

Basin Development, Proven Plays and Exploration Potential of the Central Sub-Andean Basin from the Mega-Regional Prospective

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Central Andes Mountain chain extends for over 5000 km and has a long geological history. The sedimentary basins located to the east of it form one of the world's most prolific hydrocarbon trends. The majority of the basins to the east of the Andes are or have been recently in the foreland basin stage and are rimmed by the fold and thrust belt on their western margin. The basins have elongated shape and asymmetrical fill which thin and onlaps the Amazon craton.

The basins share many similarities in development, structural style, sediment fill but also have significant differences. The northern basins (Llanos- Barinas, Oriente- Putumayo, Marañon) are characterised by the dominantly Cretaceous (Cenomanian – Santonian) marine source rock of Chonta/Napa formation and thick Cretaceous shallow marine reservoirs. The basins in the south in Peru and Bolivia (e.g. Chaco) contain Paleozoic petroleum systems, with Mesozoic and lower Tertiary sediments largely missing. The middle and upper Devonian marine shales are dominant source rocks. The central group of the basins (Ucayalli, Madre de Dios) contain multiple petroleum systems in Paleozoic, Triassic-Jurassic, and Cretaceous rocks.

In order to better understand individual basin development, it is important to consider them in the mega-regional tectonic framework for the Phanerozoic. Here we attempt a series of paleo-tectonic reconstructions and paleo-geographic maps to improve the understanding of basin phases, their fill, and petroleum systems. The break-up of Laurentia and Gondwana and formation of the Iapetus Ocean in the latest Neoproterozoic set up the passive margin in Early Paleozoic for the southern part of the area. Consequent transformation to the subduction zone and docking of the arc terrains in mid-Paleozoic is responsible for the thick sediment fill in present day Bolivia and southern Peru. A series of the Hercynian events in late Paleozoic resulted in a significant uplift and erosion of section.

Mesozoic history is shaped by the establishment of the volcanic arc along the western South American margin and formation of back-arc basins; the opening of the central Atlantic in the late Triassic and the progressive opening of the South Atlantic in the early Cretaceous. In late Cretaceous, long periods of sag in the northern basins led to the deposition of thick shallow marine sandstones. In Turonian to Santonian, the basins were progressively affected by compression and transpression and transitioned from sag to flexure. Period flooding events deposited the source rocks of the Chonta formation.

Eocene transpression brought folding and thrusting in Venezuela and Colombia; at same time, Peruvian basins have experience tectonic tilting and regional flexure. A series of the Neogene Quechuan deformation in late Oligocene and Miocene led to a major uplift of Eastern Cordillera in Colombia and Venezuela and thrusting and mountain building in Peru, resulting in the present day basin configuration.