HYDROGEOCHEMICAL STUDY OF DON JUAN POND IN THE DRY VALLEYS AREA, SOUTH VICTORIA LAND, ANTARCTICA (EXTENDED ABSTRACT)

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The Don Juan Pond, discovered by MEYER *et al.* (1962) in 1961, is located in the enclosed drainage basin in the South Fork of the Wright Valley in the dry valleys area, about 7 km west of Lake Vanda. This pond is small and very shallow, and in midsummer is fed mainly by meltwater, but has no outflow. Its size considerably changes from year to year due to the fluctuating water supply.

This pond is a very unique brine pond. Pond water contains about 40 wt% salt, and more than 90% of the salt is calcium chloride which is a nearly-saturated solution.

In December 1963, TORII and other Japanese geochemists visited this pond and they found a peculiar type of large crystal that reached a length of about 10 cm. The results of chemical analysis and X-ray powder diffraction analysis of the crystals agreed with those of artificial calcium hexahydrate, $CaCl_2 \cdot 6H_2O$. TORII and OSSAKA (1965) proposed the name Antarcticite for this new mineral.

The succeeding geochemical observations of this pond have been done for these 20 years since the austral summer season of 1962–1963 by Japanese geochemical and geophysical parties. The results of these observations during 15 years since the first visit to this pond have been reported by TORII *et al.* (1977).

The sequential changes in chemical composition of this pond water during 5 years after the 1977–1978 austral summer season are shown in Table 1, and the calcium to chloride concentration ratios during about 20 years are shown in Fig. 1.

Changes in the water supply and evaporation rates are reflected by changes in the concentration of chemical elements in the pond water, but concentration ratio of calcium to chloride is comparatively constant, with values between 0.50–0.55, except for the season of 1970–1971 when the ratio was 0.49. This season is known to have had excessive runoff to the extent of a rise in water level of Lake Vanda by two meters (TORII *et al.*, 1977). Inflow into the Don Juan Pond also increased and the maximum water depth recorded was 25 cm in this season (TORII *et al.*, 1977).

From a geochemical point of view, the most interesting problem is the source of the salts in this high saline pond. Many investigators reported the various hy-

Table 1. Chemical composition of the saline water in Don Juan Pond and occurrence of antarcticite.

Sample No.	21	22	23	24	25
Sampling date	Jan. 17, 1978	Jan. 12, 1979	Jan. 16, 1979	Dec. 3, 1979	Dec. 22, 1980
Water temperature (°C)	—	16.5	7.8	9.8	9.5
Specific gravity at 25°C	1.356	1.340	1.342	1.328	1.311
Na (g/kg)	4.77	2.29	2.41	6.13	9.95
K 〃	0.22	0.15	0.14	0.17	0.15
Ca 〃	124.6	130.2	130.9	115.3	107.7
Mg 〃	1.9	1.45	1.46	1.90	1.66
Cl 〃	229.8	238.7	241.9	231.2	209.6
SO_4 〃	0.0	0.0	0.0	0.0	0.0
Evaporation residue at 180°C (g/kg)	—	319.6	368.0	355.1	344.8
Occurence of antarcticite	No	No	No	No	No
Sampling by	T. TORII T. CHO	T. TORII N. MASUDA	T. TORII N. MASUDA	Y. YUSA S. NAKAYA	T. TORII S. NAKAYA G. MATSUMOTO

Sample No.	26	27	28	29	30
Sampling date	Jan. 9, 1981	Jan. 26, 1981	Nov. 30, 1981	Dec. 21, 1982	Jan. 4, 1983
Water temperature (°C)	12	6.1	—	—	10.6
Specific gravity at 25°C	1.323	1.322	1.302	1.334	1.292
Na (g/kg)	6.95	7.80	7.75	2.50	10.6
K 〃	0.19	0.19	0.17	0.19	0.10
Ca 〃	117.2	112.0	106.0	130.4	108.7
Mg 〃	1.49	1.55	1.86	2.37	1.63
Cl 〃	215.4	215.6	207.9	238.0	210.9
SO_4 〃	0.0	0.0	0.0	0.0	0.0
Evaporation residue at 180°C (g/kg)	354.8	350.5	325.3	354.1	310.4
Occurence of antarcticite	No	No	No	No	No
Sampling by	I. MAZE	I. MAZE	T. TORII Y. YUSA	R. H. J. DICSON T. BUTLER	T. TORII S. NAKAYA N. MASUDA N. TORII

potheses on the origin of the salts in this pond, but there is no consensus on the origin of the salts yet. The various hypotheses put forward fall into several categories; geothermal, trapped seawater, chemical weathering of rock, sea spray, glacial meltwater, and ground water discharge.

