Ammonia Oxidising Archaea in the OMZ of a freshwater African Lake

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Some oceanic or freshwater (stratified lakes) aquatic regions are characterised by the presence of oxygen-deficient water layers (i.e., ozygen minimum zones, OMZ) that represent a minor fraction of total Earth aquatic volume [Paulmier and Ruiz-Pino 2009]. In oceans, OMZ could barely contribute to ca. 50% of bioavailable nitrogen removal [Codispoti et al 2001, Gruber 2008, Lamp et al 2009, Ward et al 2009] supporting diverse microbial communities with critical roles in nitrogen cycling on Earth. Within the nitrification, the ammonia oxidation (i.e., the first step of the reaction) is the rate-limiting stage [Kowalchuk and Stephen 2001]. Until recently, ammonia-oxidizing bacteria (AOB) included in the Beta- and Gammaproteobacteria classes have been considered to be the unique microorganisms responsible for this biochemical process [Purkhold et al 2000]. However, recent evidences highlighted the importance of Archaea and Thaumarchaeota phylum as potential contributors to nitrification [Venter et al 2004, Treusch et al 2005, Könneke et al 2005] especially in oligotrophic marine and freshwater environments [Wuchter et al 2006, Beman et al 2008, Santoro et al 2010]. Lake Kivu is a deep, meromictic and oligotrophic African lake with a permanent chemocline located around 40–60 m depth with a putative community of AOA [Lliròs et al 2010, Descy et al 2012]. Two distinct lake water column conditions (i.e., rainy and dry seasons) were analysed in order to detect partitioning of AOA populations by combining 16S rRNA gene pyrosequencing and quantification approaches. Archaea represented a minor fraction of the planktonic microbial community in Lake Kivu ($<$10%), however AOA represented the main archaeal group in oxic and OMZ water compartments. Besides, no AOB-related sequences were recovered from these water layers and Nitrospira-related sequences were only recovered in the OMZ. Furthermore analyses of the active fraction of the archaeal assemblage revealed AOA as the main active archaeal component in the oxic and OMZ water compartments during rainy but not in dry season. Altogether evidenced the potential implication of AOA and Thaumarchaeota in nitrification processes taking place in the OMZ of Lake Kivu.

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