

GeoMol

Current State of 3D Modeling in the Molasse Basin

Dr. Olivier Lateltin
Swiss Geological Survey

In cooperation with the CTI



Energy funding programme

Swiss Competence Centers for Energy Research



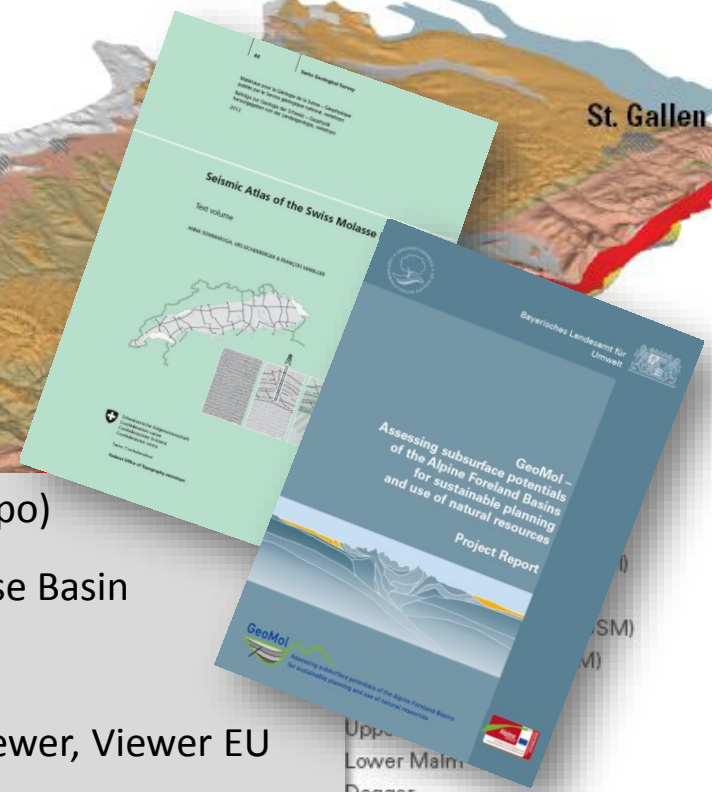
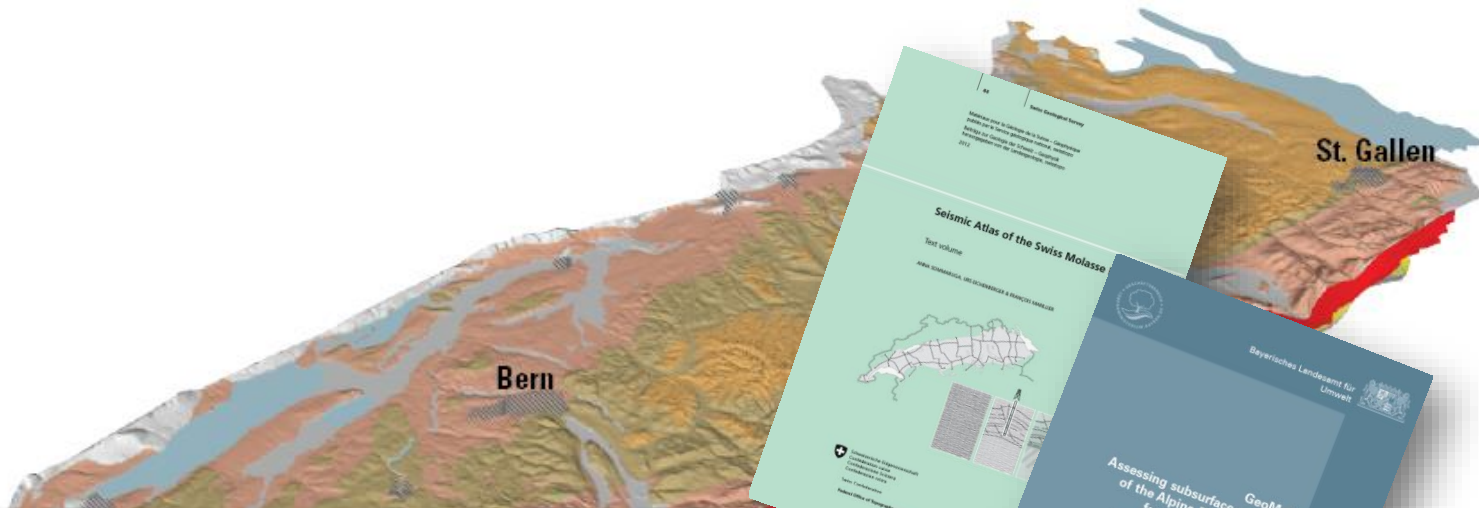
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Commission for Technology and Innovation CTI

Framework Model

GeoMol CH
Framework Model
 1 : 200'000

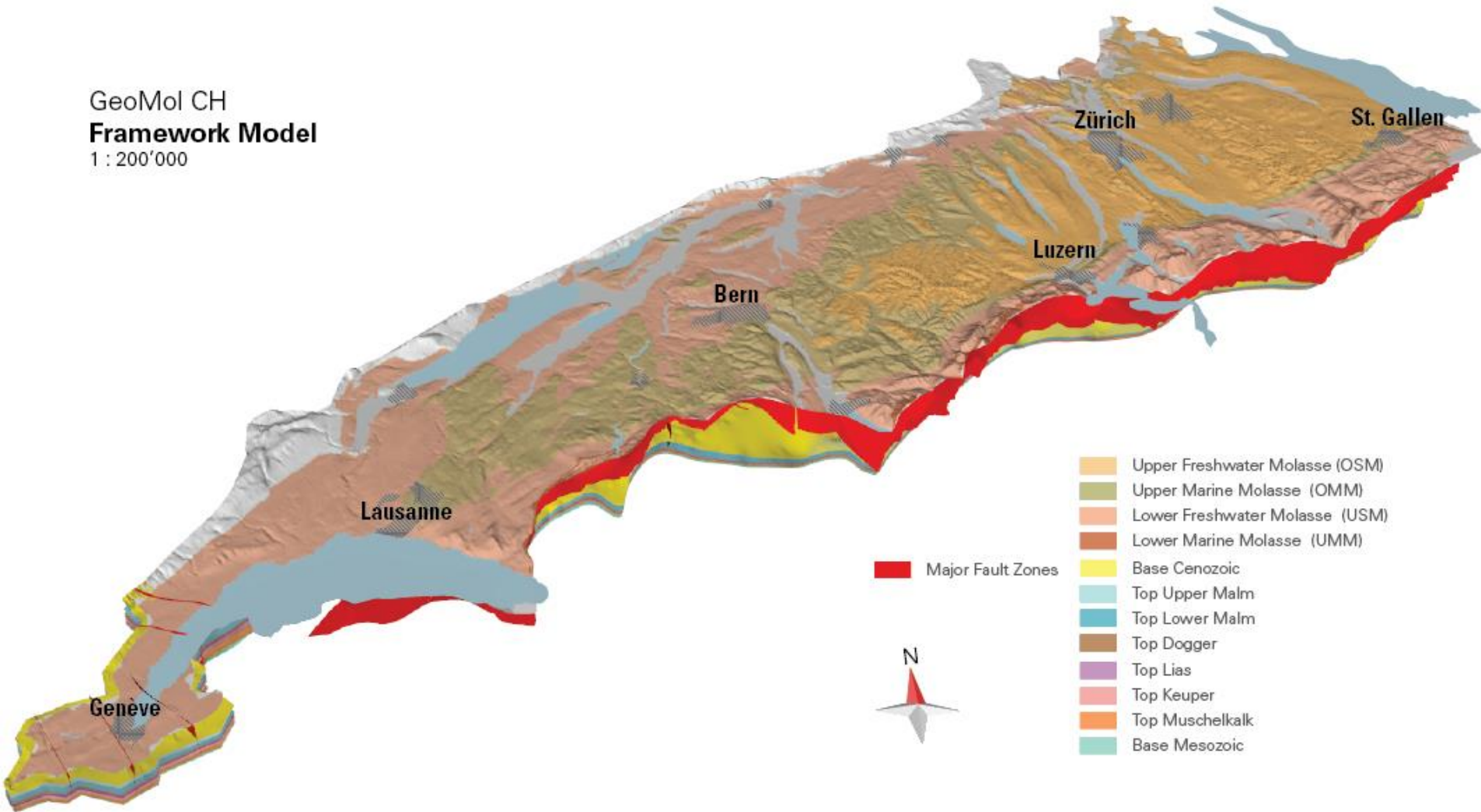


Constructed by	Swiss Geological Survey (swisstopo)
Based on	Seismic Atlas of the Swiss Molasse Basin
Collaboration	GeoMol EU
Product	GeoMol EU Final Report, GST-Viewer, Viewer EU
Remarks	<ul style="list-style-type: none"> - Homogenized & simplified model - Boundary adjustments with F, D, A - Major fault zones

