

Distribution and origin of large reef blocks deposited by the 2004 Indian Ocean tsunami at Pakarang Cape, Thailand

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On 26 December 2004, one of the largest tsunamis in human history (the 2004 Indian Ocean tsunami), generated by the Sumatra-Andaman Islands earthquake, struck coastal areas around the Indian Ocean. Such a large tsunami can remove sandy sediments from the sea bottom and beaches, and transport large amounts of sediments landward or seaward to form tsunami deposits (e.g., Goto et al., 2005; Moore et al., 2005).

The abundant meters-long reef blocks now scattered along western shore on Pakarang Cape, Thailand were certainly transported by the 2004 Indian Ocean tsunami (Goto et al., 2005). These large reef blocks at Pakarang Cape are the first undisputed evidence that tsunami waves can transport blocks as long as 4 m landward. Clarifying how these blocks were transported can help us to understand the inundation pattern, the hydrodynamic force, and impact strength to the coast of the tsunami wave currents. We, therefore, investigated the process by which these blocks were transported onto the shore at Pakarang Cape.

Several blocks at Pakarang Cape retain flat surfaces covered by calcareous algae. The presence of barnacles of genus *Balanus* on these blocks suggests that they originated in the intertidal zone. Our field investigation and numerical calculations suggest that the first, eastward-directed tsunami wave struck the edge of the reef, 300 to 600 m offshore of the cape, thereby detaching and transporting blocks of the reef shoreward. No blocks are found on land, indicating that the hydraulic force of the tsunami wave decreased on reaching the land. Reef blocks were transported less than 300-600 m eastward by the first tsunami wave, and may have been redistributed subsequently by northward-directed coastal currents.