Tracing atmospheric nitrogen and sulphur deposition in Tasmania using isotopic fingerprinting in lichens

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Lichens and their isotopic composition have been previously successfully used as bio-indicators of atmospheric deposition and pollution, particularly in remote areas where air quality assessments are difficult. The clathrate, fruticose lichen *Cladia retipora* (Labill.) Nyl. is widespread throughout Tasmania. Lichens with a green-algal phycobiont, such as *C. retipora*, are not capable of direct assimilation of atmospheric molecular nitrogen. Thus, their nitrogen supply is determined by their uptake of atmospheric nitrate, ammonia, ammonium, and organic nitrogen compounds.

Little is known about atmospheric nitrogen (N) and sulphur (S) deposition in Tasmania. We have therefore collected lichen samples of *C. retipora* from all over Tasmania and analysed for total nitrogen (TN), total sulphur (TS), and their nitrogen ($\delta^{15}N$) and sulphur isotopic composition ($\delta^{34}S$) to investigate the spatial distribution of atmospheric N and S input to ecosystems and to identify potential N and S sources for Tasmania. *C. retipora* was sampled from locations as low as sea level, and as high as 1250 m elevation, from various habitats including temperate forests, alpine and subalpine heath, and the coastal biome.

Results show that TS contents in *C. retipora* are low, ranging from <0.01 to 0.31%. $\delta^{34}S$ values range from -21.9 to 16.5‰. The lowest TS samples have $\delta^{34}S$ values consistent with dimethyl sulfide, biogenic sulphate, and sea salt sulphate. The highest TS samples are associated with the lowest $\delta^{34}S$ values, indicative of H_2S emissions from bacterial sulphate reduction in tidal flats.

TN contents varied from 0.15 to 0.44%, and $\delta^{15}N$ values ranged from -6.9 to +7.5‰. The lowest $\delta^{15}N$ values tend to be located in the most remote inland regions where population density is lowest. However, our overall results suggest that anthropogenic sources form an insignificant fraction of the nitrogen and sulphur input into terrestrial ecosystems in Tasmania.