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Paleoenvironmental analysis of the Late Cretaceous Wombat kimberlite maar sediments, subarctic Canada: implications from geochemical and microfossil data

SERHIY D. BURYAK[1], ALBERTO REYES[2], PETER A. SIVER[3], LONG LI[2], BRITTA J.L. JENSEN[2], CAROLYN M. FURLONG[1] AND NANCY K. MCKEOWN[1]

[1]MacEwan University
[2]University of Alberta
[3]Connecticut College

The Wombat kimberlite pipe in subarctic Northwest Territories, Canada, preserves ~195 m of lacustrine sediments deposited ~81 Ma, recording high-latitude terrestrial environments within a Canadian Shield region otherwise lacking Mesozoic strata. We apply bulk organic geochemical proxies, C_{org} (1.1-10.3 wt%), C_{org}/N_{tot} (14.6-38.4), $\delta^{13}C_{org}$ (-25.3‰-30.2‰), and programmed pyrolysis (HI = 18-186 mg HC g^{-1} C_{org}; T_{max}~ 425 °C), integrated with micropaleontological assemblages (siliceous microfossils, pollen) to evaluate organic-matter sources, preservation, and diagenetic modification in a carbonate-bearing lacustrine archive. Organic matter is dominated by Type III kerogen derived from C_3 plants, with episodic increases in autochthonous algal contribution and preservation. Stratigraphic covariation in δ^{13}Corg and C/N tracks shifts in terrestrial versus algal organic-matter delivery, while geochemistry and petrography suggest semi-permanent bottom-water anoxia, and variable organic matter preservation under changing lake conditions. These proxy patterns record a transition from a moderately deep, seasonally mixed lake to shallow, acidic, humic-rich conditions prior to infilling. Beyond reconstructing local paleoenvironments, this study highlights the behavior and limitations of bulk organic proxies in complex lacustrine systems and provides rare high-latitude terrestrial paleoenvironmental data that complements coeval marine records during Late Cretaceous greenhouse conditions.