

Using neo-tectonic and subsurface data to guide the search for large oil fields: Examples from Colombia, Ecuador and Peru

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ABSTRACT

We present new structural transects and new neo-tectonic interpretations from Colombia, Ecuador and Peru, that we utilize to delineate different structural domains, which help to define zones with higher or lower probability for large hydrocarbon accumulations.

Neo-tectonics can destroy or help preserve giant hydrocarbon accumulations. They have a direct impact on the structural timing, access to charge, migration routes, trap integrity, seepage and breaching. For that reason it is critical to thoroughly examine their effects in oil exploration projects. Shallow reflectors in onshore seismic are often absent in the data, very noisy or poorly processed, so seismic data alone often is not good enough to fully understand the shallow section. Surface geology, remote sensing and detailed topography analysis are helpful tools in overcoming these limitations of the seismic data.

A new structural transect showing the context of the giant Orito field, the largest producing oil accumulation in the Putumayo Basin, South Colombia, is presented. Combining the structural cross-section with neotectonic data allows us to correlate subsurface faults with active fault scarps at the surface, to recognize active migration pathways and helping to explain oil charge into Tertiary Pepino Formation reservoirs that are commonly not economically producible in this area.

Integration of structural cross-sections with topographic data and age dating of modern fluvial terraces in the Pastaza megafan, Oriente Basin, Ecuador, enables us to understand present-day tectonics and the role of active faults in oil field preservation. Geomorphic evidences of active deformation can be used to identify new prospects below this modern megafan.

A structural cross-section from the underexplored central Marañón Basin, Peru, was integrated with surface geology and neotectonic data. Tilted fluvial terraces near the mountain front and drainage pattern anomalies around the very large Loreto Dome are indicative of modern tectonic movements. Integrating the data allows us to differentiate between presently active and non-active structures and, hence, to better understand breaching risks.

Based on subsurface information and integration with neotectonic data, a regional map of the study area shows the different structural domains and how the data integration helps delineating prospective from less prospective trends. Thorough integration of neotectonic with subsurface data can be utilized in applied petroleum exploration. These methodologies are even more powerful when combined with surface geochemical data and oil seep distribution.