# The European HIKE fault database: Challenges across borders and for 3D application

Esther Hintersberger, Geosphere Austria

# HIKE – Hazards and Impacts Knowledge for Europe / fault data base

## Goal:

An European-wide fault data base to provide easy access to fault information for various stakeholders

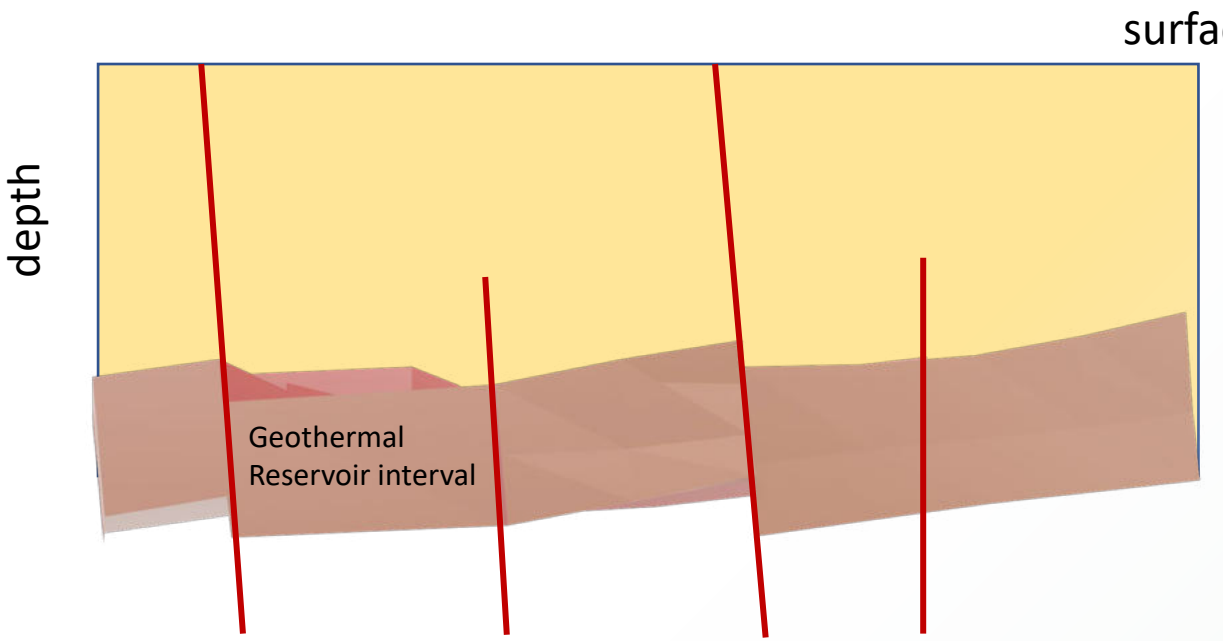
## Challenges:

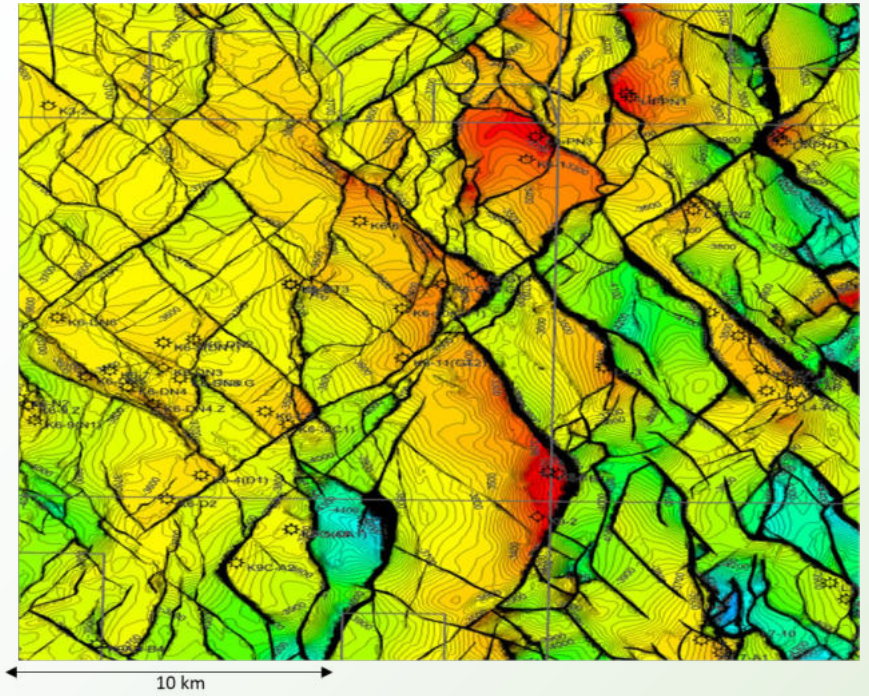
- Input is focused on different topics (e.g. Austria – fault deformation, NL – 3D fault geometry)
- Highly variable input from different countries
- Highly variable information per fault
- Need for common agreement on minimum specifications

Partners from HIKE and supporting projects: (Geoconnect3d, HotLime, 3DGeoEU)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166

# Challenges describing subsurface faults



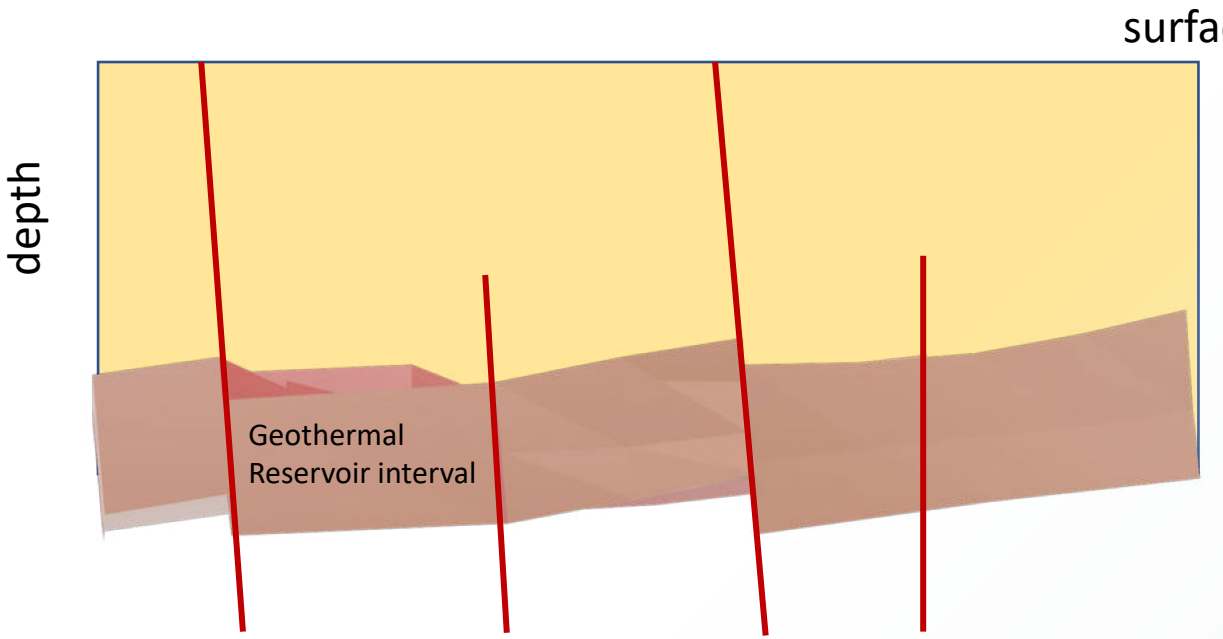




Example of a dense fault network at a 3-4 km deep reservoir level

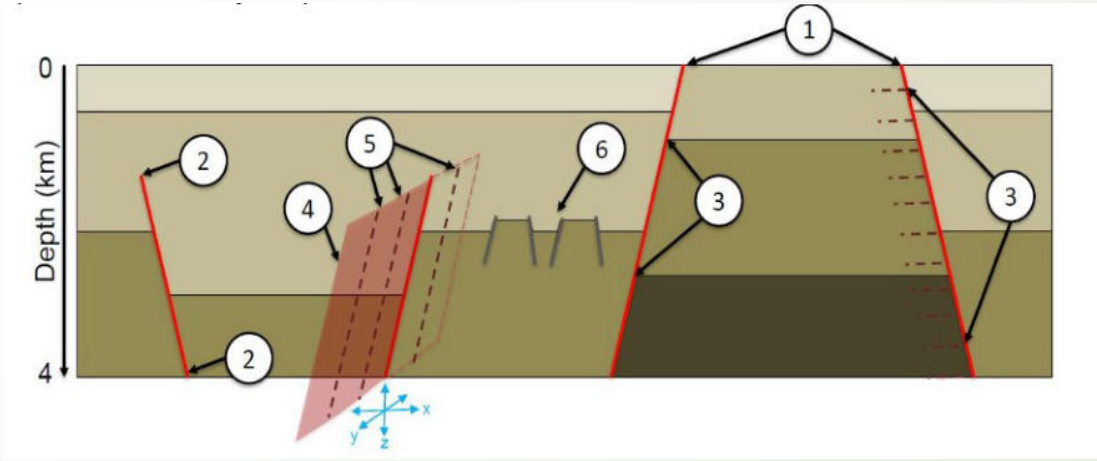
Fault geometries and intersections at surface level and deep layers

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# Challenges describing subsurface faults



