Miocene to Recent History of the Southern South China Sea (Sunda Shelf): A Complex Record of Tectonics, Paleoclimate, Eustasy, and Sediment Supply*

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The southern part of the South China Sea (or Sunda Shelf) is underlain by continental and arc-related crust that underwent rifting during Paleogene time. Rifting created a complex system of depocenters that are locally filled with over 10 km of sediment. Many of these rift depocenters were tectonically inverted during late Oligocene to Pliocene time (inversion may be ongoing locally). The most intense inversion, however, occurred during early to middle Miocene time over large parts of the South China Sea and Indonesian backarc region, which probably reflects lithosphere with a nearly "idea"' rheology – that is, a lithosphere that was weak enough for the inversion to occur rapidly (most inversion-related contraction occurred in less than 10 million yr) and significantly (reverse displacement on original faults was beyond their null point), but strong enough to transmit in-plane compressive stress over a vast area (from offshore South China to Indonesian back-arc region). Structural styles associated with basin inversion also indicate that the principal compressive stress responsible for inversion was oriented roughly NW-SE. The most likely cause of the inversion was the arrival of Australian continental crust along eastern parts of the Indonesian subduction zone during early to middle Miocene time. Thereafter, subduction became more strongly coupled and significant shortening began across the Indonesian backarc region and Sunda Shelf. Post-inversion tectonic subsidence also has been minimal across the region. The lack of post-inversion tectonic subsidence suggests that subcrustal lithosphere thinned during Paleogene rifting may have been mechanically "rethickened"' during inversion.

Miocene to Recent siliciclastic successions record progressive filling of depocenters and regional patterns of shelf progradation provide insight into sediment source areas and timing of sediment bypass across the Sunda Shelf into deep-water environments. Minimal post-inversion tectonic subsidence over broad parts of the Sunda Shelf meant that accommodation was almost entirely related to eustatic change. Much sediment bypassed has bypassed the Sunda Shelf since middle Miocene time and accumulated in slope and basin fan systems farther eastward.

Miocene shallow-marine carbonate-platform facies also are common on fault-bounded highs of various tectonic origins, whereas deeper water siliciclastic facies were deposited in adjacent basinal areas. Syn-depositional tectonic deformation affected the stratigraphy of many platforms in complex ways. Examples of tectonically affected carbonate platforms provide important constraints

on regional deformation events, including displacement histories on some major shear zones that transect the SCS. Carbonate platforms also show characteristic windward-leeward facies patterns that change over time and space. These windward-leeward facies patterns may record the evolution of the East Asian Monsoon, one of the most important climatic systems on Earth.