



## **Bulk Organic Geochemistry, Geochronology, and Paleoenvironments of the Late Cretaceous Maar Lake Sedimentary Fill of the Wombat Kimberlite Pipe, Subarctic Canada**

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The Wombat pipe (64.73°N, 110.59°W) is a diamondiferous kimberlite in the Lac de Gras kimberlite field of Northwest Territories, Canada. Two drill cores, CH 93-29 and DDH 0-005, intersect the Wombat crater facies and include 195 m of well preserved, undisturbed lake sediment fill. Bulk sediment elemental analysis, C isotope composition, and Rock-Eval pyrolysis, together with inferences from microfossils, are used to characterize conditions of sedimentation and paleoenvironmental variability in the maar lake.

Bulk sediment C/N, hydrogen index (HI), and  $\delta^{13}\text{C}$  indicate material derived from  $\text{C}_3$  land plants dominates the sedimentary organic matter, with a minor algal contribution. The  $\delta^{13}\text{C}$  values range from -25.3 ‰ to -30.2 ‰ and C/N ratios vary between 14.6 and 38.4, recording the shifts in the proportions of land-derived material and algal organic matter as climate conditions fluctuated. Eighteen samples analyzed by Rock-Eval pyrolysis all plot in the Type III kerogen field for HI vs.  $T_{max}$ , with average  $T_{max}$  values  $\sim 425$  °C indicative of the low thermal maturity of organic matter. Total organic carbon (TOC) averages 3.6 wt% and average total carbonate content is 14.1 wt%, indicating bottom water anoxia and substantial carbonate input from weathering of overlying carbonate cover rocks, respectively. Together with well-preserved freshwater microfossils (e.g. diatoms, chrysophytes, synurophytes), the results indicate deposition in a non-marine setting, likely during a period of regression of the Western Interior Seaway.

The age of the Wombat maar lake sediments is determined using MC-LA-ICP-MS U-Pb zircon geochronology from two distal rhyolitic tephra beds found in the core DDH 0-005, yielding a date of  $82.94 \pm 0.20$  Ma (MSWD = 2.2, n = 19 of 33 grains analyzed). This minimum age suggests that Wombat kimberlite pipe emplacement occurred during the Late Cretaceous, with sedimentation in the maar beginning shortly thereafter. Determination of the Wombat kimberlite emplacement age using LA-ICP-MS U-Pb rutile geochronology from kimberlite facies samples found in core CH 93-29 is currently ongoing. Though our geochronology is preliminary, our findings from the Wombat pipe post-eruptive maar lake sediment fill provide direct evidence for a non-marine environment in the Lac De Gras area during the Late Cretaceous. Furthermore, microfossils in the Wombat pipe sediment fill likely include the oldest-known occurrence of freshwater diatoms and synurophytes.