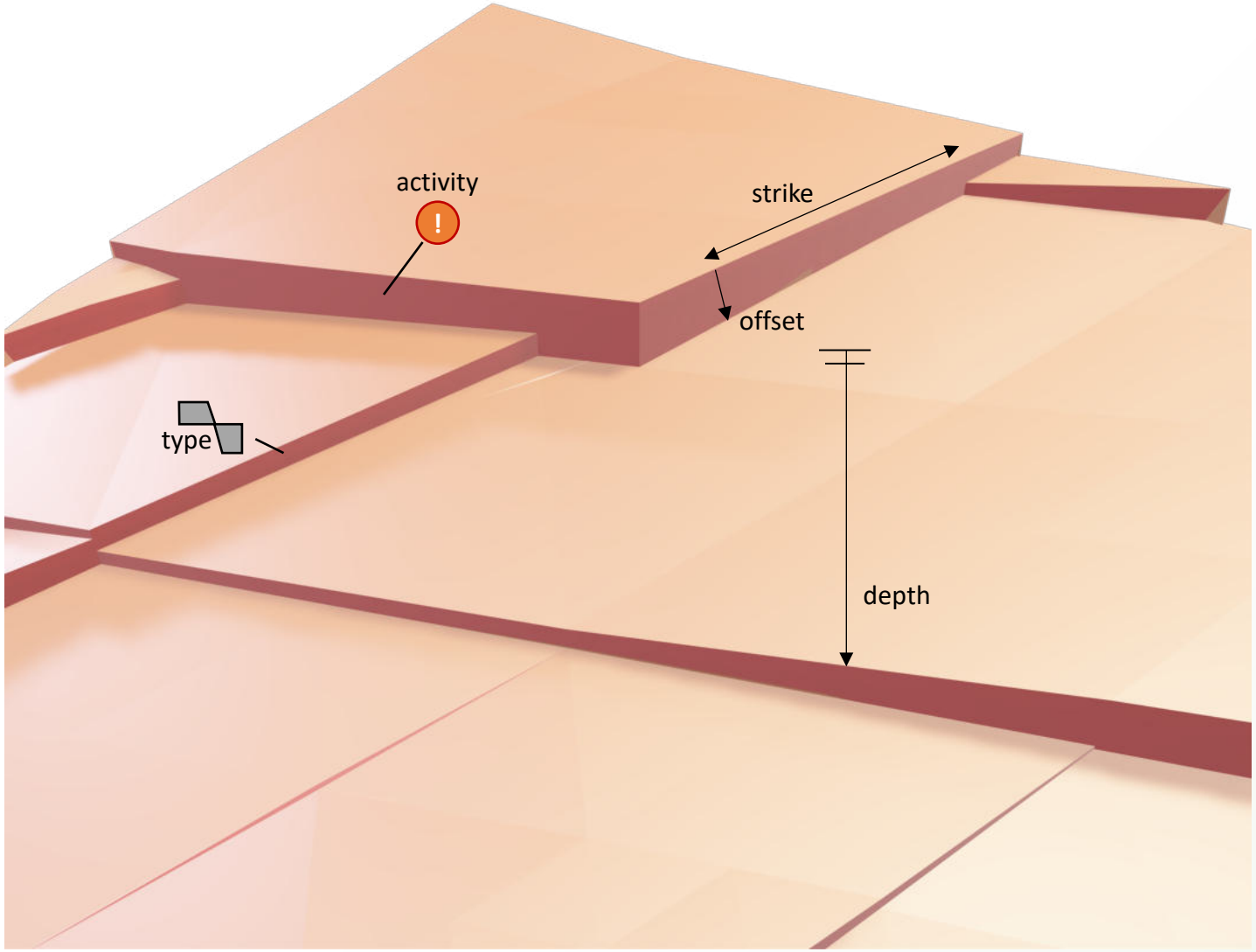

- Which fault geometry?
- Which reference horizon?




Fault geometries and intersections at surface level and deep layers

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# Challenges

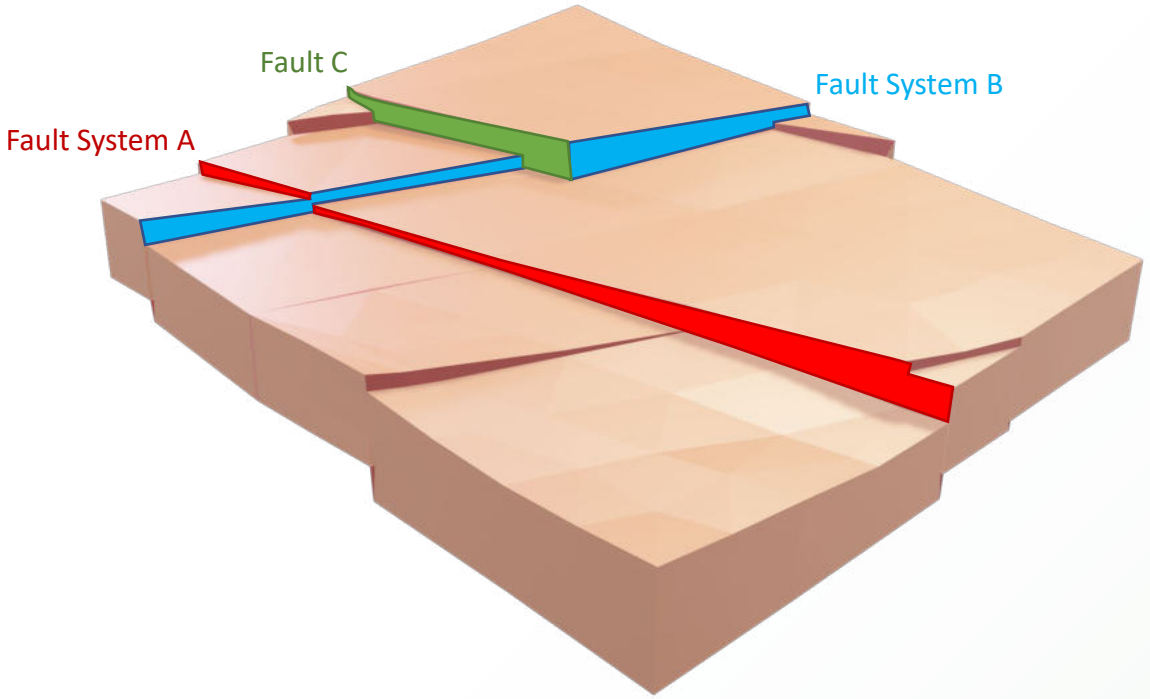



- Which fault geometry?
- Which reference horizon?
- Which parameters describe a fault? Which are mandatory?

comprehensive set of fault parameters and characteristics

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# Challenges

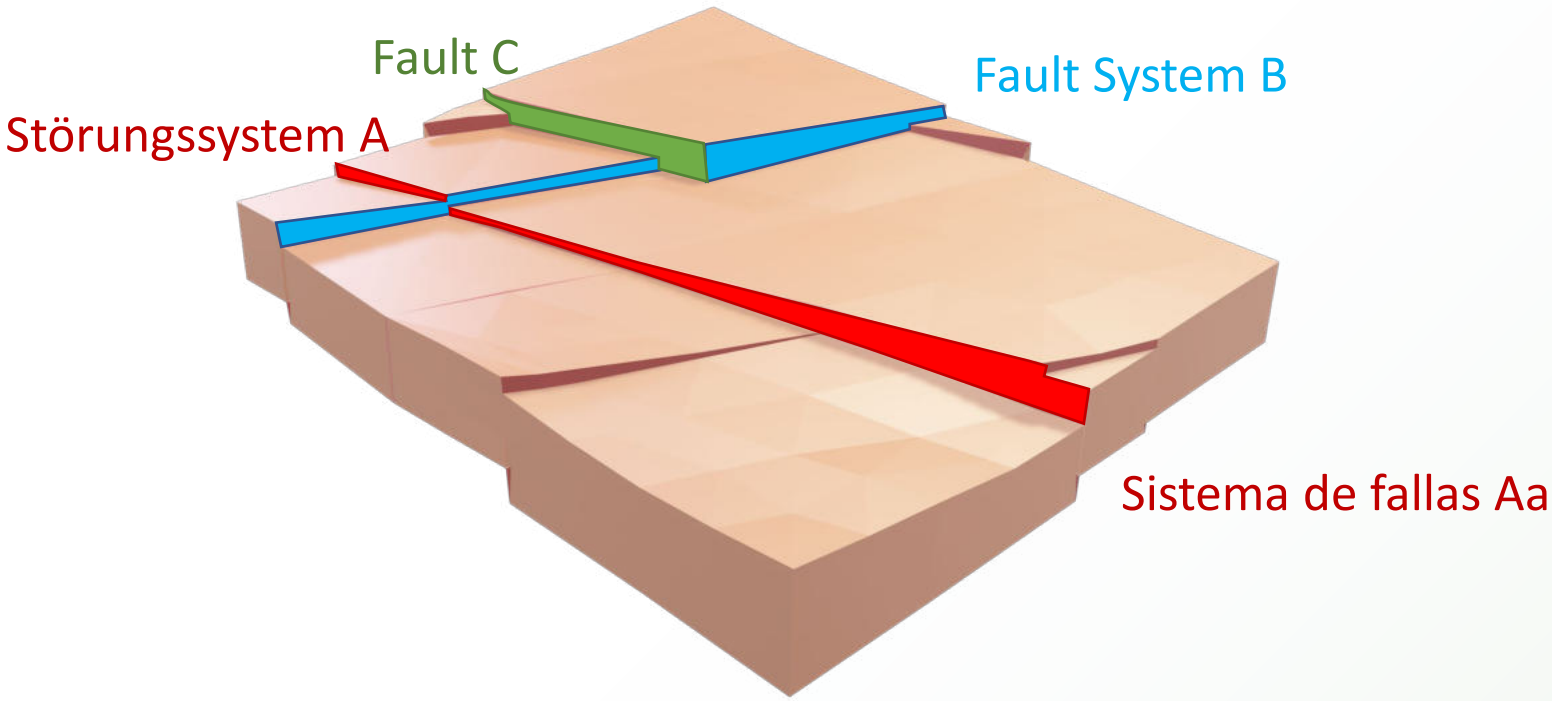



- Which fault geometry?
- Which reference horizon?
- Which parameters describe a fault? Which are mandatory?
- How to describe the kinematic relationship between faults?
- Can we group similar faults?

