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# Boron Isotopes and FTIR Analysis to Determine Past Fire Occurrence in the Upper Nepean Catchment, NSW, Australia

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Bushfires have been a prominent feature in the Australian landscape for millennia, shaping ecosystems and biodiversity across the continent. However, current records, which largely employ the use of remote sensing data and radiocarbon dating of charcoal, do not portray an accurate image of past fire severity and occurrence. Without such record, mitigation, mediation and post-fire recovery efforts are limited in their capabilities. Therefore, the aim of this project is to calibrate two novel techniques 1) boron isotopes analysis and 2) Fourier Transform Infrared Spectroscopy (FTIR) against known fire occurrence in the Upper Nepean Catchment of New South Wales, Australia to determine their suitability as proxies.

The Upper Nepean Catchment was extensively burnt in the 2013 bushfire season, providing opportunity for calibration. Alluvial sediments provide an insight into the signal transport from source to reservoir and lake sediment sinks. Creeks were selected using the criteria of draining an area experiencing the highest severity fire to maximise the signal to be detected by the two proxies. Boron isotopes analysis was conducted on the clay fraction of sediments. Boron isotope composition decreases with depth, possibly illustrating the decrease in biological and atmospheric inputs. This decrease is interrupted at the fire-effected layer, which is characterised by a heavier B isotope composition.

Two methods of FTIR were employed for comparison on bulk sediments- attenuated total reflectance (ATR)-FTIR and FTIR by KBr discs. The FTIR spectra for both methods highlight changes in molecular composition with depth, following fire there is an observable shift from aliphatic to aromatic compounds. The ATR-FTIR spectra displays increased thermal decomposition of carbon-carbon, carbon-oxygen and carbon-nitrogen bonds, creating a fire signature. By calibrating these two proxies in parallel, an opportunity for a greater understanding of bushfire characteristics, such as the role of temperature and pyrolysis conditions, on the formation of the signature is presented. Whilst further investigation is needed over larger time since last fire intervals, these results are promising for the formulation of catchment scale fire records. This could be adopted in the Australian context as well as other fire hotspots around the world.