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Lipid and compound-specific carbon isotope analysis of Lake Pupuke sediments as indicators of environmental change in the Auckland region over the last 50,000 years

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Lake Pupuke exists as a fresh water lake located on the North Shore of Auckland City, New Zealand. Accumulated sediments within Lake Pupuke represent a continuous record from crater formation ca. 200 Ka to Present, making them an important record of climatic change in northern New Zealand.

Lipid composition and compound-specific carbon isotope analyses were carried out on Lake Pupuke sediment cores spanning ca. 50,000 cal. yr BP to Present. Compounds of interest included n-alkanes, n-alkanols, n-alkanoic acids and botryococcenes. Bulk sediment and compound-specific carbon isotope records exhibit a positive excursion during the period 18,000 to 27,000 cal. yr BP. This coincides with the Last Glacial Cold Period (LGCP) and in the absence of native C4 plant species most likely reflects decreased discrimination of the ^{13}C isotope as a result of low pCO$_2$. Termination of the glacial period occurs ca. 18,000 cal. yr BP and is defined by a steady increase in organic carbon content with a decrease in bulk and compound-specific δ^{13}C which continues until ca. 10,000 cal. yr BP. Both aquatic and terrestrial biomarkers (represented by botryococcene and long chain n-alkyl compounds respectively) exhibit an increase in δ^{13}C values beginning ca. 7,500 cal. yr BP through to present day. This is not reflected in the aquatic macrophyte biomarkers (mid chain length n-alkyl compounds) and may be caused by increased carbon recycling as a result of greater lake productivity and an increased canopy effect during this period.

A marked increase in botryococcene biomarkers is noted during the period 7,500 to 9,500 cal. yr BP, reaching total concentrations as high as 19 mg/g. This is accompanied by a relative increase in C_{29} and C_{31} n-alkane terrestrial biomarkers. This zone is also evident to a lesser degree in the bulk sediment proxies, which exhibit increased carbon content, C/N ratio and δ^{13}C values. The abundance of botryococcenes would suggest algal blooms of *Botryococcus Braunii*. Such blooms usually occur after periods of heavy rain and in association with dissolved phosphorus. This would suggest a period of increased storminess and erosion, which would also account for the increase in terrestrial input to the lake.