Forewarning of *M* 7.6 earthquake at Andaman Islands: where next?

On Monday, 10 August 2009 at 19 : 55 : 39 Universal time (UT) (11 August 2 : 56 a.m., Thailand local time), an earthquake of surface wave magnitude (*M*) 7.6 occurred off the coast of Port Blair, Andaman Islands, India[1]. This quake (depth at 15 km of 13.991° : 93.838°E)[2] spawned a regional quake which was felt up to some 600 km west of its epicentre. At Thong Pha Phum, Kanchanaburi, western Thailand, the quake started at 2 : 57 a.m. and persisted for more than 60 s. This earthquake is located about 200 km north of the pre-2004 rupture areas related to the 1941 earthquake (Figure 1).

According to the prediction made before the 2004 Sumatran earthquake[3], this recent earthquake of *M* 7.6 at the northern Sunda Trench was not the first of its kind[4]. An earthquake with a magnitude up to *M* 8.0 was expected to recur at 157 ± 43 years from the rupture zone of Car Nicobar Islands after 1881 – i.e. between 1995 and 2081 (refs 5 and 6). At southern Sunda Trench, seismological data reveals that the recurrence of the quake at Sumatra with a magnitude ≥*M* 9.0 may not be earlier than 140 years from 2004 (ref. 7). Though this *M* 7.6 earthquake was about 500 km away from the previously expected recurrent zone[5,6], it confirmed the probable recurrence in the pre-2004 rupture zone according to the seismological and geological predictions. To date, sedimentological evidence also extends tsunami history for the Sunda Trench region. If the youngest sand sheet beneath 2004 tsunami layer found in Thailand[8] and Indonesia[9] is a predecessor of the 2004 Indian Ocean tsunami, the expected recurrence with a similar magnitude of tsunamigenic earthquake at Sumatra is inferred to possibly recur in the next 600 years. These issues challenge the scientists to narrow down the prediction of the recurrence of such a potential mega-tsunamigenic earthquake spatially and temporally along the Sumatra–Andaman subduction zone. However, the possibility of a local tsunamigenic earthquake should also be taken into account.

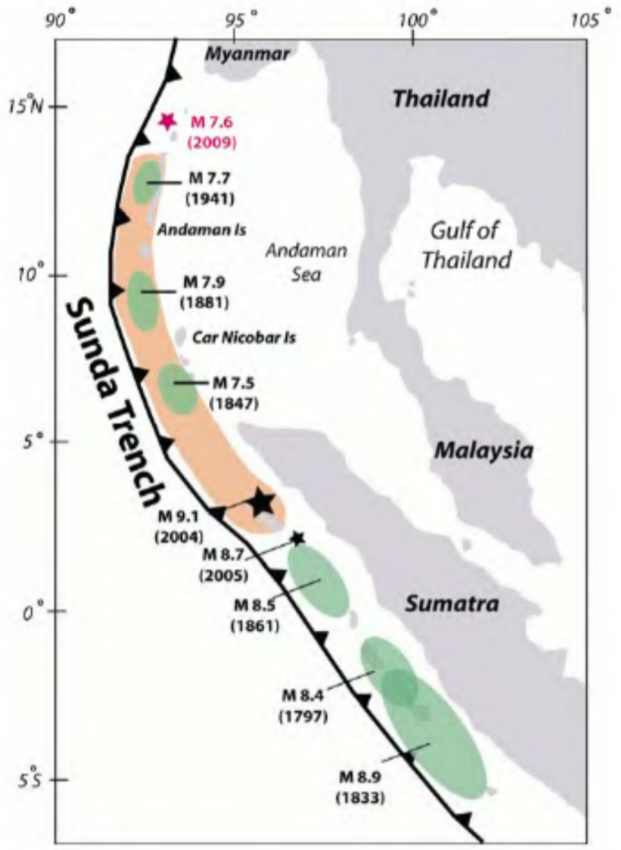

Figure 1. Historical records of submarine earthquakes along Sunda Trench[3–6]. The 2004 (*M* = 9.1) event at Sumatra rupture extended to Andaman Islands (pale brown)[7–9]; green circles indicate rupture zone for each event.

