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Control of mass-failure events on the evolution of a submarine channel network, offshore Brunei Darussalam

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The present-day continental slope offshore Brunei Darussalam (NW Borneo) is worked into several networks of submarine channels possessing a number of planform attributes similar to those observed in better studied river systems. The position of many of these depositional submarine channels, however, is strongly influenced by topography developed by the release of recent mass-failures (Plio-Pliestocene?). We have studied one submarine network in detail using a 3D survey of industry seismic data. This network contains 13 channels, is positioned directly down slope from the Champion Delta shelf-edge and encompasses an area approximately 6 km by 24 km in the strike and dip directions, respectively. Present-day water depths increase from approximately 300 m to 1200 m moving from the proximal to distal end of the network. Using the seismic data we have mapped the seafloor and two shallow ($<$0.5 sec TWT below seafloor) regional surfaces beneath the network of interest. These subsurface horizons define the geometries of scarps and slide planes associated with several regionally extensive, mass-failure events ($>$40 km^2). Up-dip from the failure scarps the locations of present-day channels are entirely pre-determined by the positions of older, buried channel-forms. Down-dip of the scarps the system is reset, but channel position has been strongly influenced by scarp geometry. In particular, channels cross the failure surface where the scarp planform is concave in the down-dip direction. Scarp shape also appears to focus flow from several, smaller channels into single, larger channels. Failure scarps induce local maxima in erosion and deposition immediately up dip and down dip from the structures, respectively. All of these effects on the seascape are small compared to changes in the overall pattern of slope construction that appear simply associated with relative distance from shelf-edge. Local depth for all three mainstem channels systematically increases from about 0 to 45 m over their

initial 6 km length. The magnitude of in-channel deposition smoothly decreases over this same reach. Downstream from this position, both channel depth and in-channel deposition remain approximately constant throughout the course of the study area. This network illustrates the importance of preexisting topography in controlling the planform location of submarine channels, but unlike terrestrial systems, channel depth and in-channel deposition are correlated more with distance from shelf-edge than with channel gradient.