

Detection of tsunami sediment layers in southeast of Taiwan using Ground Penetrating Radar

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Surveys of tsunami sediments are important to reveal the history of paleo-tsunamis in Taiwan where damages by tsunamis have been rarely recorded in the old documents. Recently, investigation of the tsunami sediment has been made progress in the southeast of Taiwan (Ota, 2013; Lallemand et al., 2015). The regional distribution of the tsunami sediments would inform the run-ups of paleo-tsunami and sedimentary condition when the tsunami was inundated. However, large-scale trench survey is generally difficult to be carried out because of expensive cost and difficulties of agreement from residents. The remote-sensing survey method is required to trace the tsunami sediment layers nondestructively. We employed the Ground Penetrating radar (GPR) to detect the regional distribution of the tsunami sediment layers.

The GPR survey was carried out at Chenggong (north of Taitung) and Lanyu Island from August 27 to September 2, 2015. We surveyed using GPR equipment and carried out drilling using hand-auger to refer the layers. Used frequencies of GPR equipment are 500 MHz and 1 GHz. The maximum penetrating depth is about 1-2 m for the wet mud condition.

In the Chenggong, we carried out the surveys at middle terrace (asl. 18 m). From the survey at the terrace out of the Chenggong town, we could detect the undulation of boundary (between soil and mud layer) with the depressions of 20 cm at the depth of 50 cm. The fragments of the corals and shells deposited densely at the bottom of the depressions. These fragments could be detected by GPR profile as the diffracted body.

The GPR survey was carried out at Lanyu Island. We surveyed at northwest of Yayu village, southeast of Hongtou village, near the Yeyin village, and northwest of Langdao village at Lanyu Island. In the northwest of Yayu, we have set two long survey lines along the shore and four short survey lines perpendicular to the shore at the talus deposit near the shore. This site consists of three layers. The top layers consist of medium-grained sand with corals. From the previous study, the bottom of the first layer composed of the sand which was transported by typhoon or tsunami waves (Sakai 2015BS). The middle and bottom layer consist of mud and mud with gravel, respectively. The 3-D imaged boundary between first and second layer using the GPR profile shows that the boundary inclined gradually seaward.

In the southeast of Hongtou, we carried out the GPR survey at the talus (asl. 10 m) between coral terrace and mountain slope. We could detect the boundary among soil layer, sand layer, and the basement. Moreover, we could detect the diffraction by pebbles or gravels in the sand layer.

The results suggest that the detection of the tsunami sediments layer would be possible if the layer contains fragments of corals and shells.

Keywords: tsunami sediments, Taiwan , Ground Penetrating Radar