Lithospheric structure beneath the extinct Mid-Ocean-Ridge in South China Sea: Constraints from passive-source OBS data

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The extinct Mid-Ocean-Ridge (MOR) and the seamount chain above it in the central sub-basin of the South China Sea (SCS) represent a unique type of global MOR systems, in which magmatic processes continued for many million years after the ridge has been abandoned. Here we present a 3-D shear velocity model of this ridge using seismograms recorded at two passive-source Ocean Bottom Seismograph (OBS) array experiments in the SCS basin. The model is derived by inversing phase velocities of Rayleigh waves at 8 periods in the range of 18 –50 s, which are sensitive to the structure to 80 km deep. The model shows a high-velocity lid beneath the extinct ridge, which is ~ 15 km thicker than the prediction of the cooling model of the oceanic lithosphere. The anomalously thick lithosphere can be explained by the melt-extracted mantle, consistent with a low-density gravitational anomaly across the ridge confirmed by both observation and modeling. A low-velocity anomaly (1 –2 %) below the lid is also imaged, likely suggesting the presence of a high temperature of ~135 K at those depths. A low-velocity stripe on the subducting SCS slab beneath the Luzon Island coincides with the location of the MOR, indicating there exists a tearing along the subducted MOR in the upper mantle.

Keywords: OBS, Rayleigh waves, mid-ocean-ridge

