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Quaternary Tectonic and Climatic Processes shaping the Central Andean hyperarid forearc (southern Peru)

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Understanding the forearc structure and processes related to Quaternary evolution and uplift of the Western Andean Cordillera remains an outstanding scientific issue. Models of Andean Plateau evolution based on Tertiary volcanic stratigraphy since 5Ma suggest that the deformation was focused along the eastern margin of the plateau and that minimal uplift occurred along the Pacific margin. On the contrary, new tectonic data and Quaternary surface 10Be dating highlight the presence of recently active deformation, incision and alluvial processes within the upper Andean forearc together with a regional uplift of the coastal zone. Additionally, the high obliquity observed in the northern Arica Bend region makes it an ideal target to discuss whether partitioning of the oblique convergence is accommodated by the neotectonic features that dissect the Quaternary forearc. Our goals are both to decipher the Quaternary tectonic and climatic processes shaping the hyperarid forearc along strike and across strike. Finally, we aim to quantify the respective influence of these factors in the overall uplift of the Western Andes. Indeed, sequences of pediment surfaces, landslide products, paleolake deposits and marine terraces found along the oblique Peruvian margin are a unique set of datable markers that can be used to quantify the rates of Quaternary processes. In this study, we focus on the southern Peru hyperarid Atacama area where regional surfaces and tectonic markers (scarps, folds, temporary streams and paleolake levels offsets...) are well preserved for the Quaternary timescale. Numerous landsliding events align on the major fault segments and reflect Plio-Pleistocene climatic and tectonic activity together with filled and strath terraces. As the present day sea-level is one of the highest levels recorded for Quaternary time span, any emerged marine terrace is preserved by tectonic coastal uplift. In particular, the geomorphic and chronologic correlation between marine and continental planation surfaces or terraces permit to deduce net vertical rates and suggests that the along strike uplift affected not only the coast but also the overall $\sim$50 km-wide forearc of the Western Andes. We produced a chronology of remnant low-relief surfaces and a new neotectonic map of the Central Andean forearc between $\sim$14° and 18°S based on detailed field mapping and 10Be cosmogenic dating. We address 1) the spatial and temporal correlations of various markers, and 2) the correlation of the surface abandonment ages to various regional climatic events and 3) the description of neotectonic activity accommodating both uplift and partitioning. Multiple markers yield 10Be surface abandonment ages that spanning 35 ka to >2 Ma. Erosion surfaces >2 Ma yield low erosion rates of <0.1mm/yr. However uplift rates of $\sim$0.1-1mm/yr and multiple surfaces dated at $\sim$35 ka suggest that the hyperarid forearc landscape has been recently modified through Quaternary surface uplift and climatic events, contradicting the Miocene fossil forearc hypothesis. Generally, surface abandonment ages and activated landslides periods tend to correlate with cold wet periods preceding Plio Pleistocene deglaciation on the Altiplano. Finally, neotectonic oblique faults connecting at depth participate to topography building in the Arica Bend region and suggest that Quaternary surface abandonment is the result of both surface uplift in the forearc and specific high-discharge climate periods in the high Andes. Obtained Quaternary regional uplift rates and individual slip-rates suggest that the Andean forearc may accommodate as much as 0.5 to 1 mm/yr of regional uplift for the Quaternary time period.