Upper Malm (SM)
 Lower Malm (M)
 Dogger
 Lias
 Keuper
 Muschelkalk
 Mesozoic

Framework Model

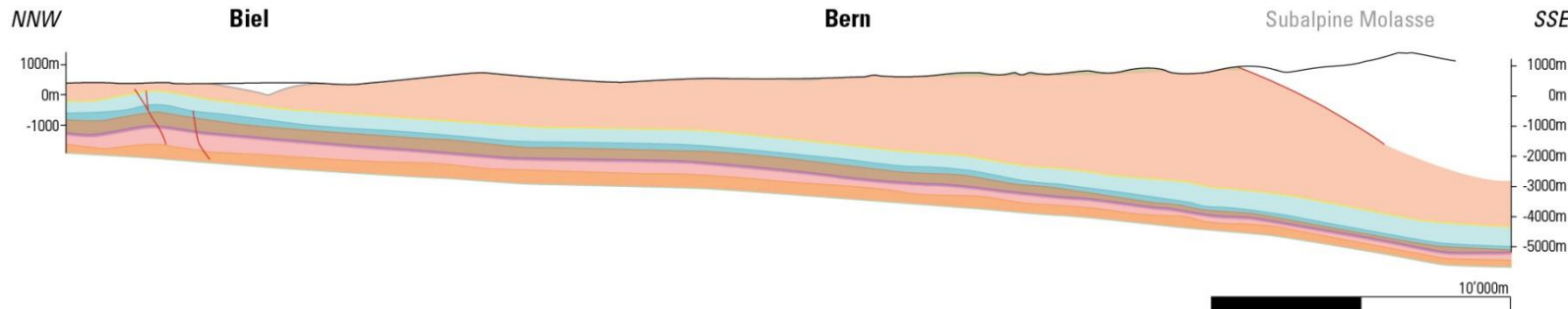
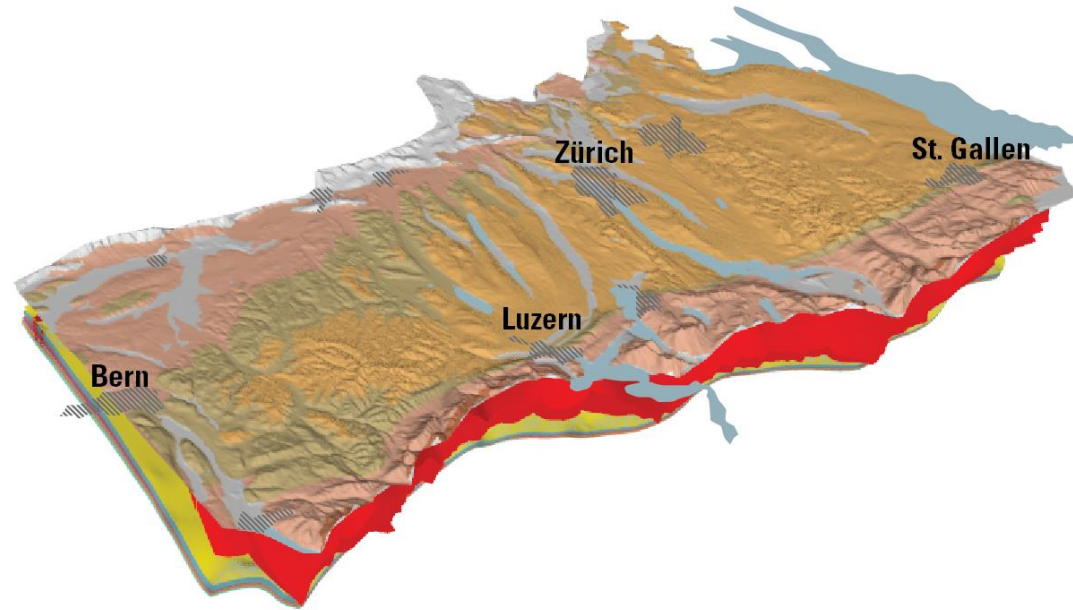
GeoMol CH
Framework Model
 1 : 200'000



Framework Model

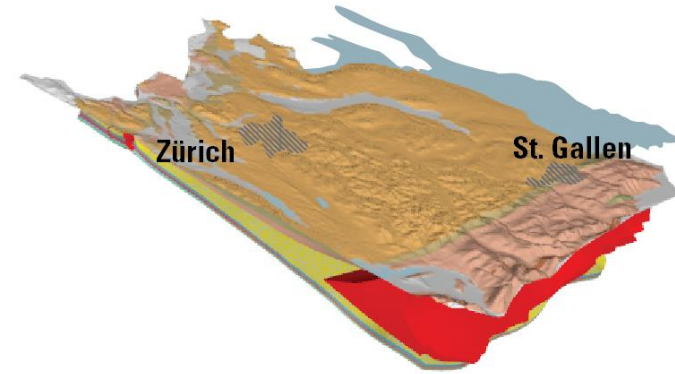
GeoMol CH
Framework Model
 1 : 200'000








-  Upper Freshwater Molasse (OSM)
-  Upper Marine Molasse (OMM)
-  Lower Freshwater Molasse (USM)
-  Lower Marine Molasse (UMM)
-  Base Cenozoic
-  Upper Malm
-  Lower Malm
-  Dogger
-  Lias
-  Keuper
-  Muschelkalk
-  Base Mesozoic

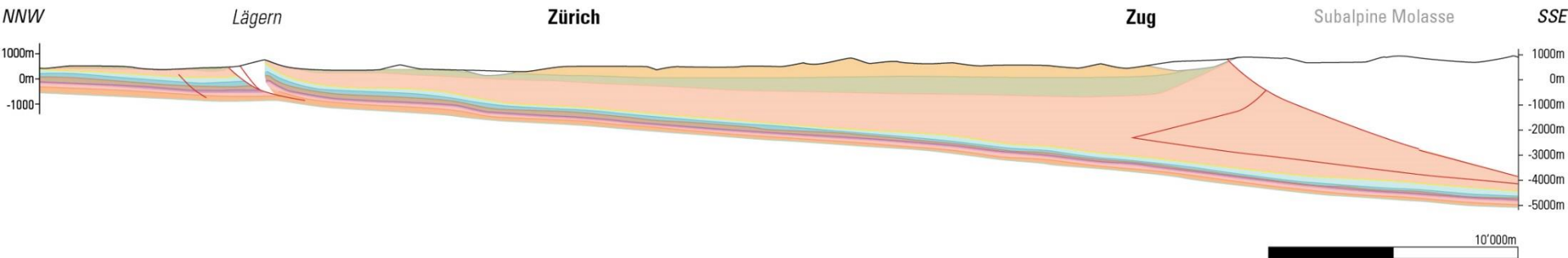


Framework Model

GeoMol CH
Framework Model
 1 : 200'000



-  Upper Freshwater Molasse (OSM)
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GeoMol CH – Partner

Thickness maps

GeoMol CH
Detailmodel
1 : 50'000

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Quality Check Partner M

CRITERIA	
DATA DELIVERY	
1	Modelling journal
1.1	Date
1.2	Report
1.3	Author
1.4	Contact
1.5	Format
1.6	Version
Figures	
1.7	Figures delivered separately
1.7.1	Format
1.8	Additional figures (Annex)
CONTENT	
2.1	Structure of the report is
2.2	Chapter database
2.3	Chapter data validation and preparation
2.4	Chapter modelling workflow
2.5	Chapter boundary adjustment
2.6	Chapter References
2.7	Content of report is
FIGURES	
3	Quality of figures
3.1	Resolution of figure
3.2	Size of figure
3.3	Legend
3.4	Localisation (base map)
3.5	Orientation (north arrow)
3.6	Vertical and horizontal scales
3.7	Level of detail
3.8	Fonts in figures
3.9	Colour-code according to GeoMol Stratigraphy
3.10	Colouring of seismic sections according to guidelines
3.11	Indication of exaggeration
DATABASE	
4	Surface data
4.1	List of geological maps
4.2	Scale of surface data

Modell GE
Uni. GE (& BRGM)

13.09.2016

Prof

Well

NW

1000.0 m

0.0 m

-1000.0 m

-2000.0 m

Federal Office of Topography swisstopo
Swiss Geological Survey

3D Model Evaluation

GeoMol-CH, AUG Region

31 March 2016

8

2000.0 m
1000.0 m
0.0 m
-1000.0 m
-2000.0 m
-3000.0 m
-4000.0 m
-5000.0 m
-6000.0 m
-7000.0 m

