

LIPID BIOMARKERS AS INDICATORS OF ORGANIC MATTER INPUTS IN AN AMAZONIAN CORE

V. B. Pereira¹, A. A. Lopes¹, R. C. Cordeiro², D. A. Azevedo¹

¹ Universidade Federal do Rio de Janeiro, Brazil

² Universidade Federal Fluminense, Brazil

Lipid biomarkers are detected in sediments, and the characterization of their composition is of great importance for geochemical studies. They can be applied to investigate how organic matter varies to the extent of different organisms' inputs into the watershed (Farella *et al.*, 2001). In general, the discussion on source, composition and distribution of sedimentary organic matter has been of great relevance, both to acquire their implication on reconstruction of deep-time environments, and to study anthropogenic activity on natural resources (Zhang *et al.*, 2019).

This work addresses a comprehensive evaluation of lipid biomarkers present in a sediment core from a Brazilian Amazonian lacustrine core, as to deep understanding of the organic matter source and composition dynamics of this ecosystem.

A 12 cm long sediment core from the Jacundá lake, a branch of the Tapajós River, in the Brazilian Amazonian basin, was collected, sectioned at 2 cm intervals, freeze-dried and analysed. Extraction was performed using ultrasonic agitation using 3×50 mL CH₂Cl₂:MeOH (9:1) with approximately 1.0 g of each sample. Samples were saponified, and neutral lipids were fractionated into saturated hydrocarbons, aromatics hydrocarbons and neutral polar compounds using activated silica liquid chromatography. The acid fraction was derivatized using N-methyl-N-trimethylsilyl-trifluoroacetamide (60°C, 30 min). All fractions were analysed by gas chromatography coupled to mass spectrometry (GC-MS) system (Agilent Technologies, 5973 model).

Saturated compounds were detected, with individual concentration of *n*-alkanes varying from 4.83 to 1982.2 ng/g of dried sediment (Fig. 1), with bimodal distribution with C_{max} at C₂₃ and C₃₁. The predominance of long-chain *n*-alkanes (>C₂₁) indicates large input of terrestrial higher plants. This was confirmed by the terrigenous:aquatic ratio (TAR), which varied from 9.62 to 29.95 (mean value 17.54) (Zhang *et al.*, 2018; Regnery *et al.*, 2013). Several hopanoid and isoprenoid structures also were detected, including *des*-(A)-lupane and 22,29,30-trisnorhop-17(21)-ene. Unlike most sediments, isoprenoid and hopanoid compounds comprised up to 67% of total area in the chromatographic profile, indicating an intense biological production in the sampling site. Most works present *n*-alkane peaks at a much higher abundance than other classes.

Polar constituents (*i.e.* alkanols and alkanoic acids) reflect inputs of either algae (and photosynthetic bacteria) or macrophytes organisms. Proxies of these classes indicate a strongly bacteria-dominated state, and both presented unimodal or bimodal distribution to lower carbon number (<C₂₀), with C_{max} at C₁₆ to all samples. On the other hand, the higher abundance of sitosterol over cholesterol points to a macrophyte environment (Zhang *et al.*, 2019).

