8th International Symposium
on Andean Geodynamics
(ISAG)

Variations of the crustal structure of Merida Andes - Venezuela, observations from gravity data analysis and modeling

J. Sánchez-Rojas[1], M. Schmitz[1, 2], F. Rondón[1], S. Celis[1], N. Orihuela[2], M. Bolívar[3]

[1]FUNVISIS, Caracas, Venezuela
[2]Universidad Central de Venezuela, Caracas, Venezuela
[3]PDVSA, Puerto la Cruz, Venezuela

Western Venezuela shows a very complex geodynamic setting where the South America, Nazca and Caribbean plates and several smaller crustal blocks are interacting. The Merida Andes (MA) is an orogeny delimiting the Maracaibo block to the west mainly in response to the iterations of the Caribbean Plate and South American continent. Exist many open questions about the origins, evolution and actual structure of MA.

In recent times the crustal scale project GIAME (Integral Geoscience of the Merida Andes) has been set up in order to collect new geophysical, geological and geodesic data that may help to constraint the understanding of MA. In the framework of this project four wide-angle seismic profiles, one magneto telluric profile and new high-resolution gravity survey were carried out. The present work presents the main results from the potential field data analysis and modeling. This work was made in different step. First step consisted in satellite potential field data analysis, second step was ground data analysis, third step was 2D forward gravity and magnetic modeling over the seismic profiles, last step was a 3D forward gravity and magnetic modeling. Satellite data was used to extend data analysis beyond edges of the seismic lines. Over these profiles more than 1000 gravity stations were acquired at 1 km spacing. In the surrounding areas between seismic lines more than 2000 were also surveyed at 3 km spacing. New data from oil exploration surveys were included. All gravity data was processed from raw records. 2D gravity forward models at the seismic profiles confirms the strong variations of the thickness of the crustal root and its asymmetry and gave new insight of the actual structure of MA. All gravity data was used to present a new 3D model fully constrained by the finding of the 2D seismic lines and by available published information from oil exploration studies concerning to densities and depth of the sedimentary layers. Cenozoic sediments and Cretaceous sediments show densities between 2.2 to 2.55 g/cm3. The crystalline basement shows a density of 2.78 g/cm^3 down to about 15 km beneath the basins and 25 km beneath the orogen. The lower crust is modeled with a density of 2.84 g/cm3, underlain by the upper lithospheric mantle, with density of 3.22 g/cm3. Analysis of a new high-resolution gravity data and 3D gravity forward models confirm the existence of an incipient A-subduction of continental South America towards the Maracaibo block with structural asymmetry. Strong variations of the thickness of the crustal root toward the south and north of the main strike of this feature is necessary to achieve a good fit of the observed Bouguer anomaly.