10000.0 m

0.0 m

10000.0 m

20000.0 m

30000.0 m

40000.0 m

Vertical exaggeration: 4x

Federal Office of Topography swisstopo
Swiss Geological Survey

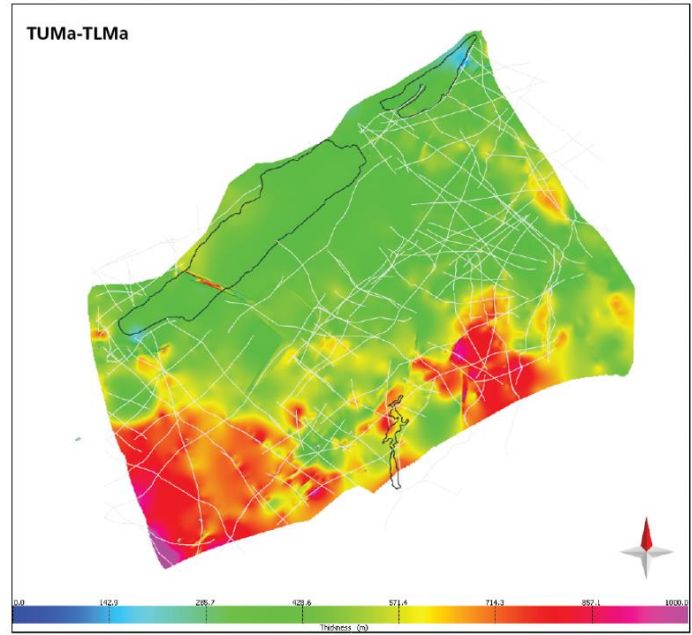
3D Model Evaluation

GeoMol-CH, AUG Region

23 February 2016

33

TUMa-TLMa



Federal Office of Topography swisstopo
Swiss Geological Survey

Evaluation 3D Model – GeoMol Model FR
23 February 2016

Federal Office of Topography swisstopo
Swiss Geological Survey

3D Model Evaluation

GeoMol-CH, AUG Region
31 March 2016

59

$$dZ = \text{Well marker elevation} - \text{grid elevation}$$

- Top Dogger
- Top Lias
- Top Keuper
- Top Muschelkalk
- Base Mesozoic

GeoMol

6

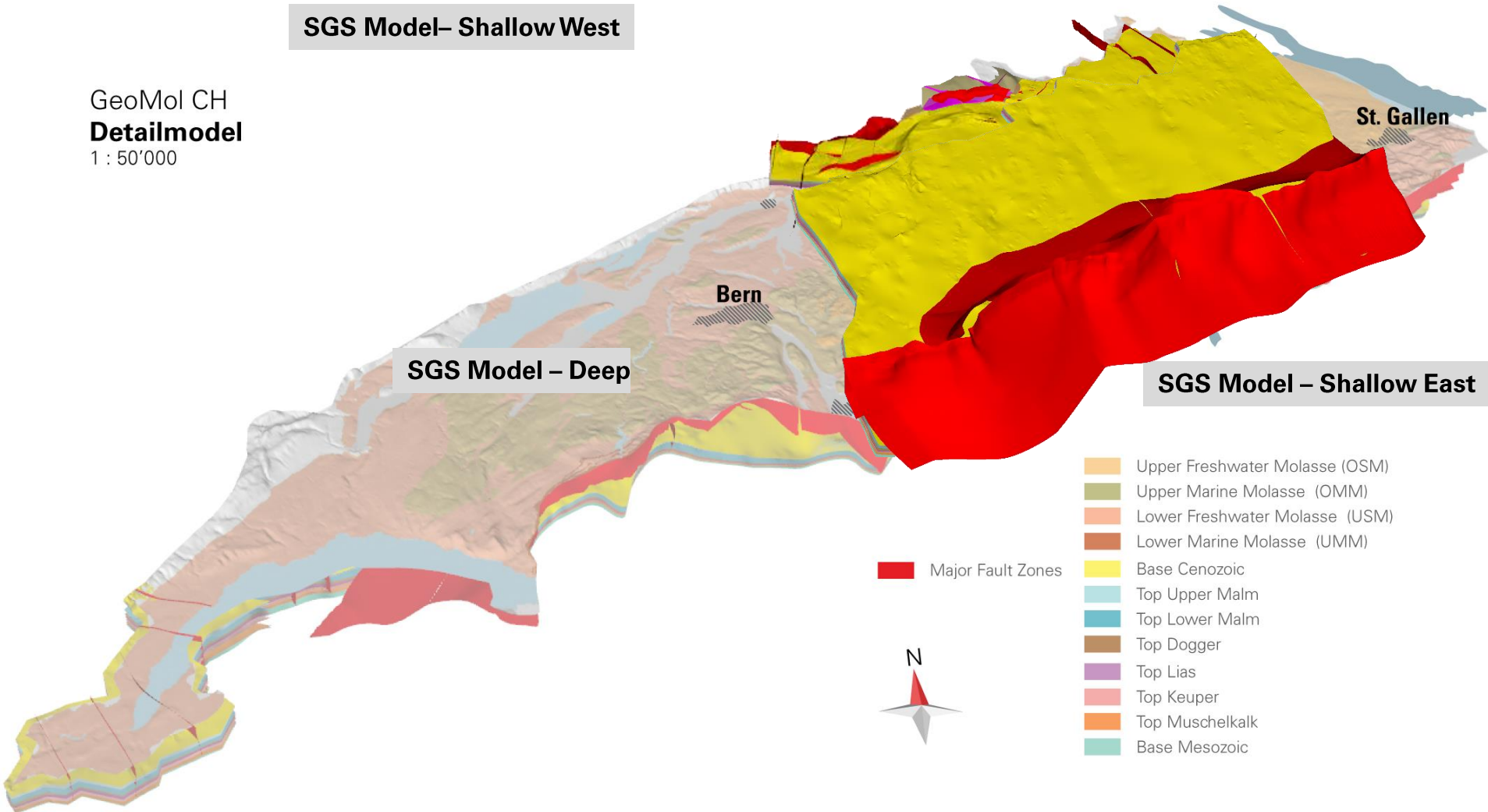
GeoMol CH – SGS Models

SGS Model– Shallow West

GeoMol CH
Detailmodel
1 : 50'000

SGS Model – Deep

SGS Model – Shallow East

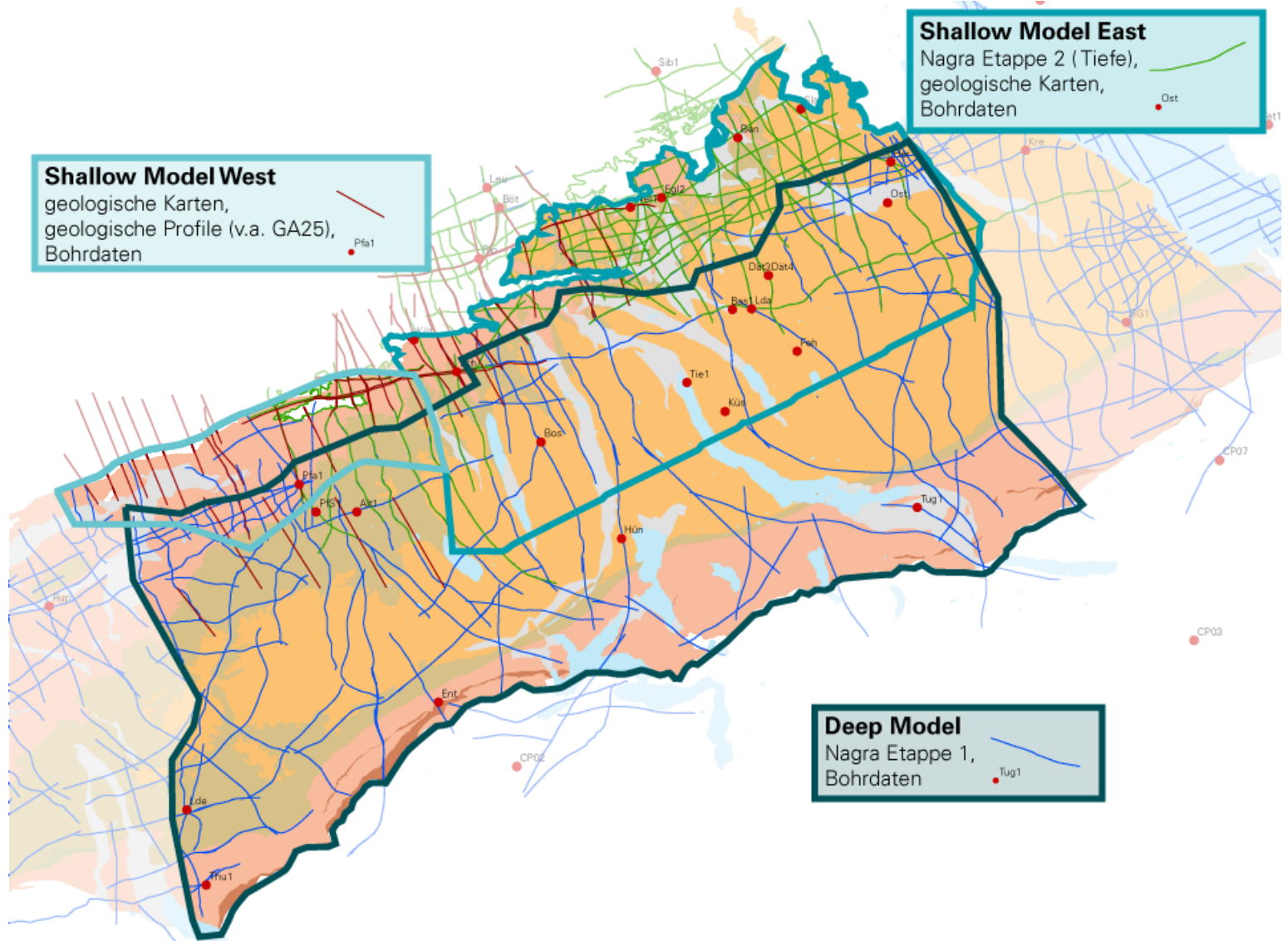


-  Upper Freshwater Molasse (OSM)
-  Upper Marine Molasse (OMM)
-  Lower Freshwater Molasse (USM)
-  Lower Marine Molasse (UMM)
-  Base Cenozoic
-  Top Upper Malm
-  Top Lower Malm
-  Top Dogger
-  Top Lias
-  Top Keuper
-  Top Muschelkalk
-  Base Mesozoic

