Rock Mechanics and Rock Engineering of Geological Repositories in Opalinus Clay and Similar Claystones - Introduction

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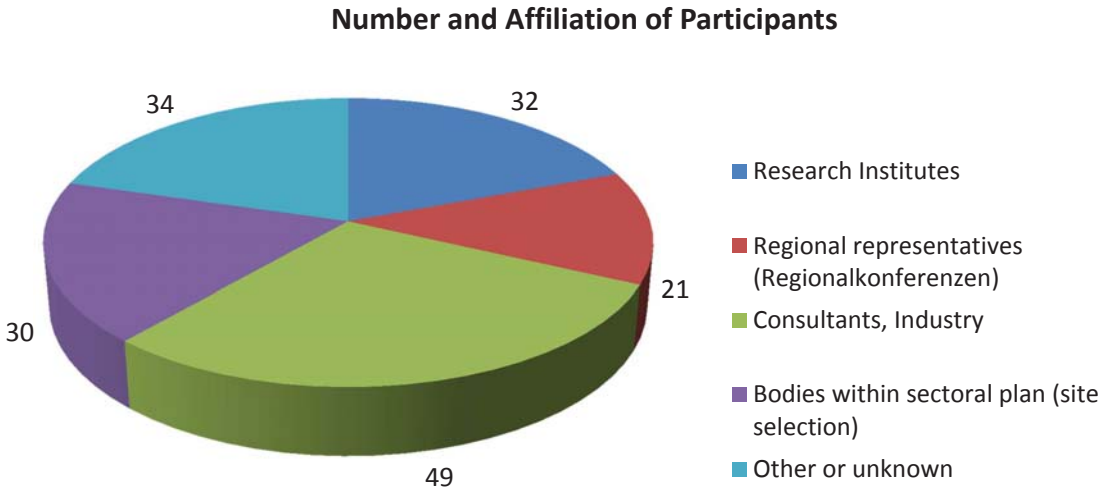
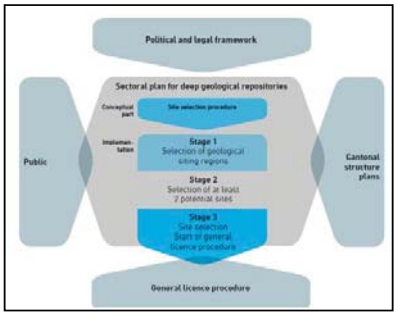
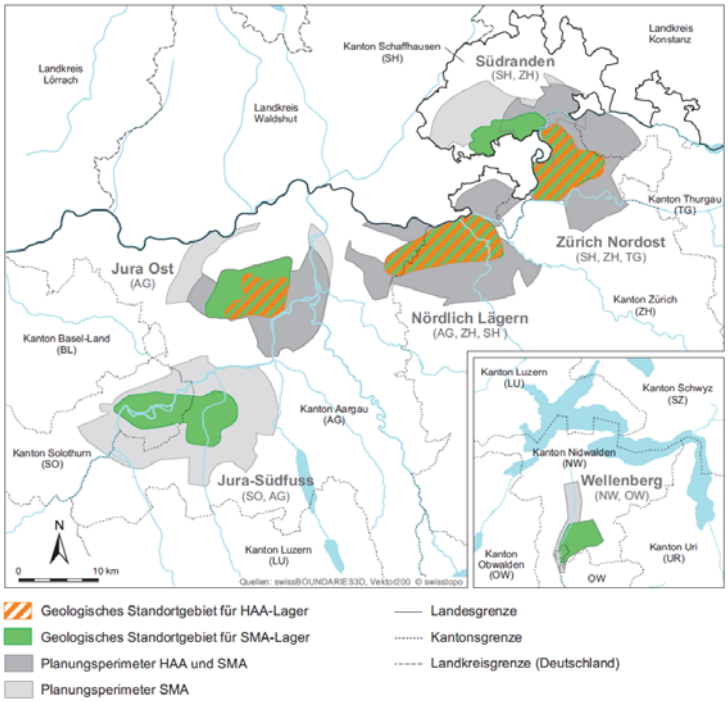
Wellcome 200 Participants and 13 Invited Speakers !



