



The characteristics of rotational slumps and subaqueous translational slab slides of the Lower Murray River, South Australia: do they have any implications for the weak-layer hypothesis?

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The peak of the recent prolonged 'Millennium Drought' (1997-2011) triggered an episode of widespread mass failure in the alluvial river-banks of the Lower Murray River in South Australia. Multi-beam surveying of the channel and submerged river-banks between Mannum and Murray Bridge and coring of the bank sediments has been undertaken in sections of the river where large bank failures threatened private housing or public infrastructure. This data demonstrates that the bank materials are soft, horizontally-layered muds and that translational, planar slab-slides have frequently occurred in permanently submerged portions of the Murray's river banks. Despite these riverine features being several orders of magnitude smaller than the translational submarine landslides of the continental margins, the submerged river-bank slides are strikingly similar in their morphology to their submarine equivalents.

Intriguingly, the Murray River translational slide failure-surfaces are usually developed as river-floor-parallel features in a manner similar to many submarine landslides which present failure-surfaces that are developed on seafloor-parallel, bedding planes. In contrast however, the Murray's river-bank slides occur on steep slopes (>20°) and their failure surfaces must cut across the horizontal laminations and layering of the muds at a relative high angle which removes the possibility of a weak sediment layer being responsible for the occurrence of these failures.

Modelling of the river-bank failures with classical soil mechanics methods and the measured physical properties of the river-bank materials indicates that the failures are probably a consequence of flood-flow scour removing the bank-slope toe in combination with pore-pressure effects related to river-level fluctuation (ie. drawdown). Nevertheless, the Murray's translational slab-slides provide a reliable example of slope-parallel planar failure in muds that does not require a stratigraphic weak layer to explain the occurrence of those failures.