 Major Fault Zones



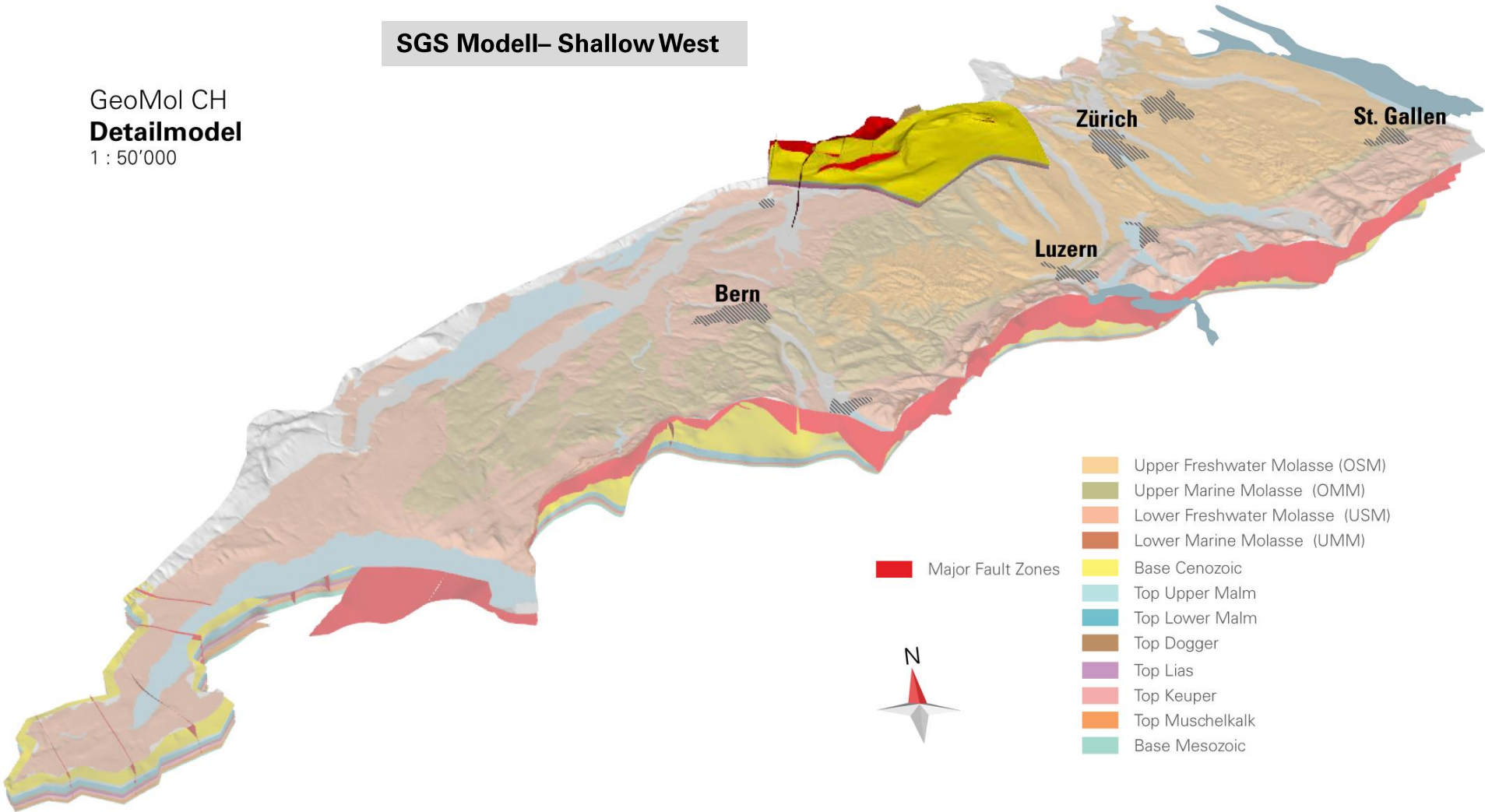
GeoMol SGS - Database



GeoMol SGS Models

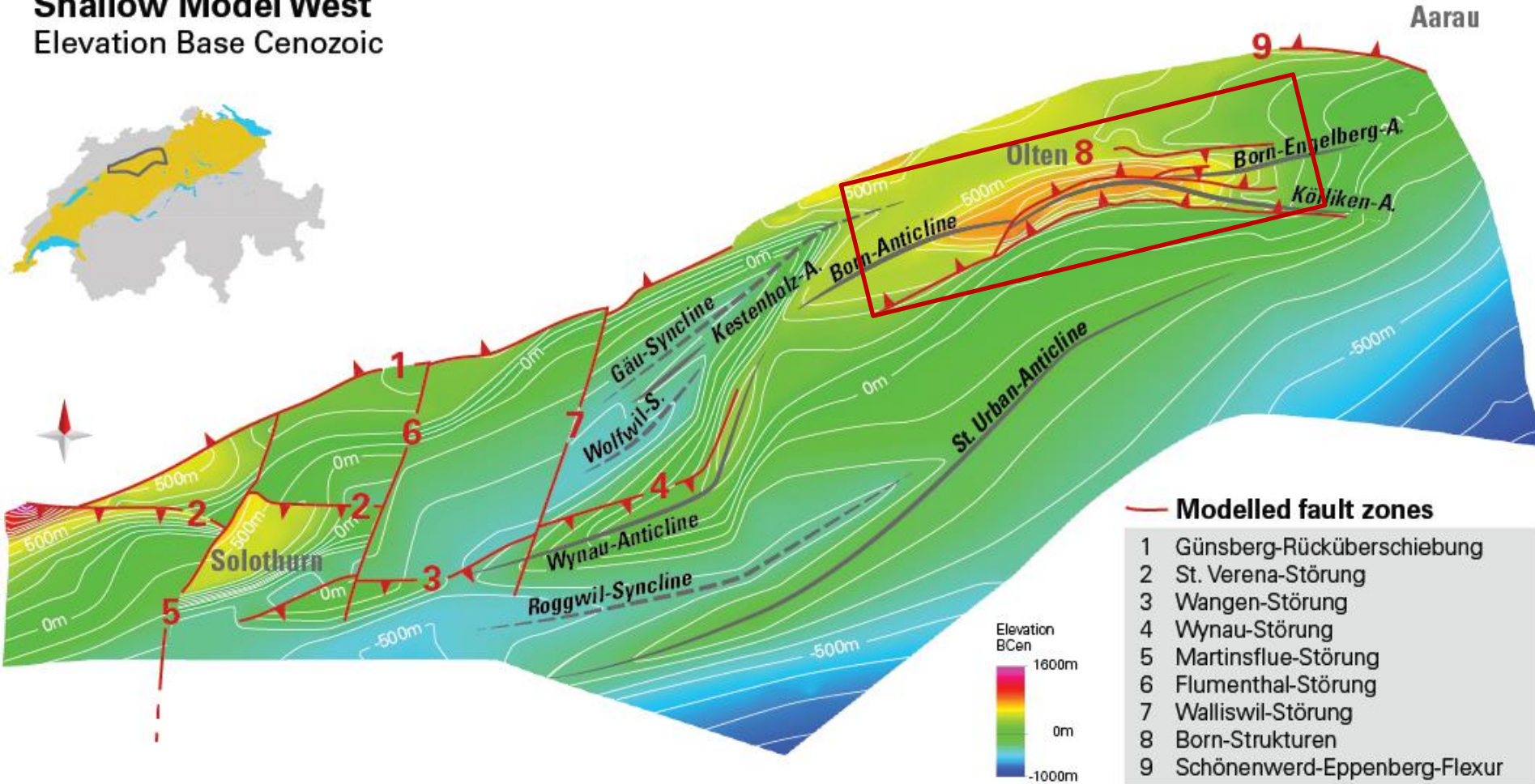
SGS Modell– Shallow West

GeoMol CH
Detailmodell
1 : 50'000











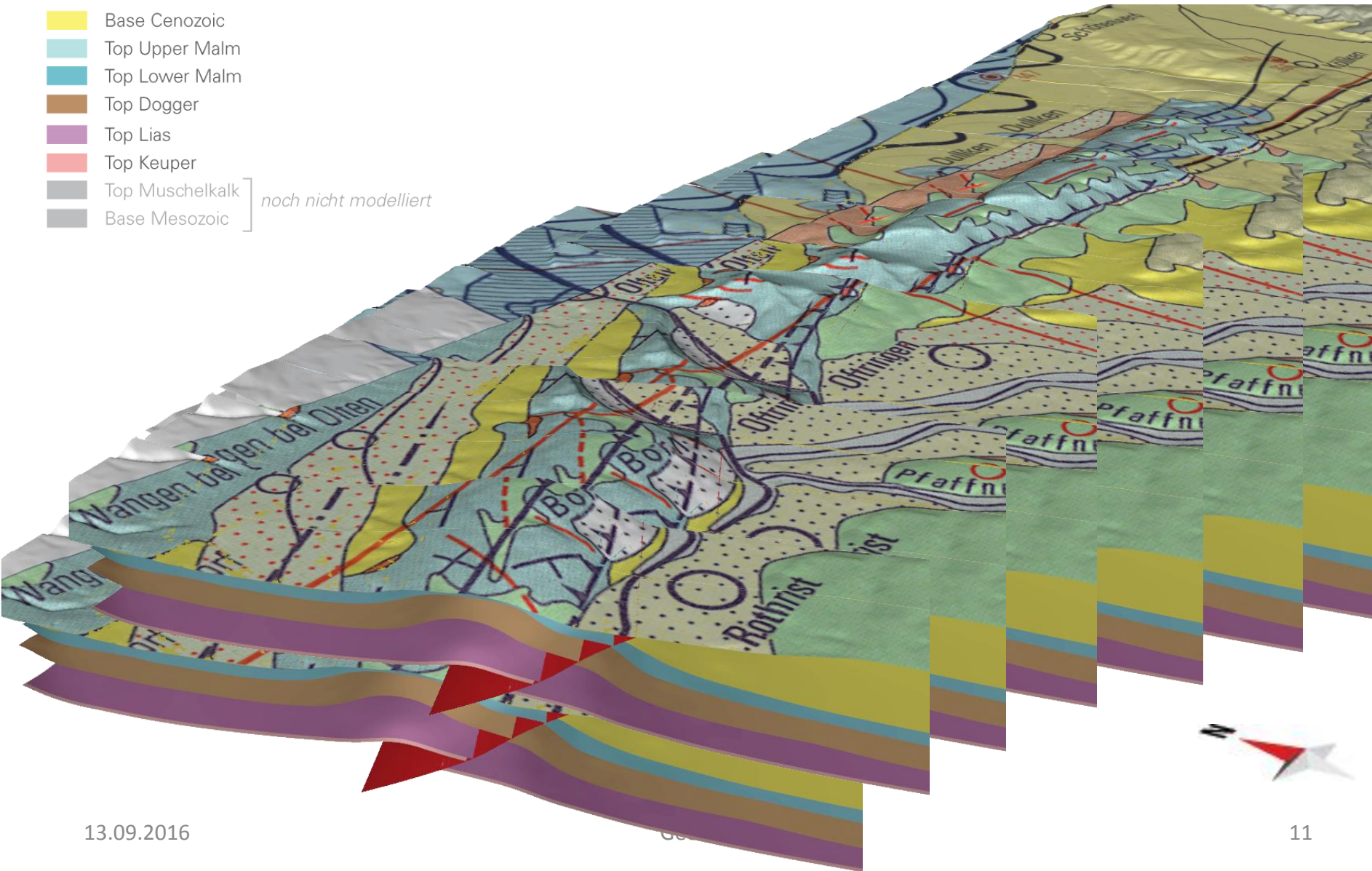
Shallow Model West - Structures

Shallow Model West
Elevation Base Cenozoic



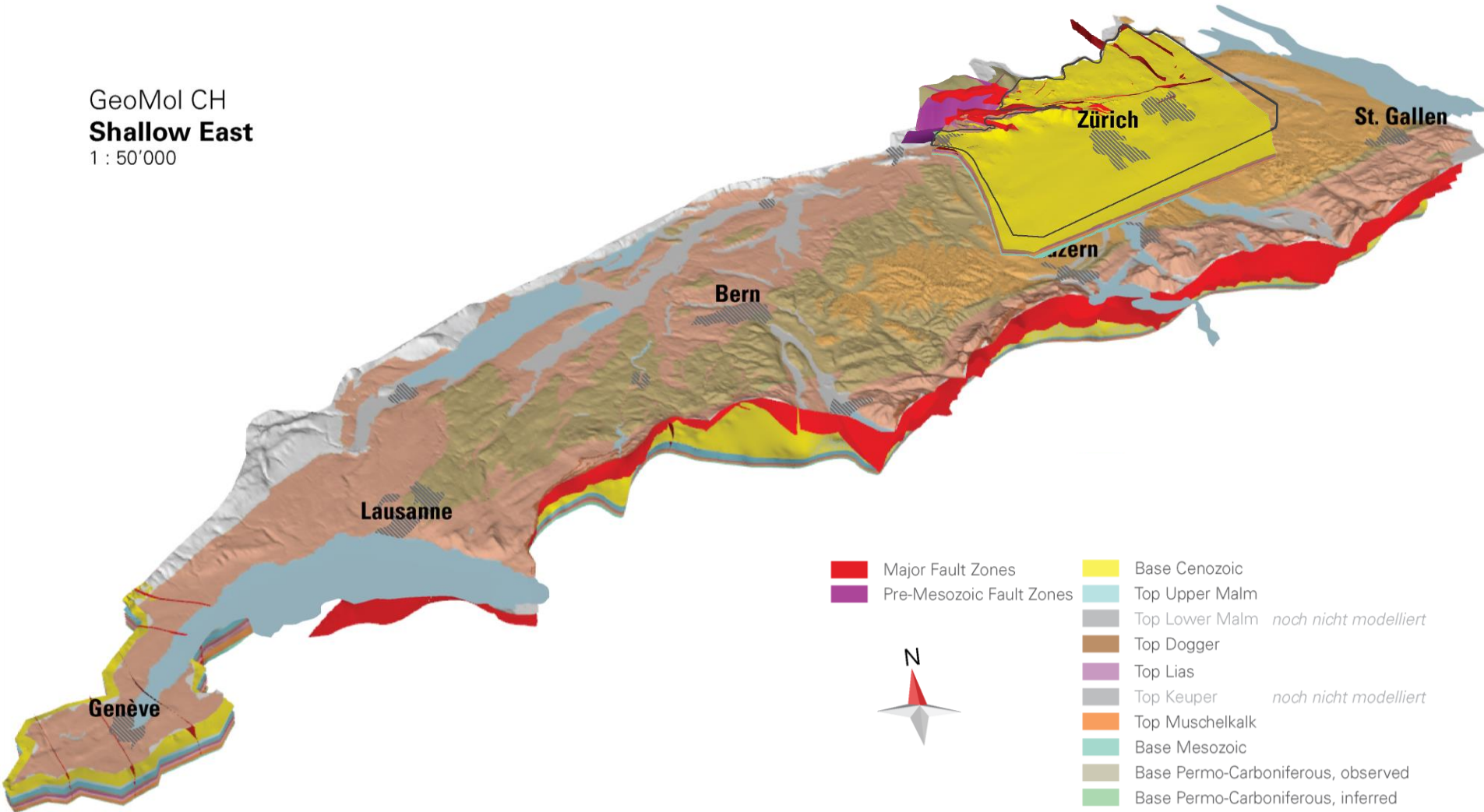
Shallow Model West - Born-Structure

-  Base Cenozoic
 -  Top Upper Malm
 -  Top Lower Malm
 -  Top Dogger
 -  Top Lias
 -  Top Keuper
 -  Top Muschelkalk
 -  Base Mesozoic
- noch nicht modelliert*



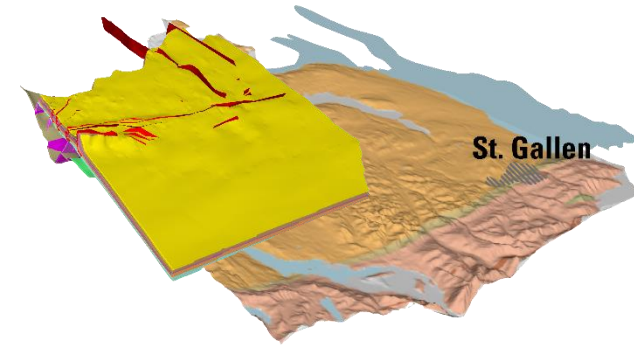
Shallow Model East

GeoMol CH
Shallow East
 1 : 50'000



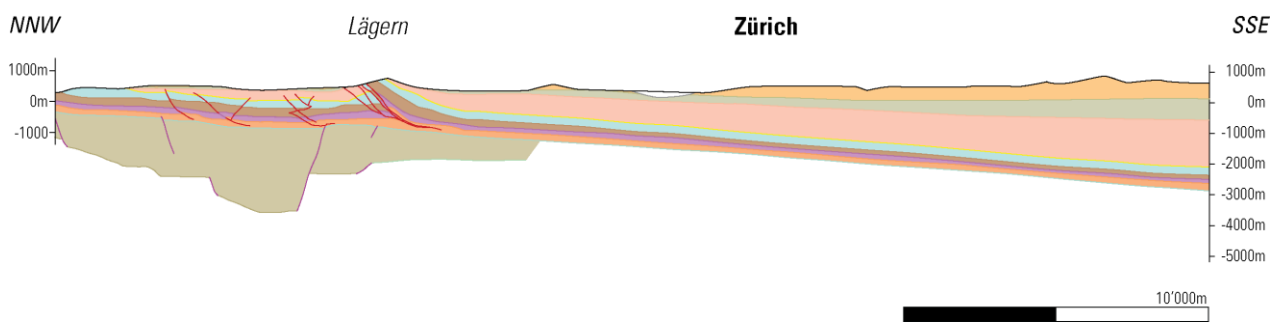