Fault classification, names, dependencies and correlation

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# Challenges

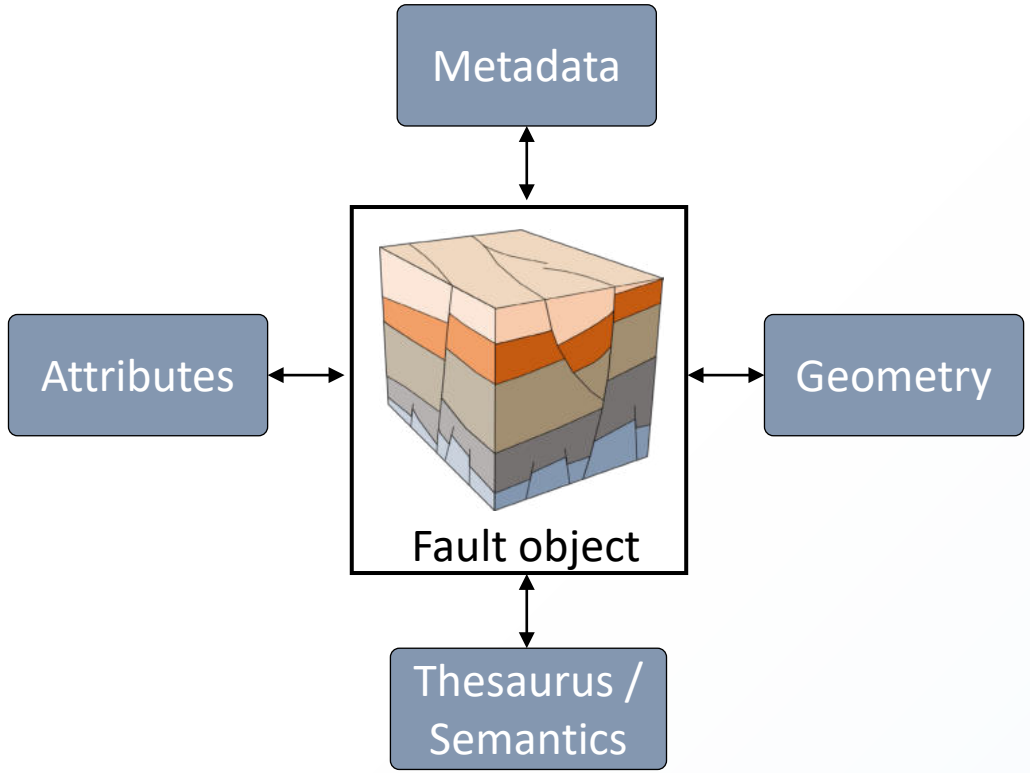


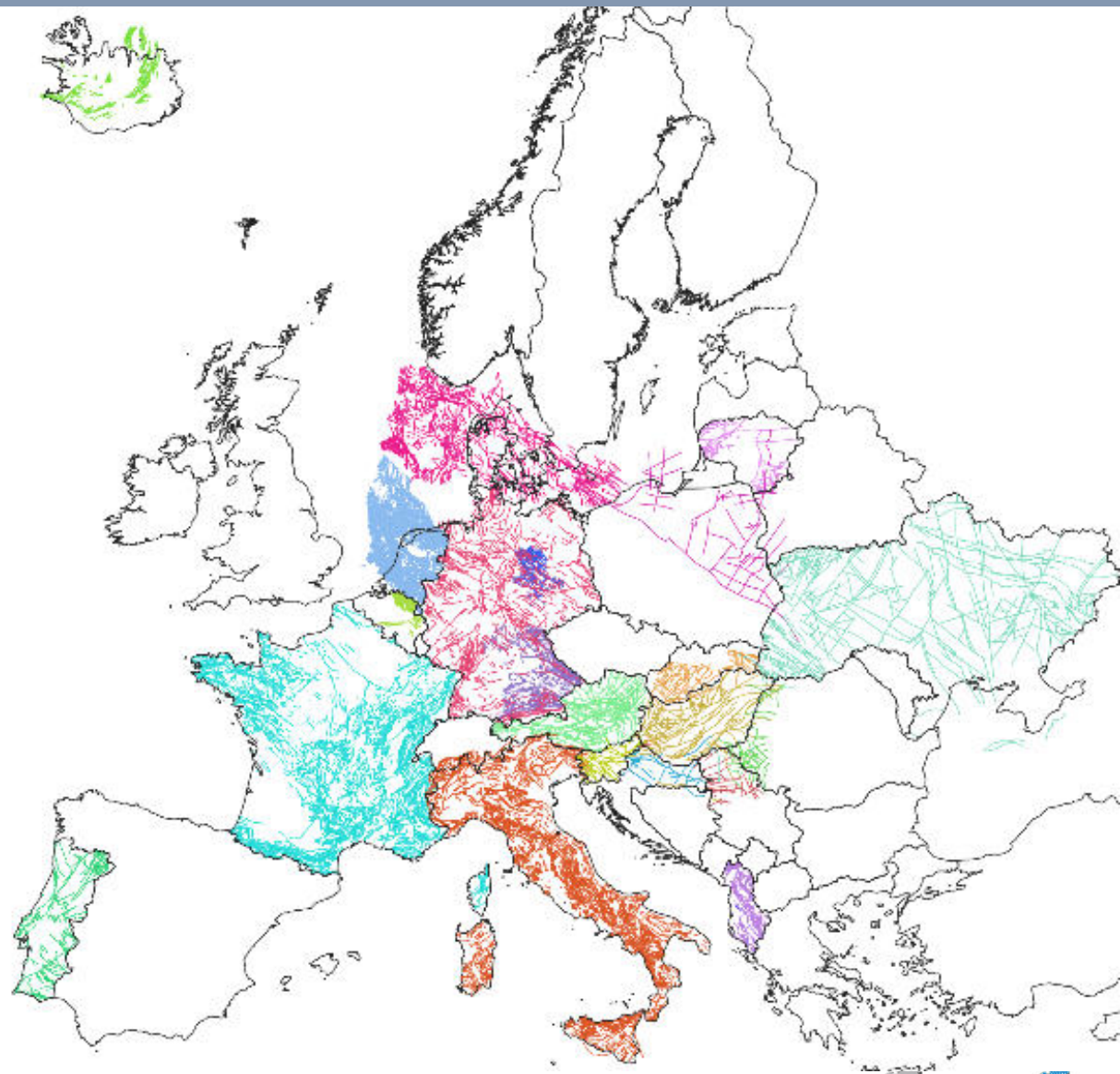

- Which fault geometry?
- Which reference horizon?
- Which parameters describe a fault? Which are mandatory?
- How to describe the kinematic relationship between faults?
- Can we group similar faults?
- How to deal with fault names in different languages?

Fault classification, names, dependencies and correlation

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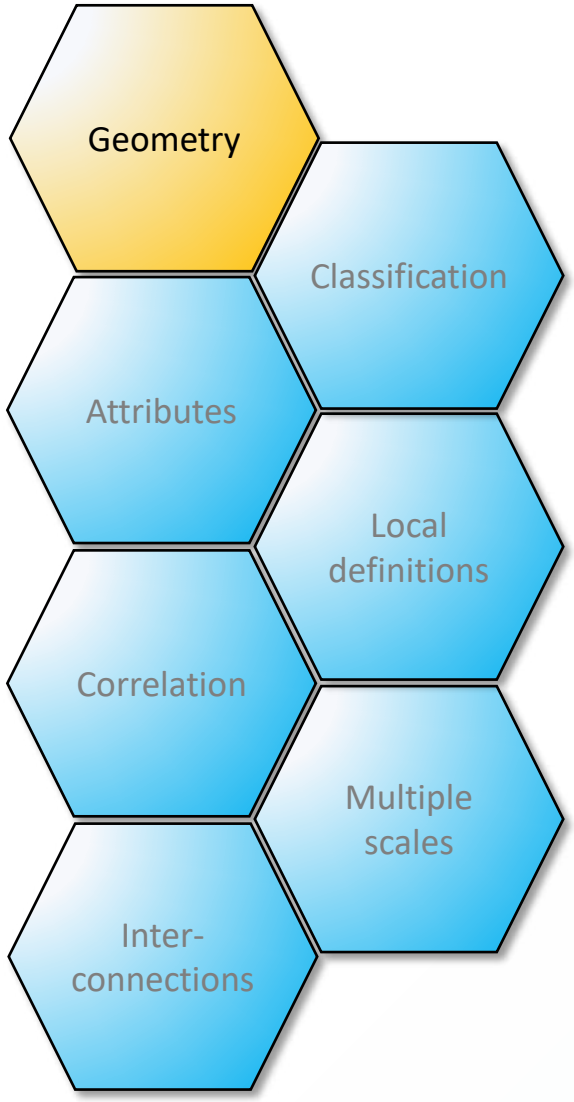
# Principle of the fault data base

