

Thrust tectonics, crustal thickening, hydrocarbon and ore deposits in northern Central Andes

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Thanks to numerous studies realized in cooperation with Peruvian institutions, we propose for the first time in the northern Peruvian Andes a crustal-scale balanced cross-section through the entire orogen to better understand structural architecture, crustal thickening and hydrocarbon-ore deposits genesis. Abundant industrial seismic data provided by Perupetro S.A. allowed to properly constrain the geometry of the forearc and retro-foreland basins (Calderon et al., 2017; Prudhomme et al., in press). Deep crustal structures and Moho geometries are constrained by a recent teleseismic receiver function study (Condori et al., 2017). The restoration, calibrated from new geochronological data and basins analysis, highlight an intermediate stage between the Incaic (late Cretaceous-early Eocene) and Andean (Neogene) orogenies corresponding to a phase of tectonic relaxation and extension. Shortening budgets established from surface and sub-surface data in the upper crust, and from crustal thickening in the middle-lower crust, make it possible to discriminate between the importance and role of each orogeny in the mountain building. The present stage of the balanced cross-section highlights a double-verging orogen, which could result from a total amount of shortening of 180 km fairly distributed between the Incaic and Andean orogenies. Important hydrocarbon and ore deposits located along the balanced cross-section are related to the geodynamic evolution of the successive Incaic and Andean thrust systems. In the forearc (Tumbes-Salaverry) and retro-foreland (Huallaga-Marañon) basins, 2D petroleum modellings have been done using sequential restorations in order to better target exploration. In the Western and Eastern cordilleras and the Subandean zone, significant ore deposits (Cu, Pb, Zn, Au, Ag...) are concentrated in sedimentary reservoirs of Incaic and/or Andean thrust anticlines. We explore and develop an innovative hypothesis, i.e., that there are strong interactions between mineralizing fluids (of both magmatic and sedimentary origin) and petroleum systems (oil shales and reservoirs). Indeed, both ore and oil types of deposits can be found in the same basins, with similar fluid migration and storage processes in sedimentary reservoirs.

Calderon, Y., Baby, P., Hurtado, C. and Brusset, S., 2017a, Thrust tectonics in the Andean retro-foreland basin of northern Peru: Permian inheritances and petroleum implications: *Marine and Petroleum Geology*, v. 82, 238–250, doi: 10.1016/j.marpetgeo.2017.02.009.

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