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Faults dominant structure? -Seismic images of the subsurface structure for the Ilan geothermal field in Taiwan.

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A prototype deep geothermal power plant is to be constructed at the Ilan plain in northeastern Taiwan. The site will be chosen from one of the two potential areas, one in the west and the other in the eastern side of the plain. The triangle-shaped Ilan plane is bounded by two mountain ranges at the northwest and the south, with argillite and slate outcrops exposed, respectively. The Ilan plane is believed situating in a structure extending area at the southwestern end of the Okinawa Trough. Many studies about subsurface structure of the plain have been conducted for years. The results showed that the thickest sediments, around 900 m, is located at the eastern coast of the plain, at north of the largest river in the plain, the Lanyang river, and then became shallower to the edges of the plain. Since the plane is covered by thick sediments, formations and structures beneath the sediments are barely known. However, the observed high geothermal gradient and the abundant hot spring in the Ilan area indicate that this area is having a high potential of geothermal energy. In order to build up a conceptual model for tracing the possible paths of geothermal water and search for a suitable site for the geothermal well, we used the seismic reflection method to delineate the subsurface structure. The seismic profiles showed a clear unconformity separating the sediments and the metamorphic bedrock, and some events dipping to the east in the bedrock. Seismic images above the unconformity are clear; however, seismic signals in the metamorphic bedrock are sort of ambiguous. There were two models interpreted by using around 10 seismic images that collected by us in the past 3 years by using two mini-vibrators (EnviroVibe) and a 360-channel seismic data acquisition system. In the first model, seismic signals in the bedrock were interpreted as layer boundaries, and a fractured metamorphic layer down the depth of 1200m was thought as the source of geothermal water reservoir. In the other model, a northwestern dipping normal faults system was interpreted, and the normal faults were the paths for guiding the geothermal energy from the depth. Although both models were possible for obtaining a promising geothermal energy in the study area, a clear conceptual structure model is needed for future development of the geothermal energy in this area. Our interpretation favorites the fault dominant structure model; however, since the bedrock was slate or argillite still needed to be identified, more data from core borings and other geophysical, geologic data are needed. In this paper, we will illustrate a 3 dimensional suburface structure model by using the seismic images and integrate with results obtained from other studies to show the possibility of the proposed fault dominant structure model.