Geophysical Research Abstracts
Vol. 14, EGU2012-13007, 2012
EGU General Assembly 2012

Comparison of rate of physical and chemical decomposition of rocks in weathering by wetting-drying and wetting-freezing-drying cycles

T. Vezmar (1), M. Kasanin-Grubin (1), N.J. Kuhn (2), and D. Milovanovic (3)

(1) EDUCONS University, Faculty of Environmental Governance, Sremska Kamenica, Serbia (tijana.vezmar@gmail.com), (2) Department of Environmental Sciences, University of Basel, Switzerland, (3) Faculty of Mining and Geology, University of Belgrade, Serbia

The type and amount of weathering is determined by a complex combination of physico-chemical properties of the material and climatic conditions. Different materials respond differently in the same environments, but also the same materials can respond in different ways to the same processes in different environments. Weathering processes are often acting simultaneously at one site and it is sometimes hard to determine the exact weathering process that resulted in a certain weathering product.
Rock characteristics, alternation of wetting and drying cycles and presence of joints and fissures are crucial for weathering processes. However, there is a big difference in the material response to precipitation depending on whether or not it is followed by freezing when more deterioration occurs.
In order to study in detail the behaviour of different rocks under moisture and temperature regimes, weathering experiments with multiple cycles were carried out. The aim of these experiments was to obtain data about dynamics of decomposition of rocks under controlled laboratory conditions. Six rocks were selected for the weathering experiments due to their geological setting in mountain regions and their physico-chemical and mineralogical characteristics: red and grey sandstone (Germany), red sandstone (Serbia), tuffaceous rock (Island), gabbro (Serbia), and dunite (Germany). Samples of each of these rocks were examined in two separate experimental sets. First set consisted of 10 identical cycles that included 4 steps: raining, freezing, thawing and drying. After each step, sample mass was measured. Second set also had 10 cycles, but consisted of two steps: raining and drying. Leachate was collected after each cycle during both sets and volume, pH and conductivity was measured. Contents of Ca, K, Mg, Si, Al and Fe were determined in collected leachate after cycles 1, 5 and 10.
Leachate characteristics were similar in both experimental sets. Volume, conductivity and pH of leachate were constant throughout all cycles. Furthermore, the concentrations of analyzed elements in the leachate were low throughout both sets of the experiment. As expected, freezing of samples did not show significant influence on concentration of tested elements in the leachate. However, the rate of mass loss differentiated samples from two experimental sets. Mass loss in samples submitted to freezing was constantly increasing with the number of cycles for all tested rocks. According to mass loss, dunite was most quickly deteriorating from all tested rocks during both experimental sets. Dunite lost about twice as much mass when frozen then when rained on. Both red sandstones behaved similarly to dunite. On the contrary, mass loss in grey sandstone, tuffaceous rock and gabbro during raining was <1%, but increased 4 times with freezing.
Rock characteristics crucial for weathering are mineralogical composition and physico-mechanical characteristics. Obtained results indicate that the physical weathering processes are important in all tested rocks. Furthermore, they indicate that the rate of physical weathering during rainfall is not an indication of deterioration that will occur during freezing.
Key words: weathering experiment, raining, freezing, rocks