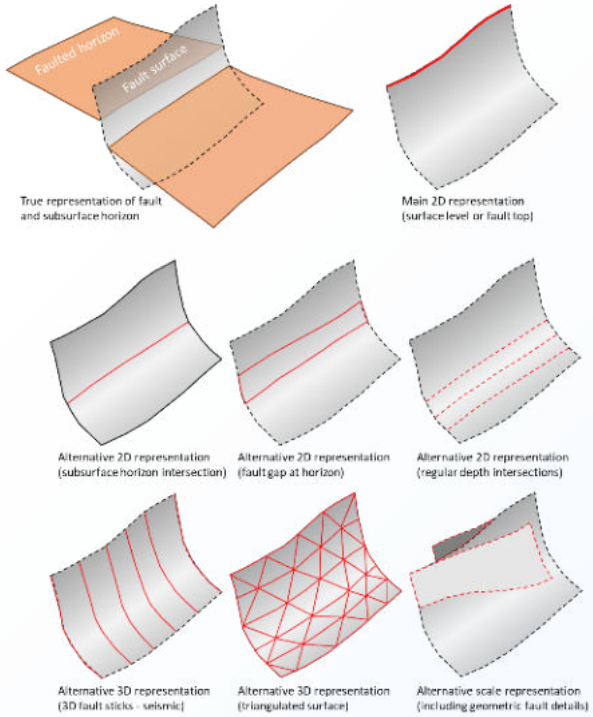


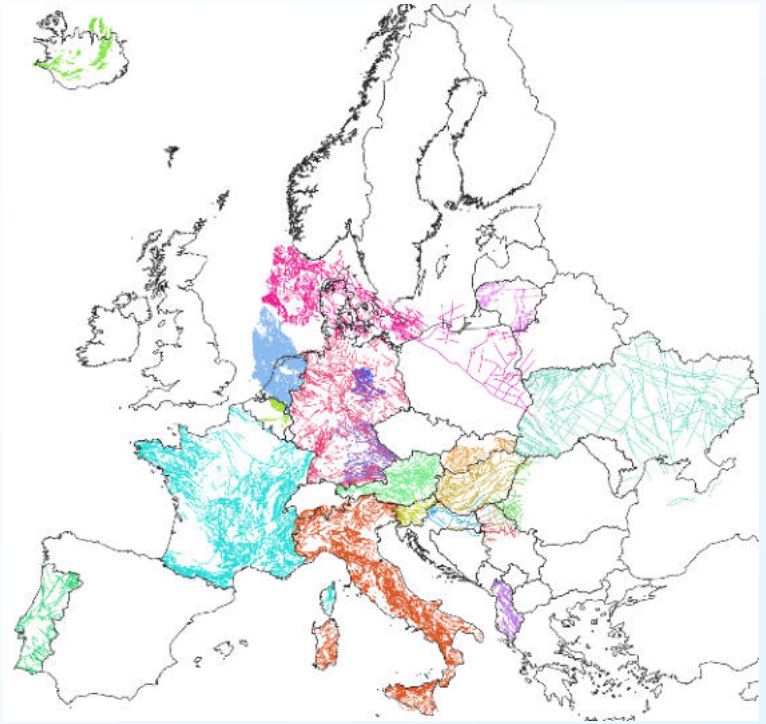



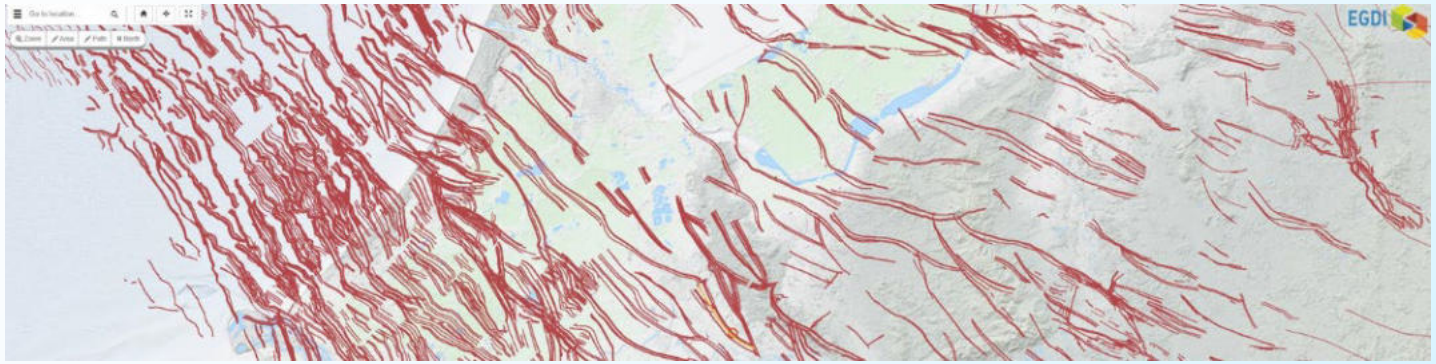
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# >55.000 faults included in the database



