Professorship of Geothermal Technologies
Department of Civil and Environmental Engineering
TUM School of Engineering and Design
Technical University of Munich
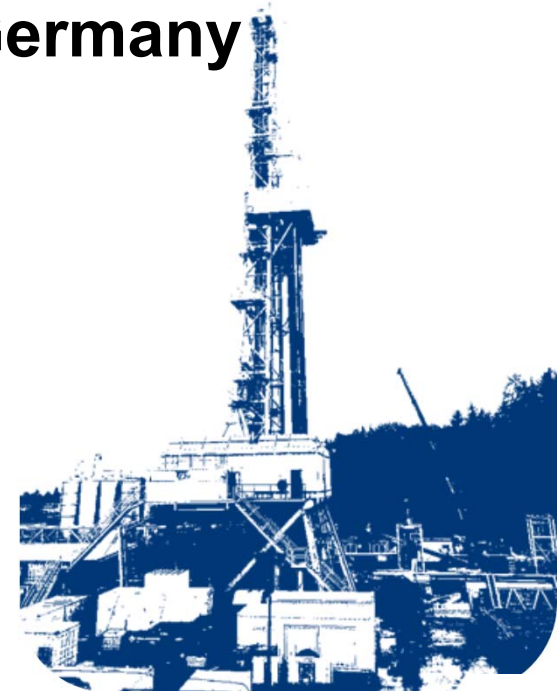
TUM

# Drilling challenges and subsurface data integration in the North Alpine Foreland Basin, SE Germany

Doctoral Candidates' Day 2023

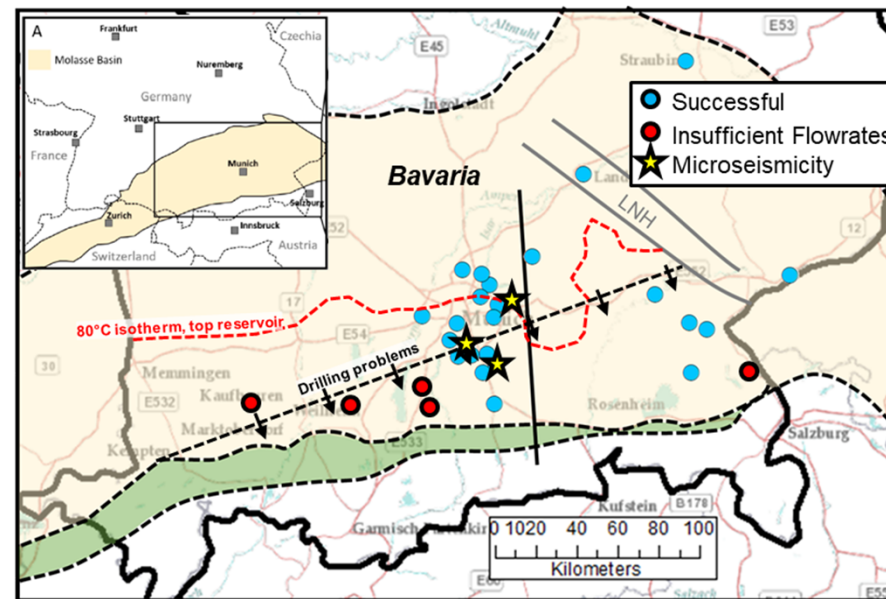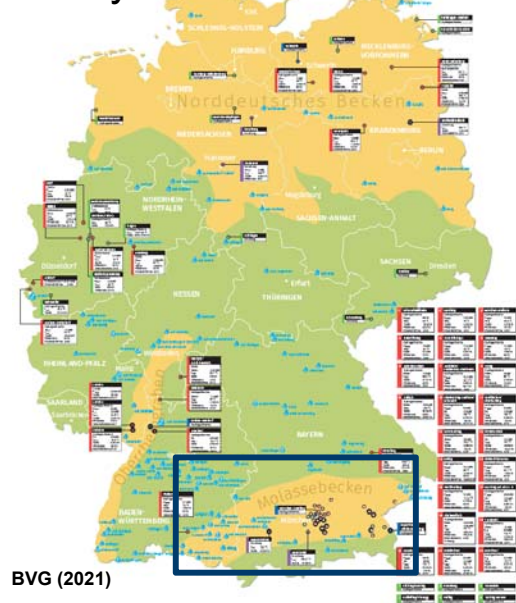**Indira Shatyrbayeva**

