



Study on Geological and Chemical Factors Controlling Calcite Deposition in Natural Waters (Tufa) at Handagiri Ella, Balangoda, Sri Lanka

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Abstract

Imbulamure and Godakumbura are main springs that generating two creeks parallel to each other and joining at the downstream for feeding Handagiri Ella water fall located at Kalthota in Ratnapura district. Handagiri Ella is the only water source for the down stream vilage called Handagirigama where people use the surface water from streams and shallow wells fed by Handagiri Ella. However, there are several proposals to set up a minihydropower project constructing a dam at upstram of water fall and release water to downstream village bypassing the water fall. The objective of this study was to investigate the chemical processes and geological aspects affecting the natural cleaning process at the water fall system. Two cross section maps were drawn for both creeks to determine the gradient of the flow path. Fifteen sampling sites for Imbulamure creek and nine sampling sites for Godakumbura creek were selected. Physico-chemical parameters including pH, conductivity, temperature, dissolved oxygen concentration, alkalinity, total hardness and flow rate of water were measured. Total Fe, Mn, Mg, Ca and Cu concentrations of pre-acidified water samples and digested soil samples were measured by using atomic absorption spectroscopy. The crystalline structures of depositions in the upstream, downstream areas and two caves located in the mid stream sites were tested by XRD-analysis. The calcite saturated level of water was derived using the Langelier Saturation Index. The results indicated that the springs contain high bicarbonate concentrations (4-10 ppm) bringing out mineral rich ground water. The springs contained high iron concentration (7.13 ppm) and deposited as oxidized form near the springs giving yellow-brown color soon after having exposed to the atmospheric oxygen. The water in the upstream sites were below the supersaturating state (< 0.5 Langelier Saturation Index) with respect to the CaCO₃ saturation. Ca²⁺ and HCO₃⁻ concentrations of water at upstream (Godakumbura 63.85, 4.00ppm and Imbulamura 61.00, 10.00ppm) was higher than downstream (Godakumbura 45.28, 1.6ppm and Imbulamura 21.3, 2.8ppm). This decrease of concentrations perhaps was due to calcite deposition at the midstream sites at the water falls. A statistical analysis showed that water conductivity, bicarbonate and iron concentrations had a positive correlation with the calcium concentration whereas pH had a negative correlation with the iron concentration. At the



supersaturated state, the activity of iron on active sites of calcite might inhibit the deposition at the upstream. Therefore, a thick calcite layer could be observed at the cascade system and in the water falls compared to the upstream. This result revealed that there was a natural purification process occurring within the midstream. If the upstream water would be pumped directly to the down stream by a minihydropower project, mineral rich water without purification will be there in the downstream.

Key words: *Calcite depositions, Iron oxides, Langelier Saturation Index, Supersaturating state*

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