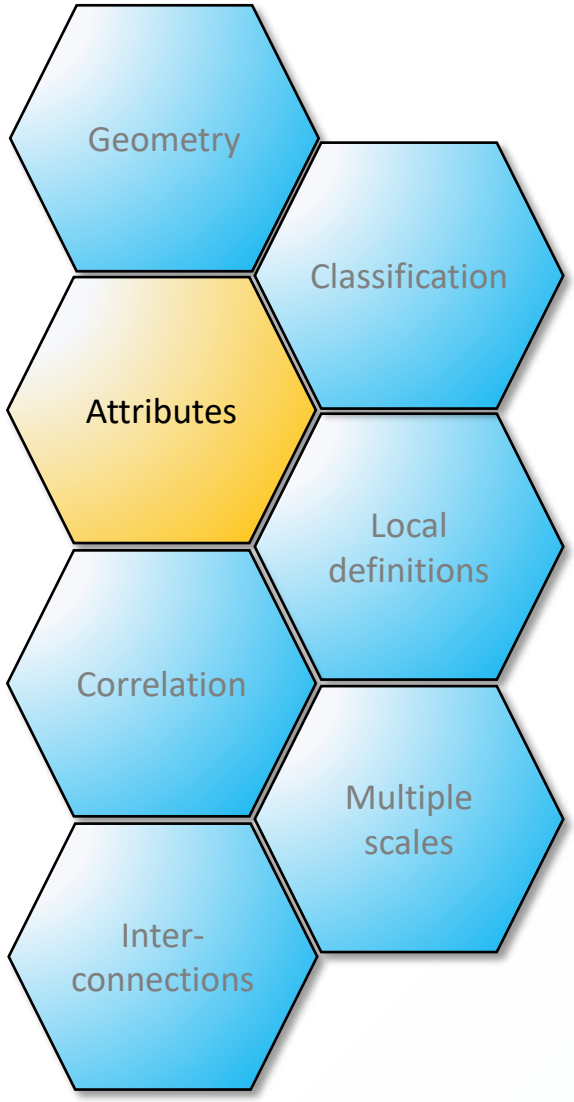



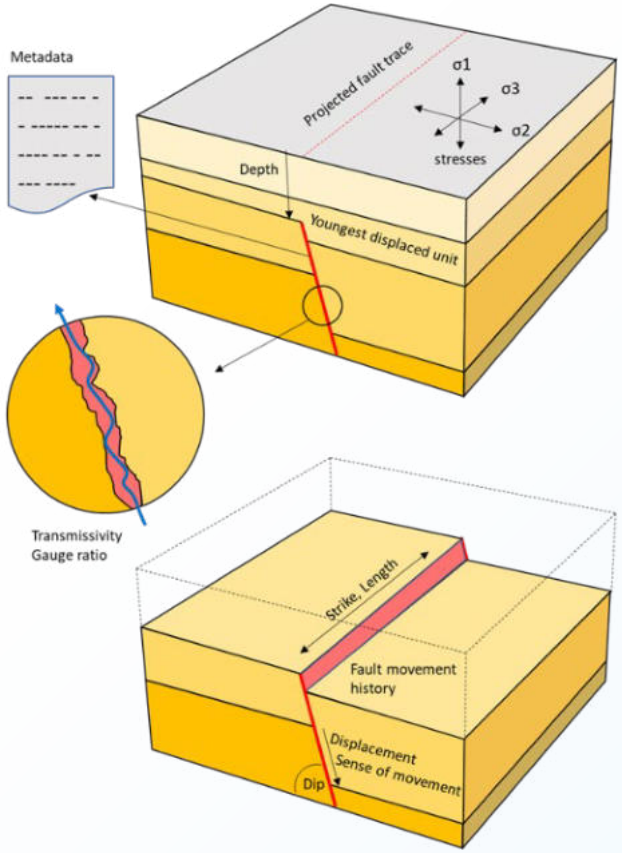



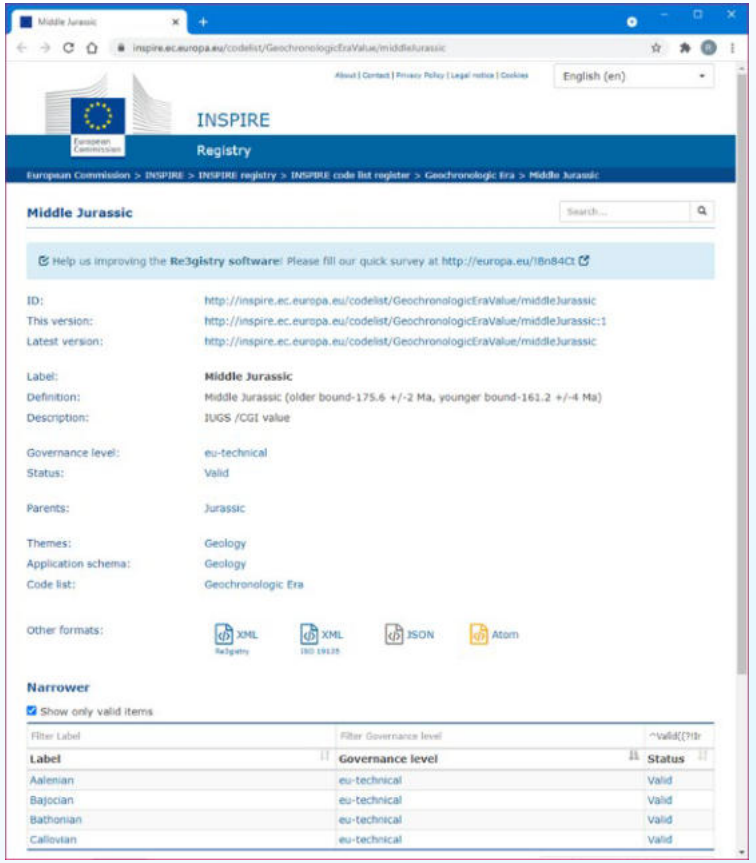



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# Standardized fault attributes



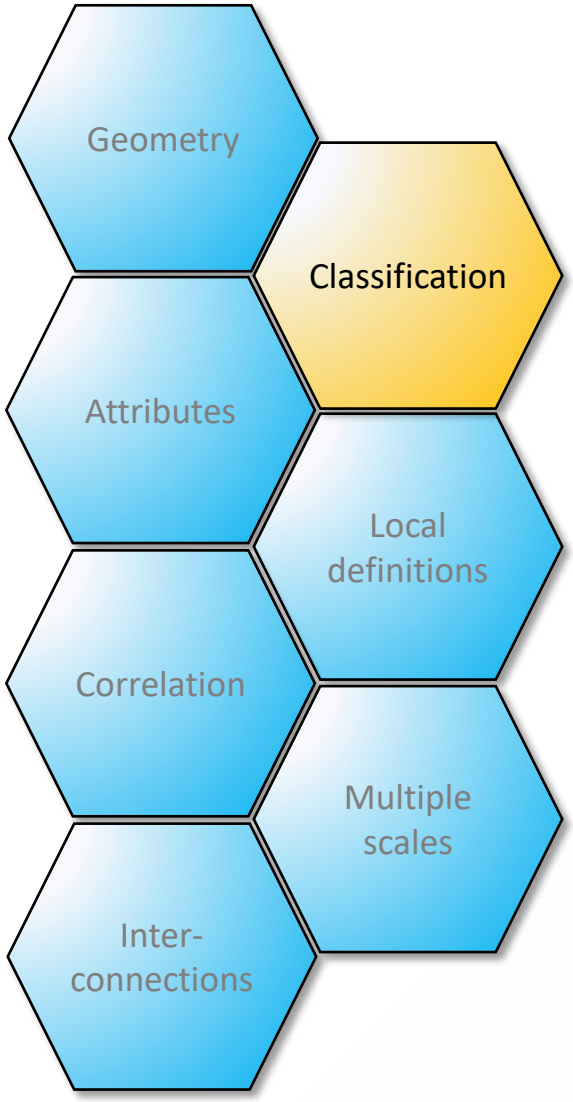



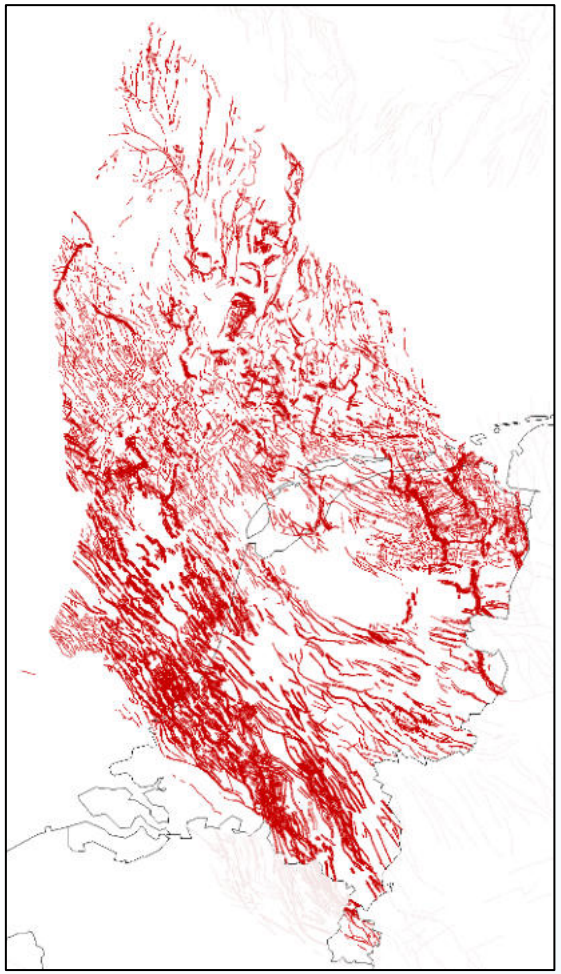



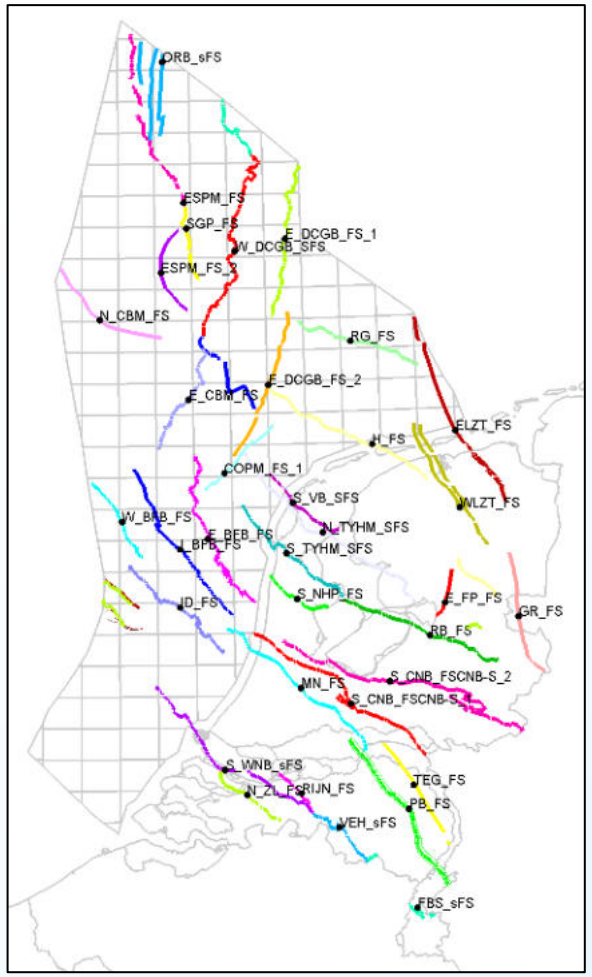

| Go to | Country Cd | Id | Local Name | Concept Uri | Eval Meth | Eval Meth Uri | Observ Meth | Observ Meth Uri | Timing | Timing Uri | Fault Type | Fault Type Uri | Young Unit | Young Unit Uri | Old Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NL | NL-4476 | v5_FltStickTWT_ZE_NU_H180015_CK | Link... | inferred | Link... | inferred projection between observed locations | Link... | Upper Cretaceous | Link... | normal fault | Link... | Quaternary | Link... | Permian |
| | NL | NL-4476 | v5_FltStickTWT_ZE_NU_H180015_KN | Link... | inferred | Link... | inferred projection between observed locations | Link... | Lower Cretaceous | Link... | normal fault | Link... | Quaternary | Link... | Permian |
| | NL | NL-4476 | v5_FltStickTWT_ZE_NU_H180015_KN | Link... | inferred | Link... | inferred projection between observed locations | Link... | Lower Cretaceous | Link... | normal fault | Link... | Quaternary | Link... | Permian |
| | NL | NL-4476 | v5_FltStickTWT_ZE_NU_H180015_KN | Link... | inferred | Link... | inferred projection between observed locations | Link... | Lower Cretaceous | Link... | normal fault | Link... | Quaternary | Link... | Permian |
| | NL | NL-4476 | v5_FltStickTWT_ZE_NU_H180015_N | Link... | inferred | Link... | inferred projection between observed locations | Link... | Cenozoic | Link... | normal fault | Link... | Quaternary | Link... | Permian |
| | NL | NL-4476 | v5_FltStickTWT_ZE_NU_H180015_N | Link... | inferred | Link... | inferred projection between observed locations | Link... | Cenozoic | Link... | normal fault | Link... | Quaternary | Link... | Permian |
| | NL | NL-4476 | v5_FltStickTWT_ZE_NU_H180015_N | Link... | inferred | Link... | inferred projection between observed locations | Link... | Cenozoic | Link... | normal fault | Link... | Quaternary | Link... | Permian |

