Imaging the Fang geothermal system with a 3-D magnetotelluric technique

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ABSTRACT

The 0.3 MW Fang geothermal power plant was the only geothermal power plant in Thailand after an early exploration during the 1980s and 1990s. It was built as a demonstration to supply electricity to the local community. Recently, a plan to resume the expansion of the power plant was re-started with the magnetotelluric (MT) survey to image the Fang geothermal system. 33 MT sites were deployed only on the southern region of the Fang system with a remote site installed about 600 km south of the study area. The instrument was left overnight to gain high quality data. The 3-D resistivity structure was constructed with WSINV3DMT inversion code. In the near surface, the resistivity model matches well with the conceptual geology of the Fang geothermal system. The high resistivity zone is interpreted as the granite rock, while the intermediate resistivity zone is associated with the Fang sedimentary basin. The resistivity contrast between the higher and lower resistivities helps reveal the orientations of the major Mae Chan Fault (MCF) and the two local faults of the area. There are two main conductors, C1 and C2, which are directly linked to the hot fluid found at the surface. C1 is shallow (<50 m), and found only beneath the Fang hot spring, and so it is interpreted as the fracture reservoir. C2 extends from near the surface to a depth of 500 m and is about 1 km south of the Fang hot spring

where the warm water was found to have seeped to the surface through the MCF. There are two possible interpretations for the C2 conductor. There is an impermeable clay zone trapping a relatively high resistivity geothermal fluid reservoir beneath, like the cap rock of a magmatic geothermal play type. The first interpretation requires a deeper well to extract the hot fluid. Another interpretation is that the C2 conductor is a fracture geothermal reservoir, as in C1, where hot fluid from the deep resides within the pores of the sedimentary rock and fractures of the altered granite. This interpretation would require a shallower well. Both interpretations suggest that the C2 anomaly is of value. Since it has never been explored, a drilling over the C2 anomaly is recommended to probe its characteristic and also to extract more hot fluid for the future expansion of the geothermal power plant.

Keywords: Thailand; Fang hot spring; Magnetotelluric; Geothermal