Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.5823

The role of early diagenesis in the shaping of geochemical records: an example from Lake Dziani Dzaha, Mayotte

IVAN JOVOVIC[1], VINCENT GROSSI[2], PIERRE ADAM[3], MAGALI ADER[4], FRANÇOIS BAUDIN[5], INGRID ANTHEAUME[6], FABIEN ARNAUD[7], EMMANUEL MALET[8], EDOUARD BARD[9], MANUELA CAPANO[10], LAURENT SIMON[11], SALOMÉ MIGNARD[12], PIERRE CARTIGNY[13] AND FRANCOIS GELIN[12]

[1]Laboratoire de Géologie de Lyon
[2]LGLTPE,
[3]Institut de Chimie de Strasbourg
[4]Institut de Physique du Globe de Paris/CNRS UMR 7154
[5]ISTeP, Univ. Sorbonne Paris Cité
[6]LGLTPE, Univ. Claude Bernard Lyon 1, ENS Lyon
[7]Université Savoie Mont Blanc
[8]Université Grenoble Alpes-Université Savoie Mont Blanc-CNRS-EDYTEM, UMR 5204
[9]Collège de France
[10]CEREGE, Univ. Aix-Marseille
[11]LEHNA, Univ. Claude Bernard Lyon 1
[12]TOTAL E&P
[13]IPGP

Presenting Author: ivan.jovovic@free.fr

Sedimentary organic matter (OM) accumulation in aquatic environments generally results from a high primary production and enhanced conditions of preservation. In the past, highly productive (hyper)saline and alkaline environments have proved particularly propitious for large accumulation of sedimentary OM that led to the formation of some hydrocarbon source rocks (*e.g.*, the Eocene Green River Formation, USA). These source rocks are often associated with typical geochemical signatures such as ^{13}C-enriched carbonates, highly-hydrogenated OM (Type I kerogen), and specific mineralogical facies. However, the timing and role of early diagenetic processes accompanying their formation remain unclear.

In order to better understand those processes, we studied most of the sedimentary history of Lake Dziani Dzaha (Mayotte, Indian Ocean), a modern (<9 kyrs BP) tropical hypereutrophic saline, alkaline and mostly anoxic crater lake. This ecosystem was recently proposed as a modern analogue of Proterozoic oceans based on its thalassohaline classification and outstanding biogeochemical characteristics [1]. The study of a long sediment core by a combination of multiple analytical techniques including Rock-Eval, elemental (C, N) and multi-isotopes ($\delta^{13,14}$C, δ^{15}N, δ^{18}O, $\delta^{33,34,36}$S) applied to bulk and/or specific organic and mineral phases [2] showed that the Lake has undergone a constant biogeochemical evolution from the initial Lake filled with marine water to the actual situation. The anoxia and high alkalinity of Lake Dziani Dzaha have gradually developed due to a continuous high primary production since the lake formation. Such conditions have led to enriched-isotope signatures (*e.g.*, $\delta^{13}C_{carbonates}\approx+18‰$, $\delta^{34}S_{pyrite}\approx+35‰$) and to an excellent preservation of OM due to early diagenetic processes comprising reductive and sulfurization mechanisms, which have yielded an exceptionally reduced character of the OM in less than 6000 years of sedimentary history. This suggests that most of the geochemical signatures associated to some source rocks could be inherited from processes occurring in the very early stages of sediment diagenesis.

[1] Cadeau, P., Jézéquel, D., Leboulanger, C., *et al.*, 2020. Sci. Rep. 10:18186.

[2] Jovovic, I., Grossi, V., Adam, P., *et al*., 2020. Org. Geochem. 146, 104055.