Nitrogen isotope as tracer of biomass recycling in an analogue of Precambrian environment

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The nitrogen isotope composition ($\delta^{15}N$) in Precambrian sedimentary rocks are mainly interpreted as reflecting that of primary producers, based on the analogy with modern analogues. Yet, the biological communities in these analogues are probably very different from those of the Precambrian, which are though to have been dominated by prokaryotes. The recent finding that the lake Dziani Dzaha (a saline and alkaline tropical volcanic crater lake located in Mayotte, Indian Ocean) hosts such a biological community offers a unique opportunity to investigate if in such systems the sediment $\delta^{15}N$ do reflects that of the primary producers. The Dziani Dzaha also revealed other analogies with some marine and lacustrine Precambrian environments. It is sulfate poor and permanently anoxic below 1.5 m depth in spite of seasonal mixing. The planktonic biomass is dominated by cyanobacteria and no multicellular organisms have been identified so far in its waters (Leboulanger et al., 2017).

The $\delta^{15}N$ values of its suspended particles are on average of 6±1‰ and homogeneous with depth when the lake is mixed and cyanobacteria are alive in the whole water column. When the lake is stratified, $\delta^{15}N$ values increase up to 12‰ below the chemocline where cyanobacteria are dead, whereas the upper part of the water column where cyanobacteria are alive remains at 6±1‰. The $\delta^{15}N$ values of surface sediments thus mostly record the isotopic signatures of suspended particles below the chemocline when the lake is stratified ($\delta^{15}N_{sed}$ = 11±1‰), rather than that of the primary producers. This increase below the chemocline probably results from a combination of: (1) an efficient degradation of primary producers, which does not constitute the major part of sedimentary organic matter, and (2) the assimilation of ^{15}N-enriched NH^{4+} by bacteria and/or archaea. Implication for interpretations of past $\delta^{15}N_{sed}$ of this behavior will be discussed.

Leboulanger et al. 2017, *PLoS One* **12**(1)