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Relationship between the West Andaman Fault (WAF) boundary and rupture evolution of Sumatra-Andaman earthquake of December 26, 2004

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The 26 December 2004 Sumatra-Andaman earthquake (Mw~9.3) rupture initiated northwest of Simeulue Island with an initial speed of 0.5-1.0 km/s for about first 100 km then accelerated to over 2.5-3.0 km/s and propagated northwards up to Andaman Islands, rupturing over 1300 km of the plate boundary uni-directionally and causing a disastrous tsunami in the Indian Ocean. Another three months later, a second megathrust earthquake (Mw=8.6) occurred just 150 km further east of Simeulue Island, and broke 300-400 km of the plate boundary in a bilateral sense and stopped near Simeulue Island. Based on recently acquired bathymetry data Singh et al. (2005) proposed that the strike-slip West Andaman Fault might be a lithospheric-scale boundary that might have acted as a barrier for southward propagation of rupture and might have helped to channel the propagation of energy northwards. Here we have extended this study close to the epicentre using shallow and deep seismic reflection data. The shallow seismic reflection data shows a push-up structure north of Simeulue Plateau, which might be due to the change in small-scale strike of the West Andaman Fault. The recently acquired deep seismic reflection data (Singh et al., 2006) shows a discontinuity in the subducting plate at about 25 km depth, which also coincides with the change in the dip of the subducting plate. The rupture propagation modelling (Chen et al, 2006 psnl. comm.) suggests that the slip increases from 2 m to 15-20 m as the rupture propagates across the West Andaman Fault, which also coincides with change in the speed of the rupture from 0.5 km/s to 2.5 km/s. After crossing the West Andaman Fault, rupture is confined between the subduction front and West Andaman Fault. These new results further corroborate the initial findings of Singh et al (2005) and suggest that the West Andaman Fault is indeed a lithosphere-scale boundary responsible for the northward propagation of the 26th December rupture propagation.

References:
Singh et al., 2005, Sumatra earthquake research indicates why rupture propagated northwards, EOS Transactions AGU, Vol. 86, No. 48
Singh et al., 2006, Seismic reflection image of the Great Sumatra-Andaman earthquake rupture from source to the surface, AGU Fall Meeting 2006 Abstract submitted.