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COTHERM - COmbined hydrological, geochemical and geophysical modeling of geotTHERMal systems

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The COTHERM project aims at a better understanding of the subsurface processes in natural high-temperature geothermal systems that are becoming an attractive alternative energy resource. Such systems form when groundwater is flowing around a magma body at depth, gets heated and then rises to the surface. How long the geothermal system is active and how much energy the fluid carries depends mostly on the depth and size of the magma body and on the permeability of the surrounding rocks. Both are difficult to assess from the surface without dense and expensive drilling. COTHERM pursues four interconnected sub-projects to advance our knowledge about these systems and to develop improved geochemical and geophysical techniques for exploration, monitoring and imaging of geothermal systems:
(1) Numerical simulations of geothermal fluid flow as a function of intrusion depth, size, host rock permeability, temperature of brittle-ductile transition etc., with a particular focus on including the deep ‘supercritical’ roots near the intrusion.
(2) Geochemical modeling of fluid-rock interaction in the system, including a variety of models for the kinetics of mineral dissolution and precipitation.
(3) Use the flow paths, temperature, pressure and fluid property distribution from (1) and the alteration mineralogy predicted by (2) to derive effective rock properties for simulating how geophysical methods could be improved to probe the sub-surface structure of such geothermal systems.
(4) Collect geochemical, mineralogical, and geophysical data at the two systems in Iceland to compare the simulation results of sub-projects 1 to 3 with actual data in order to refine, validate, and integrate these different approaches.