Schweizerische Eidgenossenschaft
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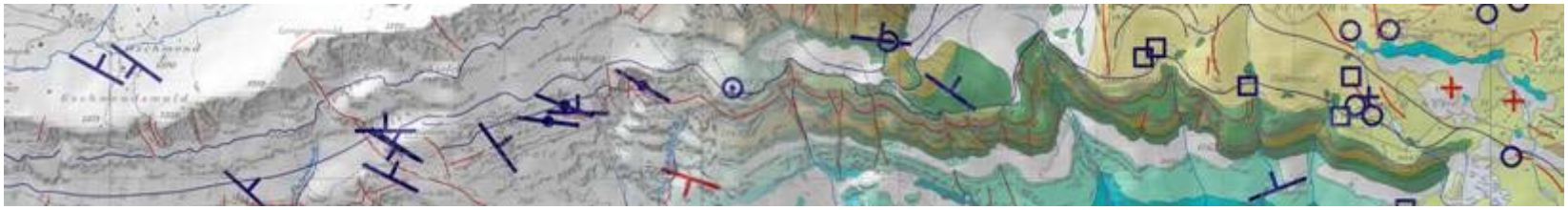
Federal Office of Topography swisstopo
Swiss Geological Survey



Technical challenges for geological surveys in model building and validation

Swiss Geoscience Meeting 2009

2009/11/21 - Roland Baumberger & Nils Oesterling

3D modelling at Swiss Geological Survey
Aims

1. To elaborate principles, knowledge and know-how in the domain of geological 3D modelling
2. To offer valid, geologically consistent and area-wide (national, regional, local) 3D models in different scales and resolutions
3. To establish a know-how transfer between economy, administration, research and the Swiss Geological Survey
4. To integrate geological 3D models into applications and/or products of swisstopo or external partners
5. To develop and of new products and services based on the geological 3D models

→ To ease the communication on geology (especially with interested laymen)

→ To encourage the understanding of geology in the broad public

3D modelling at Swiss Geological Survey
Setting the focus

The Swiss federal law on geoinformation

- Geoinformationsgesetz (§27)
- Landesgeologieverordnung (§5 and §10)

→ *No authority for the SGS to other institutions*

Special position of the SGS

- Editor's office for geological maps → no mapping/sampling campaigns
- Public institution → in the eyes of the public

