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Exploring the unknowns of levoglucosan and its isomers in sediments to increase the efficacy of this technique as a biomass burning tracer

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Biomass burning (BB) is a significant source of particulate matter to the atmosphere, impacting human health, air quality, and climate. Tracing past BB events is important for understanding the links between human activity, fire frequency, and climate, therefore assisting with the prediction of future fire activity. BB can be traced using certain markers within the plume that can be subsequently identified within sediments. This includes traditional tracers such as charcoal, but recently certain monosaccharides anhydrides (MAs) have been used as an alternative tracer. These MAs include levoglucosan, formed during the pyrolysis of cellulose, and its isomers (mannosan and galactosan), formed during the pyrolysis of hemicellulose [1]. MAs have two main advantages over charcoal counting as a tracer. First, unlike charcoal counts, MAs can be quantified analytically. Second, the ratios among the three MAs may indicate the type of biomass that burnt, thus providing additional information about past BB activity [2, 3]. Despite being popular in aerosol studies, the quantification of MAs in aquatic sediments is rare because they are difficult to extract and quantify, and their behaviour and longevity in aquatic habitats is unknown. Here we quantified MAs in age-dated lake sediment cores from the Central Highlands, Tasmania, Australia, to further understand the behaviour of MAs in sediments and to assess the efficacy of this technique as a tracer of recent BB. MAs were extracted using a novel extraction method based on ultrasound sonication using only water as the solvent, significantly reducing extraction time, cost, and environmental concerns compared to existing published methods. A method based on ion chromatography tandem triple quadrupole mass spectrometry (IC-QqQ-MS) was used to quantify MAs. Isomer ratios in surface sediments were compared to the ratios in local aerosol samples collected during the 2018/19 bushfire season to better understand MAs behaviour between the atmosphere and sediment deposition. Additionally, MAs concentrations were compared to other sediment parameters to identify potential trends.

1. Simoneit, B.R.T., Applied Geochemistry, 2002. **17**(3): p. 129-162.
2. Engling, G., et al., Atmospheric Environment, 2006. **40**: p. 299-311.
3. Bhattarai, H., et al., Atmospheric Research, 2019. **220**: p. 20-33.