Geophysical Research Abstracts
Vol. 14, EGU2012-10009-1, 2012
EGU General Assembly 2012


# Field based geothermal exploration: Structural controls in the Tarutung Basin/North Central Sumatra (Indonesia)

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The Tarutung Basin is one of several basins along the prominent Sumatra Fault System (SFS) which represents a dextral strike slip fault zone segmented into individual fault strands. The basins are located at right-stepping transfer. The Tarutung Basin hosts geothermal manifestations such as hot springs and travertines indicating a geothermal system with some decent potential in the subsurface. As part of geothermal exploration, field geology is investigated focusing on how the structural setting controls the thermal manifestation distribution.

A complex fault pattern is now newly mapped and evidences sinistral faults striking E-W (Silangkitang), normal faults striking SE-NW at the eastern strand of Tarutung Basin (Sitompul) and normal faults striking NW-SE at the western strand of the basin (Sitaka). These structures form an angle greater than $45^0$ with respect to the current maximum principal stress which is oriented in N-S. Secondary sinistral shear fractures identified as antithetic Riedel shears can be correlated with hot spring locations at Silangkitang, forming an angle of $50^0$ with respect to the current maximum stress. A large angle of normal fault and antithetic Riedel shear trend with respect to the current maximum stress direction indicates that the structures have been rotated.

Unidentified dextral strike slip faults might exist at the eastern strand of Tarutung Basin to accommodate the clockwise rotation between the eastern boundary of the basin and the NW-SE striking normal fault of Panabungan. Normal faults striking parallel with the SFS East of the basin are interpreted as dilatational jogs caused by the clockwise rotated block movement with respect to the NW-SE fault trend sinistral shear along ENE-WSW faults. Silicified pyroclastics in association with large discharge at hot springs at these NW-SE striking normal faults support this hypothesis.

As proposed by Nivinkovich (1976) and Nishimura (1986) Sumatra has rotated $20^{\circ}$ clockwise since the last two million years due to the increase in sea-floor spreading rate of the Indian-Australian plate. The combination of regional clockwise rotation of Sumatra with local clockwise rotation caused by simple shear along the dextral SFS might generate the complex fault pattern which controls fluid flow of thermal water and placement of hot springs.

Acknowledgements :

Deutscher Akademischer Austausch Dienst, DAAD.

German Ministry for Education and Research, BMBF.

Badan Geologi – KESDM Bandung, Indonesia.