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Thermal signatures of continental breakup at the northern South China Sea margin: preliminary results of IODP 367-368

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Continental breakup and the formation of oceanic crust is a fundamental stage in plate tectonics. The rift to drift transition represents a critical change in the mode of extension inducing drastic modifications of physical parameters, including those controlling thermal regimes. In this environment, thermal conductivity, fluid-advection, magmatic-intrusion and radiogenic heating within the crystalline basement need to be considered. Geothermal gradient and lithospheric composition are two critical parameters controlling deformation mode and magma production, quantitatively unravelling thermal aspects will greatly improve the modeling and conceptual vision of continental breakup.

The recent expeditions 367-368 of the International Ocean Discovery Program (IODP) along the northern margin of the South China Sea provide new observations of the processes involved in continental breakup. These two expeditions sampled distinct drilling sites across the continent-ocean transition (COT). The different sites record various sedimentary units bearing pre- to post-rift ages overlying the top of the acoustic basement.

Results of these IODP expeditions represent a unique opportunity to investigate the thermal evolution of a rifted margin during and after continental breakup, by estimating the palaeotemperatures recorded in the overlying sediments. Importantly, in the northern South China Sea margin, direct measurements of the uppermost sedimentary section indicate an anomalously high heat flow (>110mW/m^2) and high geothermal gradient (>90°C/km). Our study attempts to constrain the origin of the anomalously high geothermal gradient and determine wether it is related to breakup, and whether it is a product of recent thermal events or legacy of pre-rift thermal conditions. Future work on the characterization of the organic matter within sediments using biomarkers, molecular markers, Raman spectrometry, organic petrography and pyrolysis will also permit to consider the effect of past thermal conditions in deeper older sediments. Taken together datasets from a transect that records different ages and stages of rifting will enable us to study trends and shifts in thermal conditions along the northern South China Sea. These results can be used to provide constraints on the tectonic evolution of the South China Sea opening.