16th March 2023

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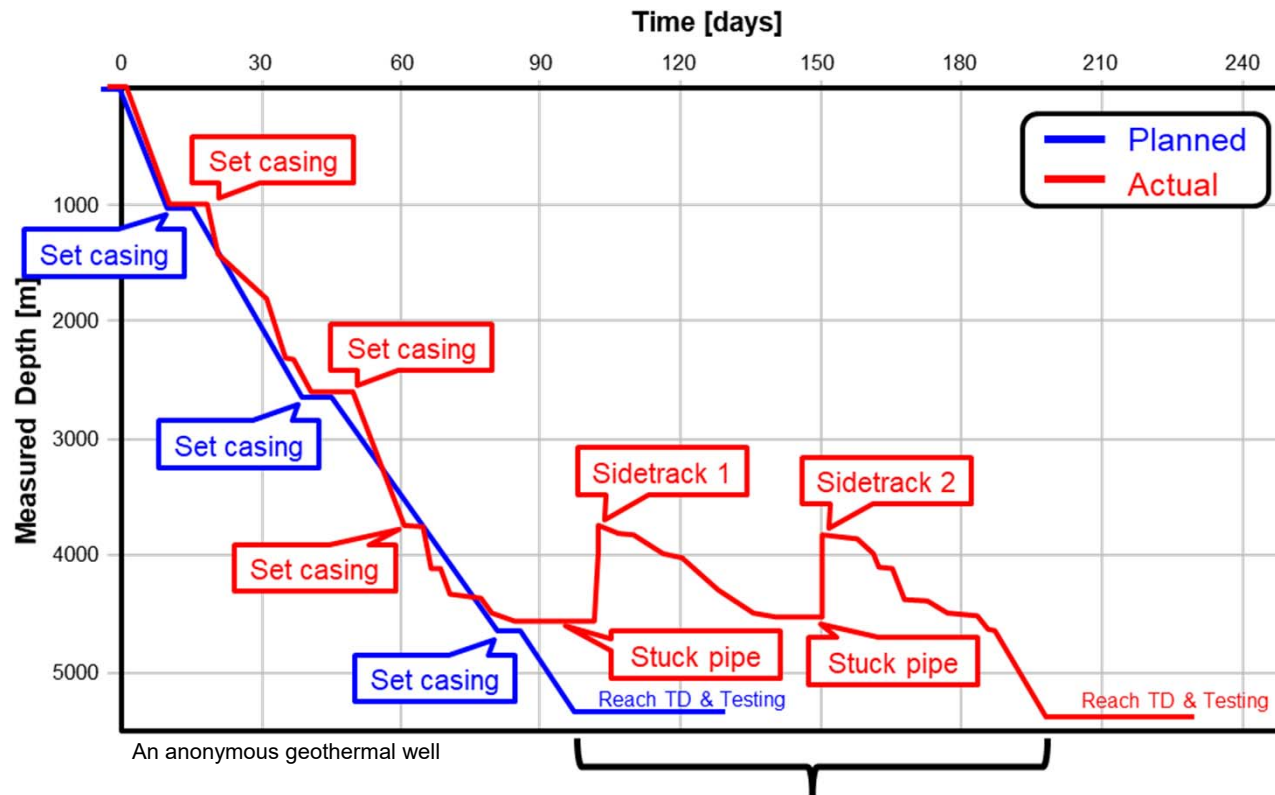# Bavaria – one of Europe's geothermal hotspots

- ✓ 25 successful deep geothermal projects
- ✓ >80 deep geothermal wells
- ✓ Heat >95% of German output
- ✓ Electricity >80% of German output