Stage 1 Regions for HLW (orange) and LLW/ILW (green) Repositories & Planning Areas (gray) in Northern Switzerland. Stage 2 Selections 2014





NTB 11-01

Repository Excavation induces Spalling and Overbreak in intact and faulted Opalinus Clay at Mont Terri Underground Rock Laboratory (elevation 400 m bgs)

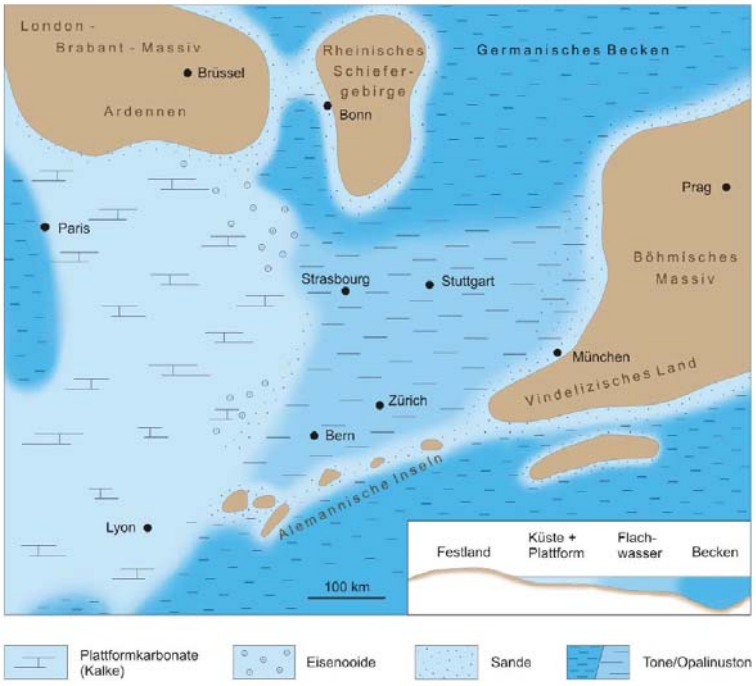
The Predicted Degree of Damage and Deformation of the Opalinus Clay Barrier in the Various Siting Regions is a Criterion for Site Selection

Key Factors influencing Short and Long Term Damage and Deformation of Opalinus Clay in Northern Switzerland are:

- Intact Rock Strength and Deformability
- Repository Depth
- Tectonic Faulting and Jointing
- In-situ Stress Field

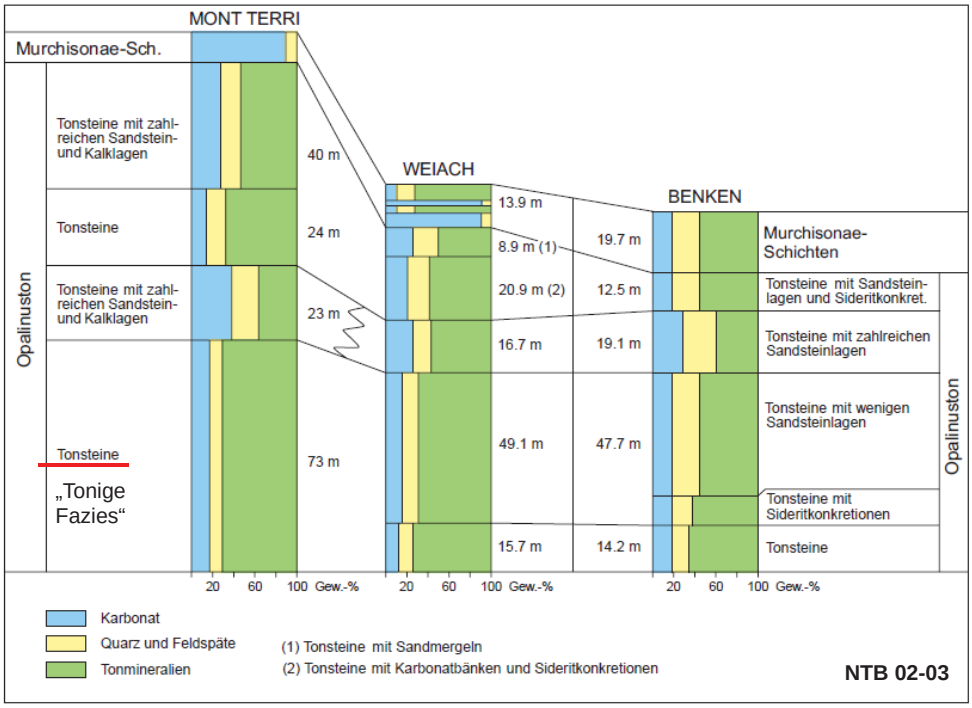
- Swelling and Pore Pressure Coupling
- Excavation Dimensions and Shape
- Excavation and Support Methods