Shallow Model East

GeoMol CH
Shallow East
 1 : 50'000



Specifics Shallow Model East

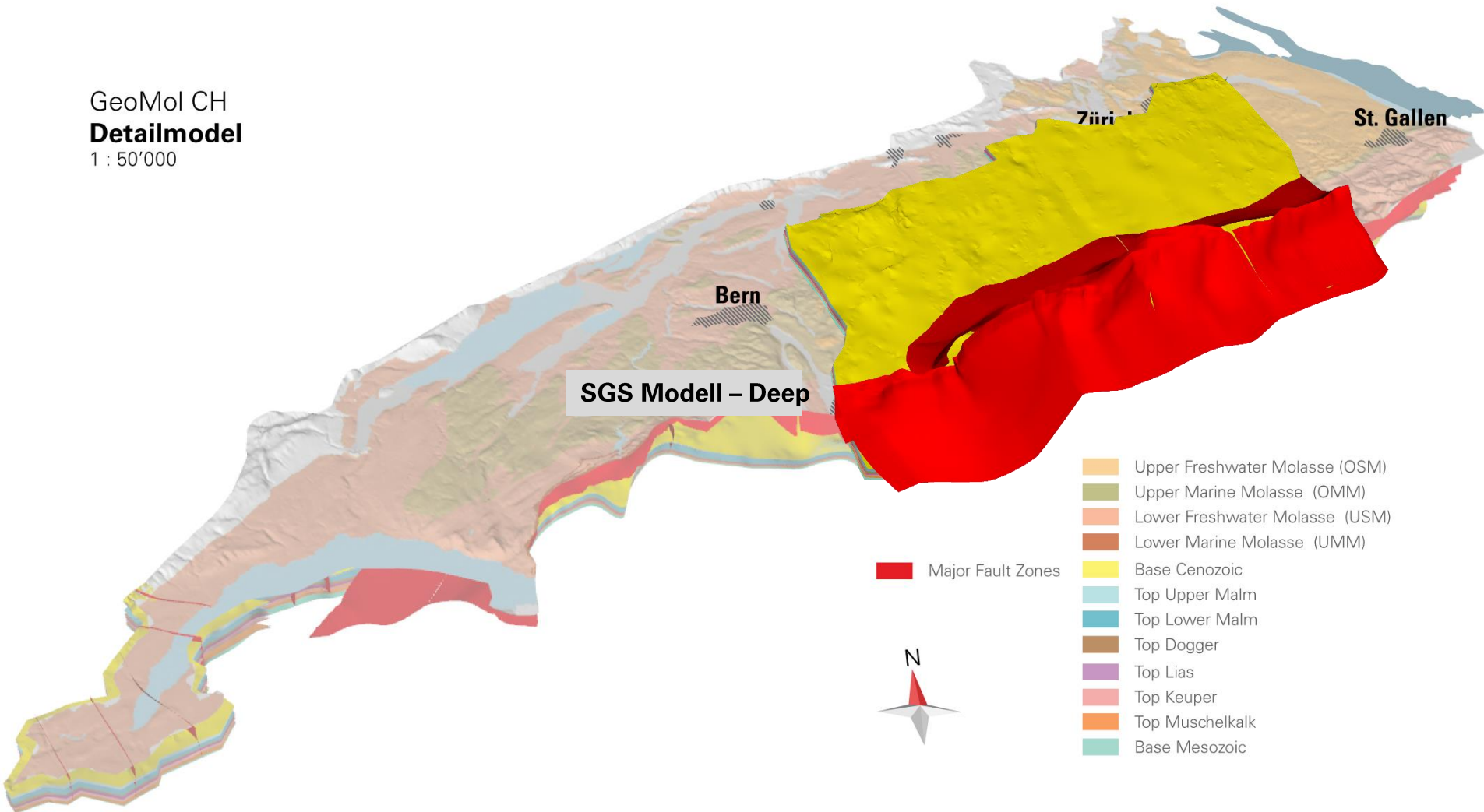
- Input data in Z
- Nagra Etappe 2 Data (depth converted 2D seismic)
- Model includes Paleozoic Troughs



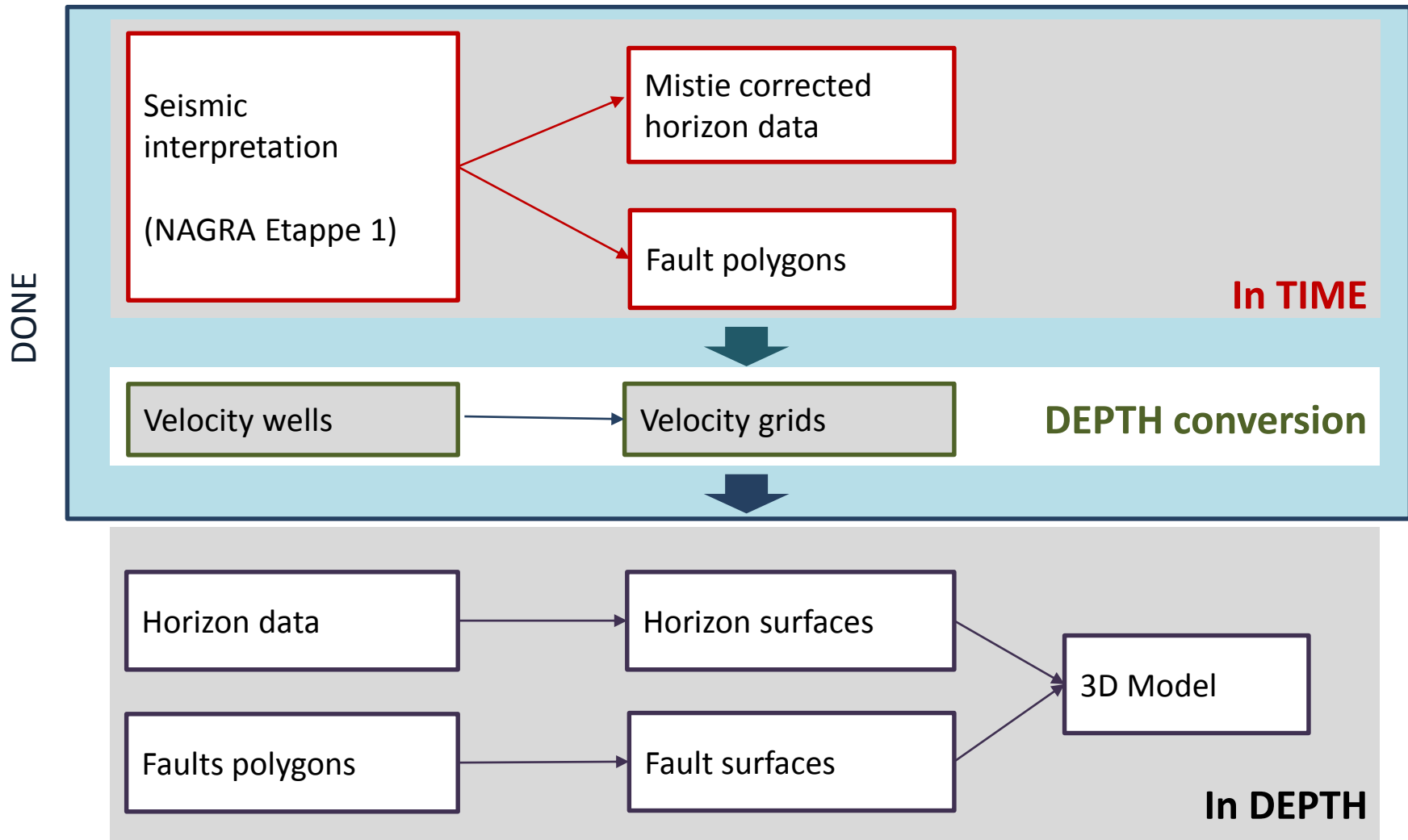
- Upper Freshwater Molasse (OSM)
- Upper Marine Molasse (OMM)
- Lower Freshwater Molasse (USM)
- Lower Marine Molasse (UMM)
- Base Cenozoic
- Top Upper Malm
- Top Lower Malm *noch nicht modelliert*
- Top Dogger
- Top Lias
- Top Keuper *noch nicht modelliert*
- Top Muschelkalk
- Base Mesozoic
- Base Permo-Carboniferous, observed
- Base Permo-Carboniferous, inferred
- Major Fault Zones
- Pre-Mesozoic Fault Zones

