Introduction & Objectives

We present a new integrative geo-model of the structurally complex and poorly explored Cauca Patia Basin, located in southwestern Colombia. Ongoing exploration activity made it necessary to spatially integrate all of the available data into a 3D-earth model, honouring all of the data, with the fundamental aim to correctly represent the structural-geometric configuration of the basin. The main objective was to detect prospective structural trends and to better understand overall exploration risks.

Workflows & Methods

MOVE 2013.1 structural modeling software was used for this task. The following data was utilized for model construction: Digital terrain data, surface geology (contacts, fault traces, strike-dip data), oil seeps, regional gravity and magnetics data, 24 semi-regional reprocessed and newly acquired 2D seismic lines (each ~20-50km long) of poor to moderate quality, 1 deep well (TD in Tertiary strata, well above the basement) and about 10 shallow stratigraphic wells with typically only a few hundred metres penetration each. After loading all data into the structural modeling software, seismic interpretation was carried out, including fault correlations and picking of stratigraphic horizons (**Figs. 1, 2**). This was mainly based on seismic character, surface geology and the only deep well in the basin (ANH deep well).

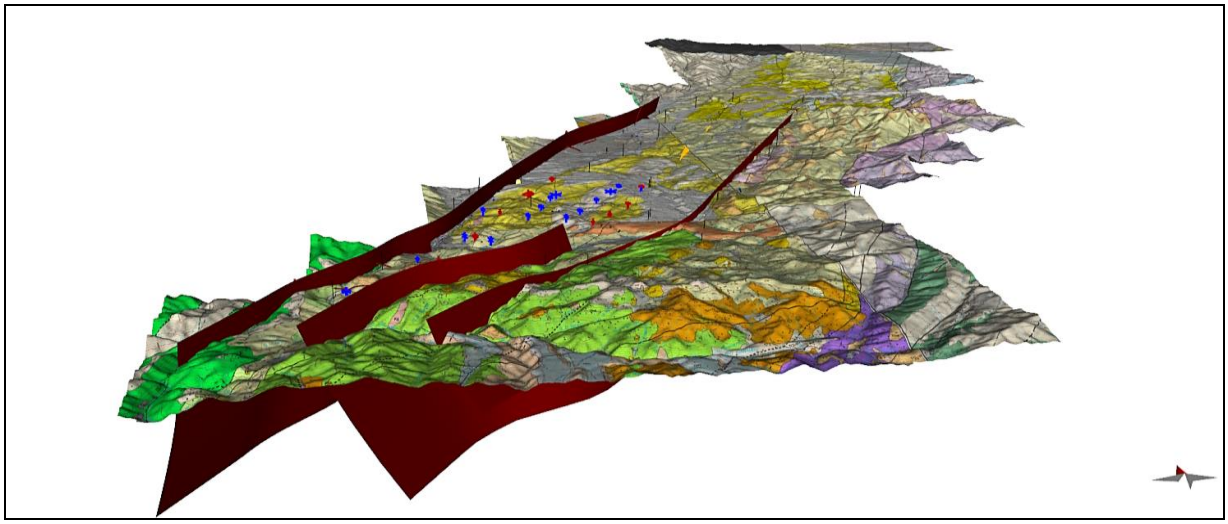

Fig. 1: *Cauca Patia geo-model with principal faults, digital terrain data and surface geology (red arrow indicates north). From southwest to northeast the model is more than 100km long.*

Observations & Results

Even though the well does not provide a basement penetration, a laterally consistent interpretation was conducted, based mainly on mappable seismo-stratigraphic packages (**Fig. 2**). Subsequent building of 3D fault planes, 3D surface horizons (mesh surfaces), gridding and contouring resulted in a consistent geo-model (~100km long from Southwest to Northeast) of the southern part of the basin with far greater detail than previously published data (Alfonso et al., 1994; Suter et al., 2008).

Based on the correlation of surface and subsurface information, potentially prospective structural trends – with different degrees of structural relief, surface areas and structural uplift – are delineated in the subsurface, enabling us to distinguish between areas with higher and lower structural exploration risk. Numerous anticlinal domes and several large flower-like structures can be correlated, some of them for distances of more than 10km. Thick-skinned structural styles seem to dominate. Apparently these structures have formed due to oblique strike-slip tectonics (dextral transpression) during at least two main phases of relief building. Both basin shoulders are dominated by km-scale uplift of Cretaceous oceanic basement over the Tertiary basin fill, representing the latest tectonic increment in the basin (likely post-Miocene). Present-day seismicity and displaced quaternary terraces indicate that the basin is tectonically active today.

