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CHEMISTRY AND STRATIFICATION OF COASTAL AND INLAND MELTWATER PONDS (LAT 77-78°S), VICTORIA LAND, ANTARCTICA.

B.R. Wait[1], J. Webster-Brown[2], M. Healy[2], K.L. Brown[2]

[1]Gateway Antarctica, University of Canterbury, Christchurch, New Zealand, [2]University of Auckland, Auckland, New Zealand

In order to establish the range of chemical conditions tolerated by pond biota, the geochemistry and vertical stratification of shallow meltwater ponds near Bratina Island on the McMurdo Ice Shelf, and in the upper Wright and Victoria Valleys in the McMurdo Oasis, have been determined for late winter (October) and summer (January) conditions. A total of 24 ponds were investigated as part of this study. In October, the frozen ice columns of all except the most dilute ponds were stratified with respect to conductivity, with an increasing abundance of saline fluid inclusions in the ice at greater depth. Half of the ponds had highly saline basal brines (conductivities of up to 148 mS/cm) beneath the ice, at temperatures of -16 to -20^{o}C. In January, 80% of the ponds retained conductivity stratification in the meltwater column, with a significant increase in salinity in the deepest 10-20cm. Significant thermal stratification was observed in just over half of the ponds, with a maximum temperature difference of 10^{o}C.

The coastal basal brines, ice and meltwaters near Bratina Island were Na-Cl or Na-SO_4 dominated, whereas inland ponds were consistently Na-Cl dominated. The inland ponds were significantly enriched in NO_3 relative to the coastal ponds, due to the dissolution of NO_3-rich mineral salts in the soil, and the reduced influence of marine aerosols and biological productivity in the inland ponds. FREZCHEM modelling, supported by changes in ionic ratios, indicated that the precipitation of mirabilite ($Na_2SO_4.10H_2O$) and gypsum ($CaSO_4.2H_2O$) during progressive freezing is an important determinant in the chemical evolution of the basal brine. High pH (up to11.2) and over-saturation with respect to dissolved oxygen (>20mg/L) in summer, and the presence of sulphide ion in basal brines in winter, occurred in those ponds which experienced high biological productivity during the summer months, particularly the coastal ponds.