GeoMol CH – Deep Model

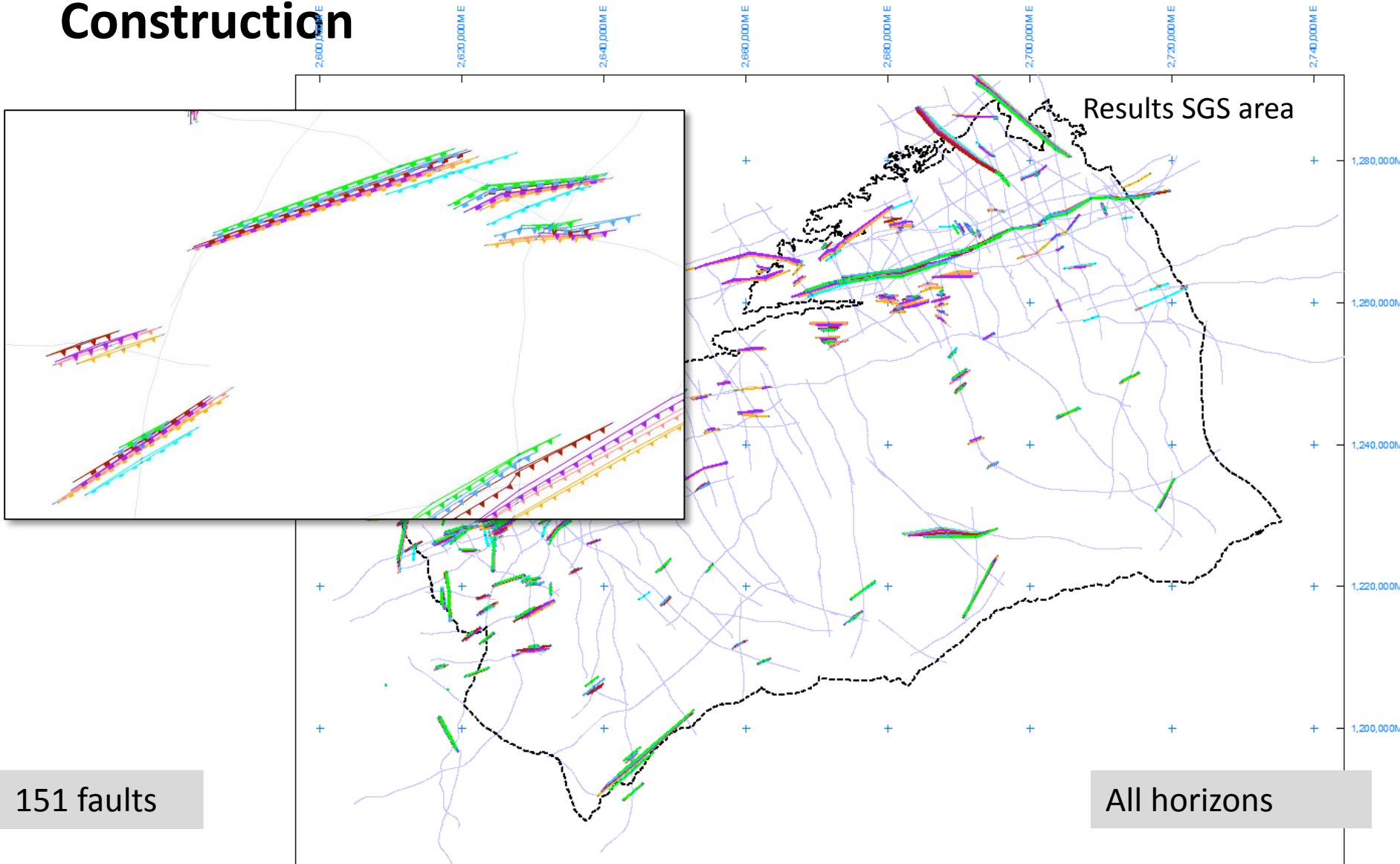
GeoMol CH
Detailmodel
 1 : 50'000



Deep Model - Workflow



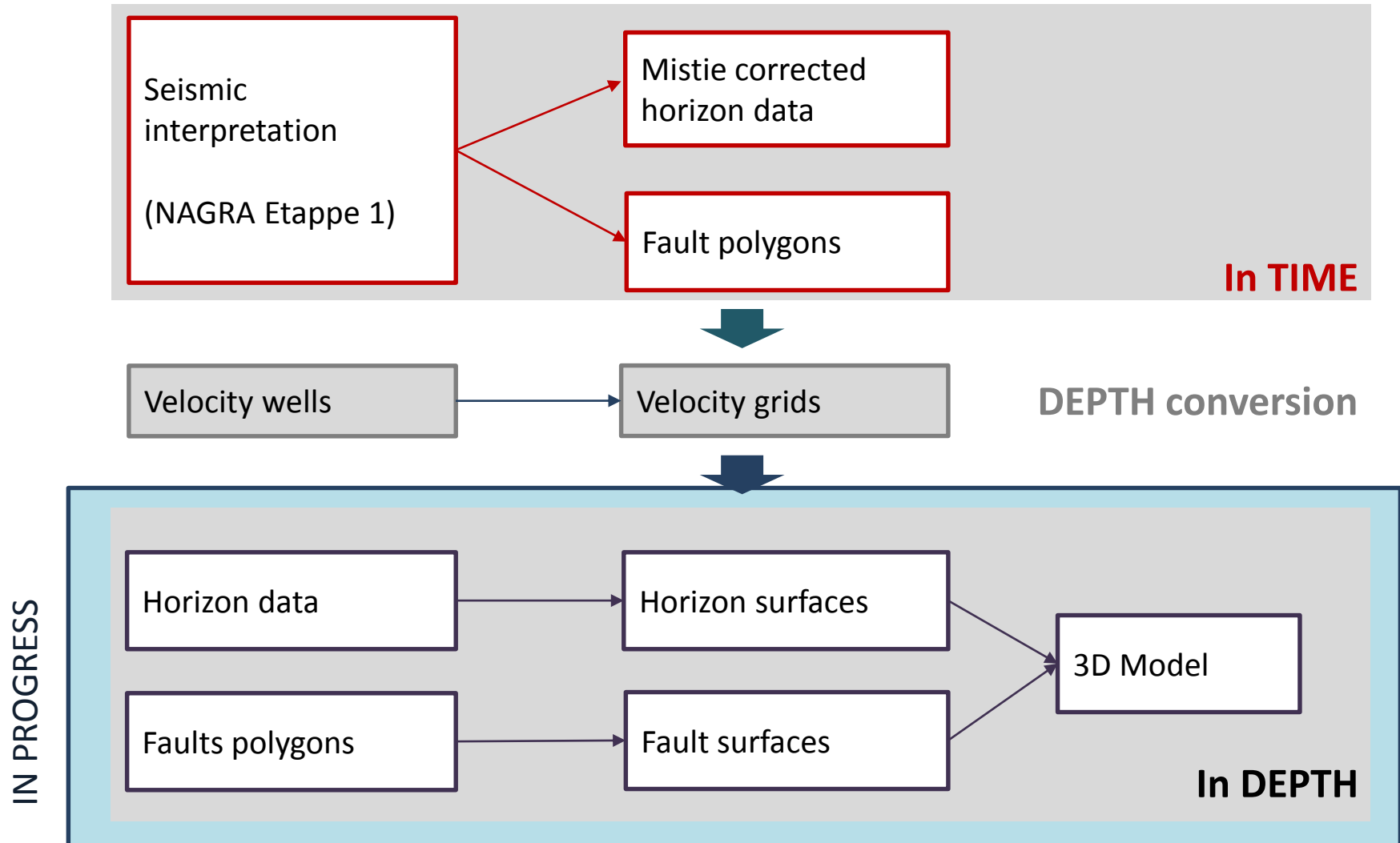
Deep Model - Fault Polygon Construction



151 faults

All horizons

Deep Model - Workflow



Short term prospects



2016

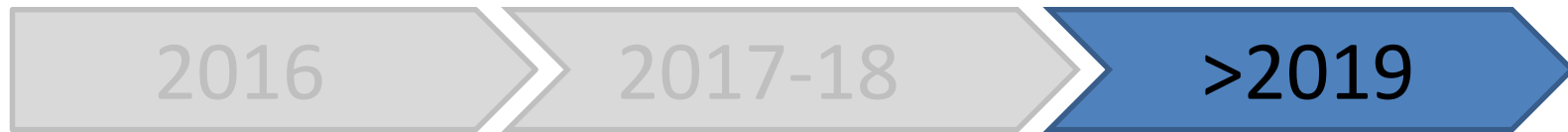
- Complete the SGS GeoMol 50k model

Mid term prospects



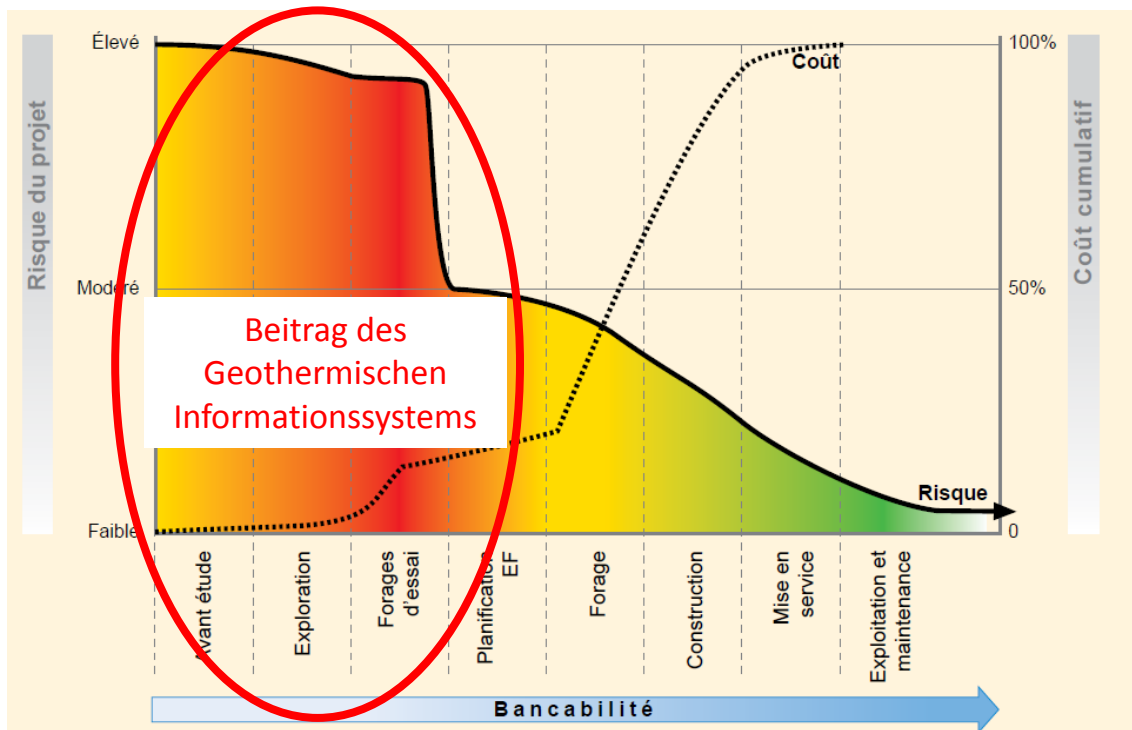
- Combine the GeoWatt temp. model with the 200k FWM
- Harmonize and combine the GeoMol 50k partner models
- Tie GeoTherm products to the 50k model
- Continue producing geological 3D models
- Continue developing workflows for geol. 3D modeling

Long term prospects



- Begin National Geological Model (NGM) which will offer online access to geological data

GeoTherm - Geothermisches Informationssystem für die Schweiz



Source : ESMAP. Guide géothermique : planification et financement de la production d'énergie. 2012.

Je besser die **Datengrundlage** ist,
umso geringer ist das **Fündigkeitsrisiko!**

Wie es dazu kam

Energiestrategie 2050



11.3563 – Motion
Tiefe Geothermie. Schweizweite geologische

Eingereicht von




Einreichungsdatum 15.06.2011
 Eingereicht im Ständerat
