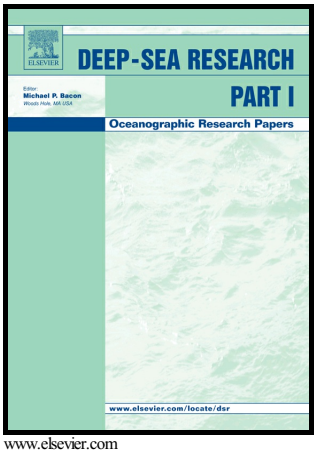

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Relation of sortable silt grain-size to deep-sea current speeds: Calibration of the 'Mud Current Meter'

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Abstract.

Fine grain-size parameters have been used for inference of palaeoflow speeds of near-bottom currents in the deep-sea. The basic idea stems from observations of varying sediment size parameters on a continental margin with a gradient from slower flow speeds at shallower depths to faster at deeper. In the deep-sea, size-sorting occurs during deposition after benthic storm resuspension events. At flow speeds below 10-15 cm s^{-1} mean grain-size in the terrigenous non-cohesive 'sortable silt' range (denoted by $\overline{SS}$, mean of 10-63 μm) is controlled by selective deposition, whereas above that range removal of finer material by winnowing is also argued to play a role.

A calibration of the $\overline{SS}$ grain-size flow speed proxy based on sediment samples taken adjacent to sites of long-term current meters set within ~100 m of the sea bed for more than a year is presented here. Grain-size has been measured by either Sedigraph or Coulter Counter, in some cases both, between which there is an excellent correlation for $\overline{SS}$ (r = 0.96). Size-speed data indicate calibration relationships with an overall sensitivity of 1.36 ± 0.19 cm s^{-1}/μm. A calibration line comprising 12 points including 9 from the Iceland overflow region is well defined, but at least two other smaller groups (Weddell/Scotia Sea and NW Atlantic continental rise/Rockall Trough) are fitted by sub-parallel lines with a smaller constant. This suggests a possible influence of the calibre of material supplied to the site of deposition (not the initial source supply) which, if depleted in very coarse silt (31-63 μm), would limit $\overline{SS}$ to smaller values for a given speed than with a broader size-spectrum supply. Local calibrations, or a core-top grain-size and local flow speed, are thus necessary to infer absolute speeds from grain-size.

The trend of the calibrations diverges markedly from the slope of experimental critical erosion and deposition flow speeds versus grain-size, making it unlikely that the $\overline{SS}$ (or any deposit size for that matter) is simply predicted by the deposition threshold. A more probable control is the rate of deposition of the different size fractions under changing flows over several tens of years (the typical