Geotechnology Hydrogeology Monitoring

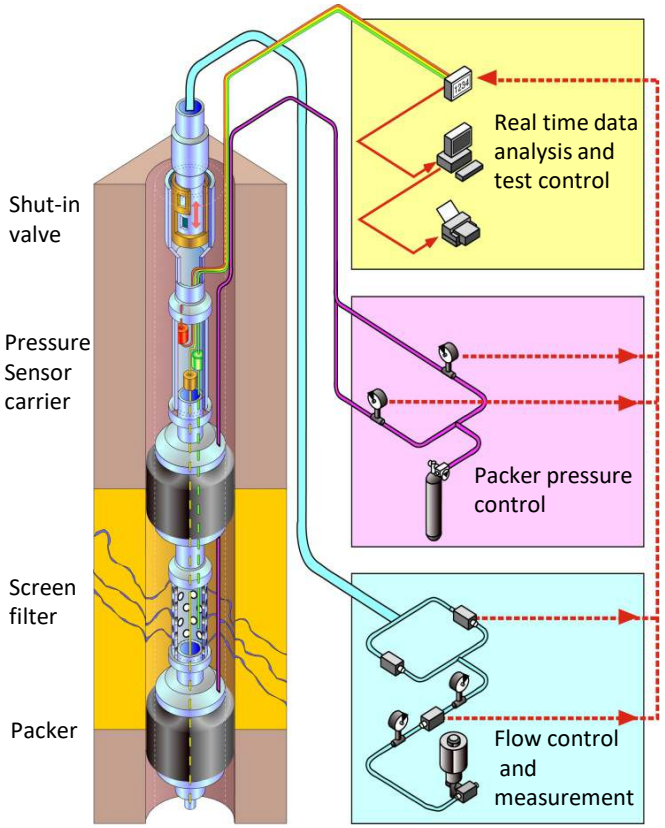
SOLEXPERTS

Swiss Precision Geomonitoring

Solexperts in-situ borehole test services

Hydrogeology

Solexperts packer systems for testing of isolated borehole sections



https://www.solexperts.com/files/downloads/de_04_hydraulic_borehole_tests_eng.pdf

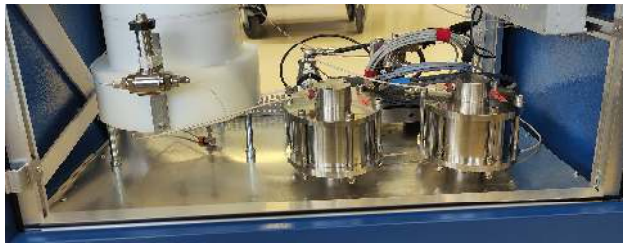
Solexperts a global service provider

- Testing in boreholes drilled from the surface or from underground
- Field proven reliable equipment for testing under very harsh boundary conditions
- More than 30 years of experience
- Tailor made instrumentation
- Wide range of equipment and large stock

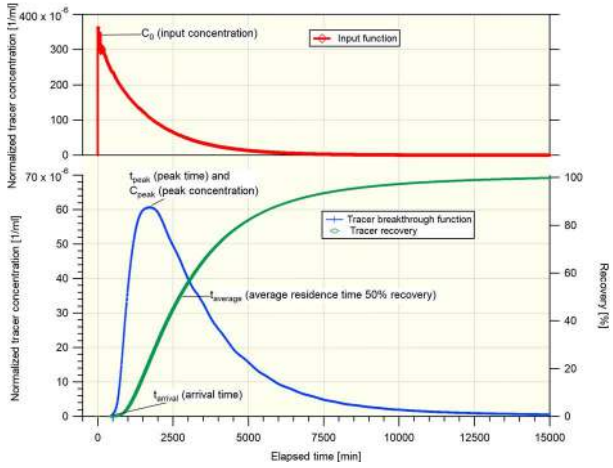
Solexperts in-situ borehole test services

