HYDROGEOCHEMISTRY OF CHHOTA SHIGRI GLACIER, LAHAUL-SPITI VALLEY, HIMACHAL PRADEAH

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ABSTRACT

Glacierised areas present an ideal environment in which to study water-rock interaction, since chemical weathering rates are high and anthropogenic impacts are often minimal. The present study investigates chemical characteristics of melt water of Chhota Shigri Glacier in terms of association of different chemical compounds with the geology of the area. In the melt water the presence of cations varied as $c(Ca^{2+})>c(Mg^{2+})>c(Na^{+})>c(K^{+})$, while the order of concentration of anions has been $c(HCO_3^-)>(SO4^{2-})>c(Cl^-)>(NO_3^-)$.

The average pH and EC of melt water of Chhota Shigri Glacier was recorded as 7.3 (6.7-7.8) and 13µs/cm (10-30 µs/cm) respectively. The average concentration range of major cations was found to be Ca^{2+} 80.34µeq/l (65.96-95.45µeq/l) and Mg^{2+} 69.14µeq/l (41.54-111.2314 µeq/l) foliowed by Na^+ 19.92µeq/l(13.50-28.47 µeq/l)and K^+ 15.82 µeq/l (12.38-20.49 µeq/l) respectively. The average concentration of major anions was HCO3- 131.50 µeq/l (63.89-184.5 µeq/l) followed by SO_4^{2-} 53.77 µeq/l (25.00-70.70 µeq/l), Cl^-14.29 µeq/l (6.59-22.70 µeq/l) and NO_3^- 1.20 µeq/l (0.00-8.32 µeq/l) respectively. The average TSM of Chhota Shigri Glacier meltwaters was 613.66mg/l (150-1310mg/l) and dissolved silica was 28.05µm/l. The charge balance between anions and cations of the samples averaged -4.40. Most of the samples show negative charge balance indicating cation removal from the

system possibly due to ion exchange processes along with multiple sources which controls the anions such as aerosol /dust deposition.

The high ratio of c(Ca^{2+}+Mg^{2+})/Total cations(0.81)and c(Ca^{2+}+Mg^{2+}) c(Na^{+}+K^{+})(4.2) indicate that the melt water chemistry of the Chhota Shigri Glacier is mostly controlled by carbonate weathering of granites and other crystalline rocks and could be the major source of dissolved ions in the water. The ratio of c(Na^{+}+K^{+})/ total cations is low (0.19), which indicates that there is very small contribution from silicate weathering. Melt water of Chhota Shigri glacier shows a high Na^{+}/ Cl^{-} ratio (1.4) suggesting that most of the sodium in melt water results from silicate weathering and very negligible contribution from sea salt. The estimated bicarbonate contribution from carbonate and silicate weathering using the equation suggested by Raymahasay(1986) indicate that most of the HCO_3^- (67%) comes from carbonate weathering and remaining(33%) from silicate weathering