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Stress State in the Tip of Ilan Plan and Its Applications for Taiwan Geothermal Plan

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Understanding the relationship between in-situ stress and fluid-conduits is one of the most important keys for developing the enhanced geothermal system. At the same time, understanding this relationship also provide insights into evaluating the well locations and drilling direction.

The Ilan Plain of northeastern Taiwan is located between the Hsuehshan Range and Backbone Range and is influenced by the compression of mountain building between the Eurasian and Philippine Sea Plates and the back-arc extension of Okinawa Trough simultaneously. As a result, the 3D stress field is complicated and the attitude and spatial distribution of fluid conduits is not clear. To develop the technology of the enhanced geothermal system, this study focused on the evaluation of in-situ stress state on multiple scales.

Stress inversion of regional focal mechanism suggests that the stress state varies dramatically in the region and it is strike-slip faulting stress regime with NNE-SSW compression in the tip of Ilan Plain. The paleostress inversion results from the southern foothills show that the stress pattern of strike-slip faulting and normal faulting regime took place repeatedly and horizontal minimum stress orientation switched between N-S and W-E orientation. Analysis of anelastic strain recovery experiments on the retrieved cores of 720-920m indicates that a strike-slip faulting stress regime with NNW compression and NEE tension. Several hydraulic fracturing tests were conducted in the interval of 750-765m. The shut-in pressure is determined as 13.57MPa and reopening pressure is estimated as 12.66MPa. Diameter Core Deformation Analysis and rock mechanics experiments are also conducted. Integration of different stress assessments and rock strength data will provide insights to understanding the reasonable 3D in-situ stress in the tip of Ilan plain and further help the development of enhanced geothermal system.

Keywords: in-situ stress, enhanced geothermal system, Taiwan, Ilan Plain, hydraulic fracturing, ASR