Controlling Factors in Regolith-Hosted Rare Earth Element Deposit Formation at the Coastal Cordillera, Central-Southern Andes of Chile

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In the central-southern Andes, in the Coastal Cordillera, where tropical to mid-temperate climatic conditions prevail, regolith-hosted rare earth element (RH-REE) deposits have been discovered in the last decade. Understanding conditions of pediplanes in which these deposits develop is still matter of research. Remote sensing, geophysical surveys, field data, petrographic studies, and geochemical and U/Pb dating analysis were carried out to characterize areas with the potential to contain RH-REE deposits. Remote-sensor geomorphological analysis was used to determine zones with low slope-and-roughness index in order to find areas with regoliths associated with pediplanes and zones with high weathering and low erosion. Climatic conditions over the last thousands of years have allowed the development of regoliths in these areas. Complementary field mapping and petro-geochemical analysis allows us to understand the favorable lithologies for RH-REE deposit formation. The Carboniferous granitic plutonic rocks (330–310 Ma, U/Pb zircon ages), with a volcanic-arc and syn-collisional geochemical signature, seem to be the most favorable lithological unit. Triassic (230–215 Ma, U/Pb zircon ages) subvolcanic rocks also seem to be favorable with an intraplate signature. We find a relation between the $\%SiO_2$ and REE content: more basic compositions in Carboniferous intrusive rocks exhibit a higher total REE content, while more acidic compositions in Triassic subvolcanic rocks show a higher total REE content. Additional preliminary geophysical and structural analysis suggests that regional faults may control pediplane formation. From this, we conclude that the main controlling factors in RH-REE deposit formation are as follows: 1) favorable lithologies, like granitic and subvolcanic rocks, most likely to be REE-bearing host rocks; 2) climatic tropical to mid-temperate conditions that led to in situ weathering of the rocks; and 3) the existence of geomorphologic and structural features, over which regoliths preferentially develop.