Fachgebiet für Geothermal Technologies
TUM School of Engineering and Design
Technische Universität München

TUM.GTT Master thesis topics, 2026

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FG Geothermal Technologies (TUM.GTT)

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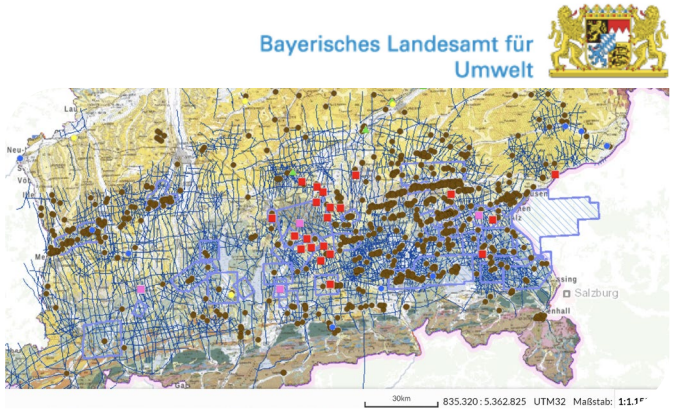
Wellbore stability of Chattian sandstones in the Bavarian Molasse Basin

Motivation

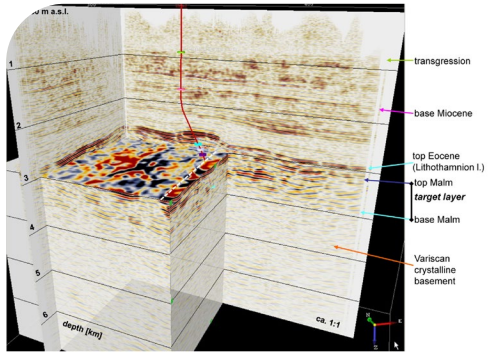
The Bavarian Foreland Molasse Basin (BFMB) is Germany‘s most important deep geothermal energy play. Deep geothermal energy can deliver a significant contribution to green heating. So far deep geothermal energy is extracted from the Upper Jurassic carbonate „Malm“-aquifer. However, also medium deep Chattian sandstones might host considerable geothermal potential, but have only been tested by vertical oil and gas wells. In this thesis we would like to investigate how stable these sandstones are if large fluid volumes are produced with horizontal wells.



Tasks and requirements

- Compilation of a dataset from existing oil and gas wells
- Interpretation of geophysical well logs to derive information about reported wellbore instabilities, pore pressure, stress field and geomechanical properties of Chattian sandstones
- Analytical modelling of wellbore stability and potential sand production

- **Requirements**: Successfully attended Reservoir Geomechanics module
- **Work type**: Office only (work place is in GTT-offices in RiWa 3, Munich)
- **Context**: The master thesis is linked to several research projects related to deep geothermal energy.



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Supervisor(s)

Michael Drews (michael.c.drews@tum.de)
Kai Zosseder (Kai.Zosseder@tum.de)

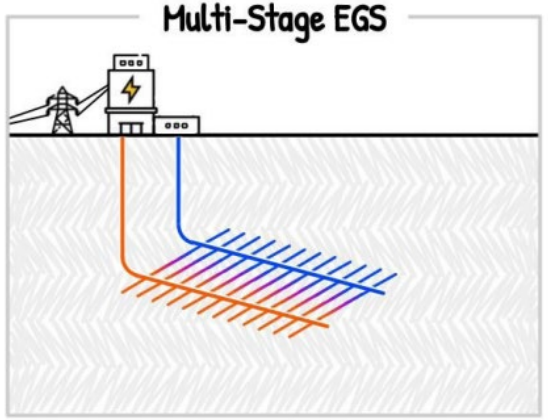
Geologic screening of potential sites for a Next-Generation Geothermal Project in Southern Germany

Motivation

Unlike traditional geothermal systems, which rely on specific geological conditions, next-generation enhanced geothermal systems utilize multistage stimulation technologies and enable access to deeper, hotter, and more widespread geothermal reservoirs. These innovations eliminate the geographic limitations of conventional geothermal energy, allowing nearly any region to benefit from this sustainable and renewable energy source.

While next-generation geothermal energy is advancing rapidly in the United States (as demonstrated by Fervo Energy), Europe has yet to fully harness its transformative potential. In Germany, this innovative concept could enable the sustainable supply of heat to cities and municipalities.

