

The heat source of geothermal energy in the Ilan Plain, Northeast Taiwan

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The Ilan Plain, Taiwan is located at the southwest-most part of Okinawa trough which is a back arc basin spreading due to the Philippine Sea plate subducted into the Asian continent margin. There are many hot springs occurred in and around the Plain indicate that it has high geothermal gradient underneath this area. Recent measurements on the heat flows using direct borehole and geothermometry methods also show the same results. The Ilan area, therefore, has the most potential geothermal energy in Taiwan, and has been assigned as the major national energy program by NSC on exploring and developing geothermal power in the future. Why does the Ilan have so high geothermal gradient? Based on the profiles of magnetotellurics (MT) to the depth 10 km, it shows that there are two thermal reservoirs underneath the deep with lower resistivity, and can be divided into the shallower and deeper ones. Meanwhile, the properties of seismic waves of micro-seismicity show low values V_p and V_s with higher V_p/V_s ratio in the depth between 4 to 6 kilometers. It infers that the thermal fluids in the deeper reservoir may be from the magma intrusion, based on the lower resistivity and anomaly of seismic velocity. Geochemical data including helium, Oxygen and sulfur isotopic ratio of gases and precipitated minerals phases of hot springs also support the magmatic origin of thermal fluids in the Chingshui area. This study, thus, combines the data got from geophysical and geochemical results to propose that the high heat flow and geothermal gradient in the Ilan area is due to the magma intrusion which may be generated from the subducted Philippine Sea plate underneath the Asian continent margin.