Controls on Chemoautotrophic Production along Depth Profiles of the Water Column off the Northwestern Antarctic Peninsula

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Recent discoveries have revealed that the oxidation of a variety of reduced inorganic compounds, like sulfide and ammonia, may be used as an energy source by pelagic microbes in the oxygenated water column of the dark ocean, highlighting the need for increased efforts in quantifying and understanding dark carbon fixation in marine ecosystems. The aim of this study was to determine the relevance of chemoautotrophic production in the waters off the Northwestern Antarctic Peninsula by assessing the in situ rates of prokaryotic dark carbon fixation, and their response to the addition of various substrates. Samples were collected at four oceanographic stations located in Gerlache and Bransfield Straits in the euphotic zone, below the euphotic zone, and near the seafloor. Incubations were performed by measuring the incorporation of 14C-bicarbonate in the dark at approximate in situ temperatures. Treatments amended with ammonium, ammonium and antibiotics, nitrite and thiosulfate were compared to killed and unamended controls. The average rates varied from 0.01-0.09 µgC/L.h in Bransfield, and from 0.004-0.04 µgC/L.h in Gerlache, and the addition of ammonia generally stimulated activity when compared to other treatments. The sample located above the hydrothermally active Hook Ridge had relatively higher in situ rates, suggesting that chemosynthesis at this location might be stimulated due the presence of substrates released into the water column by venting activity. At the same depth, samples were also taken for assessing the identity and functions of active microorganisms using RNA-based approaches. Combined with the chemosynthetic rate measurements, this will provide important information on the relevance of chemosynthesis in oxygenated waters of the Southern Ocean.