- ✓ 30% of all deep geothermal wells experienced drilling problems
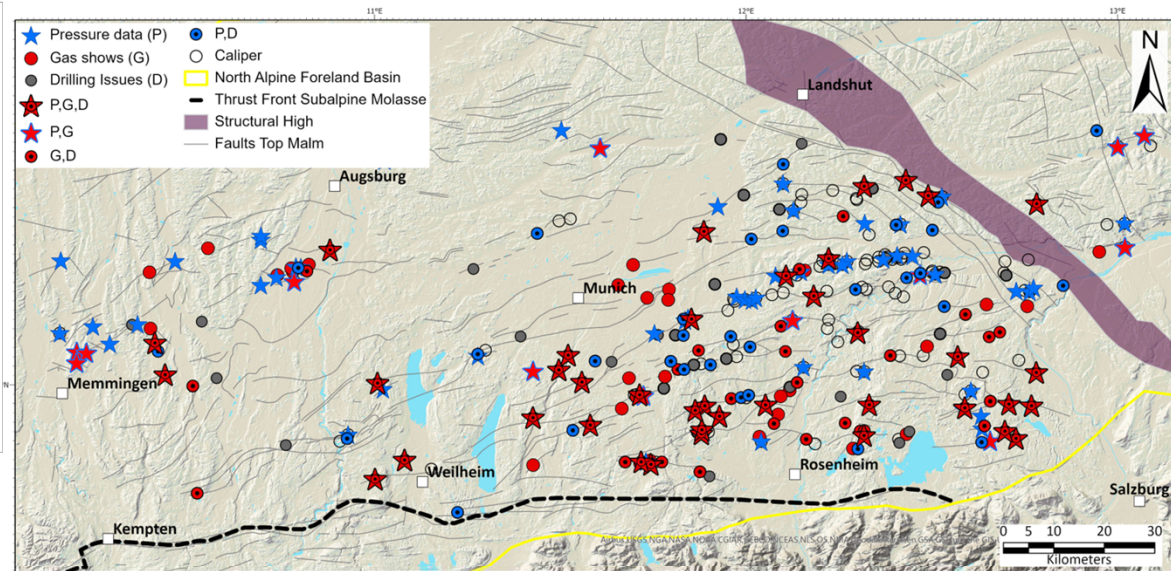- ✓ Almost all problems in shales and / or overpressured sections
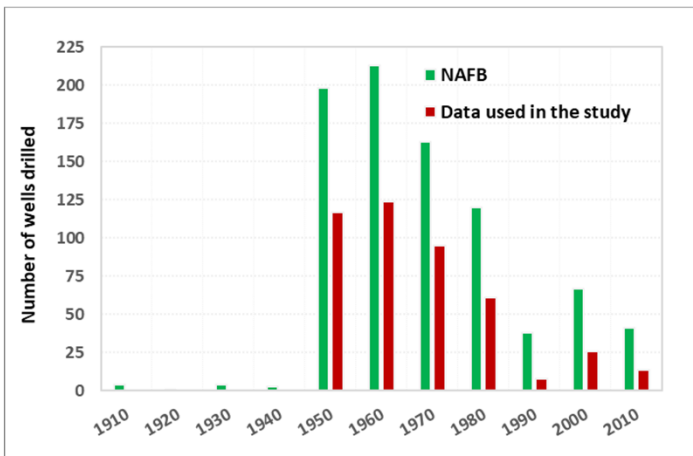


BVG (2021)

# Drilling can account for 30–70% of the overall project cost



An anonymous geothermal well

**delay >100 days = +50% drilling cost = +15% project costs ≈ 4-5 Mill.€**

# Data acquisition: Nearly half of the NAFB wells analyzed



| Data type | #wells | Data source |
|---|---|---|
| Pressure (Well tests, Kicks) | 138 | Geological well reports, well test reports (geothermal wells only) |
| Drilling mud weights | 445 | Geological well reports, header information of logging runs, mud logs (geothermal wells only), drilling reports (geothermal wells only) |
| Drilling issues | 133 | Geological well reports, drilling reports (geothermal wells only) |
| Caliper logs | 200 | Digital well logs |
| Total gas readings | 110 | Geological well reports, mud logs (geothermal wells only) |

