



2004 Indian Ocean tsunami inflow and outflow at Phuket, southern Thailand

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At Bangtao Beach on the west coast of Phuket Island, the 2004 Indian Ocean tsunami produced a series of flows in which rapid inflow of turbulent water was followed by ponding and then by gradual outflow. Several photographs and eyewitness accounts point to the fact that an initial withdrawal was followed by series of inflows. The tsunami left behind a sand sheet with the observed maximum thickness of 25 cm. The sheet contains both parallel and inclined lamina as well as landward and seaward inclined lamina in addition to the normal grading commonly reported from tsunami deposits. The sheet also shows evidence for two times of vigorous inflow. Each of these is marked by mud rip-ups, medium to coarse sand that grades upward to fine, landward-inclined laminae, and a sharp basal contact. The top of the sheet, when observed in the first days after the tsunami, abounded in current dune and ripple bedforms of mostly landward orientation. The tsunami's first positive wave left no onshore sedimentary record in this pitting area. The second wave deposited sand that is much less extensive and slightly finer than that of the third wave. The deposit of both these waves contains multiple fining-upward sequences possibly due to multiple surges in one wave train. The depth-averaged flow velocity estimated from thickness and grain size are in the range of about 7-21 m/s, whereas a near bottom threshold velocity calculated from

bedforms reveals the order of magnitude difference from 1.74 to 1.03 m/s.