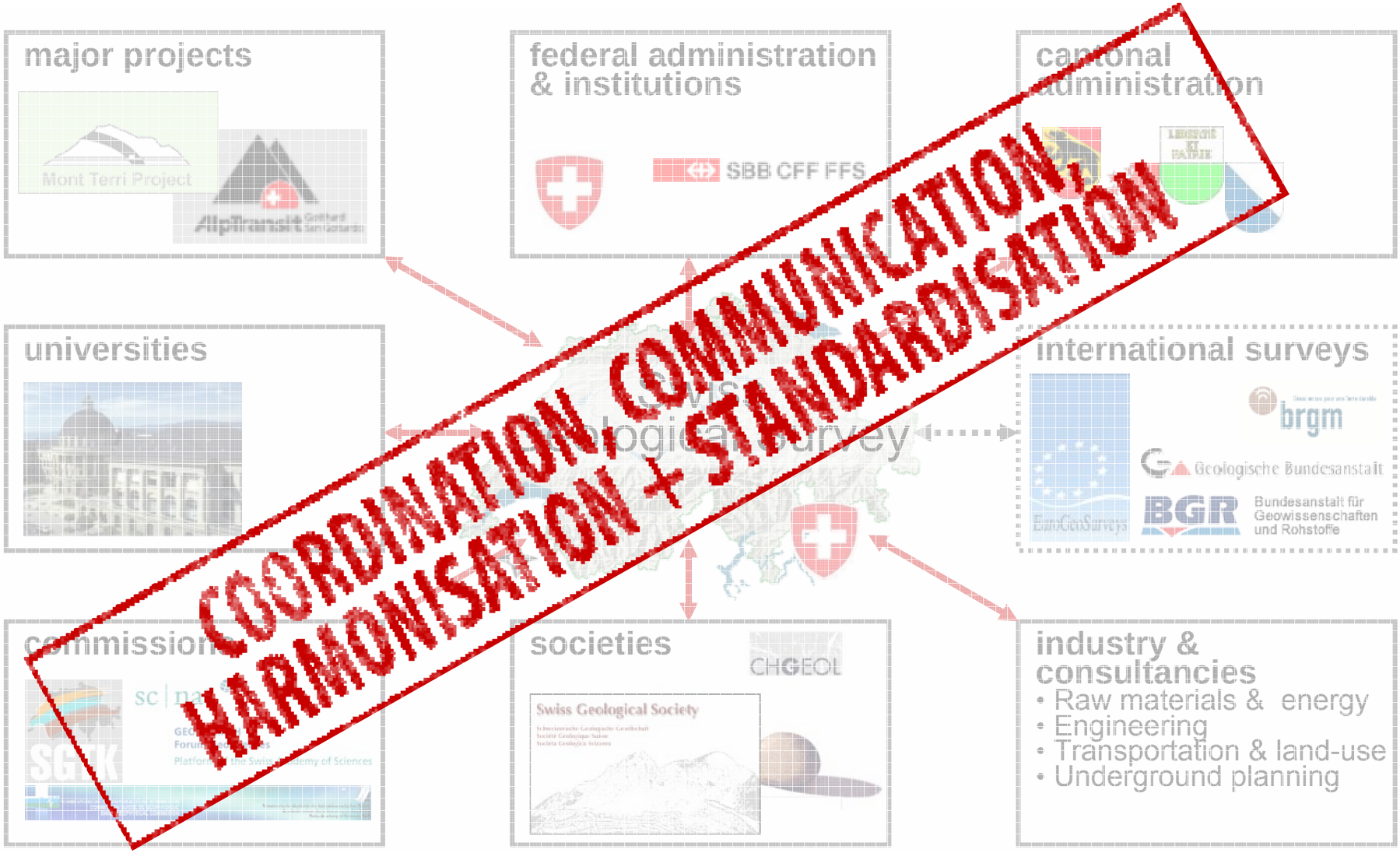
→ *No own data*

→ *Special requirements concerning quality of 3D models*

Consequences

5 major challenges for geological 3D modelling

Challenge 1
Heterogeneous geo-community



Challenge 2
Model building

Data acquisition – no common data source

- Data sources are widely distributed
- Their existence is sometimes uncertain/sparsely known

→ Identification of data owners and data producers

Data preparation – no standards defined

- Data quality depends on the producer and shows big differences

→ Assessment of the data (quality, age and reliability) is mandatory

Data storage – no common understanding

- Technical backgrounds and approaches are varying
- Different concepts of data management and 3D modelling

→ Standardisation is needed (data management, interoperability)

Challenge 3
Model validation

@ SGS, most of the data originate from third parties

Input data reliability

- Which data (sub-)set is the most reliable? Purpose of usage?

→ Definition of data assessment criteria

Geological consistency, accuracy & QC

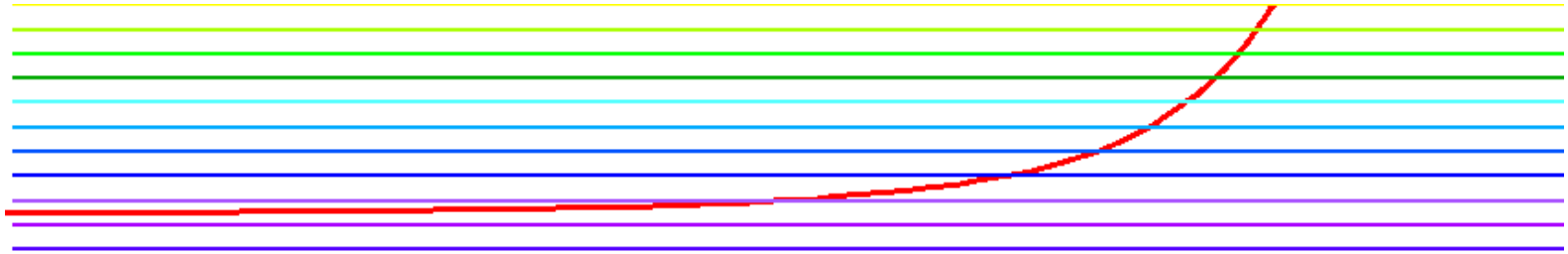
- How to achieve consistent & accurate geological 3D models?
- How to achieve high quality from potential uncertain data?
- 3D models vs. traditional mapping – corelations?

→ Definition of detailed workflows and checklists

→ Definition of criteria concerning quality management and quality control

Challenge 3
Example

Initial position: layer cake before “move on fault” event



Some schematic examples

2D	retro- and prograde restoration
	sedimentation simulation/analysis
3D	restoration 0° shear angle
	restoration 45° shear angle

Challenge 4
Version management

Data history

- What data has been used?
- Which version has been used?
- Who was the author?
- Who was the publisher?