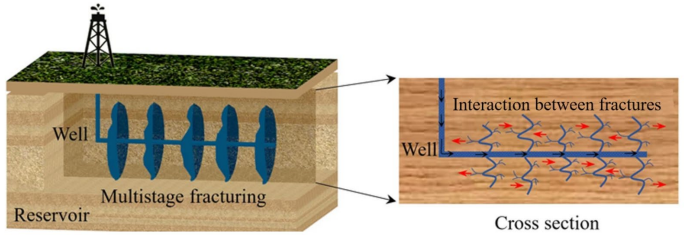
The primary objective of this master's project is to lay the groundwork for the development of next-generation geothermal energy in Southern Germany by creating a comprehensive portfolio of the most promising sites for deployment. The key part of this work involves analysis of geological data to identify promising locations that could serve as candidates for Germany's first next-generation pilot projects. The selected sites will provide a blueprint for future projects, paving the way for widespread adoption across Germany and Europe.



Source: The Future of Geothermal in Texas

Tasks and requirements

- Literature review and open database search to find geological data for pre-defined sites in Germany
- Correlation and integration of seismic and well data
- Ranking of sites and prioritization of the most promising candidates for further analysis
- **Requirements:** Strong data-searching, data-analyzing and problem-solving skills, background in geology, GIS skills



Source: Rock Mechanics and Rock Engineering

Supervisor(s)

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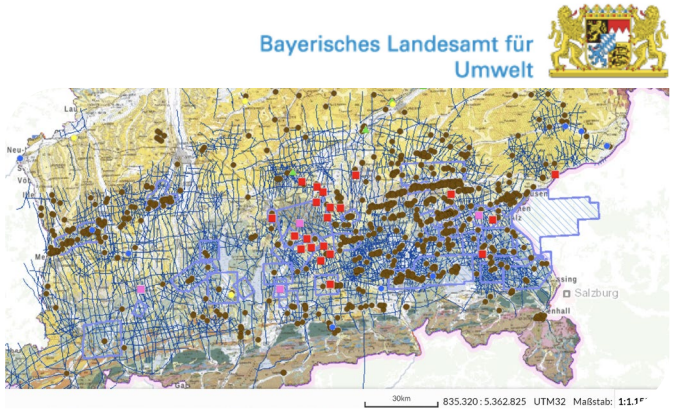
Subsurface mapping in the Bavarian Foreland Molasse Basin

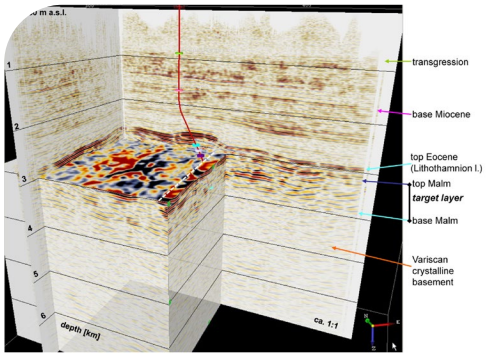
Motivation

The Bavarian Foreland Molasse Basin (BFMB) is Germany‘s most important deep geothermal energy play. Deep geothermal energy can deliver a significant contribution to green heating. In addition the BMBF also offers oppertunities to store hydrogen and CO_2, both of which are important future technologies to master the energy transition and to minimize the CO2 footprint. Thereby, mapping and characterization of the subsurface of the BMBF by the means of interpretation of seismic reflection data and its integration with existing well data is a key step towards an efficient and safe employment of these technologies. In the framework of our research project GeoChaNce, funded by the Bavarian Environmental Agency, we offer several exiting Master thesis topics in subsurface mapping.



Tasks and requirements

- Structural and stratigraphic interpretation of 2D and 3D seismic reflection data
- Correlation and integration of seismic and well data
- **Requirements**: Interest in geology, geophysics and 3D geology of the deeper subsurface
- **Work type**: Office only (work place is in GTT-offices in RiWa 3, Munich)
- **Context**: The master thesis is linked to several research projects related to deep geothermal energy.



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Supervisor(s)

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Florian Duschl (florian.duschl@tum.de)

Overpressure modelling in sedimentary basins

Motivation

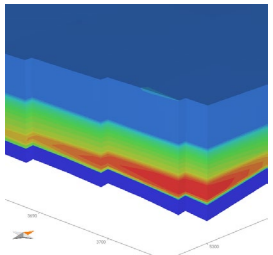
Overpressure is the excess pressure above normal hydrostatic pressure. Quantification of overpressure is important for reservoir characterization, production, seismic processing, well planning and safe drilling, but also for understanding the structural evolution of sedimentary basins.

