

ARSENIC AND THEIR ENVIRONMENTAL IMPACTS ON SOILS AND CROPS IN THREE SUB-BASINS OF BOLIVIAN ALTIPLANO

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The Altiplano is an endorheic basin in the Central Andes of Bolivia located between the Western and Eastern Cordilleras. Since the early Quaternary, the Altiplano has always been occupied by lakes, but these have not always had the same extent as the present day lakes. The present lake system on the Altiplano is the result of the evolution of a more ancient system which began from the lower Pleistocene, with the transition at the end of the Pliocene from a relatively warm climate to a cool damp climate. The size of the lakes is directly related to the recession of glaciers at the start of the interglacial periods. In Bolivia, there are very few comprehensive studies so far on As and other trace element (TE) contamination of water resources from geogenic sources or anthropogenic activities and their impact soils and crops. The present study attempts to understand the relationship between water used for irrigation which has caused to enrichment of the soils with As and other TE and subsequent uptake by crops in the area around Poopó Lake. Sampling was carried out during 2008 in three mining areas viz. Coriviri, Ventaimedia and Poopó, which included surface water and groundwater, soil and crops [beans (*Vicia faba*), potato (*Solanum tuberosum*), barley (*Hordeum vulgare*) and alfalfa (*Medicago sativa*)]. The similar distribution of surface water and groundwater samples on Piper plots suggest that a narrow variations hydrochemical facies which is predominantly Ca-Mg-HCO₃ type. The Eh values reveal that arsenate (AsV) is the principal aqueous species in groundwater and surface water with almost same As-species. The soil samples are characterized higher total TE concentrations and lower values of Fe/S can be observed in the floodplain. Arsenic concentrations in soils were higher (13.0—40.0 mg/kg), compared by unimpacted soil and there are in the same order than those of the crustal median values. Crops contain relatively higher As concentrations and lower Cu, Zn and Pb concentrations as compared to the literature. Principal Component Analysis shows that the TE concentrations in the crop do not relate to the TE contents of the soils. This possibly means that the TEs in the soils are not significantly bioavailable and bulk of the transfer of TE to the crops seems to take place from the water used for irrigation.

Keywords: trace element, crops, Bolivian Altiplano