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Organic Iron Complexation in the Oligotrophic Sub-Tropical Waters in the Tasman Sea, North of New Zealand

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Photosynthetic carbon fixation by marine phytoplankton and the subsequent export of particulate organic carbon to the ocean interior represent a biological carbon pump that regulates atmospheric CO2 concentrations and climate over geological time scale. The important role of iron as a limiting micronutrient for primary production in the ocean has become widely accepted. However, there have been relatively few measurements to date to examine phytoplankton limitation in subtropical open ocean waters. Here we present data for the chemical speciation of iron and on-deck multi-factorial incubations for two stations located in the oligotrophic regions to the south and north of the Tasman Front (TF), northwest of New Zealand. Results confirm that both regions are typical of oligotrophic waters, in being dominated by picophytoplankton and bacteria. The dissolved iron concentrations were low (<0.25 nM) in the surface waters and the chemical speciation of iron was dominated by organic complexation. The iron-complexing ligands were higher for the upper water column north of the TF. The vertical profiles of the ligands showed a maximum consistent with the biological sources for ligand production. Interpretation of incubation results along with chemical speciation data suggest that community primary productivity was nitrogen-limited in these oligotrophic subtropical wasters, and the fixed nitrogen limitation may result from iron control of nitrogen fixation. The data are in support of the iron –limited nitrogen fixation hypothesis that by controlling N2 fixation, iron may control not only nitrogen limitation but also carbon fixation and export and hence biological sequestration of atmospheric carbon dioxide.