RESEARCH & DEVELOPMENT

The underground laboratory GeoLaB shall address fundamental challenges of reservoir technology and borehole safety. Planned experiments will significantly contribute to our understanding of processes associated with increased flow rates in crystalline rock.

The application and development of cutting-edge tools for monitoring and analyzing will yield fundamental findings, which are of major importance for safe and ecologically-sustainable usage of geothermal energy and subsurface resources.

As an interdisciplinary and international research platform, GeoLaB will cooperate with the German Research Foundation (DFG), universities, industrial partners and professional organizations to foster synergies and technological and scientific innovations.

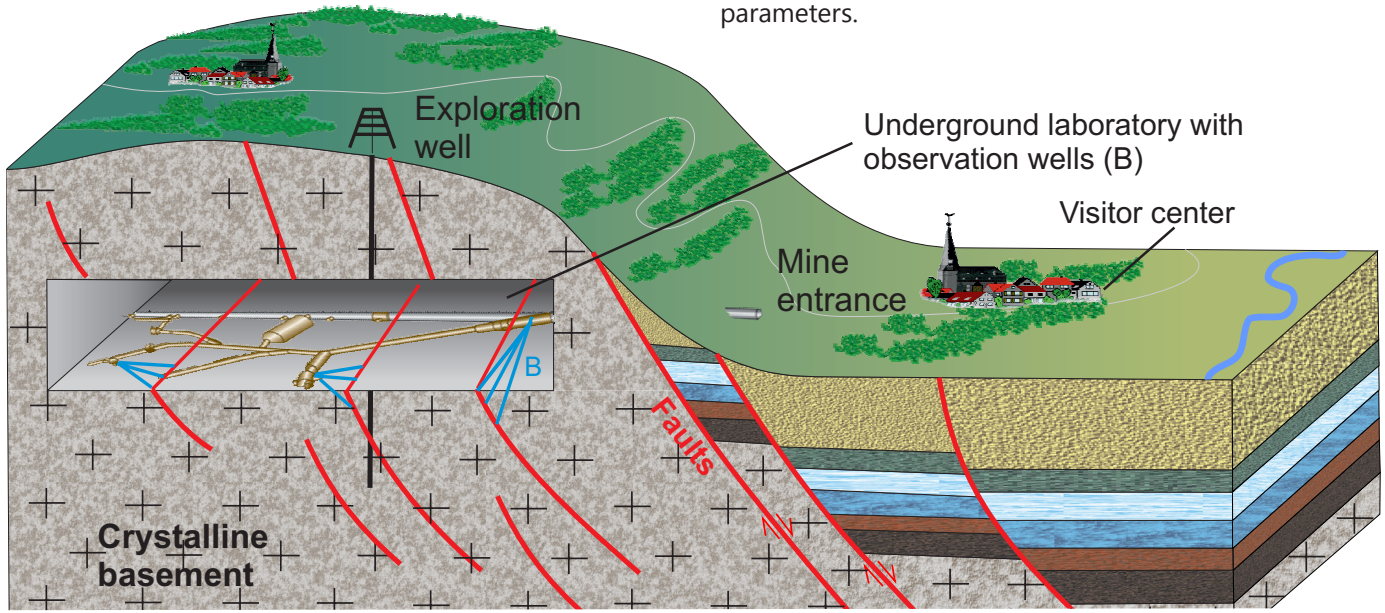
THE INFRASTRUCTURE

GeoLaB - Geothermal Laboratory in the Crystalline Basement

GeoLaB is designed as a generic underground research laboratory in the crystalline basement of the Black Forest or the Odenwald. The target rock is representative of the world's most widespread geothermal reservoir rock, the crystalline basement.

In an exploratory phase, the suitability of the potential site for the installation of GeoLaB will be proven by an exploration well. Then, a 1-km long gallery will be excavated, tapping individual caverns, in which controlled, high-flow experiments will be conducted at a depth of ~400 m.