Paleogeography during the deposition of the Opalinus Clay: 80-120 m thick mudrocks deposited in a shallow epicontinental shelf sea with a relief formed by synsedimentary subsidence and fault reactivation



NTB 08-04

Regional Stratigraphic Correlation and Variation of Mineralogy in the Opalinus Clay between Mont Terri and the Siting Regions

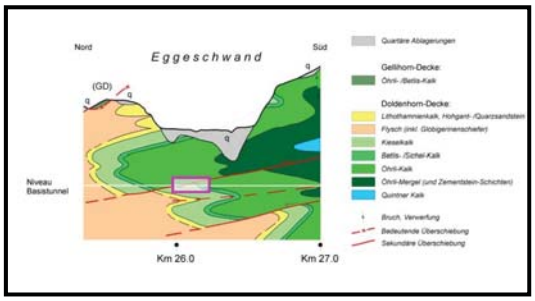


Regional Variations in Maximum Burial Depth (Overconsolidation), Porosity, Density & Ultrasonic Velocity of Opalinus Clay in Northern Switzerland

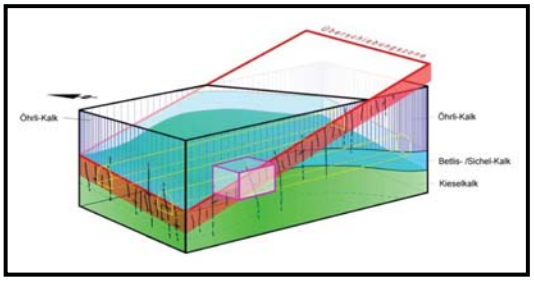
- Maximum Mesozoic and Cenezoic burial depth decreases from East (Herdern) to West (Mont Terri):
  - about 2850 m Herdern
  - about 1700 m Benken
  - about 1650 m Weiach
  - about 1000 m Mont Terri
- This results in regional trends of intact OPA properties:
  - Porosity increases from East to West (Bodensee about 4%; Züricher Weinland about 7-12%; Mont Terri about 14-18%)
  - Density decreases from East to West
  - Ultrasonic rock velocities decrease from East to West

Geologie – Baugrundmodell - Gefährdungsbild

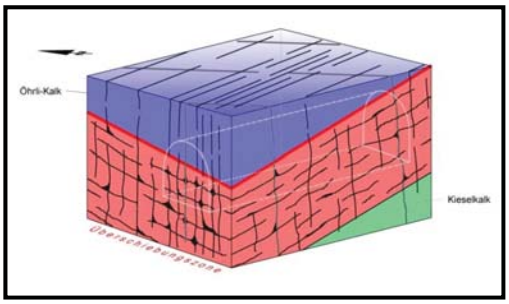
1. Erfassung der tektonischen Strukturen



