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Wide Rift Formation of the South China Sea Basins System

Alejandra Cameselle (1), Cesar Ranero (2), Udo Barckhausen (3), and Dieter Franke (3)

(1) Universidad de Aveiro (acameselle@uvigo.es), (2) Barcelona-CSI, ICREA at CSIC, Instituto de Ciencias del Mar, Barcelona, Spain (cranero@icm.csic.es), (3) BGR, Hannover, Germany (Udo.Barckhausen@bgr.de)

We examine the rift structure of the South China Sea (SCS) deep-water basin system with geophysical transects and geological data. We have reprocess more than 3100 km of multichannel seismic data with modern techniques acquired across the SCS rifted system. A cross section across the SCS system displays the tectonic structure and crustal architecture of the entire rifted system. We analyze the amount, distribution, and timing of extension to study the mechanisms of crustal extension and final breakup. We discuss the structure in light of the classical pure- and simple-shear extensional models.

We interpret that concurrent extensional deformation occurred over a c. 850 km-wide area. The tectonic structure has 8 segments characterized by sectors of comparatively thick continental basement (6-8 s TWT c. 18-24 km thick) that thins significantly (less than 3.2 s TWT or < 10 km thick) associated to normal faulting. At the axis of the six resulting sub-basins, ß factors are ∼3.3 to 6.5 and usually accompanied by large faults, some of which seem to reach the Moho boundary. Continental breakup finally occurred at only at one of these locations where continental crust was thinned to less than 10 km.

We constrained the timing of rifting and breakup in interpreting a series of key horizons based on nearby published modern 2D and 3D seismic reflection data and industrial wells from the northern and southern SCS rifted margins. Our results support that extension at the six rift-axis was fundamentally simultaneous from early/middle Eocene to early Oligocene.

Based on the tectonic structure, crustal architecture, and the ages of formation of the basins, we propose that simultaneous faulting accommodates the extension in the brittle crust over the wide margin setting, and as deformation migrates it focuses to create several large separated sub-basins clearly observed in the seismic images. We suggest that the SCS rifted margin resulted from continuous wide-rift mode of deformation from the early rifting to breakup.