The experiments will be continuously monitored from multiple drillings. This will create a unique 4D-benchmark dataset of thermal, hydraulic, chemical and mechanical parameters.



Schematic view of the proposed underground research laboratory, GeoLaB

Geothermal Underground Laboratory

GeoLaB -
A geoscientific perspective for Germany

Cutting-edge research for reservoir technology, borehole safety, and efficiency of deep geothermal energy

BACKGROUND

Basics

Deep geothermal energy

- is renewable and low-emission,
- is capable of base-load and controllable,
- provides guaranteed power supply,
- is decentralized, and
- an import-free domestic resource.

Hence, it is an ideal complement to fluctuating renewable energy sources.

Economic goal

In the long term, geothermal energy can provide 5% of the power production and 10% of the primary energy demand. The development of EGS technologies (enhanced geothermal systems) is prerequisite.

Technological requirements

1. Effective reservoir engineering for
2. economic flow rates (~50 L s^{-1}) with
3. minimal environmental impact and
4. systematic quality assurance.

To fulfill these requirements, fundamental research is urgently needed for a profound process understanding. GeoLaB provides the experimental basis for the development of a future technology for a sustainable and environmentally-compatible energy supply.

GOALS

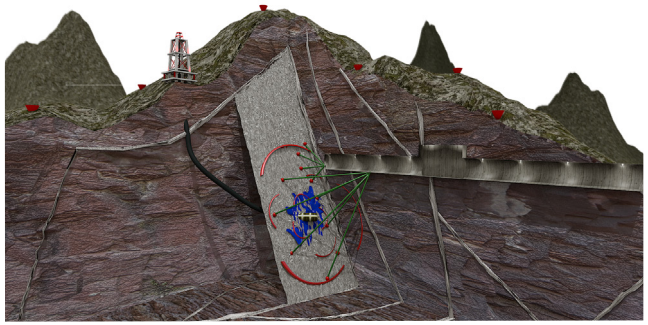
GeoLaB allows cutting-edge research for reservoir technology and borehole safety.

Increasing the efficiency of EGS with a unique geothermal underground laboratory for fundamental research.

Reduction of induced seismicity by controlled *in situ*, high-flow experiments (CHFE) in a reservoir simulator.

Reduction of the prospecting risk by benchmarking for future geothermal projects in crystalline rock.

Social acceptance of geothermal projects by developing methods and technology for efficiency, safety and ecological sustainability.



Experimental setup for CHFE with investigation shaft, injection and observation wells and a widespread monitoring system.

quantitative analysis of coupled systems

science & technology

scale dependency • hydraulics • transmissivity • rock mechanics • fluid rock interactions • geochemistry • micro-seismicity • THMC modelling • electromagnetics • heat and stress transfer • model validation • smart tracers • microbiology • fluid injection • material resistance • complex fracture networks • visualization • 4D-exploration • monitoring • drilling technology • etc.

LEADERSHIP

- Prof. Thomas Kohl (Coordinator)
  email: thomas.kohl@kit.edu
  Karlsruhe Institute of Technology
  Kaiserstraße 12, 76131 Karlsruhe, Germany
- Prof. Ernst Huenges
  email: huenges@gfz-potsdam.de
  Deutsches GeoForschungsZentrum
  Telegrafenberg, 14473 Potsdam, Germany
- Prof. Olaf Kolditz
  email: olaf.kolditz@ufz.de
  Helmholtz -Centre for Environmental Research
  Permoserstr. 15, 04318 Leipzig, Germany

CONTACT

- Dr. Eva Schill
  email: eva.schill@kit.edu
  Karlsruhe Institute of Technology
  Hermann-von-Helmholtz-Platz 1,
  76344 Eggenstein-Leopoldshafen, Germany

INITIATIVE OF THE CENTRES

- Karlsruhe Institute of Technology (KIT)
- Helmholtz Centre Potsdam (Deutsches GeoForschungsZentrum - GFZ)
- Helmholtz -Centre for Environmental Research Leipzig (UFZ)

A strategic development investment by the Helmholtz Association

Version 160211