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Influence of periglacial conditions on river chemistry in active mountain belts insights from the Zayu River catchment from SE Tibet

XIAOBAI RUAN[1] AND ALBERT GALY[2]

[1]University of Lorraine

[2]CRPG - CNRS - Université de Lorraine

Presenting Author: xiaobai.ruan@univ-lorraine.fr

The effects of the combination of periglacial conditions in active mountain belts on the critical zone processes have drawn little attention. Here, we investigated the water chemistry in the Zayu River catchment, SE Tibet. The Zayu River drains the Eastern Himalaya, one of the most tectonically active regions, with a relief of more than 5000m and a significant altitudinal climatic gradient. The upstream of the Zayu river, above 3500 m (denoted N-Zayu), is in climatic conditions typical of the southern Tibet, with periglacial conditions. Downstream, the river catchment (denoted S-Zayu) is covered by subtropical monsoonal forest. The lithology of the Zayu catchment is dominated by the Eastern Himalayan Batholigh (EHB) with variable geochemical compositions and sedimentary rocks that contains carbonate. Water samples (main river, major tributaries, streams, and seepages from mass wasting deposits) and river bedload have been collected during the monsoon season. The dissolved data are corrected for the cyclic input and secondary calcite precipitation (SCP), then proportions of sulfuric and carbonic acid, and carbonate and silicate are estimated [1].

The results show that Ca loss by SCP in the N-Zayu is 52±26 % (1σ) while in the S-Zayu the Ca lost is negligible (2±4 %). Corrected water Na/Ca ratios vary negatively with Ca loss. The carbonic acid is the dominant weathering acid, with 86±8 eq% for the N-Zayu and 69±13 eq% for the S-Zayu, assuming fully degassing during SCP, the remaining being sulfuric acid. The cation-based X_{carb} is 89%±4 eq% in the N-Zayu and 64%±11 % in the S-Zayu. In a catchment dominated by silicate lithology from the EHB, the dominant proportion of carbonic acid and carbonate-derived cations could be the result of a very low intensity of the weathering and the significant contribution of trace calcite. Future works will focus on estimating the chemical fluxes in the Zayu catchment and evaluating the contribution of periglacial weathering. However we already know that catchment in periglacial condition represent nearly 50%±25% of the discharge.

[1] Emberson, R., et al. (2018) doi.org/10.1029/2018JF004672