GeoTHERM
expo & congress

Donnerstag, 20. Februar 2025, 16.20 Uhr
Ortenauhalle Kongress 1
Tiefe Geothermie

Thursday, 20 February 2025, 4.20 pm
Ortenauhalle Congress 1
Deep geothermal energy

Faster drilling by softening hard granite rocks for deep geothermal: A reality using hybrid drilling technology from ORCHYD

Schnelleres Bohren durch Aufweichung von hartem Granitgestein für die Tiefengeothermie: Eine Realität mit der Hybridbohrtechnik von ORCHYD

Laurent Gerbaud
Mines Paris/ ARMINES

Geothermal energy is a leading candidate to meet the Net Zero Emission strategy by 2050 by providing clean, sustainable, and non-intermittent renewable source of energy. However, high drilling costs serves as a bottleneck for its scalability and adaptability across the globe. The primary reason for its elevated costs come from drilling deep, hard crystalline rocks such as granites that are found at depths more than 4 km. Drilling deeper rocks comes at a higher expense of energy required to break rocks under high confining stresses. The ORCHYD (Novel Drilling Technology Combining Hydro-jet and Percussion for ROP Improvement in Deep Geothermal Drilling) project was set up under Horizon 2020 program, funded by the European Commission, to study a different technique to increase the drilling performance in deep geothermal wells.

In ORCHYD technology, high-pressure water jetting (HPWJ) and percussion drilling techniques are combined to efficiently break the hard granite rocks. A peripheral groove created using the high-pressure water jet isolates the rock surface from the surrounding stress regimes, essentially softening it and eases the rock breakage when a mud hammer is utilized. Elaborate numerical and experimental studies were carried out over the last 3 years in designing and optimizing the influencing parameters of this hybrid drilling technology. Some of the factors considered were shape and size of the drill bit inserts, their distribution on the drill bit surface, profile of the drill bit; position, shape and size of the high-pressure nozzle to optimize the stress release effect; and other operating conditions such as the nozzle jet pressure, mud flow rate for hammer operation. All these factors – individually and in combination – were meticulously tested on a laboratory scale rig under realistic downhole conditions. Our latest prototype showcased a 4X increase in the ROP as compared to the conventional drilling technologies. Such promising results were achieved due to the combined effect of stress release effect because of peripheral slotting (1-2 cm deep) by high pressure water jet and reflection of the percussive pressure wave against the free surface in the periphery.

In this work, the following will be presented: An overview of the comprehensive study of the design and fabrication of the prototype; Optimization of the influencing factors of the hybrid drilling technology; and performance of the tests carried out at the drilling test rigs in Pau, France.

GeoTHERM expo & congress

ORCHYD technology paves a way for faster and efficient drilling in hard granites, resulting in cost reduction of deep geothermal wellbore construction.