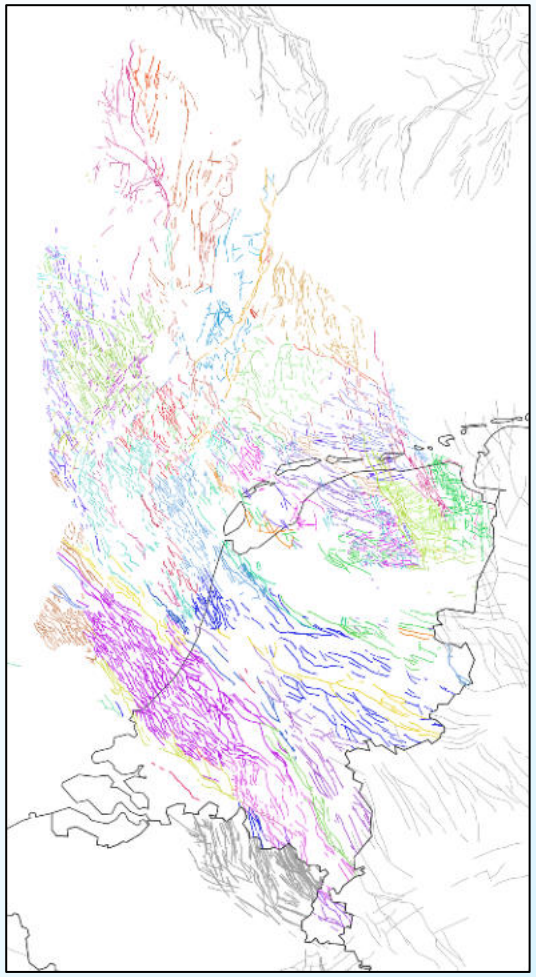
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# Hierarchical classification of faults and fault systems / fault sets



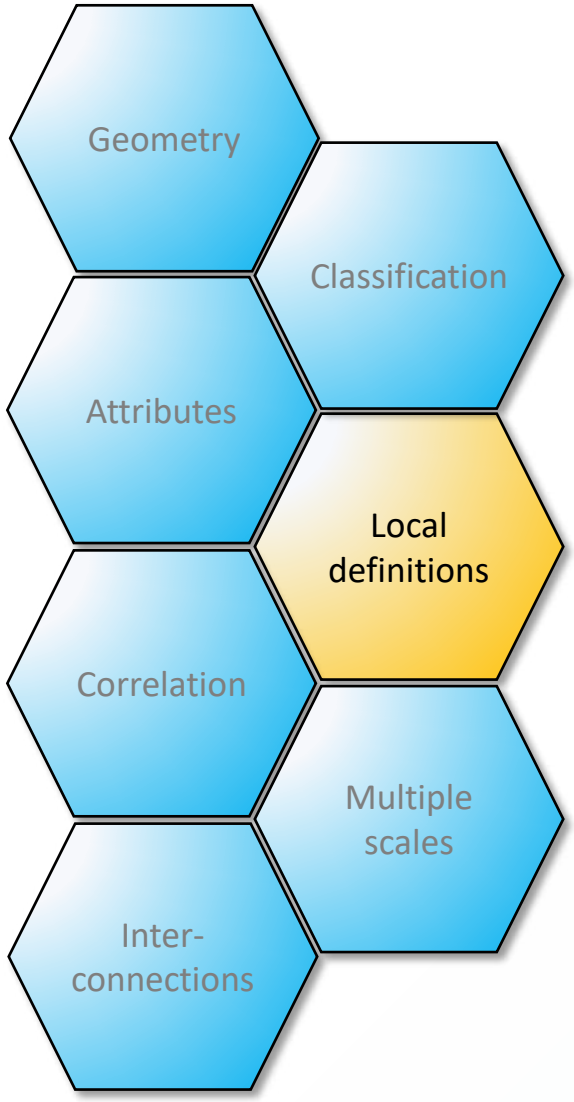



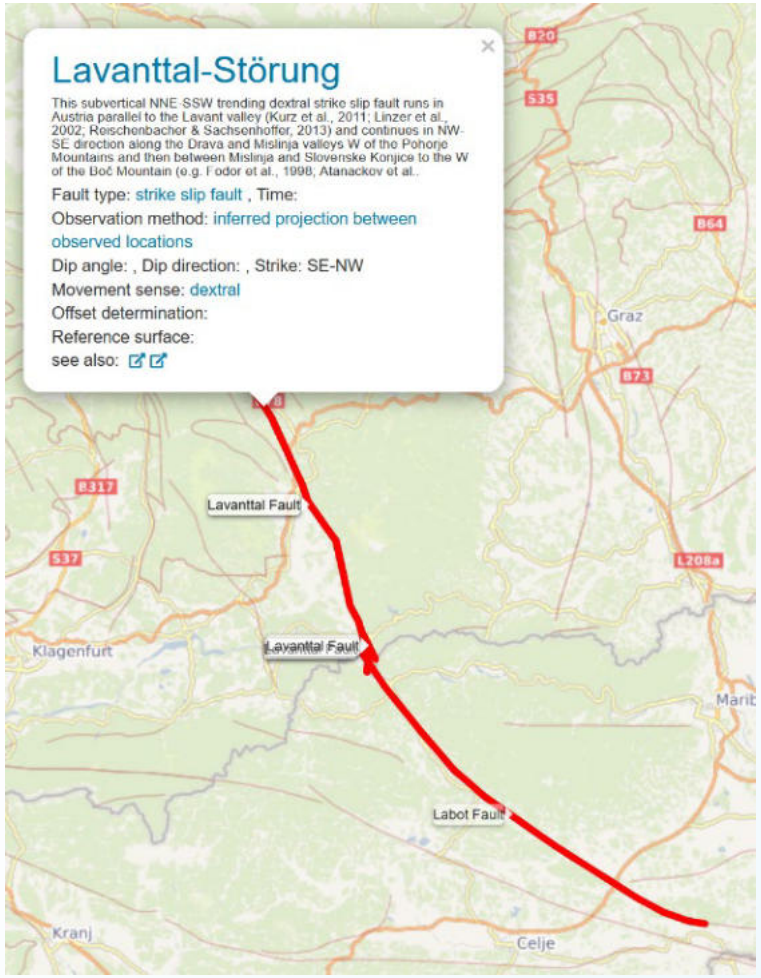


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# > 3300 named Fault Concepts (national and regional vocabularies)




# Lavanttal Fault

URI https://data.geoscience.earth/ncl/geoera/hike/faults/551

Name in several languages

Lavanttal-Störung de  Lavanttal Fault en  Labotski prelom sl  Labot Fault en

Notation: AT-10175  SI-3.001

This subvertical NNE-SSW trending dextral strike slip fault runs in Austria parallel to the Lavant valley (Kurz et al., 2011; Linzer et al., 2002; Reischenbacher & Sachsenhoffer, 2013) and continues in NW-SE direction along the Drava and Mislinja valleys W of the Pohorje Mountains and then b… Slovenske Konjice to the W of the Boč Mountain (e.g. Fodor et al., 1998; Atanackov et al., 2019). GPS measurements suggest the fault is recently active with an estimated average slip-rate of 0.5-1 mm/yr (Pavlovčič Prešeren et al., 2005). In Austria, seismic activity along the fault has been observed (XX)

Definition


— Atanackov, J. 2007: *Ocena termodinamičnega vpliva reinjekcijske vrtine na črpalno vrtino Le-2g v Lendavi : diploma thesis. Ljubljana: [J. Atanackov]: 56 p.*
— Fodor, L., Jelen, B., Márton, E., Skaberne, D., Čar, J. & Vrabec, M. (1998): *Miocene-Pliocene tectonic evolution of the Slovenian Periadriatic fault: Implications for Alpine-Carpathian extrusion models. - Tectonics 17, 5, 690-709*
— Kurz, W., Wölfler, A., Rabitsch, R., Genser, J: *2011. Polyphase movement on the Lavanttal Fault Zone (Eastern Alps): reconciling the evidence from different geochronological indicators. Swiss J Geosci, 104:323–343.*
— Linzer, H.-G., Decker, K., Peresson, H., Dell'Mour, R. & Frisch, W. (2002): *Balancing lateral orogenic float of the Eastern Alps.- In: Tectonophysics 354, Nr. 3-4, S. 211-237*
— Pavlovčič Prešeren, P., Stopar, B., Vrabec, M. 2005: *Displacement rates along the faults in NE Slovenia: campaigns from 1996, 1999 and 2002. Geodetski vestnik, 49, 407-415.*
— Reischenbacher, D. & Sachsenhofer, R.F. (2013): *Basin formation during the post-collisional evolution of the Eastern Alps: The example of the Lavanttal Basin. - International Journal of Earth Sciences (Geologische Rundschau) 102, 2, 517-543*


