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Geochemical mass-balance to study the relative weathering rates of various formations in a complex watershed of lower Himalayas

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Weathering of rocks is a major process and believed to have the potential to alter Earth's surface. Aglar, a watershed in Garhwal Lesser Himalayas is identified and various formations of this complex geology are studied to understand the weathering process. A stream passes through the fault that divides the watershed into two slopes which have different lithotectonic units. Paligar and Belgar are the two main tributaries of Aglar stream flowing along the slopes respectively and joining at the valley near Thatyur village, India. Rocks like quartzite and limestone are generally hard, massive and resistant to weathering. However, sedimentary rocks are vulnerable to weathering and erosion. On the other hand, phyllites and schists are characterized by flaky minerals which weather quickly and promote instability . Aglar has all of them. The weathering processes are studied first using the hydrochemistry of Aglar river through major cations (Ca2+, Mg2+, Na+, K+) and major anions (SO42-, HCO-3, Cl-, NO_3-). The discharges at various sampling points are calculated using area – velocity method. The basic idea in describing the discharge of material in a river is to estimate the mass of the substances transported through a cross section of the river per second. Dominance of Ca2+, Mg2+ and HCO-3 indicates that carbonate weathering is the major chemical weathering process near Belgar river. Paligar river has lower conductivity values compared to Belgar river which illustrates lower ionic concentrations. Mass-balance calculations are found often skewed and suggest the role of subsurface groundwater flow to explain the uncharacterized load. Southern side of the watershed with higher percentage of forest cover is found to have higher chemical weathering rates compared to the other slope having relatively lesser vegetation. These higher rates demonstrate the higher stream discharge load in that slope.