The Dziani Dzaha lake (Mayotte): An analogue for high $\delta^{13}C$ precambrian paleoenvironments

P. CADEAU[1]*, M. ADER[1], D. JEZEQUEL[1], G. SARAZIN[1], P. ALBERIC[2], G. ABRIL[3,] C. CHADUTEAU[1], C. BERNARD[4], H. AGOGUÉ[5], E. FOUILLAND[6], M. BOUVY[6], P. GOT[6], E. LE FLOC'H[6] AND C. LEBOULANGER[6]

[1]IPGP, Univ. Paris Diderot, France
(*correspondence: cadeau@ipgp.fr)
[2]ISTO, Univ. Orléans, France
[3]EPOC, Univ. Bordeaux1, CNRS, France
[4]MNHN, 12 rue Buffon, CP 39, 75231, Paris, France
[5]LIENs, Univ. la Rochelle, CNRS, France
[6]MARBEC, Univ. Montpellier, IRD, CNRS, France

The Precambrian sedimentary record shows two periods of positive isotope excursion of extreme intensity ($\delta^{13}C_{carb}$ of +8‰ to +14‰) in the Paleo- and in the Neoproterozoic. Two main hypotheses coexist for these excursions. The most common one involves a global perturbation of the carbon cycle by increased burial of organic matter. The alternative one involves a local increase in the dissolved inorganic carbon isotope composition ($\delta^{13}C_{DIC}$) due to methanogenesis and/or photosynthesis. To better understand these isotopic signatures, one strategy is to study current analogues of these paleoenvironments.

We present here the first results obtained on the Dziani Dzaha alkaline volcanic cater lake (Mayotte), with a focus on the carbon isotope systematics. These results allow us to identify a combination of analogies to the high-$\delta^{13}C$ Precambrian paleoenvironments never reported yet to our knowledge: (i) values of $\delta^{13}C_{DIC}$ and $\delta^{13}C_{carb}$ ranging between +10‰ and +15‰ in strong desequilibrium with atmosphere, (ii) saline and sulfate poor waters probably modified from seawater, (iii) permanent anoxia below 1.5 meter depth in spite of seasonal mixing, and (iv) a trophic chain essentially reduced to prokaryotic primary producers and mineralizers.

Several possibly co-occurring processes taking place in the lake can be envisaged to explain its high $\delta^{13}C_{DIC}$ values: addition of methanogenic DIC, CO_2 and CH_4 degassing and/or by photosynthetic primary production coupled to organic matter sedimentation. It is higlhy plausible that methanogenesis and CH_4 degassing must have been more frequently occurring in Proterozoic environments than in the modern Earth, leaving open the possibility that the Dziani Dzaha is indeed a good analogue for high $\delta^{13}C$ Proterozoic environments. Other tracers than carbon isotopes will be studied to allow independent identifications of Dziani Dzaha like environments in the rock record.