Diel variation of Marine Group I archaea decoupled with algae in the Pearl River estuary

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Marine group I archaea (currently known as Thaumarchaeota) have important ecological functions by coupling ammonia oxidation with CO2 fixation (i.e. nitrification). Because ammonia is often present in low concentation in open ocean, understanding the availability of ammonia is important for evaluating the process of nitrification in the ocean. In this study, surface water samples were collected at the Dongao island (113.658028E, 21.983961N) in the Pearl River estuary (salinity 30.10-33.97) every 2 hours during a 22 hour period by using a drone equipped with a 1-liter water bottle. Salinity and temperature were determined at each sampling time point. Water samples were filtered through 0.2 μm filters and DNA (22-33 ng/μl) collected on the filter was used for qPCR and sequencing analyses. qPCR was performed to quantify the abundance of Marine Group I Thaumarchaeota (MGI), Marine Group II Euryarchaeota (MGII), bacteria and algae. 16S and 23S rRNA sequencing was conducted to delineate the community structures of these microbial groups. Bacteria are the dominant prokaryotic community and stayed relatively constant (1.03 x 108-1.88 x 108 copies per ml) during the sampling period. The abundances of MG I, MG II and algae were 2-3 orders of magnitude lower than bacteria. One salient feature of this preliminary study was the negative correlation in abundance between algae and MG I, with MG I reaching a peak value while the algae dropped to a lowest point around 5 am in the morning. We hypothethsize that the activity of MG I in performing nitrification is repressed during the day time by photo-inhibition and algal uptake of ammonia as a nutrient; this repression is lessened during the night time when photo-inhibition is removed and algal activity subsided, leaving ammonia availale for archaeal nitrification. Observation of this diel variation in MGI abundance is important for understanding the temporal dynamics of nitrification in coastal oceans.