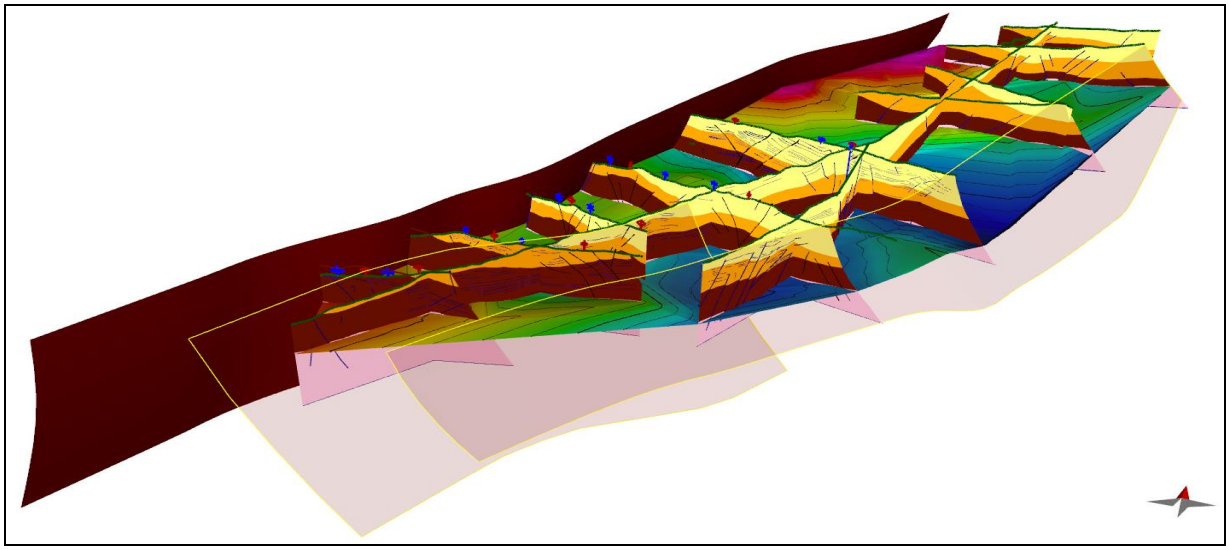

Fig. 2: *Cauca Patia geo-model with principal faults, selected structural sections and top basement map.*

Conclusions

The geo-model built here has provided numerous answers regarding exploration risks and exploration strategy in the Cauca Patia Basin. It will also serve as a powerful "live-model" that can be updated with new data anytime, such as new seismic, well data or geochemical data. Furthermore, it may be utilized to provide input into basin modeling workflows, such as mass balance calculations for hydrocarbon generation/expulsion, based on quantifiable source rock volumes that can be exported from the model (**Fig. 3**).

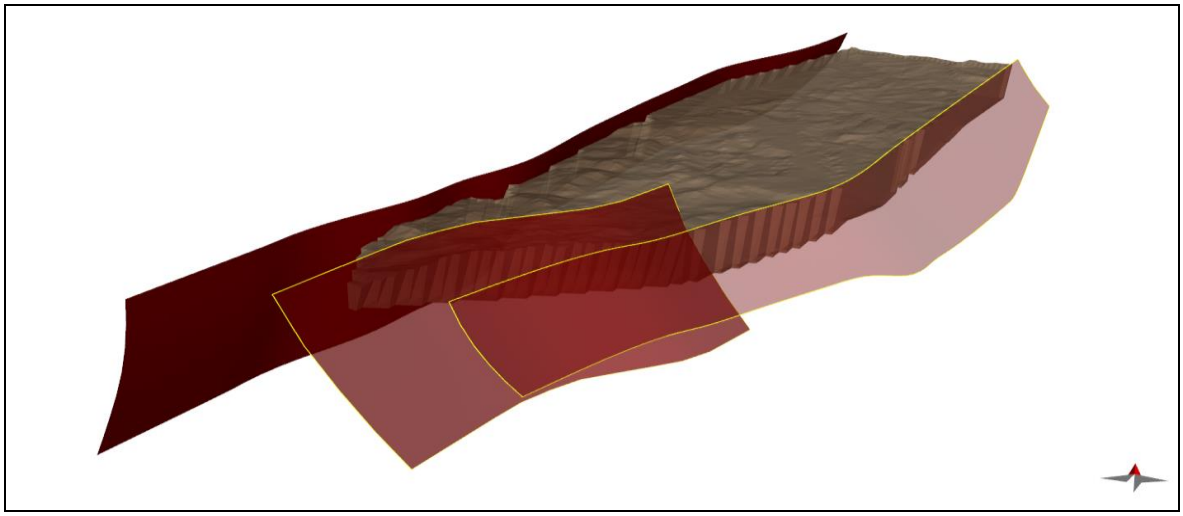

Fig. 3: *Cauca Patia geo-model with principal faults and gross basin fill (Bsmt to surface) shown by brown geo-body.*

Acknowledgements

We are grateful to the management of Gran Tierra Energy Colombia for the permission to publish this data.

References

Alfonso, C. A., Sacks, P. E., Secor, D. T., Rine, J. and V. Perez, 1994, A Tertiary fold and thrust belt in the Valle del Cauca Basin, Colombian Andes; Journal of South American Earth Sciences, v. 7, Nos. 3/4, p. 387-402.

Suter, F., Sartori, M., Neuwerth, R., and G. Gorin, 2008: Structural imprints at the front of the Chocó-Panama indenter: Field data from the North Cauca Valley Basin, Central Colombia; v. 460(1), p. 134-157.