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# SOIL DEVELOPMENT IN POLAR DESERTS: IMPLICATIONS FOR EXOBIOLOGY AND FUTURE MARS MISSIONS

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Chemical alterations, weathering and diagenesis of soil profiles from the Dry Valleys of Antarctica have been studied as analogs of regolith development for the Martian regolith. Chemical weathering processes play an important role in soil development within the Dry Valleys of Antarctica[1]. The present study has focused on a suite of core samples taken within the valley floors in addition to samples taken in the vicinity of evaporite and brine ponds. Analyses of water-soluble cations and anions from core samples have been carried out along with petrographic analysis of selected samples. Study of the water-soluble ions has shown that ionic transport processes operate primarily above the permanently frozen zone. Abundances of the water-soluble ions reflect the nature of secondary minerals produced by evaporation and weathering processes.

Chloride, calcium and sodium abundances for soils from the cores within the North and South Forks of Wright Valley, reflect the secondary mineralogy within the soil columns. Sodium occurs primarily as halite (NaCl) while chloride ions are associated with both halite and antarcticite ($CaCl_2 \cdot 66H_2O$). Calcium ion abundances reflect phases such as gypsum, calcite and antarcticite. Chloride abundances ranged from as low as 10 micromoles for soils from South Fork evaporite ponds to values as great as 4,000 micromoles in salt-rich evaporite layers from the edge of Don Juan Pond. In common with soils from other arid parts of the world, high soluble salt concentrations are characteristic of Dry Valley soils and core samples. The water-soluble ions from the soils can assist in the determination of the nature of the secondary mineralogy. Mass balance calculations for Na, Ca and Cl abundances in soils reflect the appearance of halite and antarcticite. In areas where excess Ca is present, XRD studies show the presence of gypsum.

It is well known that the Martian surface conditions may be favorable for chemical weathering.[2] Primary silicates would be expected to be reactive with any ground water. Because of the possible existence of an extensive subsurface system of water-ice and maybe even liquid water just below the Martian surface,[3] it seems likely that water is available to assist in the weathering of the primary minerals. Such weathering could result in the formation of clays, sulfates, carbonates, hydrates, halides, and zeolites. The study of the Dry Valley cores has shown that they may be excellent analogs to weathering processes operating on the near-surface of Mars. Since movement of water within the near-surface region clearly results in chemical weathering, leaching and salt formation in the Dry Valleys, similar processes are probably operating within the Martian regolith. Any experiment performed *in situ* on the Martian surface must take into account the presence of salts.

## REFERENCES

1. E. K. Gibson et al. (1983) Proc. 13th Lunar Planet. Sci. Conf., JGR. 88, Suppl. A912-A928.
2. J. L. Gooding (1989), this volume.
3. S. M. Clifford (1981) Third Intern. Mars Colloq. 44-45.