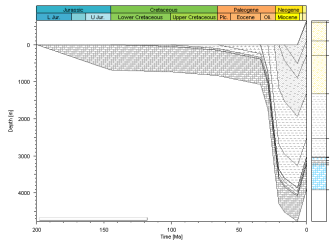
Possible sedimentary basins of interest: Upper Rhine Graben, Po-Basin, Vienna Basin, Sichuan Basin, …

Tasks and requirements

- Literature review on basin stratigraphy, structural evolution and geomechanical (pressure, stress) and petrophysical (porosity, permeability) properties
- Build dynamic 1D and 3D basin models
- Investigate different petrophysical configurations for overpressure generation
- **Requirements**: Interest in geology, modelling and deep geothermal energy
- **Work type**: Mainly office (modelling), but optional field and lab work
- **Context**: This work is part of the World Pressure Map (WPM) project of TUM.GTT

Fig. 5.1 Global occurrence of overpressure zones taken from Bigelow (1994a, b) and physical world map of





Supervisor(s)

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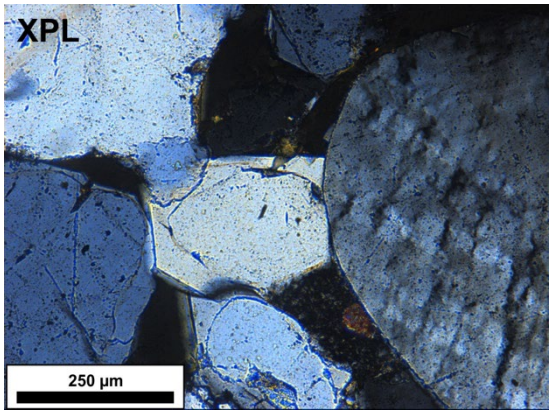
Microstructural strain analysis in sandstones from the North Alpine Thrust Front

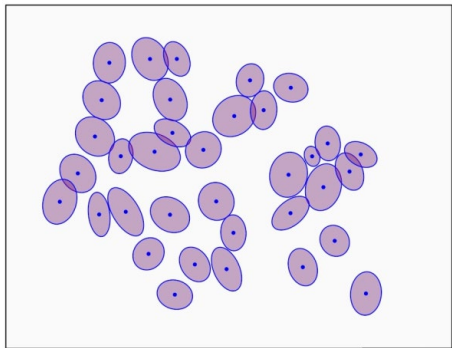
Motivation

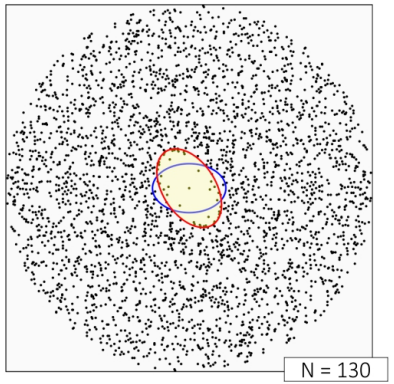
Microstructural analysis on clastic sedimentary rocks can help to determine amount and local range of deformation along a major thrust front. In this context, the microstructural deformation of (quasi-)spherical detrital particles like rounded sand grains can be used to a) identify direction of paleostress tensors, and b) provide information on the amount and range of deformation within the folded rock units. Therefore, thin sections of core and outcrop sandstone samples from the Foreland Molasse and the Subalpine Molasse in Bavaria are analysed using different microscopic methods. In addition, finite strain analysis is applied to quantify deformation features.



Tasks and requirements

- Perform microscopic analyses (standard/digital petrographic microscopy, optional: cathodoluminescence microscopy) on thin sections and identify microstructural deformation features (microfractures, pressure solution features)
- Quantify amount of deformation and determine paleostress tensors using finite strain analysis (Fry, Rf/φ) in 2D/3D
- **Requirements**: Interest in structural geology, labwork and statistical analysis
- **Work type**: 60% lab work, 40% statistical analysis/modeling





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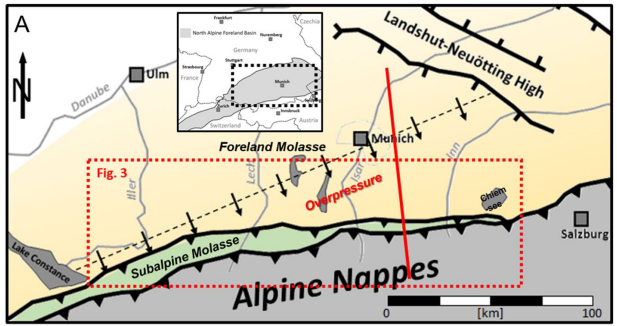
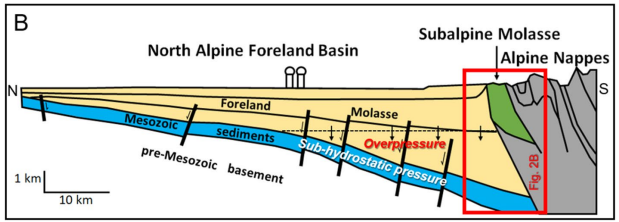
Physical properties of Subalpine shale detachments

