Chemical signatures of Melaleuca quinquenervia leaves as precipitation proxies

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MELALEUCA LEAVES AS PRECIPITATION PROXIES

ABSTRACT

The eastern coast of Australia is susceptible to variations caused by the El Niño-Southern Oscillation. The geological record in this region is therefore ideal for studying the history of El Niño variability. However, site-specific proxies for precipitation amounts are needed to examine El Niño in the geologic past.
Carbon isotope ratios of leaves and the average chain length of leaf-wax *n*-alkanes have the potential to act as proxies for past rainfall. Carbon isotope ratios respond to changes in water availability (Stewart *et al*. 1995; Korol *et al.* 1999; Cornic 2000; Van de Water *et al.* 2002). Average chain length of leaf wax *n*-alkanes has also been found to relate to climatic variables, including temperature, humidity and water availability (Tipple & Pagani 2013; F. McInerney pers. comm. 2014).
These two measures are used in this study to develop proxies for climate in modern *Melaleuca quinquenervia* leaves. We hypothesised that leaves in drier environments would have smaller discrimination values than wetter environments. We also hypothesised that average chain length of leaf wax *n*-alkanes in modern *Melaleuca quinquenervia* will show longer chain length distributions at drier sites.
The discrimination of modern leaves is positively correlated with precipitation and precipitation-evaporation for the previous four years at each site, and statistically significant negative linear correlations of average chain length with precipitation and precipitation-evaporation exist. The correlations have significance as modern calibrations for palaeoclimate proxies.
These calibrations have important geological applications to lake sediments preserving sub-fossil leaves of *Melaleuca quinquenervia,* including a known site at Swallow Lagoon on North Stradbroke Island and other identified sites of potential sub-fossil leaf preservation. The calibrations developed in this study have the potential to help quantify past precipitation and El Niño variation across the east coast of Australia.

KEYWORDS

Geochemistry, stable carbon isotopes, average chain length, Melaleuca quinquenervia, precipitation, proxies, palaeoclimate

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