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Western thrusting and uplift in northern Central Andes margin: the growth of the Calipuy Plateau

Alice Prudhomme (1), Patrice Baby (1), Alexandra Robert (1), Edward Cuipa (2), and Ysabel Calderon (2)

(1) Toulouse Paul Sabatier, Géosciences Environnement Toulouse, UMR 5563 GET, France (prudhomme.ali@gmail.com), (2) PERUPETRO S.A., Lima, Peru.

In the last decades, several studies in the Central Andes attempt to understand processes implied in the Andean relief, especially to understand the formation and the evolution of one of the largest worldwide plateau: the Altiplano-Puna Plateau. Although extensive research has been carried out on the Altiplano-Puna itself in Southern Peru, Bolivia and Chile, few studies exist on its little developed prolongation in northern Peru (7°S - 9°S).

In order to bring new information about processes that are responsible for plateau development and surface uplift during the Andean orogeny, we focused our multidisciplinary study on the poorly-known northern prolongation of the plateau known as the Calipuy Plateau.

Thanks to subsurface information available from the trench to the coast, we investigate the early and late structural history along the western margin of the ∼3500 m high Calipuy Plateau, which is marked by the major Western Andean Escarpment (WAE).
We carry out a new synthesis of stratigraphic correlations from the trench to the Western Cordillera by interpretation of offshore 2D seismic sections and field observations, in order to highlight east-west variations of the main unconformities, the depositional environments and the past tectonic setting. New apatite (U-Th)/He and fission tracks analysis were produced to constrain the timing of the Calipuy Plateau uplift. To define the evolution of the northern Peruvian Andean margin, a crustal cross-section has been restored from the middle Eocene to present, through the marine and hinterland plateau landform.

We highlight that a regional middle Eocene unconformity on which are the Calipuy volcano-sedimentary group of 40 to 11 Ma in age, extends to the oceanic forearc basins creating a flat truncation of the early Paleogene basins. This major erosional surface is located at ∼2000 depth in the oceanic forearc basin, and at ∼3000 m high along the Calipuy Plateau. Therefore this main flat surface is vertically disturbed by at least ∼4000 m high by a main structure. Finally we found on the field the presence of a network of west verging reverse faults that dissect and uplift the erosional surface along the WAE, developing this great escarpment. Furthermore, a fossil forest typical of near-sea-level tropical environment found above the main unconformity (Woodcock et al., 2009) shows that the Western Cordillera did not exist before 39 Ma. We then propose that the middle Eocene erosional surface erased a first lower Eocene Cordillera (Incaic Andean stage), now buried beneath the Peruvian platform. U-Pb dating of detrital zircons for provenance study from a breccia located just above the erosional surface display signature from the Proterozoic oceanic structural high, the northern lengthening of the Arequipa Massif, which may corresponds to the internal zone of the former Incaic orogeny. Thermochronological data suggest that the main west verging thrust was active since ∼30 Ma, which is consistent with the late Oligocene increase of convergence (Somoza and Ghidella, 2012), and that this thrust system was at least active until ∼8 Ma ago.