The predecessor of the 2004 Indian Ocean tsunami had a profound effect on the northern Sumatra section of the medieval marine trade routes of the Indian Ocean. We present robust archeological evidence that eight distinct communities along a 40-km section of the northern coast of Aceh, Sumatra, were devastated by a tsunami likely caused by seafloor uplift previously dated via coral paleoseismology to 1394±2 CE. Of these eight settlements, only the one known to Chinese traders as Lamri, perched on a hill above the reach of the tsunami, survived into the 15th century. Repopulation of these coastal settlements began to occur only many decades later and likely not by survivors from the devastated pre-1394 settlements. Our evidence is in the form of tens of thousands of ancient ceramic shards, primarily from beaches or on the berms of fishponds, recently dredged along the coast. Date ranges of these Burmese, Chinese, Japanese, South Asian, Thai, and Vietnamese shards constrain history of the settlements with multi-decadal precision through the period from about 1100 CE to present. The striking absence of shards from the period ~1390-1450 CE argues strongly for destruction and abandonment of all but the Lamri headlands settlement in 1394 and plausibly again in 1450.