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Distribution of nutrient pools in recently formed soils of Andean high wetlands (Huayna-Potosí, Bolivia)

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The Andean glaciers are experiencing since 1980 an accelerated decline associated with an increase in air temperature across the region. Encompassing the shrinking of mountain glaciers new soils are formed as deglaciation facilitates biogeochemical processes and the subsequent development of vegetation. Under extreme environmental conditions high-altitude soils are constrained by climate, substrate and geomorphological characteristics of recently deglaciated surfaces that control soil features in high mountains. At the foot of Huayna-Potosí, the glacier retreat is gradually exposing mineral substrate, which is being colonised by soil biota and plants. The subsequent accumulation of organic matter is progressing rapidly especially in wetlands developed in the proglacial area thus accelerating the processes of soil formation. The characterization of soil organic carbon (SOC) pools is necessary to understand SOC dynamics in soils and a relative measure of C stability in soils.

In this study we attempt to evaluate the distribution of SOC, C fractions and nitrogen in glacial deposits and high altitude wetlands to relate it with that of ^{137}Cs as indicator of soil stability. To this purpose topsoil sampling of moraines, colluvium and peat soil in wetlands was undertaken during a two weeks expedition to Huayna-Potosí Glacier area in the frame of IAEA INT5153 project in May 2017 and contents of SOC and its fractions (i.e. active and stable carbon fractions), nitrogen and ^{137}Cs activity (Bq kg^{-1}) were determined.

The high wetlands both at favourable flat topographic positions and slopes have high organic rich soils showing large carbon sink capacity. More abundant depleted values of ^{137}Cs in moraines and colluvium indicate greater impact of soil erosion processes in comparison to wetlands, whereas a higher ^{137}Cs content is related to higher carbon contents and more abundant vegetation that would preserve soil from erosion. The size of the nutrient pool such as carbon and nitrogen is much higher in wetlands than in glacial deposits. In the carbon pool, the active fraction is more abundant than the stable fraction but in wetlands the ratio active/stable is much higher (mean: 31) than in glacial deposits (mean: 5). The contribution of the active fraction to SOC is also higher in wetlands (c.a. 1), while the opposite was found for the stable fraction contribution to SOC with

almost a ratio of 0 in wetlands compared to 0.24 in glacial deposits. Paralleling the evolution of vegetation the enrichment in soil nutrients affects carbon (C) dynamics in the new soils that all are in the early forming stages with low C stability. Despite wetlands soils having the largest SOC content, the imbalance in the proportions of the C fractions with almost negligible stable C evidence the risk of interrupting the C cycle by loosing the more labile fraction. Therefore, focus should be directed to preserve the fragile new forming soils but specially wetlands because their key role in regulating the hydrological system and maintaining high altitude ecosystems.