Geophysical Research Abstracts
Vol. 18, EGU2016-13127-1, 2016
EGU General Assembly 2016
© Author(s) 2016. CC Attribution 3.0 License.

A method for temperature estimation in high-temperature geothermal reservoirs by using synthetic fluid inclusions

Giovanni Ruggieri (1), Andrea Orlando (1), Laura Chiarantini (1), Daniele Borrini (2), and Tobias B. Weisenberger (3)

(1) IGG-CNR, Florence, Italy (ruggieri@igg.cnr.it), (2) Dipartimento di Scienze della Terra, Università di Firenze, Florence, Italy, (3) Iceland GeoSurvey (ÍSOR), Reykjavik, Iceland

Super-hot geothermal systems in magmatic areas are a possible target for the future geothermal exploration either for the direct exploitation of fluids or as a potential reservoirs of Enhanced Geothermal Systems. Reservoir temperature measurements are crucial for the assessment of the geothermal resources, however temperature determination in the high-temperature (>380°C) zone of super-hot geothermal systems is difficult or impossible by using either mechanical temperature and pressure gauges (Kuster device) and electronic devices.
In the framework of Integrated Methods for Advanced Geothermal Exploration (IMAGE) project, we developed a method to measure high reservoir temperature by the production of synthetic fluid inclusions within an apparatus that will be placed in the high-temperature zone of geothermal wells. First experiments were carried out by placing a gold capsule containing pre-fractured quartz and an aqueous solution (10 wt.% NaCl + 0.4 wt.% NaOH) in an externally heated pressure vessel. Experimental pressure-temperature conditions (i.e. 80-300 bars and 280-400°C) were set close to the liquid/vapour curve of pure H_2O or along the H_2O critical isochore. The experiments showed that synthetic fluid inclusions form within a relatively short time (even in 48 hours) and that temperatures calculated from homogenization temperatures and isochores of newly formed inclusions are close to experimental temperatures. A second set of laboratory experiments were carried out by using a stainless steel micro-rector in which a gold capsule (containing the pre-fractured quartz and the aqueous solution) was inserted together with an amount of distilled water corresponding to the critical density of water. These experiments were conducted by leaving the new micro-reactor within a furnace at 400°C and were aimed to reproduce the temperature existing in super-hot geothermal wells. Synthetic fluid inclusions formed during the experiments had trapping temperature, calculated from the intersection of inclusions isochore with the H_2O critical isochore, in good agreement with the experimental temperature. Considering the encouraging laboratory results, an in-hole experiment have been planned in which the micro-reactor will be placed in a geothermal well.

The research leading to these results has received funding from the EC Seventh Framework Programme under grant agreement No. 608553 (Project IMAGE).