Title: Combined Geochemical and Molecular Analyses of Archaeal and Bacterial Ammonia Oxidizers in Columbia River Sediments

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Abstract: Recent studies suggest that ammonia oxidizing archaea (AOA) are actively involved in nitrification and play important roles in global nitrogen and carbon cycles. While these microorganisms are ubiquitous across diverse ecosystems, their metabolic properties and ecological functions are not well understood. Most research has focused on their roles in marine environments, with freshwater systems receiving less attention. The steep biogeochemical gradients found in freshwater sediments, however, should facilitate our ability to monitor changes in AOA populations in response to relatively severe fluctuations in nutrient concentrations. In this project, we aim to discover factors involved in niche diversification of AOA and to begin to understand the mechanisms behind their co-existence with ammonia-oxidizing bacteria (AOB) in freshwater sediments. We are exploring these questions using a combination of precise microanalytical methods and quantitative molecular approaches. Oxygen and E_h profiles were generated onsite for sediment core samples collected from the Columbia River across multiple seasons. The cores generally produced steep geochemical gradients. They were subsequently fractionated into 2 mm subsections for microbiological characterization, followed by extraction and purification of total DNA. Abundance of AOA and AOB was quantified by real-time PCR using primers specific for the ammonia monooxygenase gene (*amoA*) from each group. The composition of AOA and AOB assemblages was also examined in different sediment fractions by PCR-SSCP (Single-Strand Conformation Polymorphism) analysis. Potential relationships between measured geochemical variables and *amoA* gene diversity and abundance were evaluated. Results from these coupled molecular and microanalytical analyses provide novel information about the biology of ammonia oxidizing populations and their functions in the environment.