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Biotic, lithologic and geomorphic control on sediment production from detrital apatite geochemistry and thermochronology

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Where, and how much sediment is produced and transported in hillslope and fluvial systems depends upon the topographic slope, soil production rate, lithology, precipitation, and biota. In this study we investigate the patterns of sediment production in two catchments of the Coastal Cordillera (Chile) situated in semi-arid and mediterranean bioclimates. We do this by measuring 29 bedrock and 6 detrital apatite trace elements and apatite cooling ages with the U/Pb, fission track, U-Th(-Sm)/He thermochronometric systems. Detrital samples were collected from fluvial sediment and provide a catchment-scale view of the upstream areas. The compositional and geochronologic data measured in bedrock are analized with a Principal Component Analysis and a clustering algorithm to find the parameters that are best suited to trace sediment provenance at the sub-catchment scale. Next, we analyse the distribution of the same parameters within the detritus to infer the relative contribution of different areas within the catchments. Results indicate that spatial variations of bedrock cooling age and geochemical composition are significant even within small-scale (10-100 km^2) granitoid catchments. Therefore, the combination of detrital apatite geochronology and geochemistry allows discrimination among source areas with acceptable confidence. Preliminary results show that the impact of vegetation distribution, hillslope angles and bedrock weatherability on sediment production differs in the two bioclimatic settings. In particular, hillslope angles and lithology exert a greater impact in the semi-arid catchment.