→ Introduction of a detailed version management

Challenge 5
Special requirements

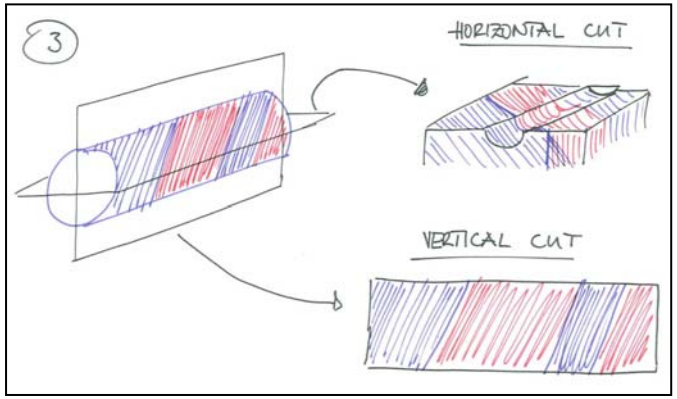
Professional interfaces

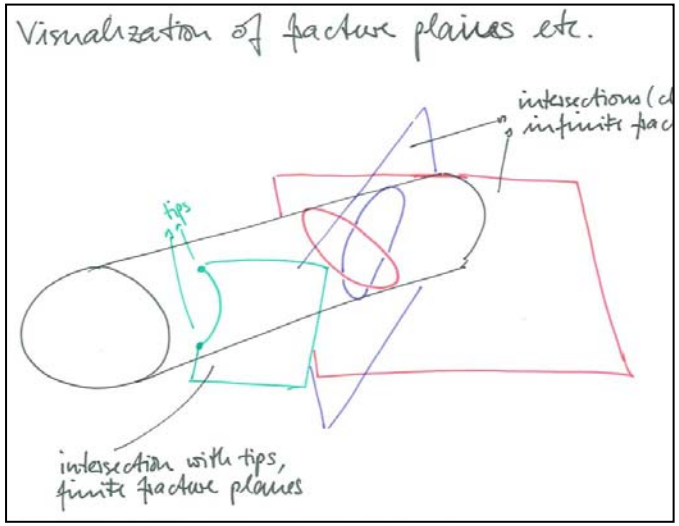
→ increasing level of complexity

→ high level of detail

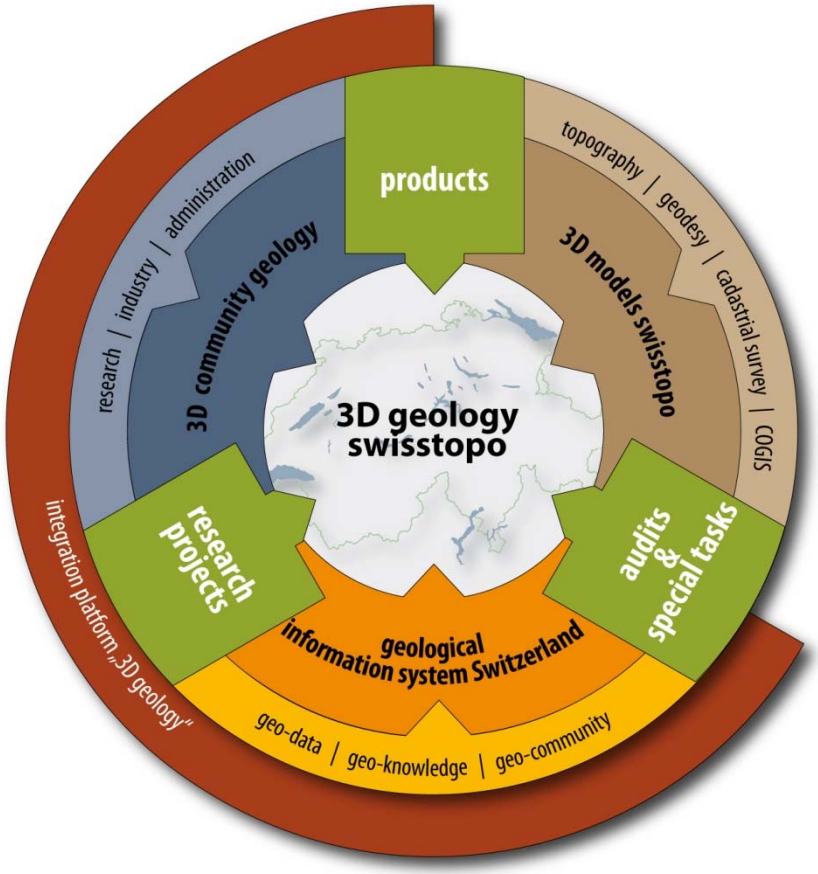
Application

- Mont Terri rock laboratory
- Sectoral plan deep geol. repositories
- Spatial planning
- Infrastructural planning
- Resources and raw materials
- Foundation analysis
- Management of natural hazard
- etc.





