

Determination of Three Thermal Properties in Japan Trench Fast Drilling Project (JFAST)

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The 2011 Mw 9.0 Tohoku-oki earthquake produced a maximum coseismic slip of >50 m near the Japan Trench. Japan Trench Fast Drilling Project (JFAST) as the Integrated Ocean Drilling Program (IODP) Expedition 343 and 343T drilled through the plate boundary fault ruptured during the Tohoku-oki earthquake at site C0019 approximately one year after the earthquake. The most highlighted objective is to detect residual positive temperature anomaly induced by the coseismic frictional heat. To interpret measured temperature anomaly and to calculate coseismic shear stress on the ruptured fault from the temperature anomaly, the full three thermal properties (thermal conductivity, thermal diffusivity and specific heat; only two thermal properties among the three are independent) are necessary. We measured the three thermal properties using four whole round core samples retrieved from borehole C0019E at 177, 697, 802 and 828 mbsf (meter below seafloor), respectively by a transient plane heat source method (also called Hot Disk method). Independently with Hot Disk method, thermal conductivity were also measured by a line heat source method for 45 half core samples using a TEKA half-space probe onboard the D/V Chikyu and by a divided bar technique using 38 crushed core samples (particle samples) in onshore laboratory. The thermal conductivities determined independently by the three methods were consistent each other. Also, the Hot Disk measurements revealed very little anisotropy in thermal conductivity and thermal diffusivity.

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