References

## Concept relations

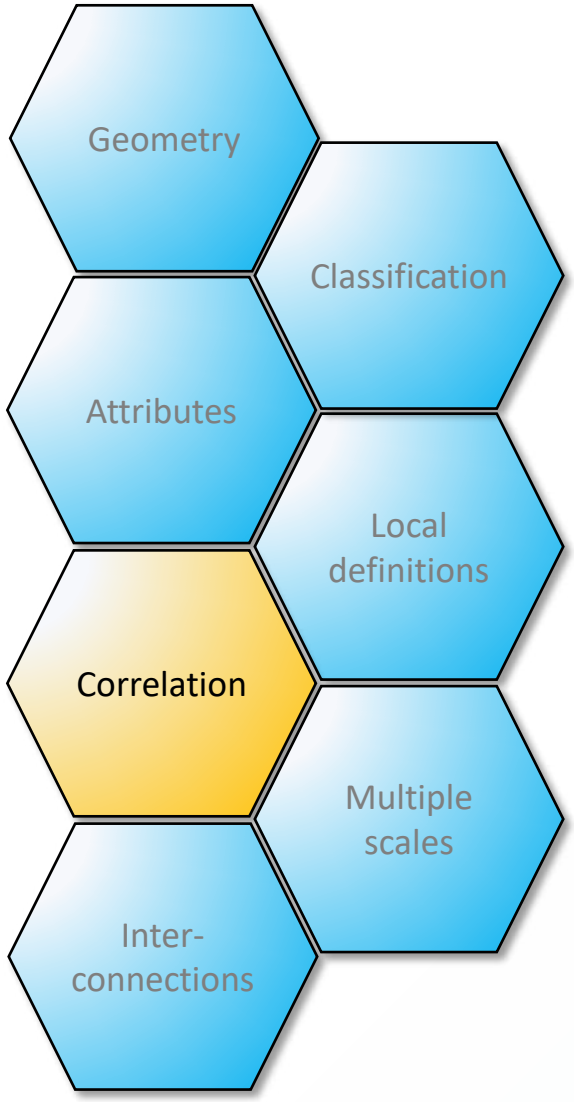
| | |
|---|---|
| broader | Pöls-Lavanttal Fault System (5) |
| exactMatch | structure/151 (GBA) |

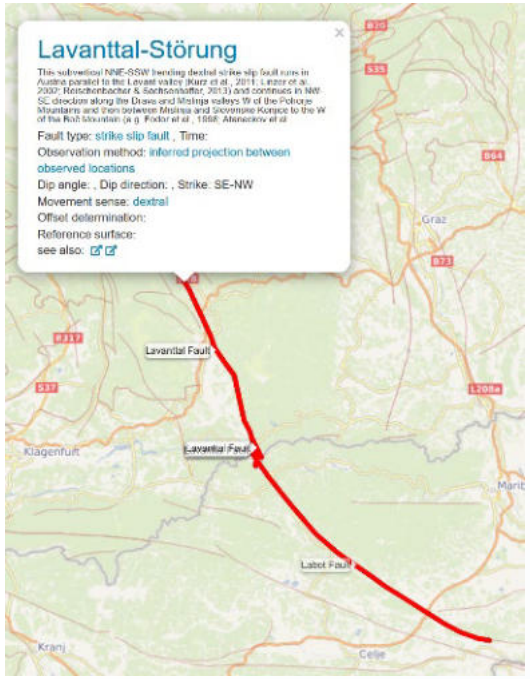
Hierarchy

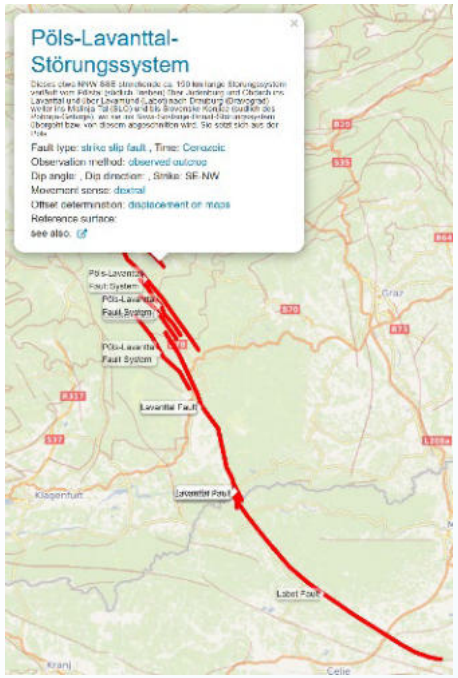
Link to other Vocabularies

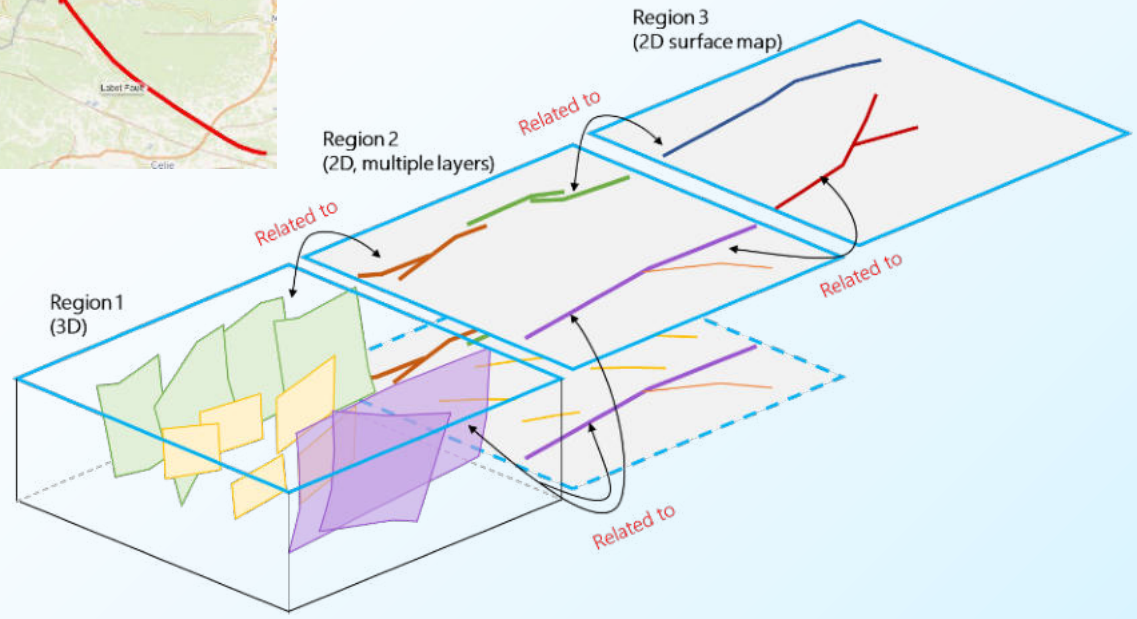
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# Cross-border correlation of faults using named concepts