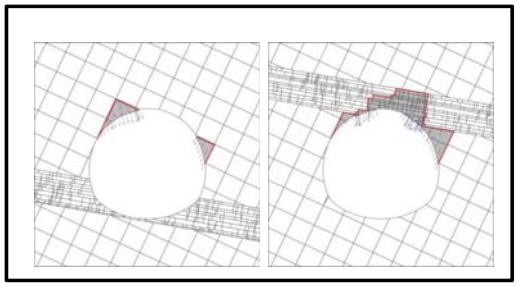
2. Beschreibung der geol. Einheiten



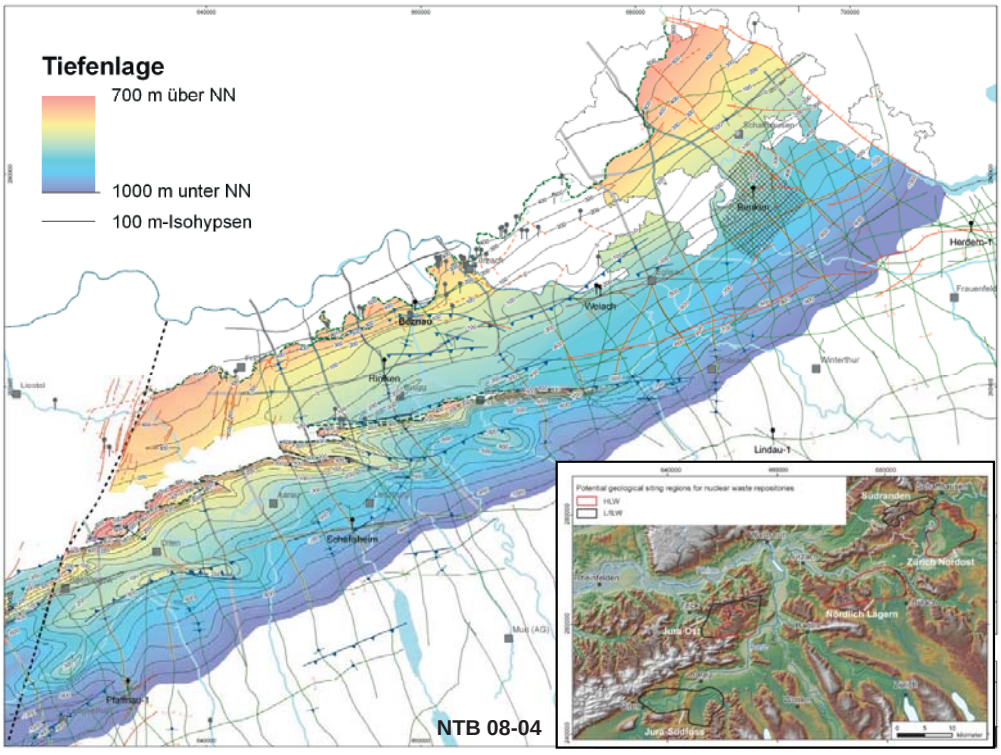
3. Ermittlung bautechnischer Eigenschaften



4. Analyse von Gefährdungsbildern

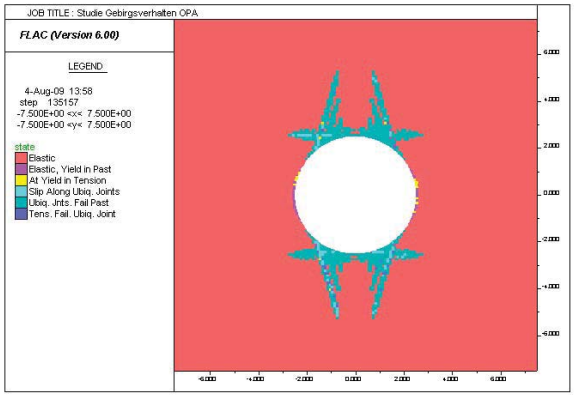


Regional Variation of Elevation (above/below sea level) and Depth (300-1000 meters bgs) of Opalinus Clay in Northern Switzerland.

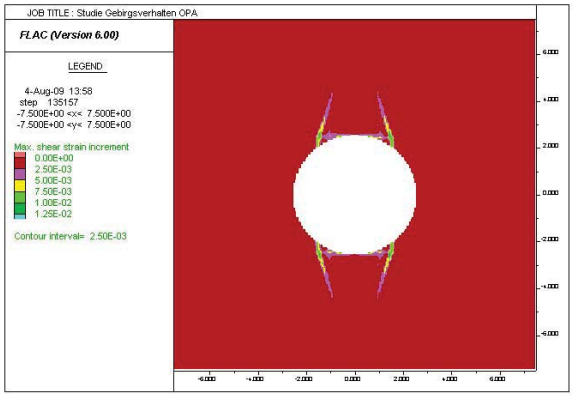


Simulated Fracture Pattern and Shear Strain at Tunnel Face: 400 meters below Ground Surface (k_0=0.9)

