

Extension as a major tectonic process of the evolution of Southern Ecuador compressional forearc

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Extensional faults are often observed along subduction zones as a response of a margin collapse. However, their role remain underestimated within the structural evolution of forearc systems. In southern Ecuador, the oblique subduction of the Nazca Plate beneath South America led to the formation of the Cretaceous-Miocene NW-SE Chongón-Colonche Cordillera surrounded by Eocene-to-recent sedimentary basins. This region, generally interpreted as an onshore-offshore compressional forearc, interferes with the active tectonic escape of the North Andean Sliver and the opening of the Gulf of Guayaquil.

Herein, we explore fault distribution and kinematics along the onshore-offshore Santa Elena Peninsula using academic and industrial 2D seismic profiles calibrated with wells and field data. Polyphase trench-parallel and NW-SE-trending, >20km-long normal faults are observed cross-cutting the former Chongón-Colonche thrust wedge. Faults are either steep and oceanward-dipping along the trench, or low-angle continentward-dipping through the platform where they likely reactivate former thrusts. We specifically observe repeated extensional pulses during Eocene, Miocene and Plio-Pleistocene times, separated by inversion periods, and shaping the geometry of various forearc basins. In the Late Pleistocene, normal faults are also associated with uplifted marine terraces.

We interpret normal faulting as an overlap of long-term and short-term processes, such as the subduction of bathymetric asperities, underplating and/or variations of convergence velocity, and more recently the North Andean Sliver escape. NW-SE extensional structures dissect the overall thrust wedge through the Cenozoic and are combined with N-S to NW-SE active faults over the Quaternary. This polyphase setting shows eastward-stacked accretionary wedges with thrusts reactivated as normal faults, suggesting that pervasive inheritance processes take place continuously. This project is part of the ANR MARACAS (ANR-18-CE31-0022, MARine terraces along the northern Andean Coast as a proxy for seismic hazard ASsessment).

Mots-Clés : stacked accretionary wedge, normal faulting, fault reactivation, forearc basin dynamics, Ecuador margin, Andean-type tectonics