Hydrogeology

Tracer tests

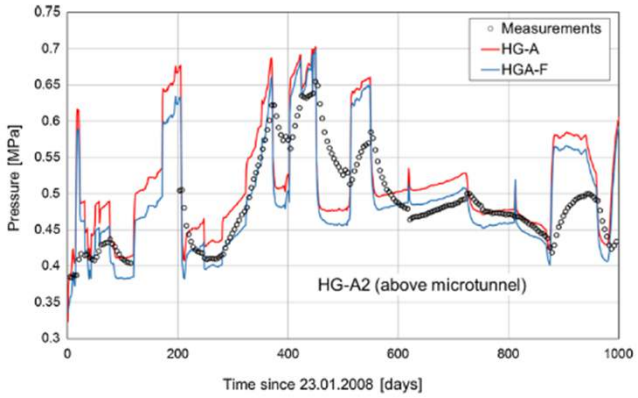


Online fluorescense tracer meassurement probe



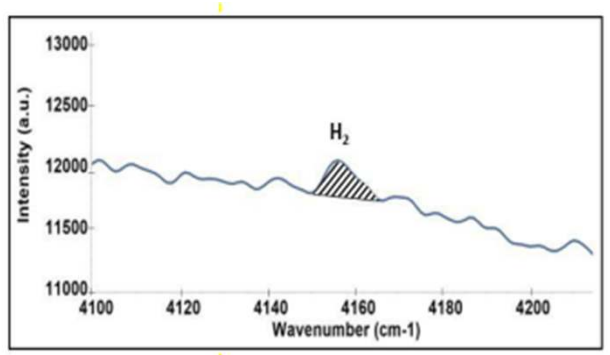
Tracer input, break-through and recovery curves of dipole injection test in fractured rock.

Gas pressure tests



Gas entry pressure and break-through curve.
Gas is flowing into the formation.
Marschall et al. 2016, ISSN 1661-8726, Swiss Journal of Geosciences

Gas measurements: SysMoG®-Probe



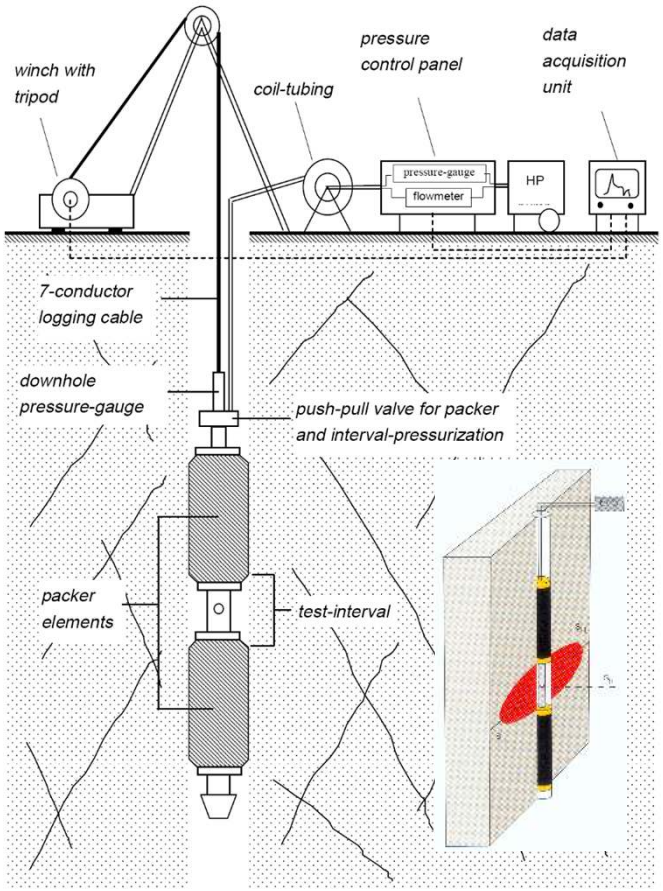
Raman spectrum measured in-situ in aquifer:
Dissolved hydrogen 0,17 mg/L

For more information:
https://www.solexperts.com/files/downloads/FP_SysMoG_Deepenglisch.pdf

Solexperts in-situ borehole test services

Geomechanics

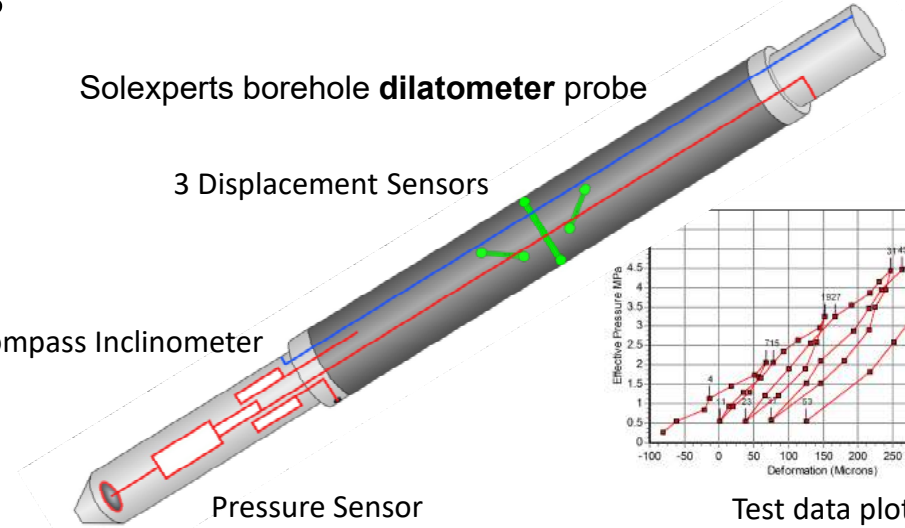
MeSy® Wireline packer systems for **hydraulic fracturing** tests



