Geophysical Research Abstracts
Vol. 19, EGU2017-8374, 2017
EGU General Assembly 2017

Spatial features and volume of seamounts in the continental slope of northern South China Sea

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The distribution, volume, and origin of seamounts in the continental slope of northern South China Sea (SCS) are not well understood, which greatly hinders our understanding of magmatism in the SCS. Based on high-resolution bathymetric data and 147 seismic profiles, together with gravity and magnetic data, we first identify 46 seamounts in the continental slope of northern SCS. These seamounts are characterized by: high amplitude outer seismic reflections; low amplitude disrupted internal seismic reflections; obvious uplift of the adjacent strata at the flanks; higher positive free-air gravity anomalies; and higher magnetic anomalies. We simulated their shape with elliptical cones and accordingly calculated their volume, height, length and the azimuths of their major and minor axes. The total volume of these 46 seamounts above seafloor is estimated at 2060.27–3324.23 km^3 and the total volume of intrusive magma above Moho is about 0.16 Mkm^3, close to the estimates for classic large igneous provinces across the world. These seamounts are mostly located on the continental slope with thin crust (approximately 12–18 km), suggesting that thinned continental crust could reduce the overlying pressure and shorten the path of magmatic upwelling. The dominant azimuth of elliptical major axis in seamounts is consistent with the synrift and synspreading fault strikes (NE–NEE orientation), indicating that these pre-existing faults provide magmatic conduits for the subsequent postrift seamounts. Based on three existing clues, i.e., (1) the seamounts, high velocity layer and Hainan mantle plume are contiguous in 3-D space, (2) the high-velocity layer is thicker beneath the continental shelf but thinner beneath the slope and (3) the basalts dredged from certain seamounts show OIB-type geochemical features, we propose a new magmatic upwelling pattern to explain the spatial and morphological features of these seamounts. The eastern branch of the Hainan mantle plume underplated the lower crust to form thicker high-velocity layer beneath the continental shelf and a thinner high-velocity layer beneath the slope. This branch of mantle plume also provided a magma source for seamounts in t the continental slope of northern SCS.