Geophysical Research Abstracts
Vol. 20, EGU2018-7228, 2018
EGU General Assembly 2018
© Author(s) 2018. CC Attribution 4.0 license.

Outcrop analogue study to determine reservoir properties of the Los Humeros and Acoculco geothermal fields, Mexico

Leandra Weydt (1), Kristian Bär (1), Ingo Sas (1,2)

(1) Department of Geothermal Science and Technology, Technische Universität Darmstadt, Schnittspahnstraße 9, 64287 Darmstadt, Germany, (2) Darmstadt Graduate School of Excellence Energy Science and Engineering, Jovanka-Bontschits-Straße 2, 64287 Darmstadt, Germany

The objective of the EU Horizon 2020 funded GEMex project (GA-No. 727550)– a Mexican-European co-operation – is to explore the geothermal potential of deep unconventional systems like enhanced geothermal systems (EGS) and super hot geothermal systems (SHGS). New exploitation approaches and technologies are being developed, allowing the use of geothermal resources under challenging technical demands. Research is underway on two sites in the areas of Acoculco and Los Humeros (Puebla), Mexico. Both sites are volcanic caldera complexes and are located in the northeastern sector of the Trans-Mexican Volcanic Belt.
The Los Humeros geothermal system is steam dominated and exploited since the 1990's with 64 wells so far (23 under production). With temperatures above 380 °C the system is characterized as a SHGS. The geothermal system in Acoculco (two exploration wells) is characterized by temperatures of approximately 300 °C at a depth of about 2 km. In both wells no fluids were found, even though a well-developed fracture network exists. Therefore, it is planned to develop an EGS.
For better reservoir understanding and prospective modeling, extensive geological, geochemical, geophysical or technical investigations will be performed within the scope of the GEMex project. TU Darmstadt's tasks are reservoir characterization, modeling the subsurface temperature distribution and geothermal resource assessment. Therefore, a detailed knowledge of thermo- and petrophysical properties of each reservoir formation, the basement and the cap-rocks and of their distribution is required. Analogue studies enable a cost-effective determination and correlation of lithofacies related rock properties. Ongoing investigations aim to identify geological and structural heterogeneities on different scales (outcrop analysis, rock samples and thin sections) to enable a more reliable prediction of reservoir properties.
Detailed outcrop analysis is important to discover the heterogeneity of the geological units. Composition, extension and distribution of the volcanic sequences are very variable within both sites. The carbonatic basement is intensively folded and thrusted by the Laramide orogeny. Hydrothermal alteration of different intensities can be observed in dykes and fault zones in the outcrops, which is one of the key processes affecting the petrophysical properties.
Until now more than 115 rock samples were taken from representative outcrops in the Los Humeros and Acoculco areas. The samples are being analysed for i.e. thermal conductivity, thermal diffusivity and heat capacity, sonic wave velocity, as well as density, porosity and permeability. Rock mechanical tests are conducted to evaluate possible stimulation of the basement. Thermotriaxial tests and thermal conductivity measurements with temperatures of up to 200 °C are intended to transfer the rock properties from outcrop and lab to reservoir conditions. First results already enable the classification of different lithofacies types with distinct properties.
Similar measurements are being carried out on core samples taken from several wells of the Los Humeros geothermal field for direct comparison of outcrop analogues and the reservoir. Likewise, the core samples show hydrothermal alteration of different intensities. Additionally, leaching processes can be identified in some wells. However, ongoing investigations focus to clarify the influence and extent of the processes governing the reservoir properties.