Proc. NIPR Symp. Antarct. Geosci., 6, 152, 1993

ORIGIN OF DISSOLVED SALTS INFERRED FROM LITHIUM ABUNDANCE IN LAKE AND POND WATERS IN THE ANTARCTIC McMURDO DRY VALLEYS (ABSTRACT)

Nobuki TAKAMATSU[1], Naoyuki KATO[2], Genki I. MATSUMOTO[3] and Tetsuya TORII[4]

[1]*Department of Chemistry, Faculty of Science, Toho University, Miyama, Funabashi 274*
[2]*School of Medicine, Toho University, Omori-nishi, Ota-ku, Tokyo 143*
[3]*Department of Environmental Information Science, School of Social Information Studies, Otsuma Women's University, Karakida, Tama-shi, Tokyo 206*
[4]*Japan Polar Research Association, Hirakawa-cho, Chiyoda-ku, Tokyo 102*

Lithium and major ionic components in lake, pond and meltstream waters and ice samples in the McMurdo Dry Valleys of southern Victoria Land, Antarctica were determined to elucidate the origin of dissolved salts. The Li concentration of the bottom water in Lake Fryxell (0.13 mg/L) was similar to that of seawater (0.178 mg/L), but those of Lakes Bonney (5.1-8.8 mg/L) and Vanda (27.0 mg/L), and Don Juan Pond (390 mg/L) were much higher. In contrast, the Li concentrations in the pond waters, glacial meltwaters, pond ice core in the Labyrinth were generally low (less than 88.0 μg/L). The enrichment factor for Li [$Ef_{Li} = (Li/Cl)_{sample}/(Li/Cl)_{seawater}$] was used to discuss the origin of dissolved salts in the water bodies. The $\log Ef_{Li}$ values of the pond waters in the Labyrinth linearly decrease with Cl concentration. Whereas these values in the bottom waters of Lakes Fryxell, Bonney, Vanda and Don Juan Pond were largely deviated from the Labyrinth pond water line, suggesting the difference of sources and/or concentration processes. The result of the dissolution experiment of dolerite in NaCl solution at 40°C and the high Li concentrations with high Ef_{Li} values of Lake Vanda and Don Juan Pond suggest that their salts are originated from ground waters influenced by hydrothermal activity. Freeze concentration experiment of seawater showed that some Li migrates into the ice phase. The freezing fractionation of Li into the ice phase, therefore, may be a significant elimination mechanism of Li from pond waters in the Labyrinth. The repeated cycles of freezing of the pond waters and subsequent ablation of ice will lead to the saline waters having low Ef_{Li} values.

(Received March 23, 1993; Revised manuscript received June 2, 1993)