PALEOEARTHQUAKE AND ACTIVE FAULT ACTIVITIES IN PENINSULAR MALAYSIA.

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The $M_o = 2.7$ to 4.2 (MMD, 2010) earthquake occurrences near Bukit Tinggi, Kuala Pilah, Jerantut and Manjung, from 2007 to 2009, has stimulated considerable interests and debate. These earthquakes are located along major faults which raised fundamental questions about fault behavior and the earthquake distribution in time and space. These earthquakes were not without precedence. Reconnaissance paleoseismic studies were able to identify evidences of paleoearthquakes related to Late Pleistocene, and Holocene to Recent surface faulting along several major faults in Peninsular Malaysia.

At Brinchang in Cameron Highlands, Recent paleoearthquakes left traces in the form of surface ruptures, reverse, normal and strike slip faults, liquefaction structures in the form of disrupted beds, mud-filled fissured beds, and mud intrusions, buttress unconformities and fault-controlled graben/subsidence. The present of N-S surface ruptures suggest that the N-S that cut through Cameron Highlands is an example of active fault.

The NW-SE Bok Bak and NE-SW Sungai Muda fault zones, located in the northwest Peninsular Malaysia, have been the source of multiple latest Pleistocene and Holocene surface rupturing earthquakes. At the intersection of these faults a Late Pleistocene alluvial sequence was found deposited in a series of small fault grabens developed on the Paleozoic bedrock. The alluvial deposits exhibit a series of clastic dykes, ball and pillow structures and soft-sediment normal, reversed and strike-slip faults. These features are the result of ground displacement and seismic liquefaction of a Late Pleistocene alluvial deposit, as the consequence of high intensity paleoearthquakes.

The raised Holocene to Recent river terraces deposit along the Bok Bak and Sungai Muda fault zones exhibit a series of clastic dykes, ball and pillow structures, convolute laminations, tilted channels, and soft-sediment normal, reversed and strike-slip faults. These features are interpreted as paleoseismites, the result of Holocene to recent ground displacement and seismic liquefaction of the terrace deposit, as the consequence of high intensity paleoearthquakes of much greater magnitude than those affecting the peninsula at present. The ages for these faulted alluviums and hence the age of seismic activities has been determined using radiocarbon dating of the organic matters which give ages of $2105 \pm 30$ Gajah Putih, $1280 \pm 30$ and $400 \pm 30$ along Sq. Muda, Kedah. Several NE-SW faults such as near Bukit Janing in Kedah, shows the presence of paleoearthquakes in the form of normal faults and folds.

The study identified several NW and NE trending major faults in Peninsular Malaysia that have been reactivated to give rise to paleo-earthquakes. The presence of surface ruptures suggested that the magnitude of the earthquakes could be greater than 5. In light of the present earthquake occurrences and paleoseismic studies, a revision is required in the seismic hazard assessment of low seismicity Peninsular Malaysia. Faults with neotectonic activity are significant features that should be borne in mind when assessing the seismic hazards of the country.