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Rifting and Breakup during Marginal Sea Basin formation: Differences from Atlantic-type margins

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The rifting and continental breakup styles of Marginal Sea Basins is illustrated by well-constrained Western Pacific examples consisting of the South China Sea (SCS), the Coral Sea (CS) and the Woodlark Basin. In these examples, rifting directly followed an orogenic event which provided a strong thermal and structural inheritance as initial conditions to their formation. In the SCS and the CS especially, the rifting style is characterized by wide rifting forming a succession of sub-basins with thin continental crust, controlled by low-angle normal faults. The formation and development of extensional faults are enhanced by the reactivation of former thrust faults.

The final stages of rifting and continental breakup are contemporaneous with significant magmatic activity in the distalmost part of these margins with the emplacement of volcanoes, dykes and sills. Continent-Ocean transitions (COTs) are characterized by a sharp juxtaposition of the continental crust against igneous oceanic crust suggesting that a rapid shift from rifting to magmatic spreading occurred. High extension rates prevent conductive cooling allowing the focusing of volcanic activity into sharp COTs, quickly evolving to oceanic magmatic accretion.

The rifting style and mode of continental breakup during the formation of Marginal Sea Basins and their margins differs significantly from that of Atlantic-type margins. In the latter, these differences are influenced by transient high mantle temperatures, which lead to thick magmatic crust (i.e. magma-rich margins), or low-extension rates and mantle depletion, which result in subcontinental mantle exhumation (i.e. magma-poor margins). The evolution of Marginal Seas Basins is also controlled by the initial rheological conditions inherited from the previous orogenic event, where a combination of elevated geothermal gradients and rapid extension rates are driven by kinematic boundary conditions. These conditions are influenced by the presence of nearby subduction zones.