



## Lichens and weathering: importance for soil formation, nutrient cycling and adaptation to environmental change

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Lichens comprise ca. 6% of the Earth's terrestrial vegetation, and are dominant in certain polar ecosystems, being primary colonists of rocks where they play a major role in the biogeochemical cycling of elements and contribute to soil formation. We present an historical overview of studies in the Antarctic, leading to recent collection opportunities on Signy Island providing new material to investigate how biodiversity has responded to regional and rapid environmental change. Mountainous, with an ice cap, glaciers, rugged topography, and a complex geology and pedology, Signy Island includes a wide range of terrestrial habitats. A small, inconspicuous lichen, *Acarospora* cf. *badiofuscata*, was discovered colonizing iron-stained quartz mica schists on the lower slope of Manhaul Rocks, a recently exposed nunatak on the McLeod Glacier, Signy Island, maritime Antarctic. Thallus colour ranged from rust to paler orange and green. Many lichens are colourful, mostly due to the presence of secondary metabolites which are of fungal origin. In some cases colour may reflect chemical coordination reactions involving lichen biomass components and dissolved cations which can lead to metal complex and mineral formation. By far the greatest research effort into characterizing elements and minerals associated with lichens concerns those occurring beneath them, research driven partly from a desire to understand weathering processes. This study, for the first time in the maritime Antarctic, addressed the hypothesis that colour reflects element localization, and examined substance localization within lichen tissues and considered responses to stress. Methods utilised include macrophotography, X-Ray Diffraction with a position sensitive detector (PSD), Scanning Electron Microscopy in back-scattered and ED modes and electron probe microanalysis for the elements Fe, C and Si and by using a third generation variable pressure secondary detector employed as a panchromatic cathodoluminescence detector, SmartStitch image acquisition and montage creation software. The lichen's occurrence in this extreme habitat suggests the use of a complex combination of mechanisms to avoid or mitigate environmental stress. Future study of such species even has the potential to shed new evidence in investigation of the existence of life on other planets, for instance through evidence provided by 'biosignatures'. As a consequence of recent rapid warming and glacial retreat, new areas of rock and ground are being exposed, providing opportunities for lichen colonization and innovative multi-disciplinary, collaborative research.

PURVIS, O. W., CONVEY, P., FLOWERDEW, M. J., PEAT, H. J., NAJORKA, J. & KEARSLEY, A. Iron localization in *Acarospora* colonizing schist following glacial retreat on Signy Island. *Antarctic Science* [in review].