

## MICROSEISMIC STUDY IN THE TARUTUNG GEOTHERMAL AREA (NORTH SUMATRA, INDONESIA)

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The aim of the passive seismic research project is to understand the seismic structure and the more detailed fault system of the Tarutung geothermal area. A temporary seismic network with 42 short-period stations was setup for 10 months from May 2011 within a 20-30 km radius covering the Tarutung basin and the northern part of the Sarulla graben along the seismically active Sumatran fault. We recorded 2,856 local earthquakes by at least 8 stations and then relocated 809 earthquakes having azimuthal gap angle less than 180 degree by using 1D (VELEST) and 3D inversion (SIMUL2000) for hypocenter and  $V_p$  and  $V_p/V_s$  determination (Muksin *et al.*, 2013a). Among 809 earthquakes we used 229 events recorded by at least 10 stations for the attenuation tomography (Muksin *et al.*, 2013b). A nonlinear spectral inversion method was applied to determine the path-average attenuation ( $t_p^*$ ). The 3D attenuation structure was then inverted by using a 3D inversion scheme similar to the  $V_p$  and  $V_p/V_s$  tomography. The detailed fault structure was studied by using a double difference relocation scheme and the focal mechanism analysis.

The spread function, the contour lines of the model resolution matrix, and the recovery test results show that we produced reliable 3D  $V_p$ ,  $V_p/V_s$ , and attenuation structure ( $Q_p$ ). The  $V_p$  structure imaged the unconsolidated material within the Tarutung and the Sarulla basins. High  $V_p/V_s$  and low  $Q_p$  values are observed within the Sarulla graben and northeast of the Tarutung basin. We interpreted these properties as fluid bearing sediments with fracturing indicating

potentially favorable conditions for geothermal exploitation. Hot fluid seems to be located at greater depth in association with magmatic activities accompanying the subduction process and transported along the Sumatran fault. The low  $Q_p$  and normal  $V_p/V_s$  beneath the Martimbang volcano is related with high temperature rocks without (with a small amount of) partial melting. The application of a double difference relocation scheme sharpens the lineation of the earthquakes along the Sumatran fault and the minor fault system that crossing the Tarutung Basin. The pattern of the seismicity and the focal mechanism evidences the presence of negative flower structure in Tarutung basin.

#### **References:**

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