

Investigation of fungal decomposition of leaf lignin using synchrotron infrared microspectroscopy

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Fungi are a major decomposer group in the aquatic carbon cycle, and are one of few groups though to be capable of breaking down woody (lignified) tissue [1]. Here we have used synchrotron Fourier transform infrared (S-FTIR) microspectroscopy to study the interface between fungal tissue and lignified leaf tissue (xylem) in two eucalypt species (River Red Gum and Snow Gum) during aquatic decomposition.

Aquatically decomposed River Red Gum leaf samples show strong depletion of lignin-bound carbohydrate immediately adjacent to the fungal tissue, spatially correlated with oxidation (de-polymerisation) of the lignin framework [2]. This observation has now been replicated with Snow Gum leaf samples (Figure 1 (a-c)) and investigated at even greater resolution using a synchrotron-coupled Focal Planar Array (FPA)-FTIR spectrometer (Figure 1(d)). S-FPA-FTIR offers sub-micron spatial resolution and can probe more subtle spatial changes in leaf chemistry at the fungal interface.

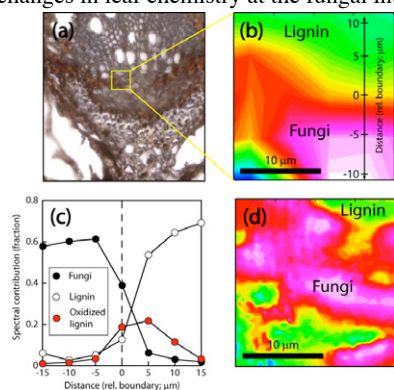


Figure 1.(a) Bright field image of Snow Gum vein; (b) S-FTIR map of fungi-xylem interface; (c) line scan across interface; (d) S-FPA-FTIR map of fungi-xylem interface.

[1] Floudas *et al.* (2012) *Science* **336**, 1715-1719. [2] Kerr *et al.* (2013) *PLOS ONE* 8(4), doi:10.1371/journal.pone.0060857

Preliminary evaluation of trace hydrocarbon speciation and abundance as an exploration tool for footwall-style sulfide ore, Sudbury Igneous Complex, Ontario, Canada

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The North Range of the Sudbury Igneous Complex (SIC) hosts footwall-style Cu-Ni-platinum group element (PGE)-rich sulfide deposits of predominantly magmatic origin but that have been influenced by multiple syn- and post-magmatic hydrothermal events. The composition of reduced carbonic phases (unsaturated and saturated hydrocarbons, C1 to C6) in fluid inclusions within the matrix of Sudbury breccia, a rock unit that is permeable to circulating volatiles and that commonly hosts footwall-style Cu-Ni-PGE deposits, has been investigated by in-line rock-crushing gas chromatography. This was done on samples from zones of breccia that are known to contain economic footwall sulfide deposits and zones barren of such deposits. Subtle but strategically significant differences have been found in the composition and abundance of bulk hydrocarbons that are released from mineralized and barren breccias when fluid inclusions are opened. These findings include: (i) statistically higher average abundances of light, saturated hydrocarbons (C1-C4) in mineralized, embayment-associated footwall packages than in breccia from barren environments (maximum difference of approx. half an order of magnitude for propane abundances; mol/g rock), and (ii) no statistically significant differences in average unsaturated hydrocarbon abundances between the two breccia environments, but differences are present when considering the spatial variations of hydrocarbons within the mineralized breccia package itself relative to massive sulfide mineralization.

Additionally, samples of breccia and quartz (from mineralized alteration assemblages) from PGE-rich environments significantly deviate from expected hydrocarbon signatures and are considerably more enriched in unsaturated hydrocarbons. It is suspected that PGE, particularly Pt, play a direct role in the catalytic dehydrogenation of saturated, into unsaturated hydrocarbon species in hydrothermal environments. These findings strongly suggest that fluid hydrocarbon signatures should be taken into consideration when exploring for Cu-Ni-PGE-rich footwall-style ore bodies as a supplemental criterion to traditional visual and geochemical approaches.