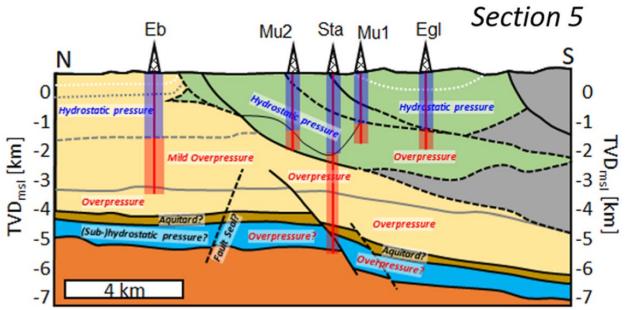
Motivation

The Subalpine Molasse is the transition zone between the Northern Alps and the North Alpine Foreland Basin with complex structural geology and several shale detachments. The physical properties of these detachments are of fundamental scientific interest to understand the evolution of the Subalpine wedge, natural seismicity and the stress field in the North Alpine Foreland Basin.

Several wells have been drilled through and cored these detachments, but have never been analysed for their petrophysical properties. In this topic you would measure basic properties such as density and porosity to understand the compaction state of shales from the Subalpine wedge, the detachment and stratigraphical counterparts from the foreland basin part.







Tasks and requirements

- Detailed structural sample description and correlation with geophysical well logs and pre-interpreted (seismic) cross-sections
- Measuring of density and porosity
- Interpretation of results in the subregional geological context using MS-Excel and ArcGIS

Supervisor(s)

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Drilling Hazards in Bavarian Molasse Basin

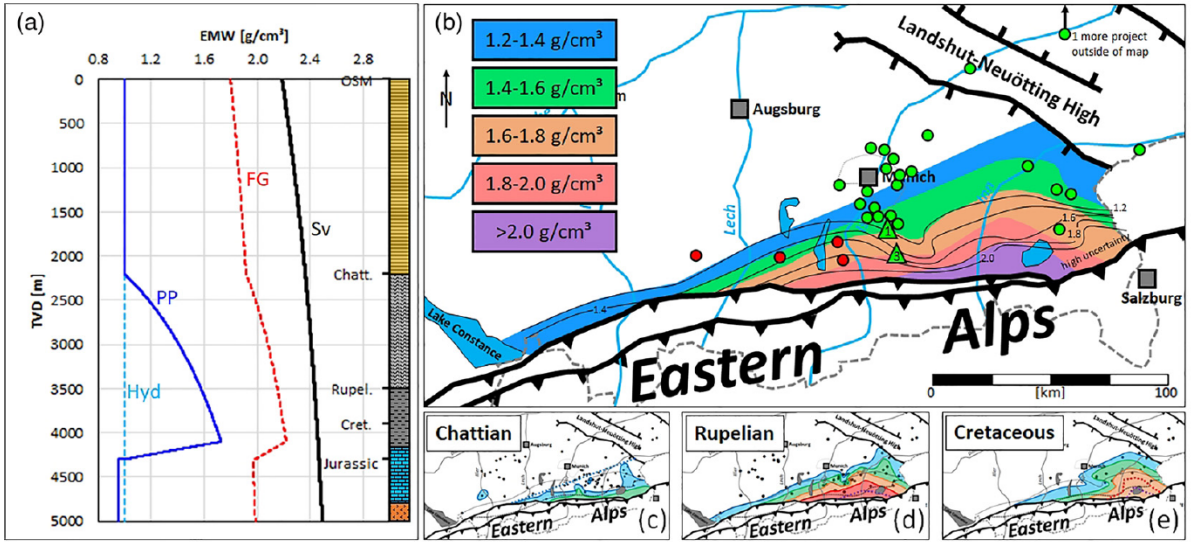
Motivation

40% additional cost due to geological drilling risks and if pore pressure and stress is not known
Understanding the subsurface is key to mitigate these risks and to formulate guidelines and best practices

Tasks & Requirements

- Post-drill analyses of deep geothermal wells in the Molasse Basin
- Generation of a drilling hazard map

Requirements: Reservoir geomechanics course



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