Progress in resolving the deep crustal structure of Shatsky Rise oceanic plateau from geochemical and geophysical observations

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In contrast to the well-documented Penrose crustal structure (~2 km of basalts and sheeted dikes, and ~4 km of gabbros) present in typical fast-spreading oceanic crust, there is no consensus over how the lower crust of oceanic plateaus is accreted or what proportion of intrusive to extrusive rocks is present in the ultra-thick (15-35 km) oceanic plateau crust. The recent IODP Expedition 324 to Shatksy Rise oceanic plateau returned a wealth of important basalt geochemical data (Sano *et al*., 2012 G^3; Husen *et al*, 2013 G^3), and previous work has shown that it formed at a ridge-ridge-ridge triple junction (Mahoney *et al*, 2005 Geology; Sager and Han, 1993 Nature). By determining the liquid line of descent and bulk geochemistry for Shatsky Rise predicted for various accretionary scenarios, estimates of the deep crustal phase equilibria and seismic velocities can be made and compared with observations (Korenaga and Sager, 2010 JGR-Solid Earth; Sager *et al*., 2013 Nat. Geosci.). While oceanic plateaus are volumetrically minor in the modern-day ocean basins, some researchers have proposed that higher mantle potential temperatures in the Archean would lead to ultra-thick oceanic crust similar to that of oceanic plateaus (e.g. Herzberg *et al*, 2010 EPSL; Herzberg and Rudnick, 2012 Lithos; Johnson *et al*, 2014 Nat. Geosci.). Thus, understanding the deep crustal structure and accretionary mechanism of Shatsky Rise and other oceanic plateaus will provide key insights into processes occurring in the modern-day ocean basins as well as in the early earth.