State



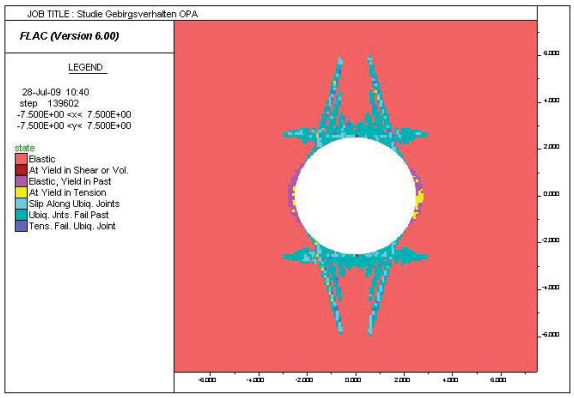
Shear strain increment



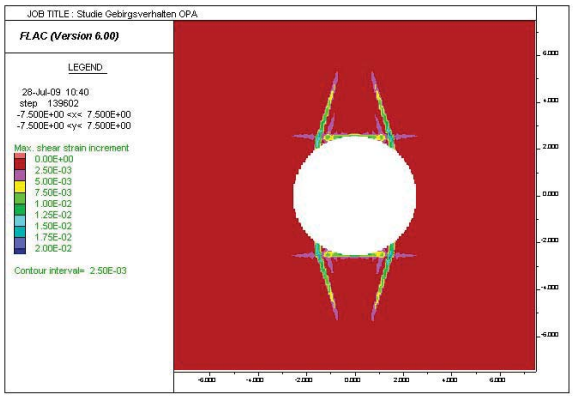
Amann & Löw 2009

Simulated Fracture Pattern and Shear Strain at Tunnel Face: 600 meters below Ground Surface (k_0=0.9)

State

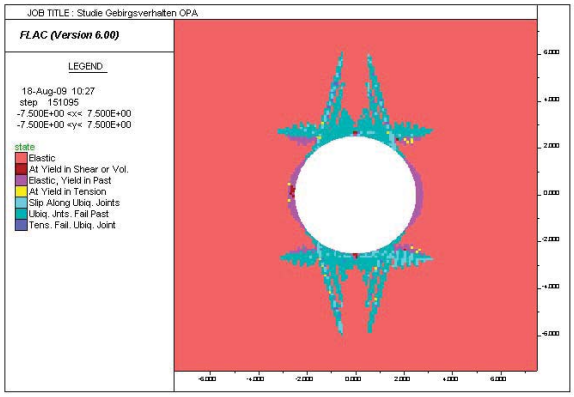


Shear strain increment

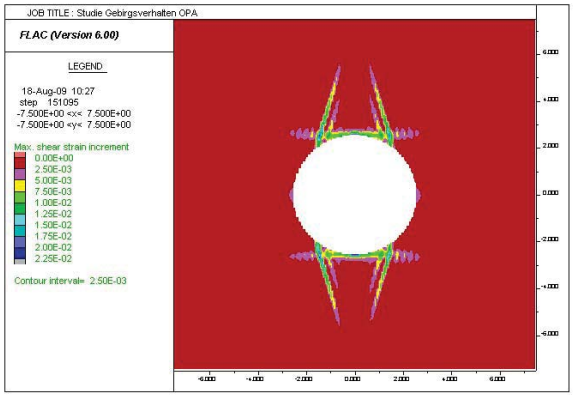


Simulated Fracture Pattern and Shear Strain at Tunnel Face: 700 meters below Ground Surface (k_0=0.9)

State

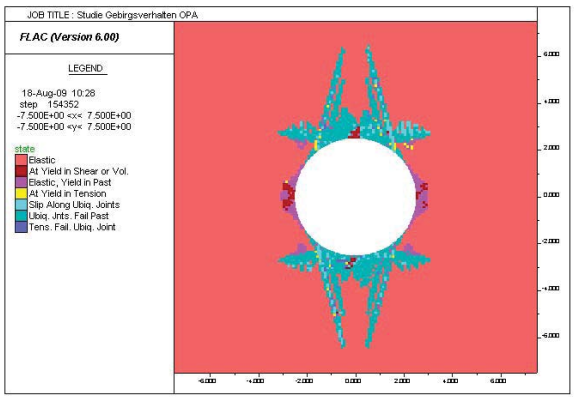


Shear strain increment

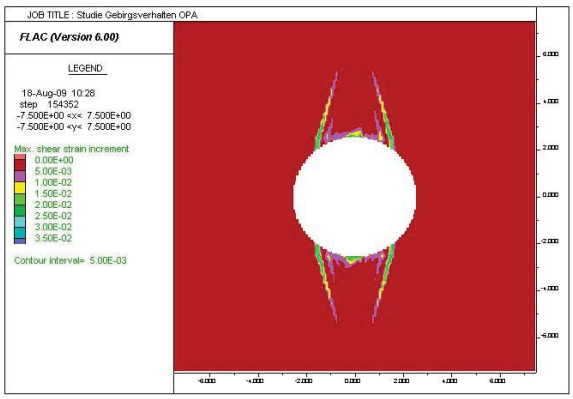


Simulated Fracture Pattern and Shear Strain at Tunnel Face: 800 meters below Ground Surface (k_0=0.9)

