

Lessons Learnt from the Deep Heat Mining EGS Project in Basel, Switzerland

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ABSTRACT

The Kanton of Basel-Stadt in partnership with a number of Swiss utility companies is endeavouring to develop a geothermal co-generation plant from an enhanced geothermal system. The project is developed and operated by Geothermal Explorers Ltd.

Prior to drilling the 5009 m deep Basel-1 well, a reconnaissance well was drilled to 2,755 m and a refined microseismic monitoring system with five additional shallower wells was set up. The monitoring array was not only for visualising microseismic activity during hydraulic stimulation, but also to observe the natural seismicity in this area, which is characterised by sparse, sometimes destructive seismicity, as shown by the historic Basel earthquake in 1356 with an estimated MW of 6.9.

The hydraulic stimulation process in the Basel-1 well was stopped after six days of injection when the induced seismicity gradually built up with magnitudes of up to ML 2.7. Four hours after shut-in a seismic event of ML 3.4 occurred, coinciding with the start of bleeding off the well to hydrostatic conditions. The short jolt, which was accompanied by a loud bang, scared the local population. The event exceeded the officially accepted threshold of ML 2.9 and led to a suspension of the project for the time being. Within 55 days after stimulation three aftershocks with $ML > 3$ were recorded.

The detailed data analysis of the reservoir growth and the analysis of fault plane solutions of induced events suggest that the excessive induced seismicity is not the result of a rupture process along a single, critically stressed fault plane, but the result of multiple shearing on oblique oriented fractures in a structurally weakened zone.

The second lesson learnt is that communication, preparing the population for felt induced seismicity, cannot start early enough and thoroughly enough. Poorly informed media called people repeatedly to report damages. These public calls triggered a flood of complaints about questionable cracks in plastered walls, whereas well informed house owners in the vicinity of the drilling rig hardly filed any complaints. A verification of the reported damages to be caused by the induced events is yet outstanding.