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The ITHERLAB project: Development of a laboratory device for the measurement of thermal rock properties at variable temperature and pressure

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Accurate knowledge of in-situ thermal rock properties typical for the conditions in the Earth subsurface is indispensable for many applications in Earth science. At drillable depth, the pressure and temperature and thus its effect on rock thermal properties diverge strongly from those measured under ambient conditions in the laboratory. As the majority of petrophysical studies in this field focuses on the single effect of pressure or temperature on the rock thermal properties, the combined effect is yet not fully understood. Consequently, for large ranges of crystalline and sedimentary rocks, no reliable formulas of the simultaneous effect is available. This constitutes a serious drawback for any geothermal calculation in the accessible depth range of the Earth crust.
The ITHERLAB project focuses on developing a new laboratory device to study the effect of simultaneously applied in-situ pT and fluid conditions on rock thermal conductivity and thermal diffusivity. The device allows measurements at pressures and temperatures that are simultaneously raised to values up to >250 MPa and >250°C, respectively. Pore-fluid pressures for variable saturants (air, water, oil, etc.) of up to 100 MPa can be also considered. These are the conditions for depths (to approx. 7-10 km), which are of interest in the use of Earth resources (such as geothermal energy, hydrocarbons, storage of energy or waste).
The proof-of-concept for the new device has already been reached and the regular measuring operation is expected to be established within 2018. As one result of the project, new mathematical formulas for p/T dependence of both parameters will be developed and it will be demonstrated whether micro-structural effects affect these relations for different rock types. Ambiguities from the application of published formulas for single effects (p or T) will be evaluated against the simultaneous effect.