EARLY DIAGENESIS AND PRESERVATION OF SEDIMENTARY ORGANIC MATTER IN AN ANOXIC, SULFIDIC LAKE (LAKE DZIANI DZAHA, MAYOTTE)

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During the first billions of years of the history of Earth, the oceans and the atmosphere would have been mostly anoxic, and aquatic systems would have been dominated by prokaryote communities (*e.g.* Donoghue and Antcliffe, 2010). Such conditions, which also prevailed later in Earth history (*e.g.* during Oceanic Anoxic Events), led to anoxic and reducing, often sulfidic aquatic environments favoring high organic matter accumulation in sediments and the formation of high quality petroleum source rocks. These conditions also insured the preservation of the molecular and isotopic signatures of ancient ecosystems.

However, the dynamism and the biogeochemistry of these anoxic aquatic systems, as well as the early diagenetic processes going along with sedimentary organic matter deposition and preservation, are yet to be understood. Some clues can be provided by the study of modern analogues of ancient anoxic aquatic ecosystems. This is the case of Lake Dziani Dzaha (Mayotte), a tropical salted crater lake. This lake is fully stratified part of the year, mostly anoxic and highly sulfidic, with sulfide contents above 3mM (Fig. 1). Most organic carbon present in the lake derives from the strong Cyanobacterial primary production in the limited upper part of the water column, and from high bacterial and archaeal biomasses underneath.

Our study aims at investigating early biotic and diagenetic processes affecting the organic matter in Lake Dziani in order to understand the mechanisms involved in the formation of protokerogen and, more generally, in the preservation of organic matter deposited in anoxic, sulfur-rich environments. We, therefore, analyzed a series of samples from a 1-meter sediment core collected from the water-sediment interface of Lake Dziani. Preliminary results include Carbon and Sulfur isotopic (^{13}C, ^{33}S, ^{34}S) and abundance data of several mineral and organic sediment phases.

The sediments of Lake Dziani are characterized by high organic carbon contents (TOC=11.7±4.2%) and enriched stable carbon isotope signatures ($\delta^{13}C_{org.\ matter}$=-15.4±1.5‰), consistent with the highly-enriched isotopic composition of the inorganic carbon sources in the current lake water ($\delta^{13}C_{inorganic}$≈13‰). Focus was put on the molecular analysis of organic sulfur compounds formed during the early stages of burial in such an environment since sulfurization processes are postulated to play a key role in the preservation of sedimentary organic matter (*e.g.* Hebting *et al.*, 2006).

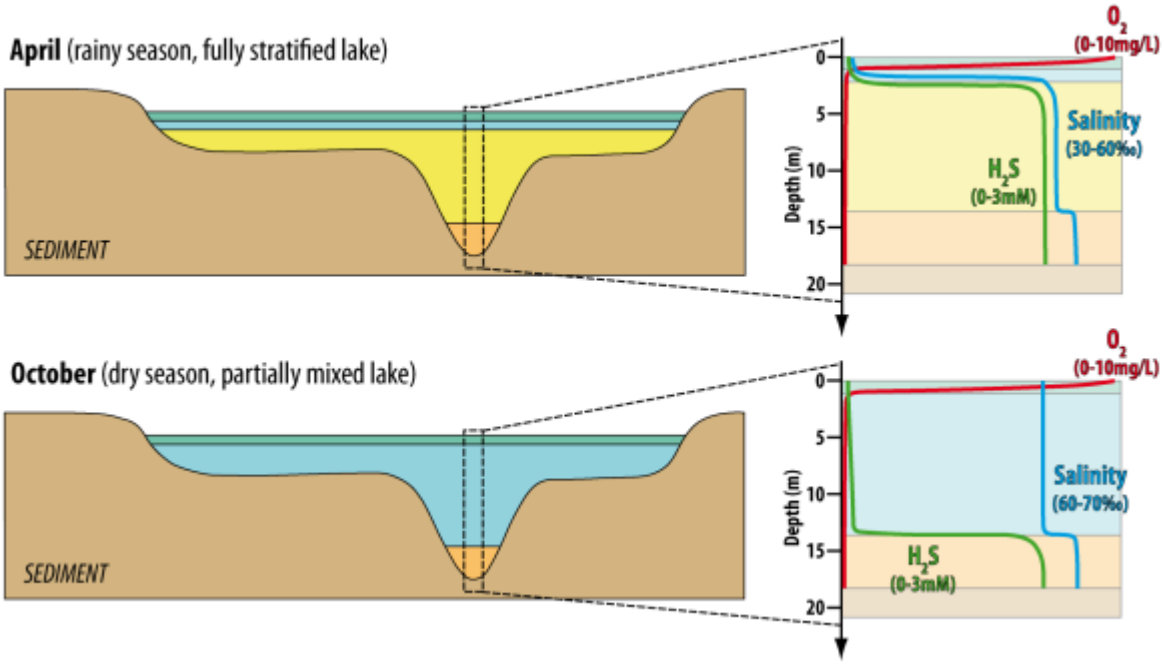

***Figure 1**: Cross-sections and O_2, salinity and H_2S log profiles of the water column showing the stratification of Lake Dziani during the wet (April) and the dry (October) season.*

Though there is a 1 meter-deep oxycline all over the year, the sulfide and salinity chemoclines are restricted to the deepest part of the lake during the mixed season (October).

References

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