

February 5-13, 2005 Field Survey in Banda Aceh, Indonesia: Insights and Future Studies

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A team of scientists from Nagoya University was dispatched during the early part of February 2005 for a 7-day field observation in Banda Aceh, Indonesia. The aim of the survey was to investigate and document the earthquake- and tsunami-related damages incurred from the December 26, 2004 earthquake particularly in the city of Aceh and its adjoining areas. Field surveys were concentrated and limited to Aceh City, Lhok Nga and Krueng Raya areas. Local landforms and geomorphology were likewise noted during the survey together with the information regarding the intense ground shaking and tsunami inundation through interviews.

Based on numerous collapsed structures, the whole region experienced intense ground shaking. Numerous engineered structures in Aceh City suffered from moderate to severe structural damage. In the same area, residential houses suffered less or even no damaged at all. Based on interviews, the felt ground shaking lasted for about 5-10 minutes and was commonly compared to shaking onboard a ship during high waves.

Most of the damages were due to tsunami that inundated the Aceh City from about 0.5km-4km from the shore. The shoreline area, especially in Aceh City and Lhok Nga, was totally destroyed leaving behind nothing but the floors, debris of concrete walls and bent columns. The mosque, which is the center of each village, noticeably survived the tsunami wave with minor damage. The highest tsunami height measured along the shore is about 14m and approached the shorelines like a vertical wall of water before finally flooding the rest of the city. The rest of the city was damaged by debris- and silt-laden tsunami with an average height of about 3m. However, in the western part of Banda Aceh particularly in Lhok Nga, the tsunami completely destroyed villages in much higher wave height. The whole area was stripped-off of almost all manmade structures and foliage. Low-lying valleys remained flooded with salt water while vegetation along the foot slopes of the mountains was obliterated.

During the survey, several observations points exemplified possible post-seismic subsidence. To verify such observations, we made some preliminary measurements at Ulee Lheue. Initial computations showed possible subsidence of at least 40cm although investigations in Lhok Nga highly indicated much larger amount of subsidence. However, at this point, possible erosion from tsunami backwash and or compaction due to intense ground shaking along shorelines cannot be wholly discounted to have influenced such phenomenon. In terms of landforms, the whole city of Aceh is built on a relatively broad flat terrain. The city sits on top of an alluvial plain produced from the Krueng Aceh and Krueng Angan rivers and its tributaries. On the other hand, the shoreline fronting the city is composed of sand spits, barrier beach, lagoons and marshlands. Considering its flatness, easy access to the sea, and good condition for aquatic production, the city's growing population and development had advanced well into this region. Thus, when the gigantic tsunami struck the city, the dwellings and all other structures along the Ulee Lheue, Jeulinkge, Kapilma, and Tembak had the slightest chance of survival.

Nagoya University plans to study further the earthquake and tsunami phenomenon in Banda Aceh considering the city's vulnerability to earthquake hazards and some evidence of previously bigger tsunami event. Initial activities to address this plan are the regional continuous GPS observation and the research collaboration with the University of Syiah Kuala that could hopefully enhance public knowledge and awareness regarding earthquake, earthquake hazards and earthquake disaster mitigation.