Stable isotope paleolimnology of ancient Lake Ontario

R. HLADYNIUK*, N. DILDAR AND F.J. LONGSTAFFE*

Department of Earth Sciences, The University of Western Ontario, London, ON, Canada, N6A 5B7
(*correspondence: rhladyni@uwo.ca, flongsta@uwo.ca)

We examined the oxygen isotopic composition of biogenic carbonates and the abundances and carbon isotopic composition of *n*-alkanes obtained from three sediment cores from Lake Ontario in order to: (i) assess how environmental changes affected the hydrology of Lake Ontario, and (ii) evaluate changes in organic productivity since the last deglaciation. Lake Ontario's unique history allows for the evaluation of impacts arising from glacial meltwater input, hydraulic closure and Holocene warming. During the glacial period, the average lakewater O-isotope composition (inferred from ostracode valves) was –17.5‰ (VSMOW), thus indicating significant contributions of glacial meltwater. Higher abundances of mid-chain length *n*-alkanes (C23 and C25) with C-isotope compositions of –32.5‰ (VPDB) initially record allochthonous input of *Sphagnum* mosses from the periglacial environment. Emergence of a tundra woodland as the glacier retreated is recorded by an increase in long-chain (terrestrial plant) *n*-alkanes (C27, C29, C31). Subordinate amounts of short-chain *n*-alkanes (C17 and C19) during the glacial period reflect only limited autochthonous production of algal organic matter. Re-routing of Upper Great Lakes at the glacial to post-glacial transition led to hydraulic closure of Lake Ontario (~12,300-8,300 cal BP) [1]. Progressively higher lakewater O-isotope compositions (to –7‰) ensued, first because of the loss of glacial meltwater input, and then because of increased evaporation and the rising oxygen isotopic compositions of precipitation. Nearly equal abundances of all *n*-alkanes during the period of hydraulic closure indicate organic matter derived from several sources. The C-isotope composition of most *n*-alkanes increased by ~1‰, and likely indicates overall higher terrestrial and lacustrine productivity. By 8,300 cal BP the climate transitioned from cold/dry to warm/dry [2]. There is little change in the lakewater O-isotope composition (–7‰) at this time. However, an increase in the abundance of terrestrial (≥C27) *n*-alkanes and their C-isotope compositions (–31‰ to –29‰) signifies greater allocthonous input and increased terrestrial productivity. Upper Great Lakes water returned to Lake Ontario at 5,300 cal BP. A progressive decrease (~2‰) in all aquatic *n*-alkanes C-isotope compositions after this time suggests a shift in the nature of the lacustrine carbon pool.

[1] Anderson & Lewis (2012) *J. Paleolimnol.* **47**, 513-530. [2] Edwards *et al* (1996) *Quat. Res.* **46**, 211–218.