Deformation, earthquakes and tsunamis along thickly sedimented subduction: Arakan segment of the Sunda Arc

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Incoming sediment thickness and composition are primary factors in the morphology and shallow structure of subduction boundaries. Sediment thickness in the Indian Ocean increases SE to NW along the Sunda arc. From <1km along Java to >15km where the boundary encounters the Ganges-Brahmaputra Delta (GBD). Here the accretionary prism broadens to the NW to >300 km wide. It is dominated by shallow-water to non-marine sediment. This segment also features a broad shallow megathrust overlain by linear anticlines rooted in splay faults. It is entirely above sea level and blind in its frontal part. This GBD segment transitions to a more familiar subduction structure and morphology along the submerged Arakan segment to the SE. The SE portion of this segment is characterized by larger splay faults that expose deep-water sediment with mud diapirism forming volcanoes and circular synclines. With increasing sediment input, the NW portion of the Arakan segment encroaches onto the GBD shelf. Both the SE and NW portions of the Arakan segment ruptured in the Mw>8.5 1762 tsunamigenic earthquake according to field and modeling evidence.

Uplifted coral reefs and marine terraces along the Myanmar and Bangladesh coasts document a >500 km rupture in 1762. The uplift, ranging from 6 m to 2 m from south to north, has been linked to rupture on the megathrust and on shallow splays. Tsunami deposits are traced for ~10 km along the St. Martin’s Island anticline and for >40 km along the Teknaf peninsula. Microfossils and mollusk assemblages in these deposits are consistently of shallow water affinity and date the tsunami to 1762. This deposit covers only a small fraction of the inferred megathrust rupture. If it is representative of the total tsunami distribution, a local anticline may have been the main source. Evidence from live coral microatolls show uplift on St. Martin’s Island continuing 250 years after the earthquake. This motion could stem from continued anelastic deformation of the anticline updip of the rupture. More widely distributed evidence from sediment and corals could address questions about megathrust and splay behavior in 1762 and after. Plans include multichannel seismic surveying, high resolution subbottom profiling and 40 m long piston coring to compare the SE to NW shelf portions to the Arakan segment along the Myanmar and Bangladesh coasts. More generally, we aim to better understand subduction and geohazards
along thickly sedimented systems.