TITLE Genomic and physiological analysis of soil ammonia oxidising archaea: always good, never bad, sometimes ugly

NAME Graeme Nicol

E-mail: graeme.nicol@ec-lyon.fr

Affiliation: École Centrale de Lyon, Université de Lyon, France

Ammonia oxidation is the first and rate-limiting step of nitrification. This microbially-mediated process transforms ammonia to nitrate, the most reduced and oxidized forms of nitrogen, respectively. While an essential component of the global nitrogen biogeochemical cycle, this process also has major economic and environmental consequences, leading to an annual loss of >$15 billion of fertilizer, nitrate pollution of water and the generation of the greenhouse gas nitrous oxide. For over a century this process was thought to be dominated by ammonia oxidizing bacteria (AOB). However, just over a decade ago, ammonia oxidizing archaea (AOA) were discovered and found to be globally ubiquitous and abundant in soils and other environments, and considerable research effort has gone into understanding whether these organisms are truly functionally analogous to their bacterial counterparts. While most initial studies used measurements of abundance and correlation analyses to imply functional attributes, the use of cultivation, genomics and incubation studies have provided crucial insights into their unique contribution to soil nitrogen cycling. Specifically, genomic and physiological characterization of two novel soil AOA, *Ca.* Nitrosotalea devanaterra and *Ca.* Nitrososcosmicus franklandus (isolated from acidic and neutral pH soil, respectively) have indicated that while AOA are central to ammonia oxidation processes in many soils, fundamental aspects of their physiology indicate that their contributions to deleterious environmental processes are much less than that of AOB in terrestrial systems.