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Determination of Stress State in Japan Trench Fast Drilling Project (JFAST)

Weiren Lin[1*], Marianne Conin[2], J. Casey Moore[3], Frederick M. Chester[4], Yasuyuki Nakamura[5], James J. Mori[6], Louise Anderson[7], Emily E. Brodsky[3], Nobuhisa Eguchi[8], Sean TOCZKO[8], Expedition 343 scientists[9]

[1]Kochi/JAMSTEC, [2]Universite des Antilles et de la Guyane, [3]University of California, Santa Cruz, [4]Texas A&M University, [5]IFREE/JAMSTEC, [6]Kyoto University, [7]University of Leicester, [8]CDEX / JAMSTEC, [9]IODP

The 2011 Mw 9.0 Tohoku-oki earthquake produced a maximum coseismic slip of >50 m near the Japan Trench, which could result in a completely reduced stress state in the region. We tested this hypothesis by determining the in-situ stress state of the frontal prism from boreholes of Japan Trench Fast Drilling Project (JFAST) drilled by the Integrated Ocean Drilling Program approximately one year after the earthquake, and by inferring the pre-earthquake stress state. On the basis of the horizontal stress orientations and magnitudes estimated from borehole breakouts, and the increase in coseismic displacement during propagation of the rupture to the trench axis, we concluded that in-situ horizontal stress decreased during the earthquake. The stress change suggests an active slip of the frontal plate-interface consistent with coseismic fault weakening and a nearly total stress drop.

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Keywords: JFAST, Stress, Breakout