

Tectonostratigraphic and structural setting of giant oil and gas clusters in the Subandean foreland basin and Pacific-Caribbean forearc region

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The Subandean belt is a semi-continuous Paleogene to recent, asymmetrical foreland basin extending 7500 km from the Plio-Pleistocene deepwater Columbus basin in eastern offshore Trinidad to the Magallanes basin of southern Chile. Within this belt there are 32 giant oil fields and 22 gas fields (>500MMBO and/or >3 tcf gas) discovered between 1913 and 2002. The 54 giants occur in 10 clusters ranging from regional super-clusters containing 40 giants in Venezuela, Trinidad and Colombia to single, isolated giants in Peru and Argentina. 47 of the giants are found in structural or stratigraphic/structural traps formed mainly as a result of flexure of the continental crust beneath the thrust load of the adjacent Andean chain. Only 8 out of the 54 giants exhibit purely stratigraphic traps. Reservoir rocks are mainly quartz-rich sandstone derived from continental rocks of the South American craton. Distinctive source rocks characterize the cluster areas: sources in northern and southernmost South America are late Cretaceous organic-rich carbonate units deposited in a passive margin setting whereas sources in the central area of southern Peru, Bolivia and northern Argentina are Paleozoic-early Mesozoic units overlapped by the Cenozoic age foreland basin. The giant-poor area of the central and southern Andes may reflect: 1) the effects of shallow subduction on the formation of Laramide-style uplifts that have disrupted basins that were originally deeper and more extensive; and 2) a generally thinner and more discontinuous foreland basin fill perhaps related to a thicker, more rigid underlying continental crust. This thinner foreland fill may have allowed the maturation of older Paleozoic source rocks that are more deeply buried and unproductive in thicker basins of the northern and southern Subandean basins.

Presentation time: Monday, July 27 at 8:10am

Are widespread flexure-related normal faults in the Eastern Venezuelan foreland basin hosting undiscovered oil fields in the underexplored, far eastern part of the basin?

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The Eastern Venezuelan foreland basin (EVFB) localizes a cluster of 5 oil giants (> 500 MMBO) and 2 gas giants (>3 tcf) in a depocenter about the size of the state of New York. EVFB oil giants cluster in the Greater Oficina area, first discovered in 1937, or in the downdip El Furrial area discovered in 1985. In addition to these conventional light oil giants, the southern updip limit of the EVFB fill hosts the Venezuelan Heavy Oil Belt with a reserve estimate of 240 BBOE. The most common trap style for Oficina giants are normal faults produced by the Oligocene to Pleistocene thrust-related flexure and reactivation of preexisting Precambrian and Jurassic age faults deforming the continental crust of the Guayana shield. Using a study of 300 km of seismic lines, high resolution gravity data, and wildcat wells drilled to depths of 5 km by PDVSA, we show that the most productive trends in the Oficina area and the Heavy Oil Belt are localized along flexurally-formed subsurface normal faults that can be traced as linear and sub-parallel, ENE-trending zones as far as 200 km to the east beneath the onlap of the coastal plain and Orinoco delta. In this remote and poorly explored, easternmost area of the EVFB, local discoveries of light oil were made in 1948 in traps framed by parallel, flexural normal fault trends similar to those better studied in the more mature Oficina and Temblador areas in the west.

Poster presentation

Subsurface structure of a 400-km-long segment of the Oca-Ancon right-lateral fault zone from the offshore margin of Colombia to the Falcon basin of Venezuela

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The Oca-Ancon fault is a right-lateral fault with 2 mm/yr of Holocene motion as much as 90 km of Oligocene and younger right-lateral offset that forms a steep and linear mountain front along the Caribbean coast at the Santa Marta massif and northern Sierra de Perija of Colombia. We have assembled 900 km of multichannel seismic data and 4 wells from the oil industry to show the variable deeper structure of the fault along this 400-km-long segment. Off the coast of the Santa Marta massif, profiles show a subvertical fault with a northward-thinning clastic wedge of Middle Miocene age. Wedging along the fault becomes less prominent up section in the Late Miocene and younger units suggestive of waning fault activity. To the east in the border region between Colombia and Venezuela, profiles show that the single, linear trace of the Oca fault exhibits both positive and negative flower structures. The location of Tablazo strait - connecting the Gulf of Venezuela and Lake Maracaibo - is controlled by a major, active rhomboidal pull-apart basin formed where the Oca fault steps 15 km to the south to the Ancon fault which continues eastward into the Falcon basin. Restoration of 85 km of right-lateral motion of the Oca-Ancon fault realigns basement provinces and hydrocarbon trends in the Maracaibo basin and Gulf of Venezuela.

Presentation time: Wednesday, July 29 at 10:40am