State

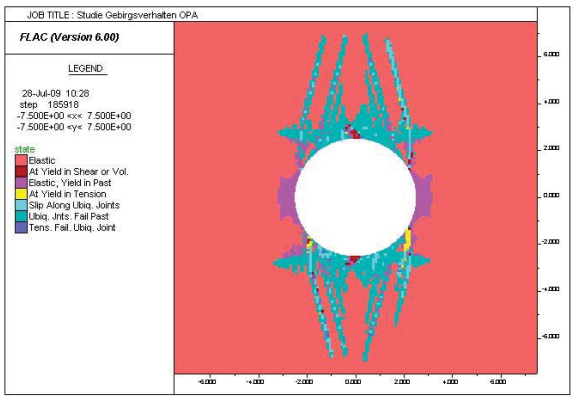


Shear strain increment

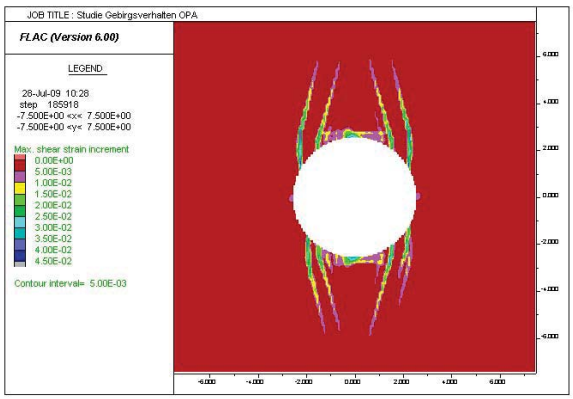


Simulated Fracture Pattern and Shear Strain at Tunnel Face: 900 meters below Ground Surface (k_0=0.9)