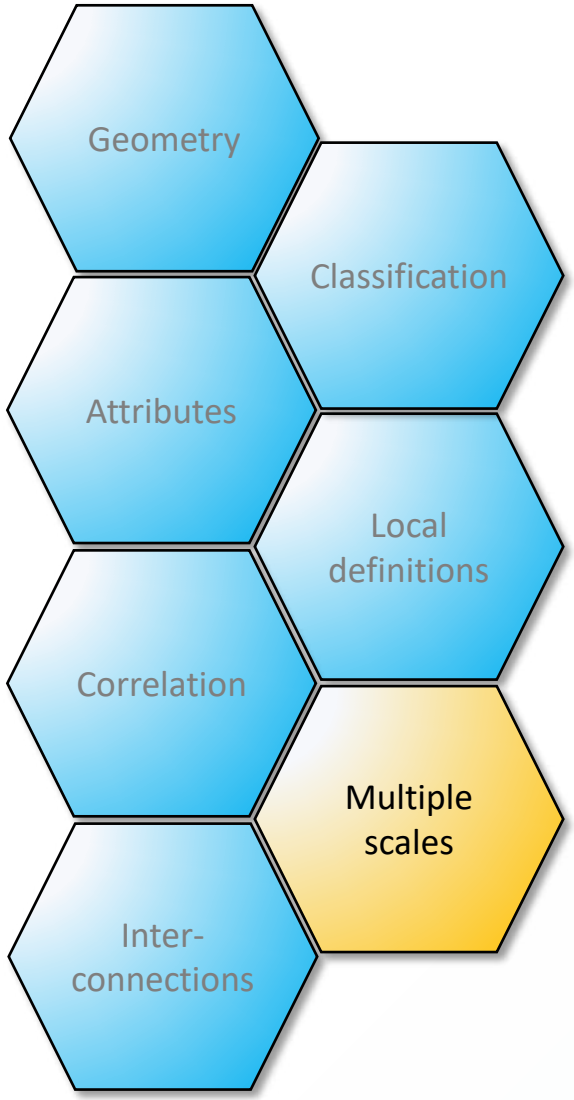



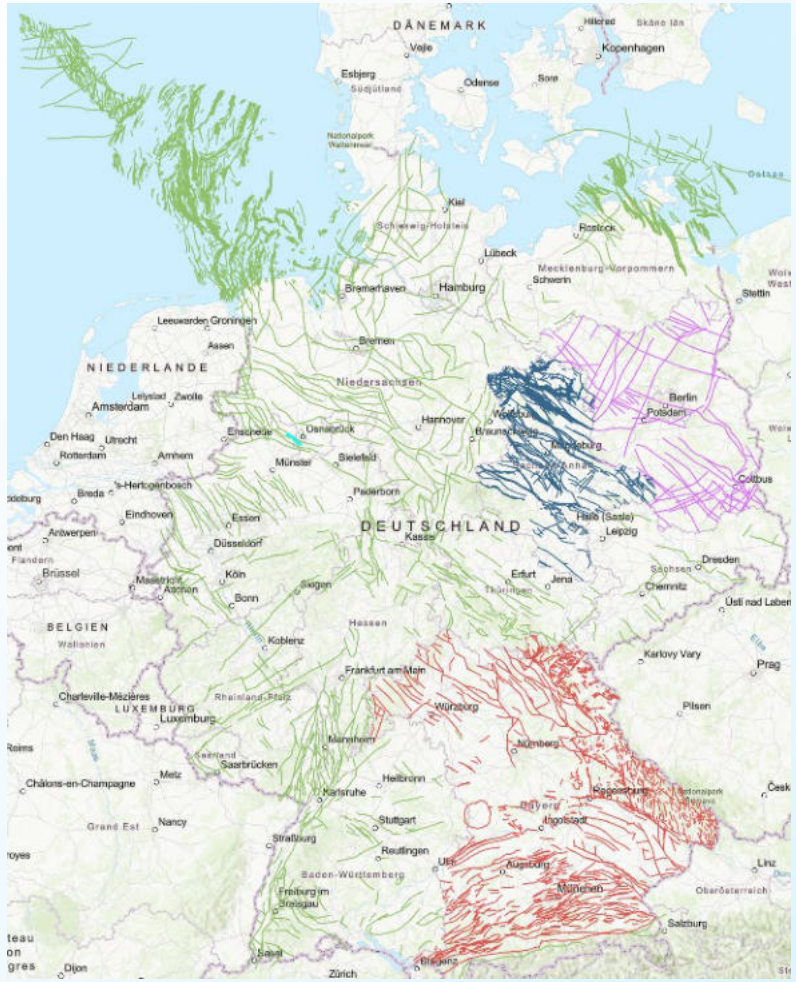

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# Multi-scale definitions, link between national and regional datasets



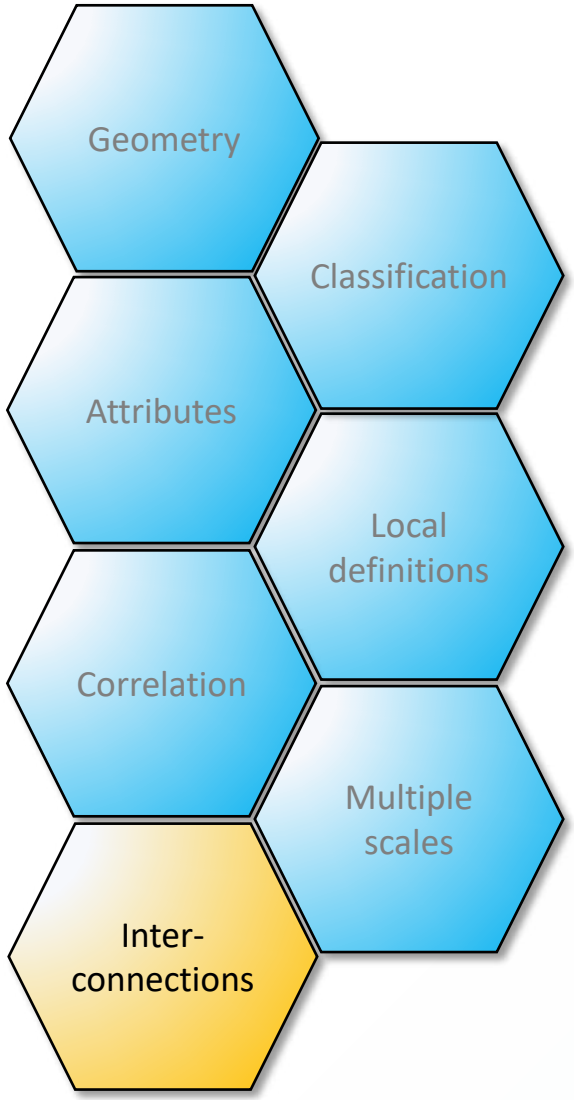







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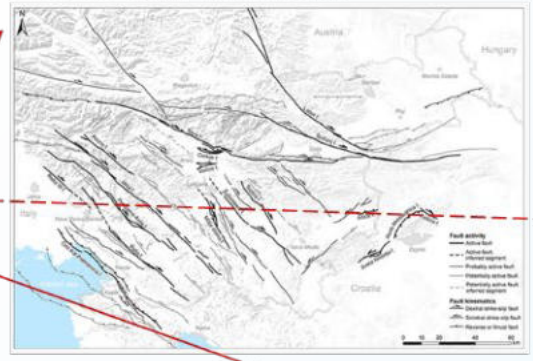
# Linking fault data to external sources and databases



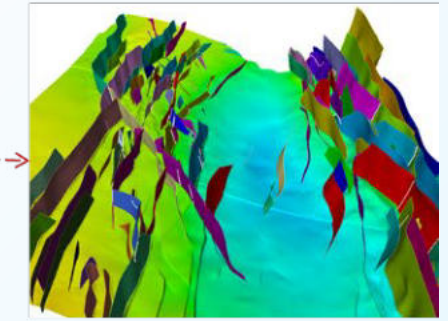




other fault databases



3D fault models



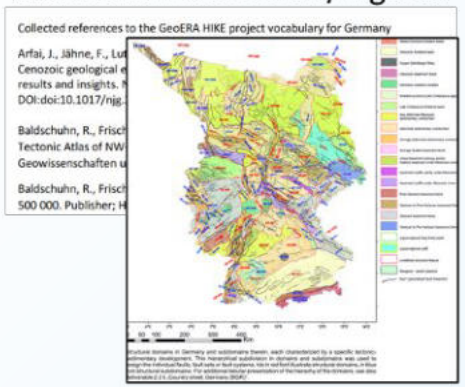
fault database entries of the same fault







additional references / figures




websites



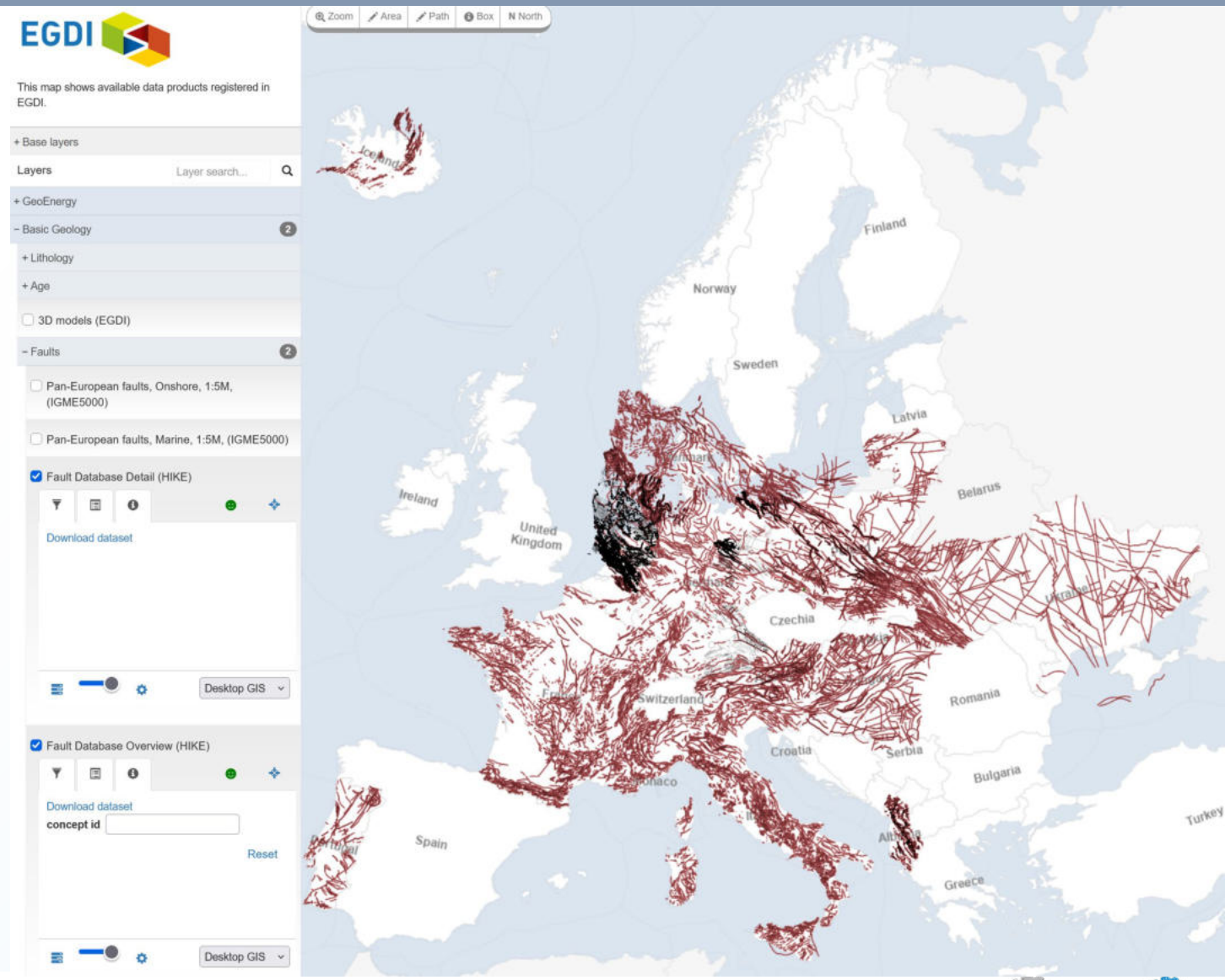




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# Update in the framework of GSEU WP3

- Transfer to the new EGDI platform https://maps.europe-geology.eu
- Update of already existing fault information (e.g. D, NL)
- Additional fault information (Malta, Croatia, Norway, Spain?)




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