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Late Neogene to Present accommodation of oblique Convergence from Northern Sumatra to Andaman Basin

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We analyse structures of the sliver plate from southern Sumatra to the Myanmar region during the Late Neogene and the Quaternary. From the Sunda Strait to Nias Island, the system is well-partitioned between the trench and the Sumatra fault, and deformation inside the forearc basin, mostly illustrated by the Mentawai fault, is now extinct. The onset of right-lateral strike-slip deformation in the Sumatra arc/forearc region and the installation of the Great Sumatra Fault are controlled by the stratigraphic record in the Sunda Strait and forearc basin. The onset of clastic deposition is dated around 12 Ma (N12) and is followed around 4 Ma by an unconformity (N18 to N20). Similar evolution is recorded onshore in the South Sumatra Basin. In the southern and central parts of the Sumatra Forearc basin, seismic lines from French-Indonesian seismic cruises indicate little deformation during and after the Pleistocene, indicating that the Mentawai Fault was mostly active previously, during the Pliocene. The beginning of the Great Sumatra Fault (s.s.) also shortly postdates a 4 Ma (NN16) tectonic inversion in the forearc basin and in the Barisan Range.

From Nias Island, going northward, the subduction front shows re-entrants accompanied by forearc uplift at Batee Island, which suggest the presence of recently subducted asperities, probably volcanic edifices of the Wharton fossile ridge. The forearc sliver is severely deformed by sigmoid folds and thrusts which mark the southern edge of the Simeulue and Aceh basins. This tectonic feature becomes linear west of the Tuba ridge and constitutes the southernmost extension of the West Andaman fault.

Toward the north, the last pulse of oceanic spreading in the Andaman Basin is younger than 4 Ma (about 120 km of newly formed oceanic crust at an average 3.5 cm/yr rate). This young portion of the basin overprints older structures of the proto-Andaman Sea.

North of the Andaman Sea, India-Sunda strike-slip component is taken partly by the Sagaing fault in Myanmar as indicated by GPS measurements, but we lack data to further precise the age of the fault along its present geometry. A tectonic inversion is recorded in the Central Burma basins at 8 Ma but there is little constraint on the evolution of the area between 8 and 4 Ma.

We propose that the right-lateral shear along the Western Sunda margin existed as diffuse deformation in the forearc and as rifting in the Andaman pull-apart basin prior to the onset of the Sumatra Fault 4 Ma ago. Then only, the sliver developed along a large but localised strike-slip fault (Sumatra/West Andaman/Sagaing) and a localised pull-apart basin (Andaman basin). The offshore North Sumatra thus appears as a complex transition zone from oblique to hyper-oblique subduction. The transition is rather sharp, the strike-slip component increasing from about 2 cm/yr (Northern Sumatra Fault) to about 3.5 cm/yr (West Andaman Fault). In the transition zone, obliquity is accommodated simultaneously onto the Sumatra Fault and the southern extension of the West Andaman Fault, the latter progressively vanishing towards Simeulue and adjacent islands.