

Temporal Variations in the Sedimentary Records of Botryococenes

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Perhaps the most source-specific biomarker is botryococcane [1] as only the *B* race of *Botryococcus braunii* biosynthesizes its precursor, botryococcene [2,3]. Hydrocarbon production by *B. braunii* is prolific; the alga can produce 30 mg L⁻¹ d⁻¹ of botryococcene under laboratory conditions [4], prompting its evaluation as a potential source of biofuels and helping account for accumulation of 10 Tg of botryococcane in the Minas and Duri oil fields of Indonesia [5] derived from Eocene-Oligocene lacustrine source rocks. Botryococcane, and its C₃₁ and C₃₃ homologs, occur in Eocene shales [6,7], whereas Quaternary sediments [8-14], notably maar lakes, also contain suites of C₃₀-C₃₇ monocyclic and bicyclic hydrocarbons with botryococcene-related structures. Sulfurized cyclized botryococenes have been reported in Upper Miocene shales [15] but this represents their only Cenozoic occurrence, raising questions about diagenetic, evolutionary, and climatic controls on the sedimentary distributions of botryococenes. Several lake sequences [9-11] exhibit temporal variations in botryococcene distributions that reflect changes in environmental conditions and/or in the dominant strains of *B. braunii*. The hydrocarbon composition of sediments from Lake la M'He in the Central Highlands of Vietnam is dominated by *n*-alkanes and series of hopanes but also contains a C_{34.2} acyclic and two C_{34.3} monocyclic botryococenes (Fig. 1). The sequence reveals higher proportions of cyclic botryococenes during glacial times and a predominance the C_{34.2} acyclic component after the LGM as the C/N ratio decreases and % C_{org} increases (Fig. 2). These temporal variations over the glacial to interglacial transition differ from those observed in sediment records from East Africa [9,10] suggesting that local factors likely represent the principal control on botryococcene distributions.

References

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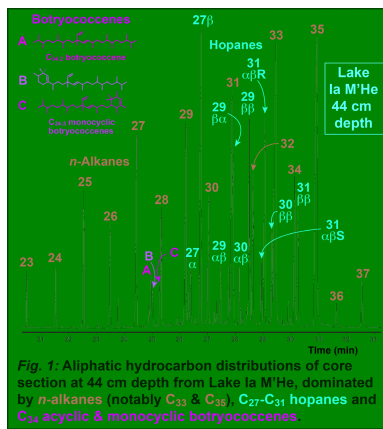


Fig. 1: Aliphatic hydrocarbon distributions of core section at 44 cm depth from Lake la M'He, dominated by *n*-alkanes (notably C₃₂, C₃₅, C₂₇-C₃₁ hopanes and C₃₄ acyclic & monocyclic botryococenes

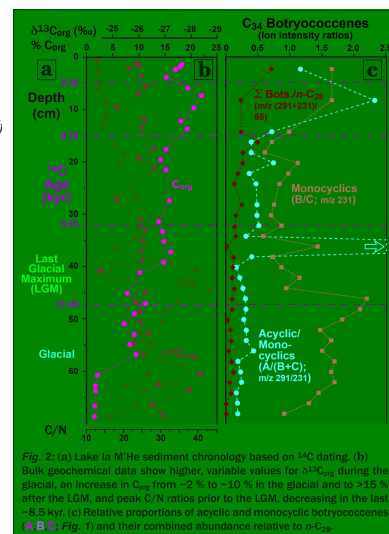


Fig. 2: (a) Lake la M'He sediment chronology based on ¹⁴C dating. (b) Bulk geochemical data show higher, variable values for ¹³C_{org} during the glacial, an increase in C_{org} from ~2 % to ~10 % in the glacial and to >15 % after the LGM, and peak C/N ratios prior to the LGM, decreasing in the last ~2.5 kyr. (c) Relative proportions of acyclic and monocyclic botryococenes A/B+C. Fig. 1 and their combined abundance relative to *n*-C₃₀