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Role of weathering and flow path length on elemental and isotope composition of spring waters from the Melamchi valley, Nepal

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Chemical weathering of continental silicate rocks plays a critical role in regulating global climate on geological time-scales by removing CO_2 from atmosphere and sequestering it in ocean in the form of carbonate rocks. Kinetically limited active mountain building regions such as the Himalayas are thought to be one of the hotspots of weathering. However, determining the precise role of silicate weathering in the Himalayas is complicated by lithological diversity, variability of tectonic and climatic controls and challenges of discriminating the contribution of ions from silicate and carbonate sources, in addition to processes that form secondary minerals. The geochemical and isotopic composition of groundwater and rivers is used to study the nature and intensity of the weathering processes and to distinguish the sources of ions, from processes. In this study we present new data from 90 spring and stream water samples combined with stream bed sediments across the Melamchi Khola basin in Nepal, ranging in elevation from 900 to 3300m across the pronounced gradient from low relief Middle Hills to the steep High Himalayas. We measured solute concentrations to identify the sources of ions in groundwater and streams and to evaluate the role of flow path length, groundwater fluxes and temperature on elemental and isotopic compositions. Our preliminary results shows an increase in elemental concentration and decrease in Ca normalised elemental ratios with decreasing elevations, consistent with increased weathering intensity due to longer flow path lengths at lower elevations and/or more rapid weathering at the higher temperature at lower elevations. A significant correlation between Na/Ca and Sr/Ca, suggests inputs from both carbonate and silicate sources. Systematic variation in ratios of silicate-derived elements (e.g., Na to Si) in higher altitude catchments may be interpreted to imply that the increase in elemental concentrations with decreasing altitude relate to flow path length. Lower altitude catchments exhibit more varied composition related to higher intensity silicate weathering reactions.