Relations of cations, sodium, potassium, calcium and magnesium, in equivalent percentages are shown in Fig. 2. As seen in the figure, this pond water seems to be divided into two groups, one is rich in sodium plus potassium, and the other is rich

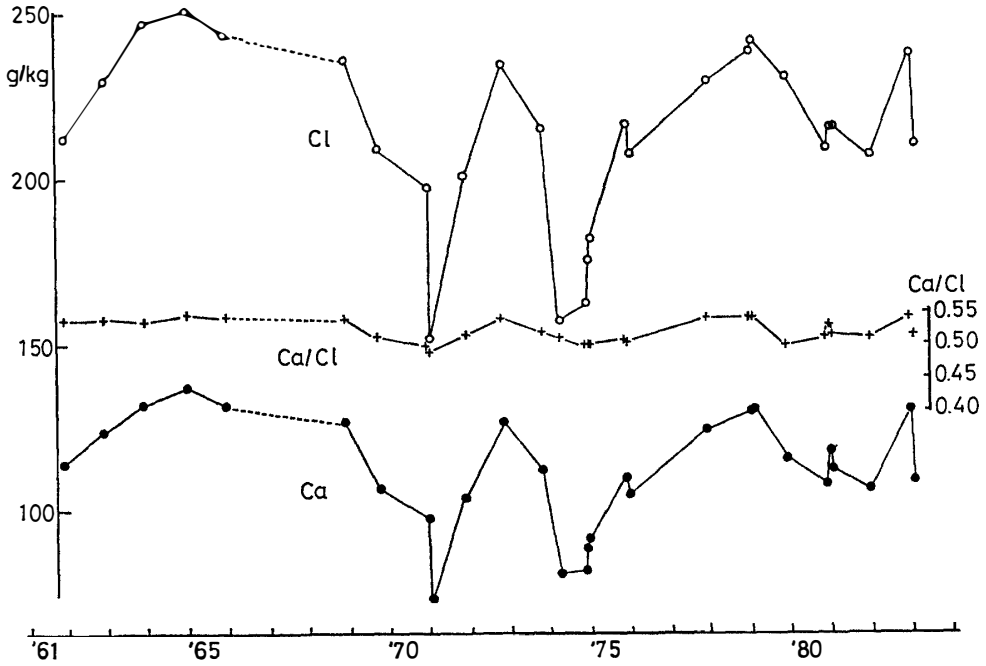

Fig. 1. Sequential changes in calcium and chloride concentrations, and concetration ratio of calcium to chloride in the Don Juan Pond water.

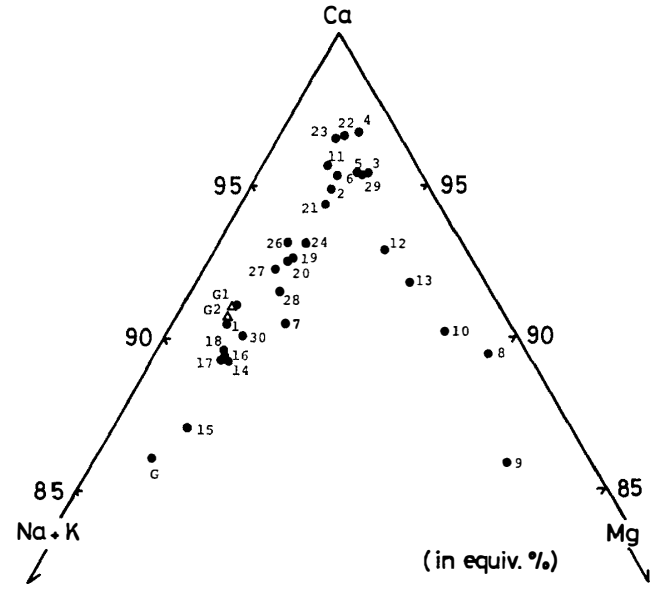

Fig. 2. Relations of calcium, magnesium and sodium plus potassium in the Don Juan Pond water. 1–30: sample number in Table 1; G, G1, G2: ground water collected from DVDP 13 borehole; G: collected by McGinnis on December 12, 1978. G1, G2: after Torii and Waguri (1975).

in magnesium. Also, chemical compositions of the ground water collected from DVDP 13 borehole in the Don Juan basin fall into the sodium plus potassium rich group.

From these results, the inflow volume and chemical composition of ground water in the Don Juan basin may reflect the origin of salts in this pond.

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