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Lower plate control of upper plate deformation at the toe of the NW Sumatra convergent margin from swath bathymetry

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We report on the results of multi-beam bathymetric data acquired during two recent oceanographic expeditions conducted on the French RV Marion Dufresne during July-August 2005 and July-August 2006, in the region of maximum slip of the 26 Dec. 2004 earthquake (M 9.1). These data are combined with existing bathymetric coverage from the British HMS Scott in the same area to provide high-resolution images of the seafloor relief of the entire NW Sumatra fore-arc extending from the Sunda trench, to the submarine volcanic arc just north of Sumatra. A slope gradient analysis applied to the combined data set reveals the regions with the steepest slopes and thus highlights those portions of the seafloor reshaped by active tectonic, sedimentary and/or erosional processes. The strongest slope gradients are located in the frontal-most 30 km of the fore-arc, near the toe of the accretionary wedge. This suggests that long-term deformation rates are highest here and that only minor amounts of slip may emerge through other thrusts faults further landward. The morpho-tectonic interpretation of our combined data set indicates that folding at the toe of the accretionary

wedge occurs primarily along landward vergent thrusts, a rare tectonic style occurring in $<1\%$ of all accretionary wedges worldwide. N-S oriented lineaments observed on the oceanic crust, are aligned sub-parallel to the fracture zones associated to the Wharton fossil spreading center. These lineaments show evidence of recent deformation with up to 20-30m vertical offsets. The intersection of these N-S lineaments with the accretionary wedge is shown to control the lateral termination of thrust anticlines as well as the emplacement of small scale margin parallel erosional features (e.g. slide scars, canyons). This interpretation also shows a significant inprint of N-S lineaments on the oceanic crust, at the toe of the wedge and further landward in the wedge.