Managing the challenges (1)
External cooperation



→ Cooperation with Swiss geo-community

→ Establishing a 3D Community Switzerland

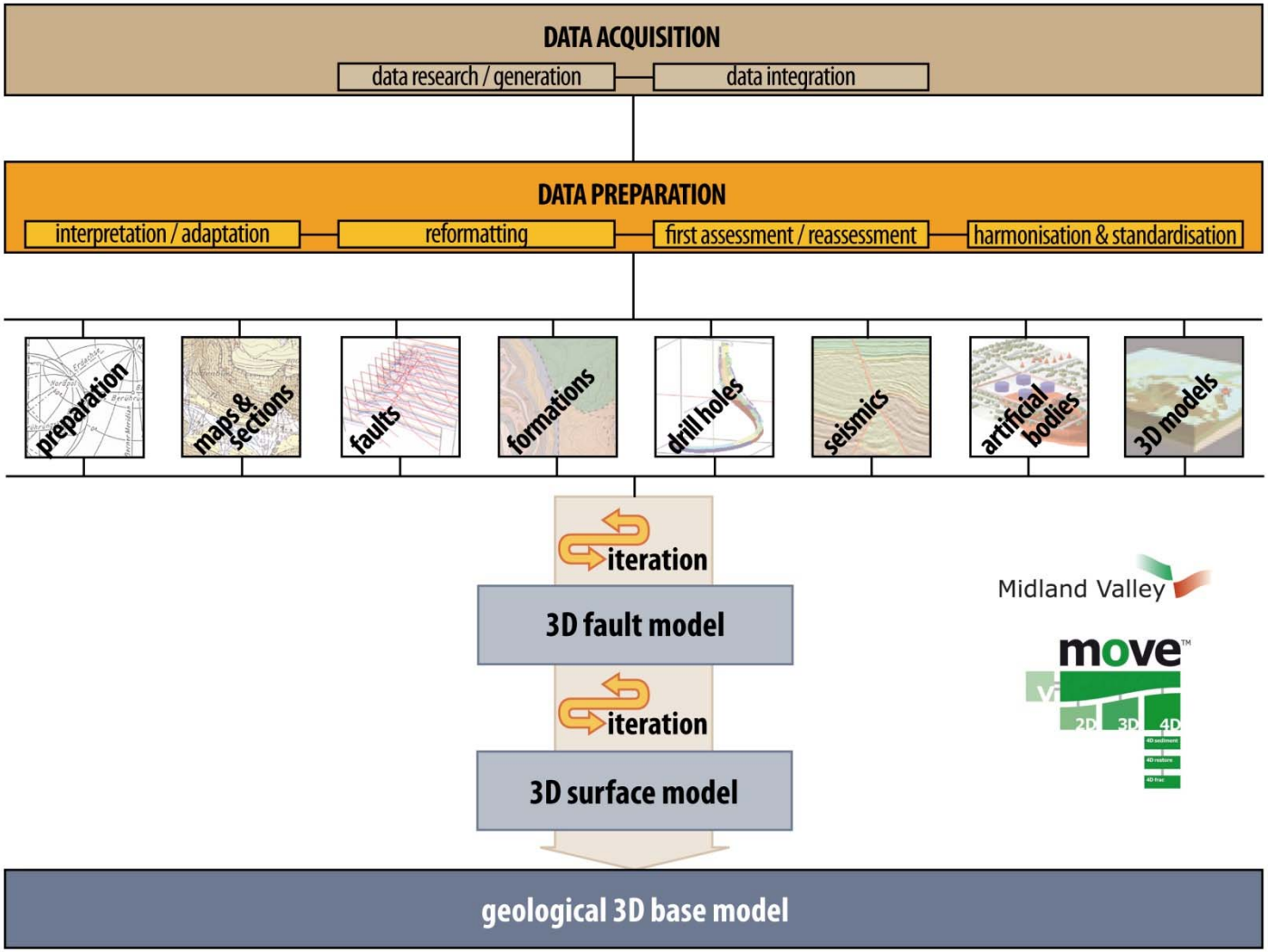
→ Integration to 3D models developed by swisstopo

