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Shallow geological structure by applying H/V method in volcanic area in northern Taiwan

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The Taiwan Island is the product of the orogeny resulting from the collision of the two tectonic plates, the Eurasia Continent Plate and the Philippine Sea Plate. The Philippine Sea Plate has subducted the Eurasia Continent Plate and formed Ryukyu Volcanic Arc in northern and northeastern Taiwan. The Datun Volcano Group (DVG) being located in northern Taiwan is the westernmost member of the Ryukyu Volcanic Arc and has the widest extent and largest eruption amount among the volcanic rock areas. About 1 Ma, compressional stress transformed into extensional stress in northern Taiwan, and magma from the depth erupted to form younger volcanoes (~20) in the same area. During this period, the Taipei Basin and the Jinshan Basin gradually formed as half grabens on a normal fault, namely the Shanjiao Fault.

The DVG and the Shanjiao Fault have been identified to be active for micro-earthquake activities and topographical features, respectively, revealed by dense and high-resolution surficial monitoring systems in the Datun Mountain area. However, owing to rugged landscape and dense vegetations, geological boreholes are few and shallow (10 to 20 meters) so that the underground geological structures in the Datun Mountain area are still unclear. In this study, microtremor cross the presumed fault trace of the Shanjiao Fault are recorded and analyzed by applying the horizontal-to-vertical (H/V) spectral ratio method, and the H/V spectrum is further decomposed into E-W and N-S components.

The H/V spectral ratio reveals different dominant frequency for different volcanic products. The results indicate that the stations on thin loose deposits (pyroclastic debris) underlying by lava flow (andesite) show the higher dominant frequency, and these stations are near crater, while the stations farther from the craters have lower dominant frequency with thick loose deposits. And these results are also consistent with the topography revealed by high-resolution digital terrain model of the Datun Mountain area.

Based on the results, the future work of this study will be describing spatial geometry of the Shanjiao Fault by distinguishing different dominant frequencies corresponding to the footwall and hanging wall.