Geophysical Research Abstracts
Vol. 19, EGU2017-17054, 2017
EGU General Assembly 2017
© Author(s) 2017. CC Attribution 3.0 License.

Multidisciplinary exploration of the Tendaho Graben geothermal fields

Egidio Armadillo (1), Daniele Rizzello (2), Massimo Verdoya (1), Claudio Pasqua (3), Luigi Marini (4), Naser Meqbel (5), Jim Stimac (6), Solomon Kebede (7), Andarge Mengiste (7), Getenesch Hailegiorgis (7), Fitsum Abera (7), and Kebede Mengesha (7)

(1) Università di Genova, DISTAV, Genova, Italy (egidio@dipteris.unige.it), (2) Tellus SAS, Sassello, Italy, (3) ELC Electroconsult SpA, Milano, Italy , (4) Applied Geochemistry, Viareggio, Italy, (5) GFZ Helmholtz Centre, Potsdam, Germany, (6) Stimac Geothermal Consulting, Santa Rosa, USA, (7) Geological Survey of Ethiopia, Addis Abeba, Ethiopia

The NW-SE trending Tendaho Graben is the major extensional feature of the Afar, Ethiopia. Rifting and volcanic activity within the graben occurred mostly between 1.8 and 0.6 Ma, but extended to at least 0.2 Ma. Very recent (0.22– 0.03 Ma) activity is focused along the southern part of the younger and active Manda Hararo Rift, which is included in the north-western part of the graben. Extension gave rise to about 1600 m of vertical displacement (verified by drilling) of the basaltic Afar Stratoid sequence, over a crust with a mean thickness of about 23 km. The infill of graben, overlying the Stratoids, consists of volcanic and sedimentary deposits that have been drilled by six exploratory wells.

Within the graben, two main geothermal fields have been explored by intensive geological, geochemical and geophysical surveys over an area that approximately covers a square sector of 40x40 km. Both new and existing data sets have been integrated. The Dubti-Ayrobera system is located along the central axis of the graben. Available data, acquired in the last three decades, comprise more than two thousands gravity and magnetic stations, 229 magnetotelluric stations and structural-geological and geochemical observations. The Alalobeda system is located along the SW flank of the graben, at about 25 km from the Dubti-Ayrobera system and has been very recently studied by means of gravimetric (300 stations), magnetotelluric and TDEM (140 stations) geological and geochemical surveys.

The new residual magnetic anomaly map has been used to map the younger normal polarity basalt distribution and infer the location of the unknown main rift axis. The bedrock surface resulting by the 3D inversion of the new residual Bouguer anomaly enlightens the main normal faults hindered by sediments and the secondary structures represented by horsts and grabens. The three-dimensional resistivity models allow mapping the sedimentary infill of the graben, fracture zones in the Afar Stradoids bedrock and the dome-shape structure of the clay cap layer. The 2D and 3D gravimetric, magnetic and resistivity models have been integrated with the structural, geological and geochemical outcomings in order to get an updated conceptual model of the geothermal systems.