→ Focus on three domains
- research projects
- audits & special task
- products

→ Integration of existing 3D models of third parties

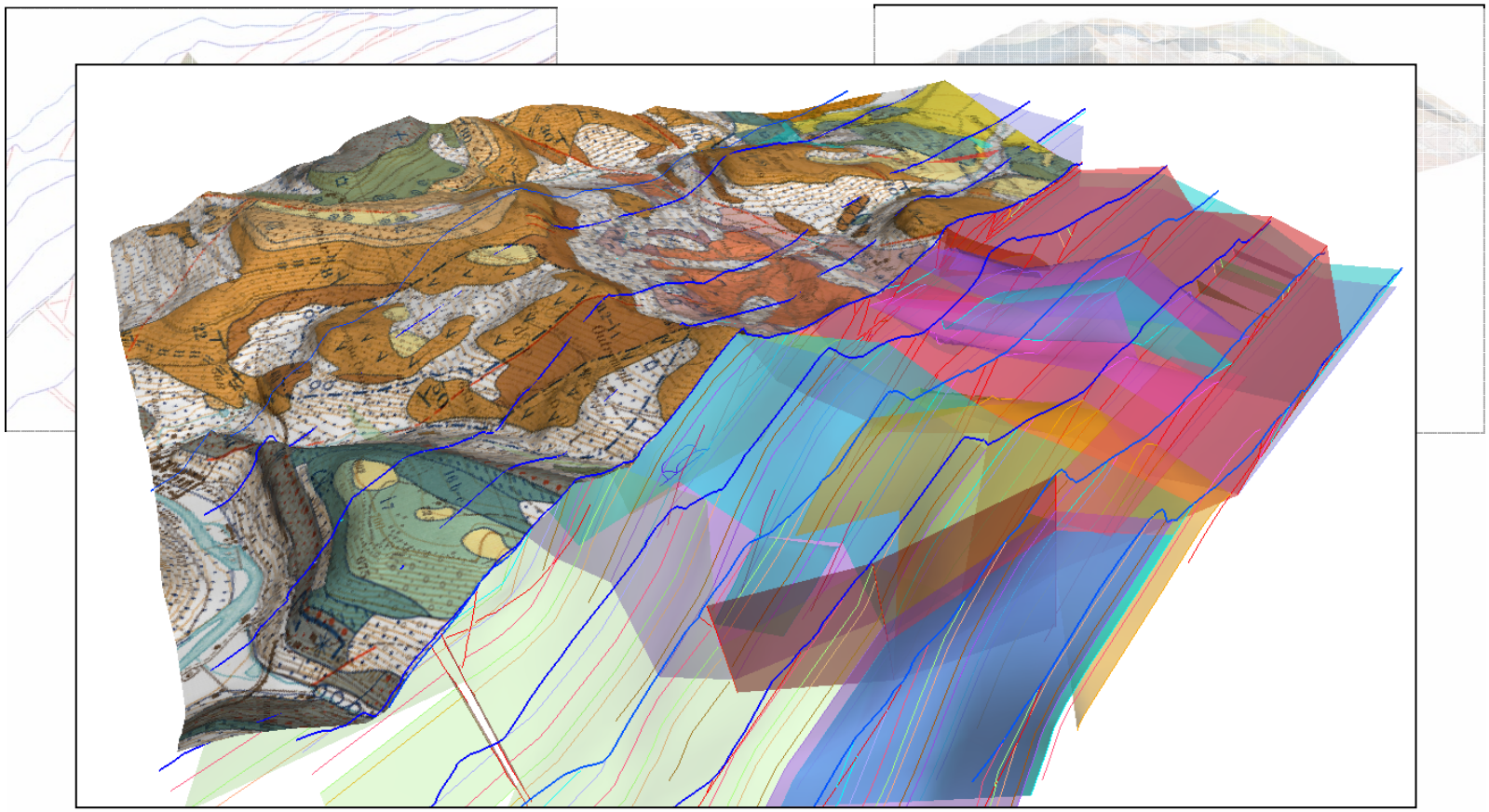
→ **Based on a conceptual data model**

Managing the challenges (2)
Generic workflow



based on Elfers et. al. (2004)

Managing the challenges (3c)
The geological 3D base model



Basics

- (Poly-)lines, polygones & surfaces (TIN, multi-z as well<)

Questions & answers

Thank you for your attention.

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