firn - the role of local soil input

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Samples of snow and firn from accumulation zones on the Victoria Upper Glacier, the Clark Glacier, the Commonwealth Glacier, and the Blue Glacier in the McMurdo Dry Valleys (~77 to 78° S and 161 to 164° E), Antarctica (Figure 1), are evaluated chemically and isotopically to determine the relative importance of local (site-specific) factors versus regional-scale climatic influences in defining glaciochemistry. Multivariate statistical analyses provide constraints for interpretation of connections between Dry Valleys climate and the broader Ross Sea and East Antarctic Ice Sheet climate systems. Spatial variation in snow and firn chemistry confirms documented trends within individual valleys regarding ion deposition relative to elevation and to distance from the coast. The results here, however, demonstrate that intra-valley trends break down when chemistry is compared among valleys.

Instead, site-specific exposure to marine and local (soil) chemical sources plays a dominant role in defining glacier chemistry along the coastal axis of the Dry Valleys. A survey of mean chemistry among the sites discussed here, for example, shows the Clark and Commonwealth Glaciers with the highest concentrations in marine species (350 µg/L and 167 µg/L for Na⁺, 25 µg/L and 21 µg/L for MS⁻), while the Blue Glacier shows unexpectedly low concentrations (72 µg/L Na⁺, 10 µg/L MS⁻), likely related to shelter provided by a coastal range to the east. Trace metals are in highest abundance at the Clark Glacier (Al concentration = 234 µg/L), with the lowest concentrations found at the Commonwealth Glacier (Al concentration = 45 µg/L). This result demonstrates that where chemical signals are influenced by locally derived particulates, differences in local context between two locations may overwhelm broader climate signals. In areas of complex terrain, the influence of these local factors must be understood before climate inferences can be drawn.

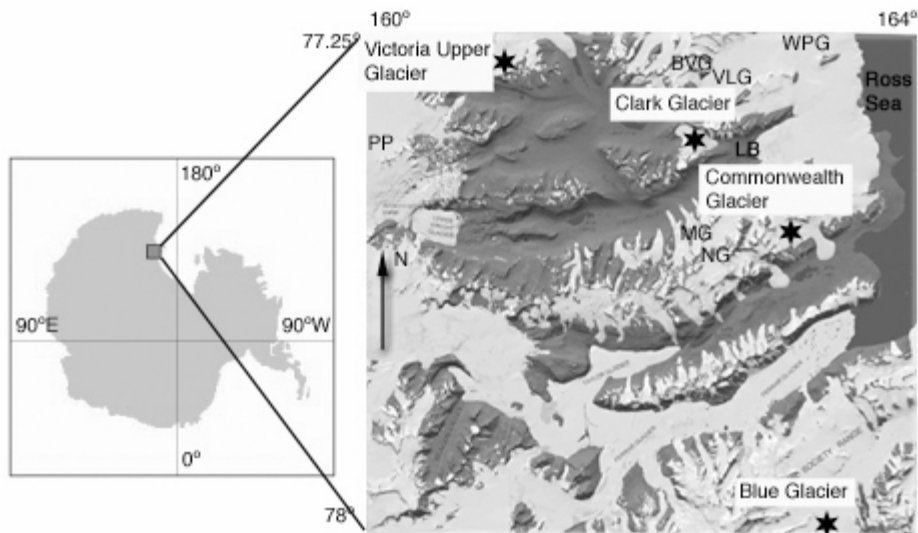


Figure 1. Index map showing locations of Victoria Upper, Clark, Commonwealth and Blue Glaciers. Base map by GeographX, 2006.