

Dating water and solute additions to ice-covered Antarctic lakes

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The McMurdo Dry Valleys region of Antarctica is the largest expanse of ice-free area on the continent. Even at mean annual temperatures of $\sim 20^{\circ}\text{C}$, ice-covered lakes containing liquid water exist in these valleys. Over the past decade we have extensively investigated the three major lakes in Taylor Valley (78°S), as part of the McMurdo Dry Valleys Long-Term Ecological Research (MCM-LTER) program. Lakes Bonney, Fryxell and Hoare have very different geochemistries and evolutionary histories even though they are within 25 km of each other. We present recently published ^{36}Cl and ^{129}I data from these lakes along with a time series of ^3H , ^3He and CFC profiles in order to better ascertain the influence of climatic variation on the impact of water and solutes influx to the lakes. The ^{36}Cl and ^{129}I profiles from each lake document lower frequency, longer term variations in the hydrologic balance of each lake and demonstrate that the lakes have different ages and sources of solute input. The ^3H data suggest that over the past 50 years Lake Fryxell and Lake Hoare have had different sources of water or that the timing of water input into the lakes has been different. Changes over the past 10-15 years in the ^3H , ^3He and CFC concentrations document more subtle, higher frequency changes in water and solute flux. This data set supports the notion that these lakes can respond dramatically to small variations in temperature. This work also demonstrates that the MCM lakes serve as important indicators of climate change in this region of Antarctica.

Experimental results from iodine speciation and transport studies

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Application of fuel reprocessing ^{129}I as a tracer in terrestrial systems is hampered by a lack of understanding of iodine cycling in soils and aqueous reservoirs. Through column and batch experiments, we examined sorption and transport of iodine species (iodide, iodate, and 4-iodoaniline) in several subsurface geological media collected at the Savannah River and Hanford Sites, where anthropogenic ^{129}I from fuel processing activities poses an environmental concern. The geological media examined exhibit a wide range in organic matter, clay mineralogy, soil pH, and texture. Transport of iodine in these sediments is complex with various processes occurring, including iodate conversion, irreversible retention/mass loss of iodide, rate-limited and nonlinear sorption. We observed appreciable iodate reduction to iodide, probably mediated by the structural Fe(II) in some clay minerals. In addition, iodine speciation in solid materials was examined using synchrotron X-ray techniques (XAS). This technique gives oxidation state and bond-length, which dictate biogeochemical interactions and reservoir residence times. Organoiodine compounds were identified alone and in combination with inorganic forms in soils, plants, and marine sediments.

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