 Stand der Beratungen Angenommen

Die Energiestrategie 2050
 Energieversorgung soll
 erneuerbaren Energien

11.4027 – Motion
Aktionsplan für die Geothermie

Eingereicht von



Riklin Kathy

Einreichungsdatum 30.09.2011
 Eingereicht im
 Stand der Beratungen

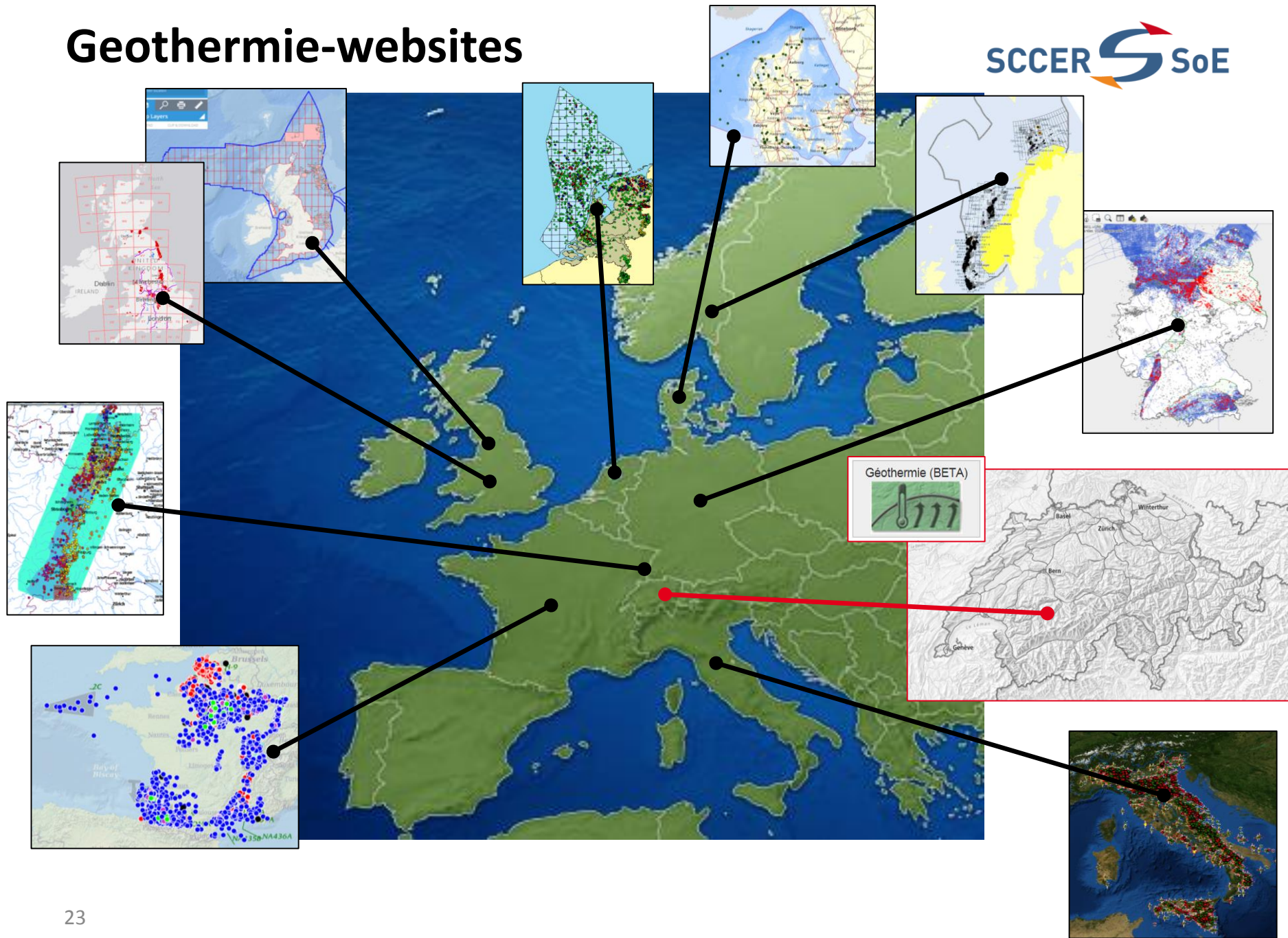


SWISS COMPETENCE CENTER for ENERGY RESEARCH
SUPPLY of ELECTRICITY

Anfallende Daten und Informationen müssen **nachhaltig gesichert** und **verfügbar gemacht** werden.

→ Gespräche zwischen BFE und swisstopo im Mai 2014 mit Beschluss zur Realisierung eines geothermischen Informationssystems Schweiz.

Geothermie-websites



Warum ein geothermisches Informationssystem für die Schweiz?



BFE, Geoenergie Schweiz
und swisstopo

Zahlreiche unstrukturierte Daten



Harmonisierung

strukturierte Daten

Web-Publikation



Géothermie (BETA)



GeoTherm

Abgrenzung des Projektes GeoTherm



- Rohdaten und interpretierte Daten: Tiefe Geothermie, hydrothermal und petrothermal
- Sammeln, Harmonisieren, Verfügbar machen
- Zielgruppe: Fachspezialisten aus Privatwirtschaft, Hochschulen, Administration



- Untiefe Geothermie, Erdwärmesonden
- Daten selber interpretieren
- Allgemeine Infos zu Geothermie, PR, Interessenvertretung

