3D gravity modeling of crustal structures beneath the Southwest Indian Ridge

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The oceanic crust is continuously produced by a combination of magmatic and tectonic processes at mid-ocean ridges, which extend about 80,000 km across the entire ocean basins. Such spreading mode at ridges in general varies as a function of spreading rates. The oceanic lithospheres are diverging with sufficient magmatic supply under faster spreading environments, whereas the plates experience brittle extension with little melt supply under slower spreading environments. In particular, the Southwest Indian Ridge (SWIR) spreading at a full rate of ˜14 mm/yr is categorized as an ultraslow spreading ridge. However, the axial depth of the SWIR changes dramatically depending on available melt supply, showing ˜1000 m depth difference across the Gallieni Fracture Zone (FZ). Recent seismic studies on this shallow segment at 50º28´E consistently revealed the presence of an extremely magmatic accretion of the oceanic crust. In this study, we utilize the two-dimensional seismic velocity model to predict the three-dimensional density structure associated with such enhanced melt supply at the SWIR. First, we constructed a 2-D reference density model in IGMAS+ based on the 2-D seismic observation and minimized errors by adjusting boundaries between distinct anomalous bodies. Then, we have continually added more 2-D sections having small offsets from the reference density model so that our gravity model can be extended to regions where no seismic data are available. Here we present preliminary results from the 3-D gravity modeling that characterize the enhanced magma supply system beneath the Southwest Indian Ridge and discuss its tectonic implications to lithospheric extension at ultraslow spreading ridges.

Keywords: Gravity modeling, Southwest Indian Ridge, Ultraslow spreading segment, lithospheric structure