



From Mesozoic subduction to Cenozoic extension: what controlled the tectonic process of South China Sea?

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The South China Sea (SCS) is one of the largest marginal seas in the western Pacific. Widespread onshore outcrops of the late Mesozoic granitic and volcanic rocks suggest that the SCS was once an active margin associated with Paleo-Pacific or proto South China Sea subducted toward South China in the late Mesozoic. It transitioned into rifting after late Cretaceous and then spreading in Oligocene. IODP drilling indicates that SCS transitioned from subduction into sea spreading in a short time (no more than 30 Myrs) and show diachronous breakup both temporally and spatially. What controlled this tectonic process? In order to answer these questions, we used a combination of data sources, including reprocessed magnetic data, drilling/dredging samples, depositional environment and deformation style on multi-channel seismic profiles to constrain the possible spatial distribution of the Mesozoic volcanic arc first and found that the southwest part of the Mesozoic volcanic arc distributes on both sides of the southwest SCS sub-basin, while the northeast part remains nearly in its original location. The results suggest that the initial breakup sites for the SCS margin might be arc area in the southwest and fore-arc area in the northeast during the opening of SCS basin. Mathematical modeling experiments suggest that several circumstances may cause fore-arc breakup, including: steepening of the subducting plate, a pre-existing rheologically/tectonically weak zone in the arc-front/fore-arc in the subduction plate, seamount or plateau subduction and damaging of the fore-arc area. Also if the subducting slab is young or the subduction time is short, fore-arc breakup will occur. Further analysis suggested that along with the rifting, two sources of magma may have contributed to the rifting. One is supposed to be decompressive melting, the other one is deep sourced and constitute the high velocity lower crustal magmatic underplating, which is supposed to be related with the subduction slab break off.