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Heat flow profile across St. Paul Fracture Zone reveals thermal anomaly of transform fault regime

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During research cruise MSM69 (November/December 2017) on RV Maria S. Merian, we measured seafloor heat flow along a profile across the St. Paul Fracture Zone (FZ) co-located on an ultra-deep reflection seismic profile (Mehouachi & Singh, 2018). The seismic image shows two sub-parallel reflectors with the upper one being interpreted as the top of the Lithosphere-Asthenosphere-Boundary (LAB). Mehouachi & Singh (2018) associate this upper boundary with the 1260°C isotherm.

Our heat flow profile of in total 29 measurements covers crustal ages from 48 (south of the FZ) to 71 (north of the FZ) Ma. Mean heat flow south of the FZ is 79 mW/m^2, slightly higher than the expected value of 73 mW/m^2 from a plate cooling model at 48 Ma (Hasterok, 2013), slightly increasing systematically towards the FZ. The heat flow values within the FZ itself are significantly higher, with a mean of 83 mW/m^2, than the expected mean value of 63 mW/m^2 (Hasterok, 2013) for this age range (56-68 Ma). North of the FZ heat flow values are still higher than expected with a tendency to decrease with distance from the FZ. None of the historic heat flow measurements (Global Heat Flow Database) in the vicinity of St. Paul FZ show values as high as the ones we measured on top of the FZ. We interpret this heat flow anomaly as residual thermal signal of the formation of the transform fault.

These surface heat flow measurements as well as the depth variation of the top of LAB (Mehouachi & Singh, 2018) will be used to constrain thermal models of the lithosphere across the FZ.