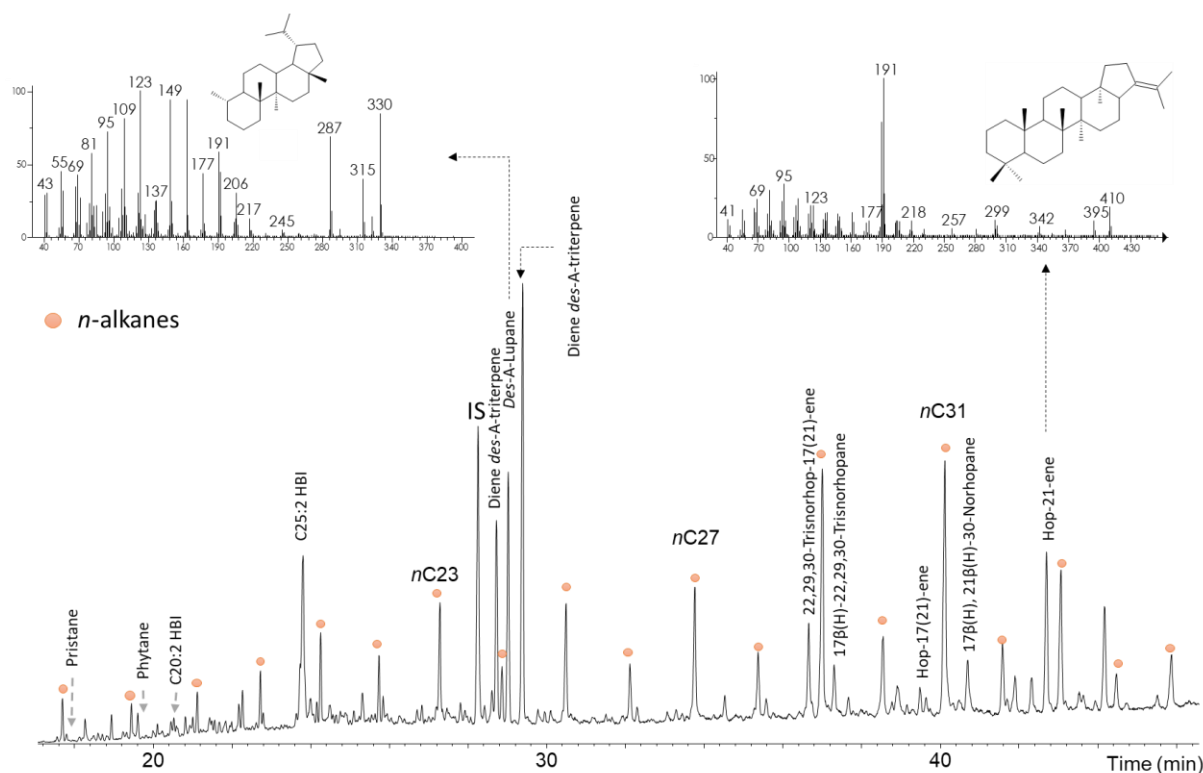


Figure 1: Total ion chromatogram (TIC) of the saturated hydrocarbon fraction from Jacundá lake sediment sample, 04-06 cm depth, showing mainly the *n*-alkane series and hopanoid compounds.

The source and composition of organic matter from the Jacundá lake was greatly influenced by higher plant inputs based on hydrocarbon proxies and high abundance of sitosterol, whereas alkanoic acid and alkanol ratios indicate strong presence of bacteria species in the lake. Many hopanoid compound structures were detected, confirming the presence of bacteria input. In order to acquire further conclusions, one must consider the sedimentation dynamics and homogeneity. Studies on large scale environments depend strongly on specific conditions, to avoid analytical errors.

References

- Farella, N., Lucotte, M., Louchouart, P., Roulet, M. 2001. Deforestation modifying terrestrial organic transport in the Rio Tapajós, Brazilian Amazon. *Organic Geochemistry* 32, 1443-1548
- Regnery, J., Püttmann, W., Koutsodendris, A., Mulch, A., Pross, J. 2013. Comparison of the paleoclimatic significance of higher land plant biomarker concentrations and pollen data: A case study of lake sediments from the Holsteinian interglacial. *Organic Geochemistry* 62, 73-84
- Zhang, Y., Su, Y., Liu, Z., Du, Y., Yu, J., Jin, M. 2018. Aliphatic hydrocarbons biomarkers as indicators of organic matter source and composition in surface sediments from shallow lakes along the lower Yangtze River, Eastern China. *Organic Geochemistry* 122, 29-40
- Zhang, Y., Su, Y., Liu, Z., Du, Y., Yu, J., Jin, M. 2019. Fatty acid and alcohol compositions in lacustrine sediments as indicators of environment and ecosystem of lakes in Eastern China. *Ecological Indicators* 97, 290-300