The *M* 7.6 earthquake provides a significant scenario to be construed as an early warning sign of the seismological stress beneath the Sumatra–Andaman subduction zone. It is interesting that the trend of stress around this part of Indian Ocean region may possibly be released northward along the northern Sunda Trench rupture zone (*M* 7.5, *M* 7.9, *M* 7.7, *M* 7.6 in 1847, 1881, 1941 and 2009 respectively). Statistically, the recurrent interval of stress release along the northern Andaman Trench is likely to be at least 60 years. If this trend of stress release is to the north, the possibility of the next earthquake may regionally recur either at the northern part of the Andaman rupture zone or at the western and central parts of Myanmar.

In terms of geological setting, the *M* 7.6 (2009) quake may have generated from a normal fault and not directly connected to the major strike–slip active fault in central Myanmar – the Sagaing Fault (SF; Figure 2)[10]. The north–south SF is more than 1000 km length on land and extends for 100 km to its south through the Andaman Sea and ending its connection with the Sumatra–Andaman subduction zone. The SF branches to the two major strike–slip active faults of the western Thailand – the Mae Ping Fault (MPF) and the Three Pagoda Fault (TPF). It is important to note that, if this trend of stress releases to the north around the northern part of Andaman subduction zone, either the strike–slip SF in Myanmar or the TPF and the MPF in Thailand may further be subjected to local movement. The movement of active faults indicates the maximum earthquake magnitude of *M* 8.5 (refs 10, 11) and *M* 6.3 (ref. 11) to *M* 6.9 (ref. 10) being generated along the SF and TPF fault zones. Thus, all countries around Indian Ocean (especially Thailand and Myanmar) need to be cautious about the next possible earthquake event.

The *M* 7.6 earthquake is primarily categorized as magnitude intensity II–III (ref. 1), but such an earthquake magnitude has rarely been felt by people living in the countries east of the Sumatra–

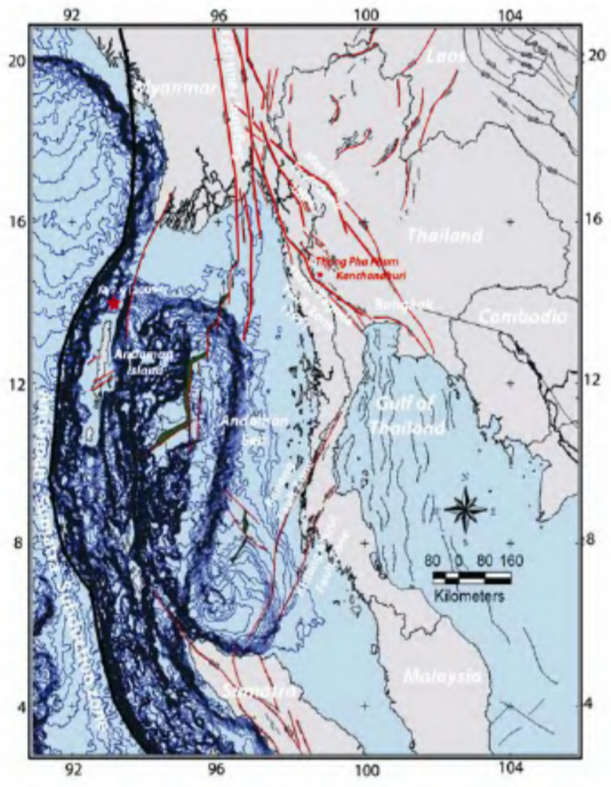

Figure 2. Major active faults (red) with their networks: Sagaing Fault (SF) in Myanmar, Mae Ping Fault (MPF) and Three Pagoda Fault (TPF) in Thailand. Red star represents the recent event of M 7.6 with the epicentre at northern Andaman Islands. Red dot shows the location of Thong Pha Phum, Kanchanaburi where the quake was felt by the author. Bathymetric contours indicated in blue. Green shade represents extensional basin in Andaman Sea.

Andaman subduction zone. Within an hour of the occurrence of the quake, the Pacific Tsunami Warning Centre sent a message alerting all the countries around the Indian Ocean for a possible teletsunami. Fortunately, no teletsunami hit the coastal region and the warning message was withdrawn a couple of hours later. Most importantly, such a M 7.6 earthquake has the potential for local tsunami generation and what would happen if an earthquake of equal or greater magnitude occurred in the night when people living in Indian Ocean coastal zone are asleep. This event, certainly, cannot be ignored and could be counted as one of the significant signs of early forewarning for future earthquakes and tsunamis that may recur at countries around Indian Ocean. These countries need to plan for the mitigation of earthquakes and night-time tsunamis that might recur in the next hundred years.

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