Projektorganisation

Lise Boulicault
Projektleiterin GeoTherm



Maité Faubert
Hochschulpraktikantin



Christian Minnig
Koordinator Georessourcen

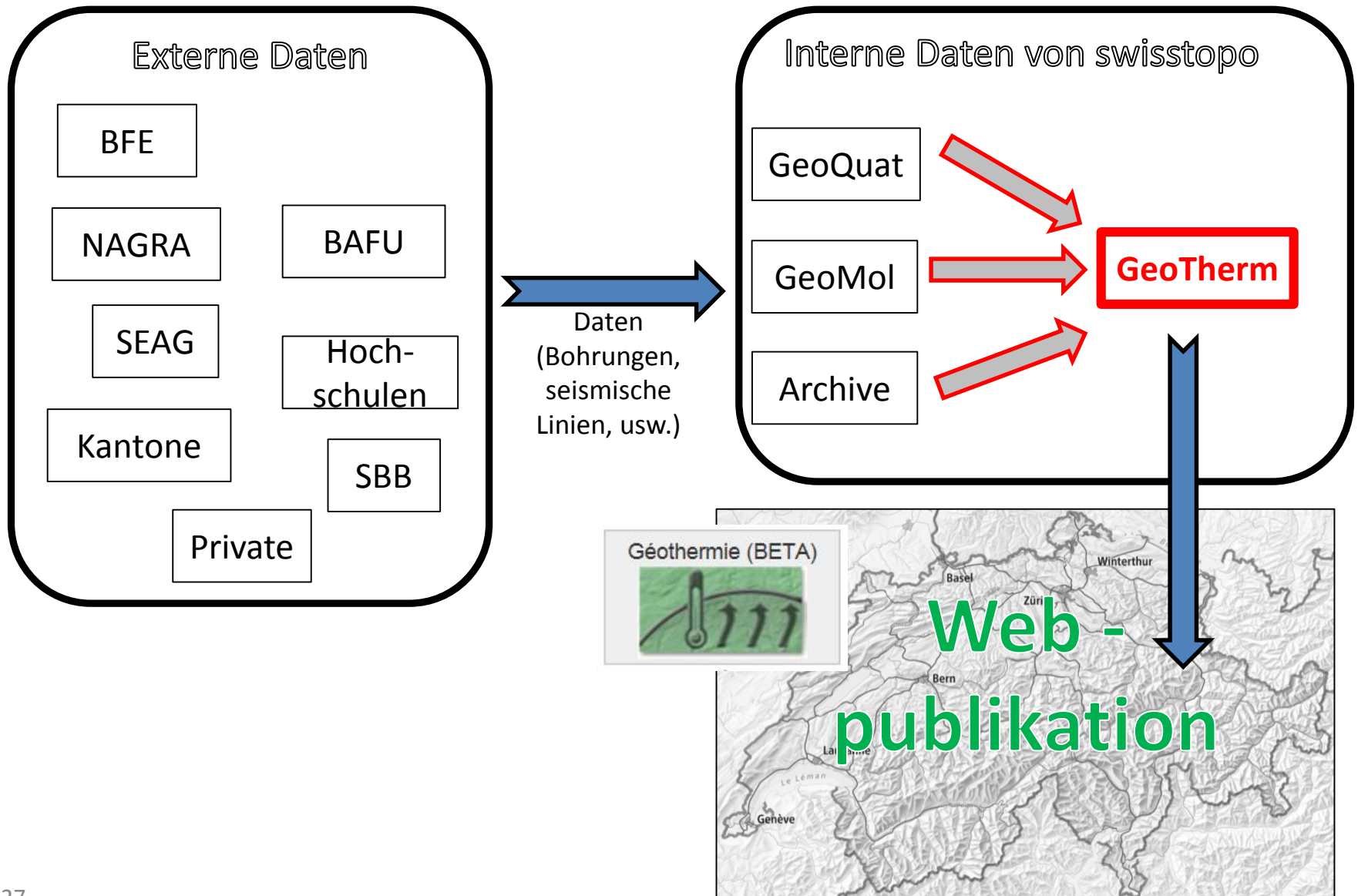


Nils Oesterling
Koordinator Dateninfrastruktur



Ladina Glaus
Geodata Manager SCCER-SoE/ETHZ

Datenbeschaffung / Zusammenarbeit



neu «Thema Geothermie»






The screenshot shows the map.geo.admin.ch interface. In the top left, the Swiss Confederation logo and name are displayed. A search bar at the top center contains the text "z.B. Bundesplatz 1 Bern, 46.7 7.5, Lärmkarte ...". The left sidebar contains a menu with the following items: Share, Drucken, Zeichnen & Messen auf der Karte, Erweiterte Werkzeuge, **Geothermie (BETA) Thema wechseln** (highlighted with a red box), Geothermie Potentiale / Modelle, Oberflächengeologie, Geometrie des Untergrundes, Grundlagen Geologie / Geophysik, Nutzungskonflikte, Raumplanung, Hintergrunddaten, and Dargestellte Karten. At the bottom of the sidebar is a "Menü schliessen" button. The main map area shows a topographic map of a region including Winterthur and the Bodensee. A grid of map layers is overlaid on the map, with the "Geothermie (BETA)" layer highlighted by a red box. The grid includes layers from various cantons (BLW, ARE, BAFU, swisstopo) and other themes like KGS Inventar 2009, Funksender, Breitbandatlas, Hist. Verkehrswege, Sachpläne, Geologie, Luftbilder, Wildruhezonen, Verkehrsunfälle, Luftfahrt, Verteidigung, Wasser, Geothermie (BETA), Schneesport, Energie, Grundstückinformation, INSPIRE, and Geokatalog.

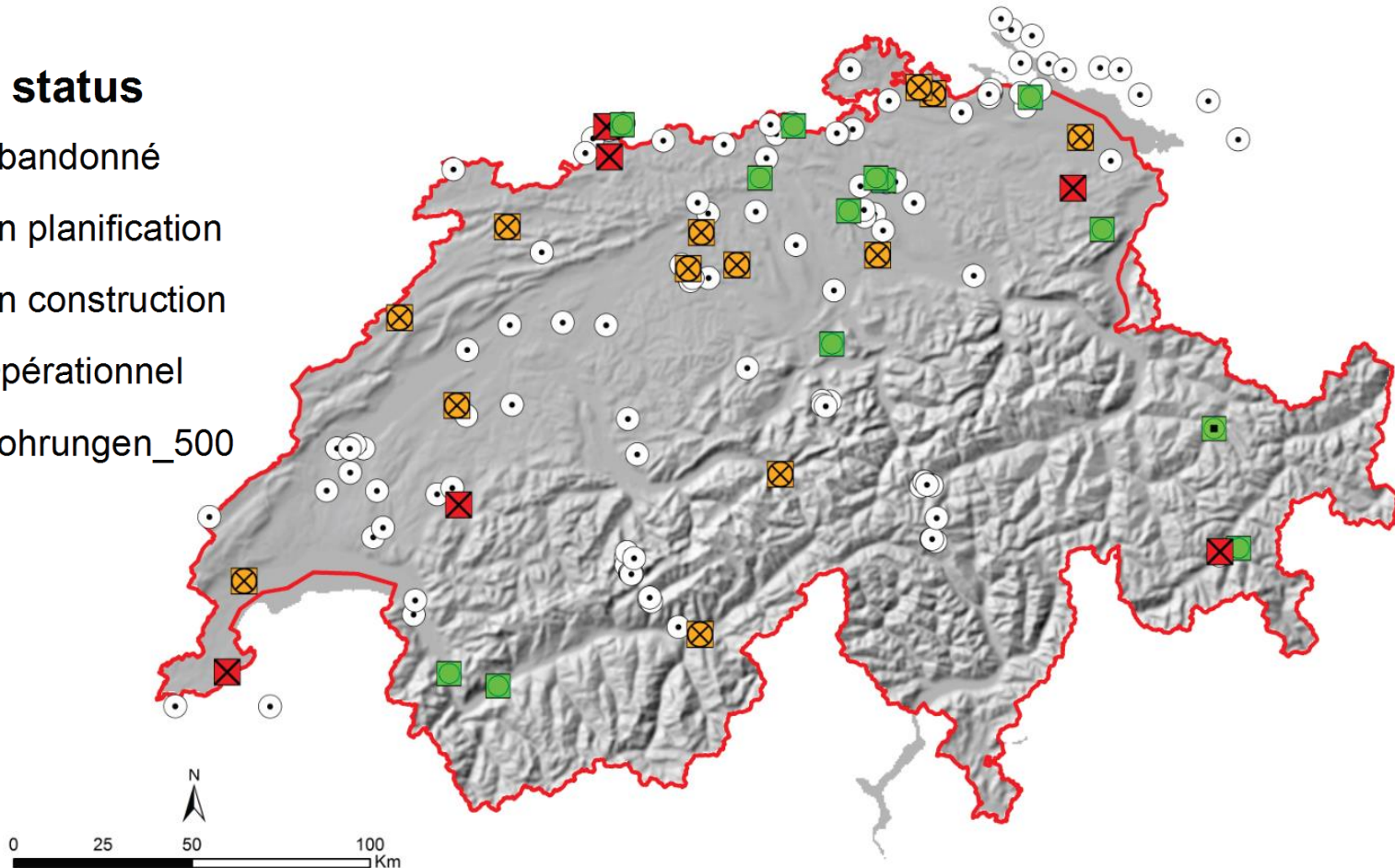
Geothermal projects in Switzerland

Wells >500m deep with associated documents

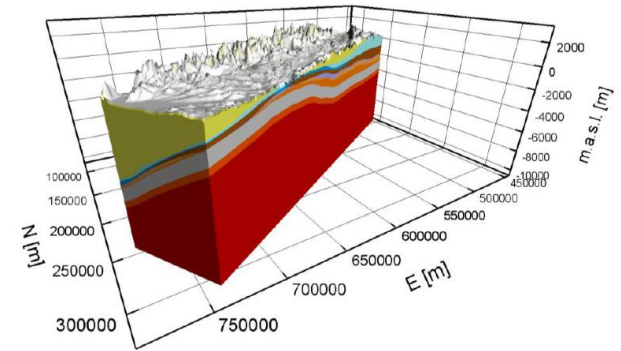
map.geo.admin.ch

Project status

-  Abandonné
-  En planification
-  En construction
-  Opérationnel
-  Bohrungen_500



Planung und Produkte



2016 (1D):

- Zugang zur DB Bohrungen
- Integration GeoWatt Modell in GeoMol (1:200'000) und Verlinkung mit GeoTherm
- Integration der Temperatur-Messdaten von Schärli und Kohl (SGPK 2002) in GeoTherm
- Publikation 2 neue Layer (tiefe Bohrungen und Projekte) in map.geo.admin.ch

2017 (2D):

- Kartenviewer mit Zugang zu den restlichen Daten (Seismik und andere geophysikalische Messungen, Berichte, Kartierungen)
- Kartenviewer mit Temperaturangaben pro Tiefe (m)
- Kartenviewer mit Temperaturangaben an ausgewählten Flächen (Lias, Dogger, usw.)

2018 (3D):

- Zugang zu GeoMol+ (1:200'000 und 1:50'000) mit Integration von externen Daten
- Virtuellen Bohrungen und Messungen sind aus dem Modell extrahierbar
- Simulationen von Temperatur, Wärmefluss usw.

Poster

From Data Acquisition to Risk Reduction: Insights from GeoTherm, the first Deep Geothermal Federal Database

L. Boulicault, C. Minnig*, N. Oesterling*, M. Faubert*, L. Glaus**, R. Baumberger**

** Federal Office of Topography swisstopo, Swiss Geological Survey, Seftigenstrasse 264, CH-3084 Wabern*

*** SCCER-SoE, ETH Zürich, Sonneggstrasse 5, 8092 Zürich*



SYMPOSIUM

05.10.2016

GURTEN / BERNE

**MATIÈRES
— PREMIÈRES
— MALÉDICTION
OU BÉNÉDICTION?**

*A PROPOS DE LA GESTION
DES MATIÈRES PREMIÈRES
MINÉRALES EN SUISSE*