GSSL-2016-(SIV)-5

MOHOROVIČIĆ DISCONTINUITY BENEATH MANNAR BASIN – A TWO DIMENSIONAL GRAVITY INVERSION

Pasan Herath[1,*], A.A.J.K. Gunatilake[1] and Dhamsith Weerasinghe[2]

[1]*Department of Geology, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka*
[2]*Petroleum Resources Development Secretariat, Sri Lanka*
[*]*Corresponding Author – e-mail: pasansherath@gmail.com*

Gravity modeling can be coupled with seismic survey data and exploratory well data used in prospecting for hydrocarbon in order to infer the crustal structure of the region deeper than that sampled by active seismic waves. A northeast - southwest trending gravity anomaly with a magnitude of about -20 mgal can be observed from the marine gravity data derived from CryoSat-2 and Jason-1 satellites, in the Mannar Basin located offshore off the west coast of Sri Lanka where recent explorations for hydrocarbons have been conducted. Application of forward and inverse gravity modeling techniques aided with seismic interpretations have been used to determine the depth to the Mohorovičić discontinuity beneath the Mannar Basin. A Mathematica® program based on an iterative algorithm was developed to calculate the gravity anomaly caused by a two - dimensional polygonal body having a density contrast with surrounding. Seismic horizons in depth domain along a seismic line crosscutting the gravity anomaly in the Mannar Basin were used as inputs to the program with the density of subsurface obtained from the well log of Barracuda exploratory well to calculate the gravity anomaly caused by three subsurface layers, water column, sedimentary column and volcanic layer. The gravity anomaly due to upper mantle was obtained from the difference between the observed free-air gravity anomaly and the summation of the calculated gravity anomalies by each of the three subsurface layers. The structure of the Mohorovičić discontinuity was modeled with a trial-and-error sequence to match with the gravity anomaly due to the upper mantle, with a suitable density contrast. The study revealed that the Moho is elevated beneath the Basin with a minimum depth of about 15 km below MSL and extending to a depth of about 45 km below MSL on either ends of the Basin, providing evidence to classify the Basin as a failed-rift or an aulacogen. The crust with minimum thickness is observed to extend from about 1.5 km to about 15 km below MSL, which on top comprises of a ~9 km thick sedimentary column with interlayered volcanics and below of a ~4.5 km thick metamorphic basement.