

Experiments on Salt Weathering in Cold Environments : Effects of Dissolved Salts on Frost Shattering

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Weathering experiment was carried out to investigate the effects of dissolved salts on frost shattering using four types of rocks (two tuffs, one sandstone and one andesite) and three types of salt solutions (sodium chloride, sodium sulphate and magnesium sulphate). Cubic specimens with a side of 5 cm in length were immersed in saturated salt solution of NaCl, Na₂SO₄, MgSO₄ or distilled water for 72h. After immersion, the specimens were covered with foil and subjected to up to 80 freeze-thaw cycles in a cold chamber where the temperature ranges from -30 °C to 10 °C within twenty four hours.

Freezing points of salt solutions were decreased by dissolved salts. In particular, the saturated solution of NaCl did not freeze under -25 °C. The linear strain on the surface of specimens was measured with strain gauge during freeze-thaw cycle. The specimens immersed in salt solutions showed greater freezing strain than those immersed in distilled water. Specimens with MgSO₄ solution produced the large strain. In most cases, the strain strongly correlated with Weathering Susceptibility Index (WSI). The decreasing rates of the longitudinal wave velocity and the Equotip hardness value during freeze-thaw cycles also correlated with WSI.

Keywords: salt weathering, frost shattering, cold environments, freezing strain, laboratory experiment