# Past drilling experiences: 1325 various drilling problems closely analyzed



✓ 75% undesired wellbore influxes and kicks occurred in highly overpressed Oligocene shales adjacent to the Alpine thrust
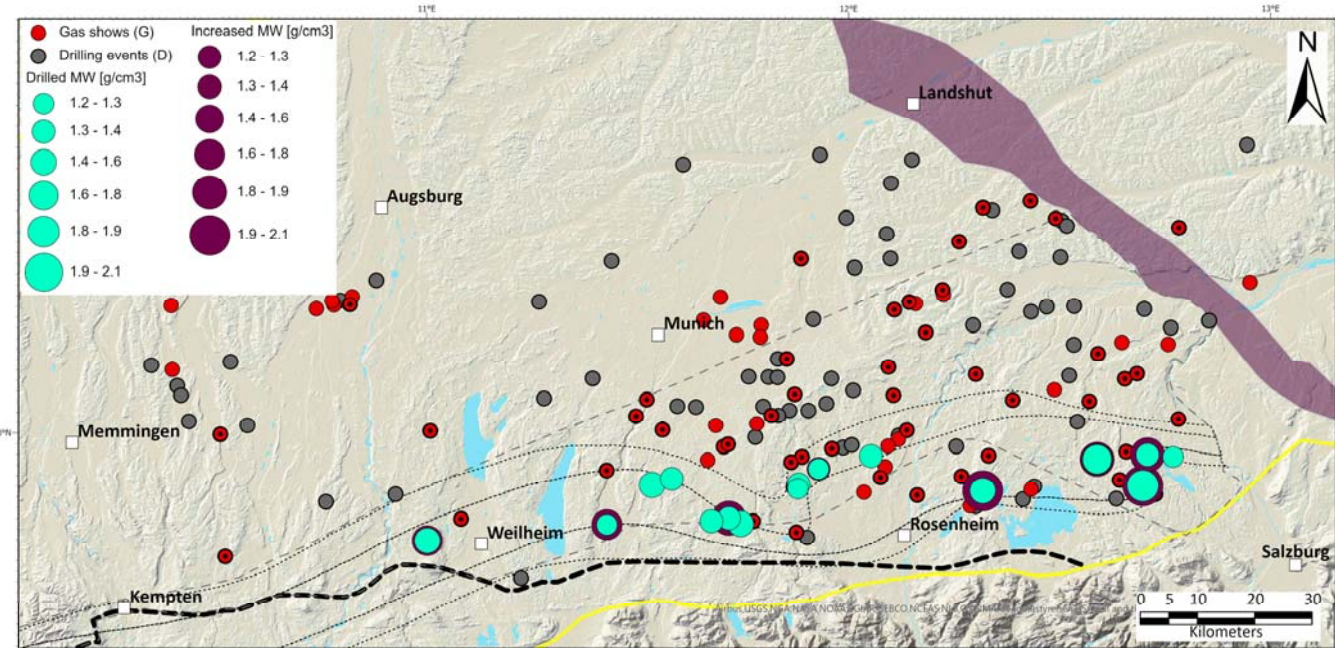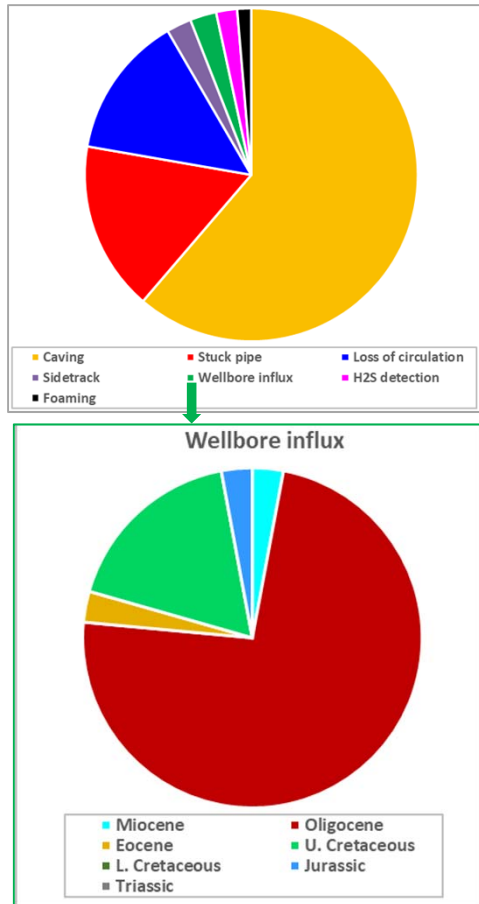
# Mud weight: 40% wells experienced severe wellbore integrity issues
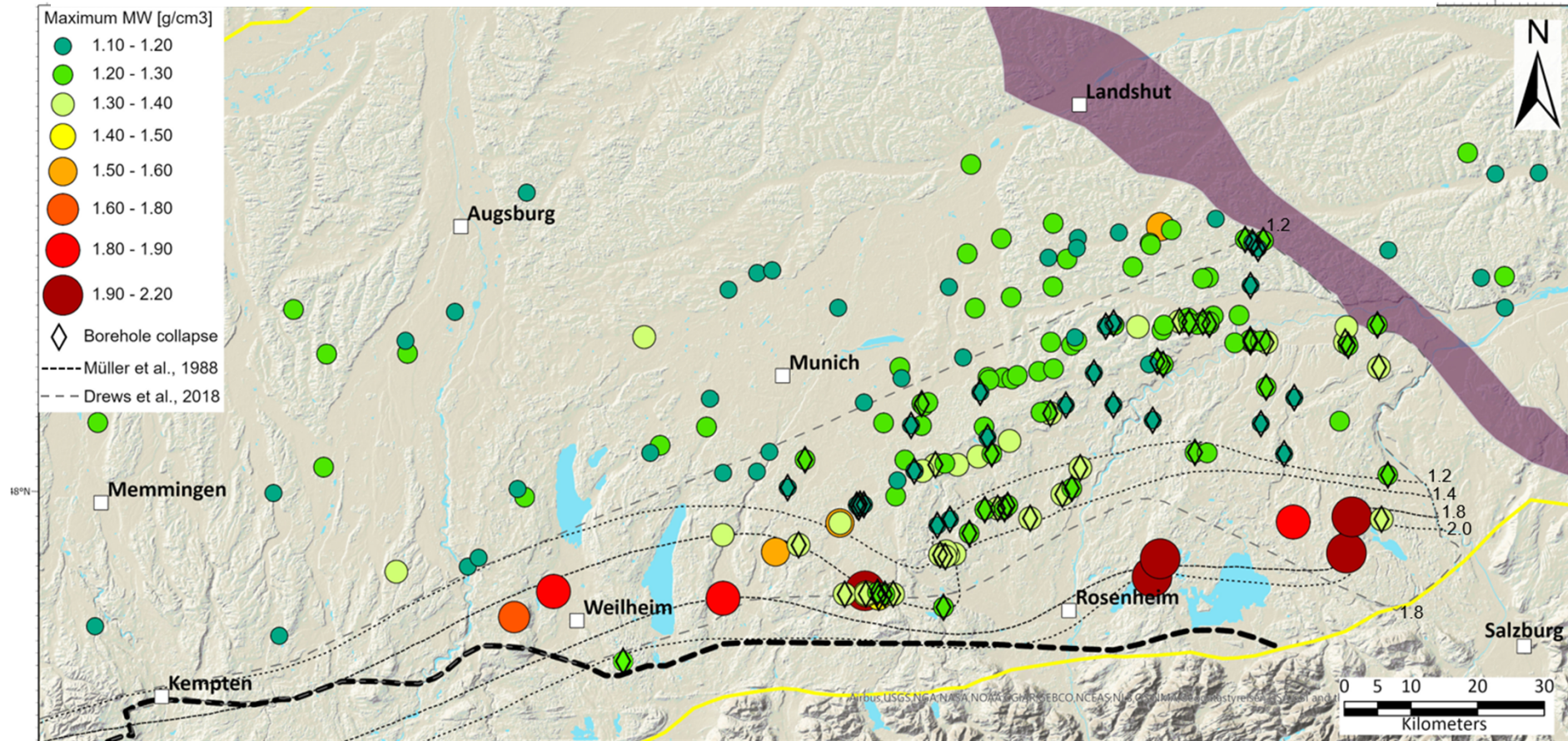
## Summary

➢ Drilling database covers nearly half of the all North Alpine Foreland Basin wells drilled between 1950 - 2018

➢ Various data integrated from multiple sources

➢ Data subject to interpretations and exposed to uncertainties

➢ Past drilling experiences can help to anticipate future drilling challenges

## Acknowledgements

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