Cost efficient because no drilling or service rig needed

Impression Packer

Solexperts borehole **dilatometer** probe



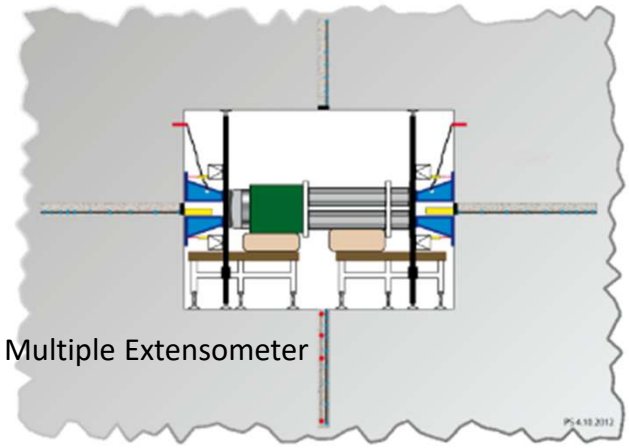
For more information:
https://www.solexperts.com/files/downloads/12_dilatometer_measurements_en.pdf

Solexperts in-situ borehole test services

Geomechanics

Plate Load Test

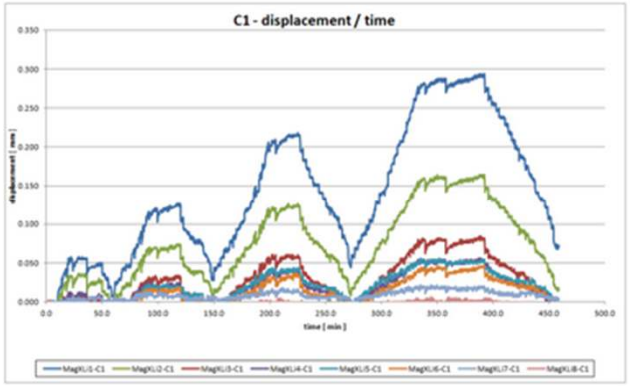
Schematic Layout

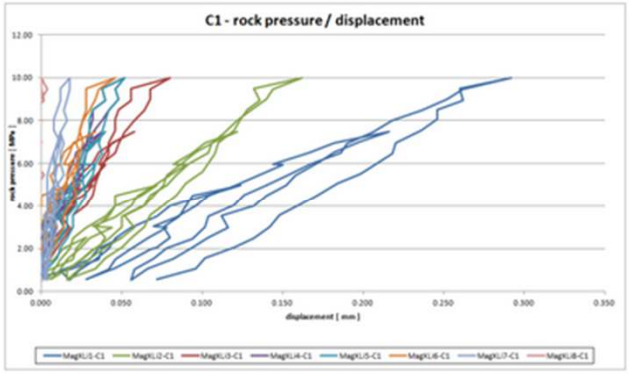


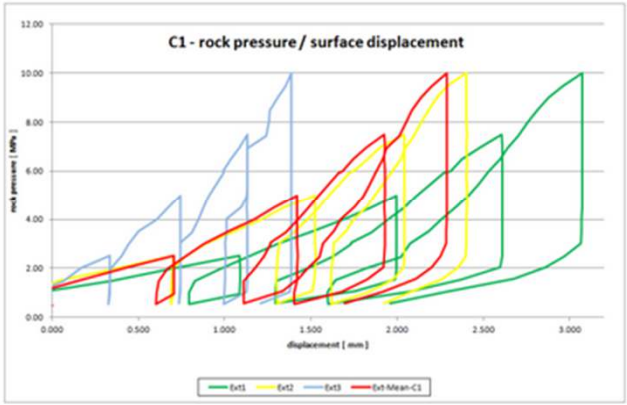
Vertical emplacement

Horizontal emplacement

Test data plots







Applications of in-situ borehole test services

Radioactive waste disposal sites

Characterization of low permeable host rock and the adjacent higher permeable layers including in-situ water sampling

Hydro Power Projects

Characterization of hydraulic conditions below the dam and around the tunnels. Rock stress determination at the high presssure tunnel, shafts and caverns help to reduce risks and to optimize the costs.

Mining and underground storage

Slope stability.
Water inflow into the mine (open pit or underground), rock stress and deformation.

Roads or railway tunnels

Characterization of water bearing features to prepare counter measures in advance to avoid high pressure water inflow. Deformation and rock stress measurements for the optimization of the tunnel design.

