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Tectonic evolution of the East Vietnam-Southwest Borneo margin breakup

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We investigate the extensional processes occurring during the rifting of a marginal basin to use long-streamer multichannel seismic transects across the entire southwestern South China Sea (SCS). The basin is characterized by space and time propagating breakup followed by seafloor spreading during Cenozoic. Stretching and thinning of the continental crust were accompanied by ubiquitous large extensional detachment faults. In the proximal E Vietnam margin, rifted basins are filled with lower syn-rift sedimentation (syn-rift I). These sediments pinch out towards the distal margin. On the conjugate NW Borneo margin, the same coeval syn-rift I is truncated at the top, suggesting a period of crustal uplift affecting solely the southern margin. To illustrate the pre-breakup geometries of the southwestern SCS margins, we restore two conjugate sections near the first oceanic magnetic anomaly (20.1 Ma, C6n). The result highlights a thick pre-breakup succession (syn-rift II) offset slightly by several seaward-dipping normal faults above the exhumed basement. The magmatism intruded this hyper-extended basin and proceeded to break up the continental lithosphere eventually. The COT configuration not only illustrates asymmetrical hyper-extension but also appears in map view to have a rhombic shape controlled by N-S abrupt segments and E-W hyper-extended ones. The spatial variation of the crustal structures suggests an initial N-S extension contemporaneous with the first phase of seafloor spreading in the eastern SCS. The extensional direction significantly changed later (circa 23Ma) to NW-SE in relation to a well-documented ridge jump. Interestingly, this change in the direction of opening is coeval with the collision and the counterclockwise rotation in Borneo, thus suggesting that those events are linked. Therefore, we propose that collision was responsible for significant change in the far-field stress and influenced the extensional regime in the SCS.