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Indian Ocean tsunami deposits along the West Coast of the Malay-Thai Peninsula: Foraminiferal and grain size analysis

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A suite of sites running north to south along the Malay-Thai Peninsula have a sedimentary record of the 2004 Indian Ocean Tsunami: Khao Lak, coastal mainland western Thailand; Koh Phi Phi and Koh Lanta Islands, Thailand; and Penang and Langkawi Islands, Malaysia. Tsunami wave incursions delivered landward thinning sand sheets.

Eyewitness accounts of tsunami approach and inundation recollect one to three waves coming ashore at each site. Waves came ashore as either distinct walls of water or as a combination of backwash from a prior wave along with reflected and refracted waves creating turbulence similar to that of a 'washing machine'. We quantified inland penetration, run-up and flow depth through physical evidence and eyewitness accounts. The extent of inland inundation varied from 52m to 2000m within our five study sites. Low coastal geomorphology enabled Khao Lak (2000m) and Penang (1500m) to have the most extensive inundations. Wave run-up height and tsunami flow depth decrease from north to south along the Malay-Thai Peninsula from ~ 8.7 to 2.4m above MSL and from 2.80 to 0.80m, respectively. Grain size analyses of the tsunami-lain sediments contained up to three fining upward sequences and up to two massive units of medium to coarse sand with shell fragments within the five tsunami deposits. The fining upward sequences likely reflect lower energy conditions between higher energy massive forewash deposits. All tsunami deposits had a sharp or erosional lower contact with the underlying pre-tsunami sediment. Grain size and foraminiferal assemblage analyses revealed that three of the five sites have a systematic relationship between the

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number of waves that came ashore and those preserved as stratigraphic units in the sediment record. At three sites, grain size between the pre-tsunami and tsunami deposited sediment showed a modal change in dominant grain size. Foraminiferal analysis showed between one and three assemblage zones at each site. These assemblage zones were often single species dominant. At three sites, the foraminiferal assemblages in the pre-tsunami sediment differed from that within the tsunami-lain sediment. This was particularly important at two of the sites, Phi Phi and Koh Lanta Island, where no lithologic or grain size distinction was apparent and thus tsunami deposit recognition at these sites may have been overlooked.