Geothermal exploration

Enhanced Geothermal Systems or Heat Storage: Reservoir Evaluation including fracture network characterization.
Rock stress determination and stimulation.

Scientific research projects e.g. Carbon Capture & Storage, Hydrogen etc.

Specific solutions for research projects. Development of new sensors and systems. Tailor made systems for very deep boreholes or particular applications. High accurate measurements and water samples. Proof of concept for innovative test methods.

Solexperts in-situ borehole test services

Hydrogeology

Test type	Method	Equipment	Result/Parameter
Hydraulic-Mechanical Test	Lugeon	❶: Single, double or multi-packer systems Downhole pressure measurements Real time data acquisition, Real time data analysis Downhole shut-in valve	Lugeon values
Hydraulic Test	RI/RW; HI/HW; SI/SW; PI/PW	❶ Downhole shut-in valve (zero displacement) Security features, Flow through cells with chemical-physical parameter probes for online measurements	k, T, S, Pf, Temp., water chemistry: pH, Eh and EC, flow models/ boundaries, borehole pressure history, numerical evaluation with "Uncertainty Analysis"
Water Sampling	Pump test	❶ + pump housing integrated in test tubing string + 2", 3" and 4" submersible pumps + PCP pumps + Downhole sampler	+Water chemistry including isotopes and dissolved gases

Test type	Method	Equipment	Result/Parameter
Gas Test	Gas Threshold Pressure Tests	❶ + Fluid exchange chamber	Gas entry pressure
Gas Measurements	In-situ separation and collection of dissolved gases in gas chamber equipped with semipermeable membrane	SysMoG®-Probe (deep boreholes) SurfMoG®-Probe (shallow borehole) Wire line winch In-situ gas sensors (CH4, H2 etc.)	Concentration of (dissolved) gases Partial pressures of dissolved gases
Tracer Test	Diffusion, Push-Pull or Dipole	❶ + Fluid exchange chamber, + Online downhole tracer measurements	Transport parameters, e.g. migration of contaminants, flow velocity, heat storage capacity, flow porosity, sorption coefficients etc.

Abbreviations:
k: hydraulic permeability; T: transmissivity; S: storage coefficient; Pf: Formation pressure
Eh: redox potential; EC: Electrical conductivity
PCP: Progressive Cavity Pump
RI/RW: Constant rate injection/extraction
HI/HW: Constant head injection/extraction
SI/SW: Slug injection/extraction
PI/PW: Pulse injection/extraction

Solexperts in-situ borehole test services

Geomechanics			
Test type	**Method**	**Equipment**	**Result/Parameter**
Stress measurements	HF/HTPF	Double packer Downhole pressure measurements, Downhole push-pull valve Wireline or tubing conveyed Impression packer Real time data acquisition, Real time data control	2D/3D rock stress Sh and SH Orientation of stress field
Rock deformation	Dilatometer	Solexperts Dilatometer which measures with high accurate displacement sensors directly on the rock wall	D- and E- Modules
	Plate Load Tests	Highly accurate multi-extensometers Constant load controller Heavy duty equipment	

Abbreviations:
HF: Hydraulic fracturing
HTPF: Hydraulic testing of pre-existing fractures
Sh: Minimum principal stress
SH: Maximum principal stress
Young's modulus: Elasticity
D-modulus: Deformation

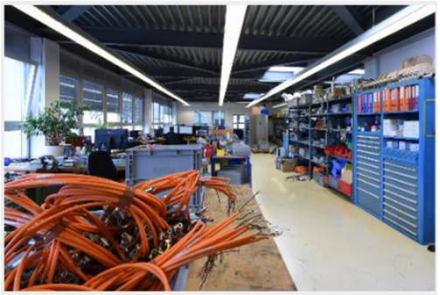
Solexperts in-situ borehole test services

Standard borehole diameters and maximum borehole depths/lengths (in stock):
Packers for diamond drilling sizes from NQ to 8 ½”
Dilatometer for diamond drilling sizes from NQ, HQ, 101 mm, PQ and 146 mm
Hydraulic testing: Max. 1500 m and stress measurements: Max. 2000 m
Dilatometer: Max. 1400 m
Other borehole sizes/length on request

Solexperts workshops:

- System design and production
- Modern in-house workshops and laboratories
- Large Stock
- Broad equipment pool
- Development of innovative instruments
- Borehole simulator (Autoclave)

Mechanical workshop



Electronic workshop

In situ testing workshop

Autoclave

Solexperts in-situ borehole test services

Contact:

1. Hydraulic Testing, Tracer Tests, Groundwater Sampling, Dilatometer Tests:

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Request for Quote:

https://boreholetestinquiry.gtc-solexperts.com