High heat with slow cooling of rift margin in the South China Sea, IODP Exp.368

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The cooling rate of the crust may depend on thermal setting including heat source, heat transportation system and thermal properties. The heat flow of the ocean plate decreases with reversed root of the plate age, and this implies that the plate tectonics is thermo dynamic system. Thermal analysis can be applied to more complex tectonic region such as marginal sea and continental divisions.

The IODP Exp. 368 has carried out at the Paleogene South China Sea, and the sediment must record thermal history of the formation of rift margin. The site U1501 is located at the most landward outer margin high of the continent-ocean transition of the rift zone. It is expected that the sediment records thermal history of initial stage of rifting. During the cruise, early Oligocene to late Eocene sediment was cored to 697 m, and high geothermal gradient of 81.4˚C/km was obtained using in-situ temperature measurement (Jian et al., 2018). The terrigenous sediment of this core includes many vitrinite fragment, and its reflectance is sensitive geo-thermometer for sediment.

The result of vitrinite reflectance from 0.21 to 0.34 % are obtained from 340 to 510 mbsf. The estimated maximum paleo-temperature is from approximately 27 to 70˚C, and obtained paleo-geothermal gradient is >250˚C/km. This is higher than present measurement value, and quite higher than world average value of the crust. In case of hot basement covers with thin sediment, apparent geo-thermal gradient gets higher, and thickening history of sediment can be measured from the deposition rate of 11mm/Ky in average (Jian et al., 2018). To satisfy the obtained vitrinite reflectance profile, this site must cool by 2.8% in million years. This cooling rate is much slower than general rate of reversed root of the plate age. This might be due to heat being transferred for a long time or being warmed by the cover sediment layer.

Keywords: Rift margin, heat flow, cooling rate, Joides Resolution, vitrinite reflectance, South China Sea