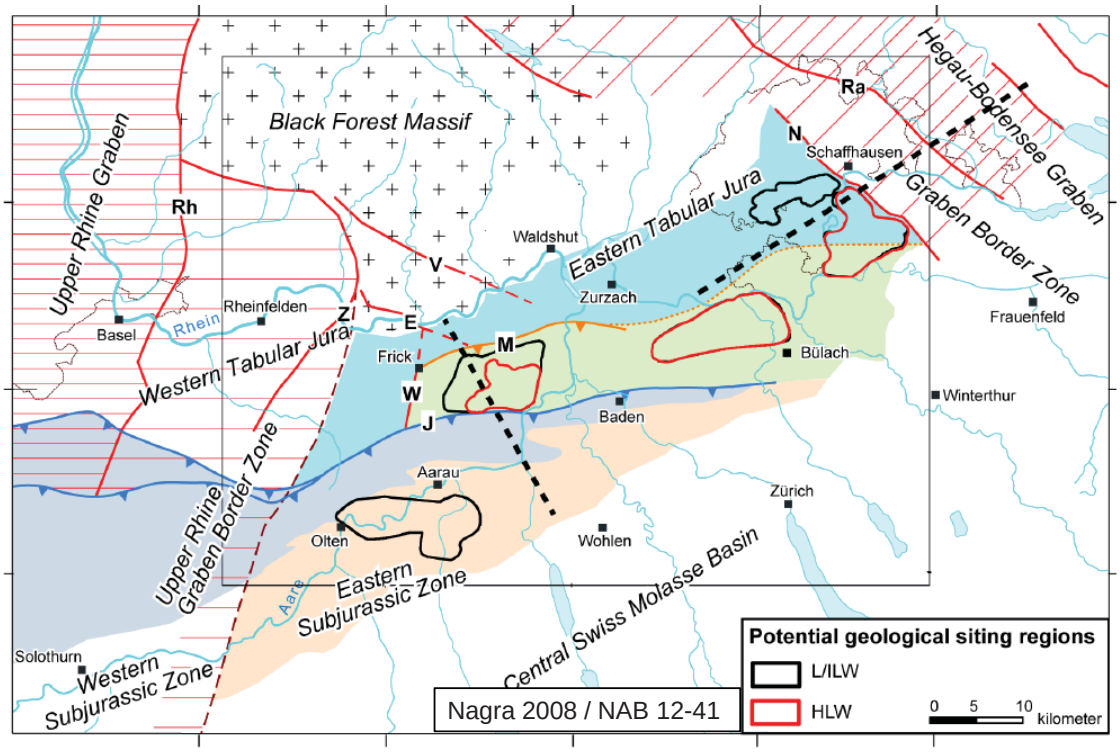
State



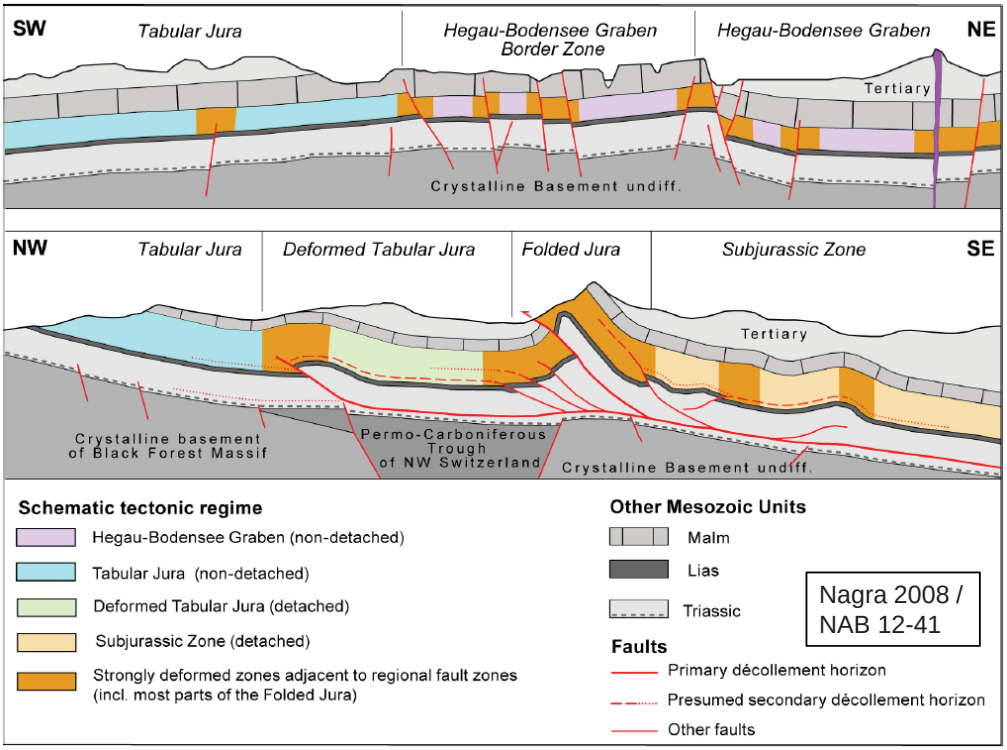
Shear strain increment



Tectonic Units of Proposed Siting Regions

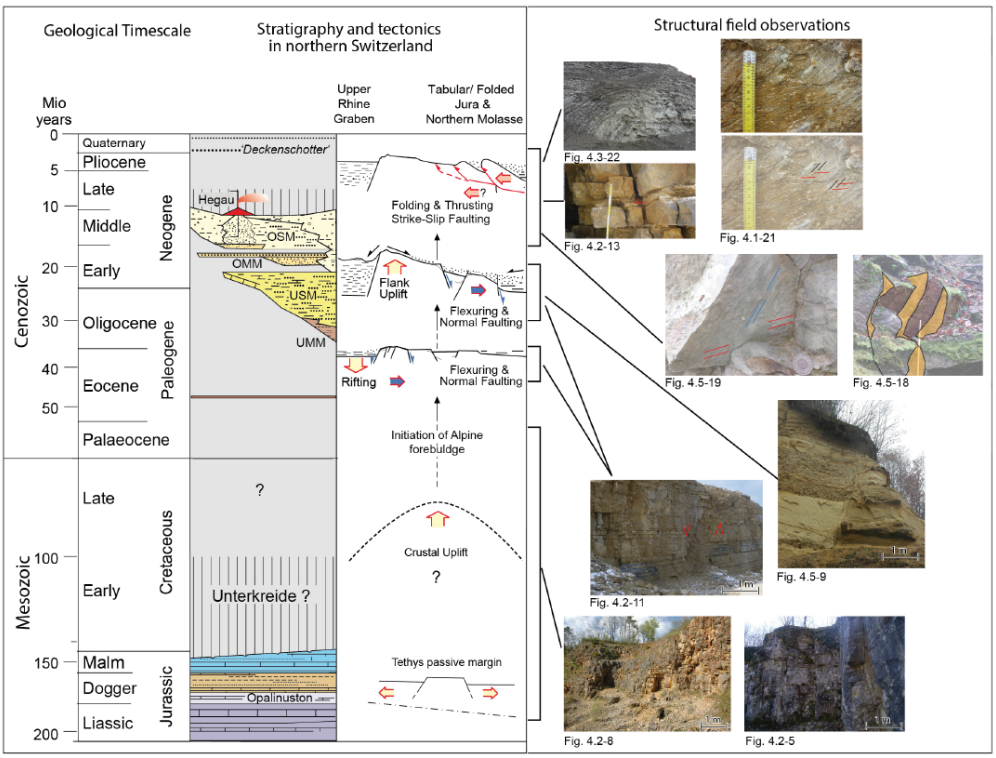


Schematic Cross-Sections Through Siting Regions in Northern Switzerland (Subjurassic Zone & Deformed Tabular Jura)

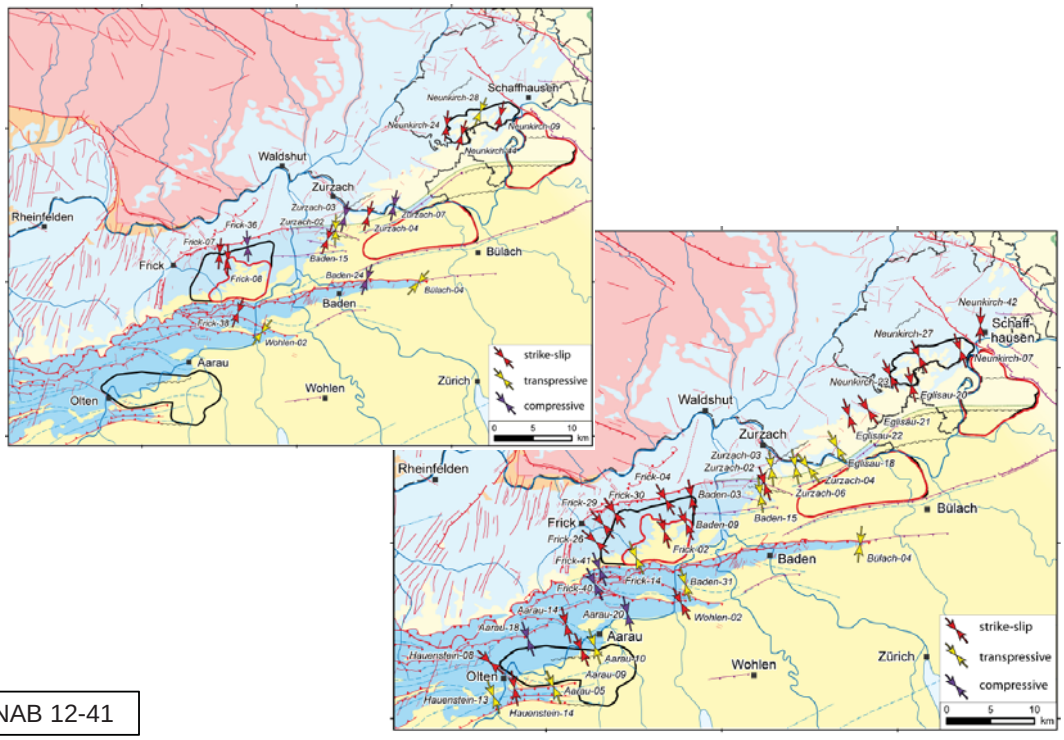


Nagra 2008 / NAB 12-41

Multistage Mesozoic and Cenozoic Jointing, Faulting (Normal, Strike-Slip and Reverse) and Folding in Northern Switzerland



Late Miocene NNW-SSE and NNE-SSW Oriented Shortening as derived from Fault Slip Analysis

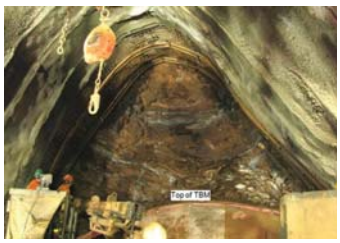


NAB 12-41

Conference Topic: Current State of Research and Experiences relevant for the Understanding and Assessment of the Mechanical Behavior of Opalinus Clay in the Proposed Siting Regions of Northern Switzerland

Session 1:
- Laboratory Experiments
- In-Situ Experiments

Session 2:
- Experiences of Underground Constructions



Session 3:
- Construction and Layout of Repositories in Northern Switzerland