

Towards a generic lithological taxonomy for the International Hydrogeological Map of Europe: Status report and work in progress

**Andreas Günther, Rainer Baritz, Klaus Duscher,
Andrea Richts & Willi Struckmeier**

Federal Institute for Geosciences and Natural Resources (BGR), Hannover, Germany

- The International Hydrogeological Map of Europe
1 : 1 500 000 (IHME 1500)
- Data situation IHME 1500 lithology
- Constraints for aggregation of sheet lithological classes
- Proposed lithology class aggregation
- Status of the work
- Work in progress
- Outlook

The IHME 1500

- Consists of 25 sheets of scale 1 : 1 500 000
- harmonised trans-boundary representation of spatial data related to hydrogeology for entire Europe and areas adjacent to the East
- long-term scientific cooperation of experts (> 320) from the European Geological Surveys
- renders complex information on lithology, aquifer characteristics, surface catchments and groundwater divides, springs, special features etc.
- hydrogeological regions and water quality (explanatory notes)

The IHME 1500

➤ **Aquifer information**

Blue: intergranular aquifers

Green: fissured and karst aquifers

Brown: non-aquifers or
only local potential

➤ **Lithological rock type**

various types in grey

➤ **Special features**

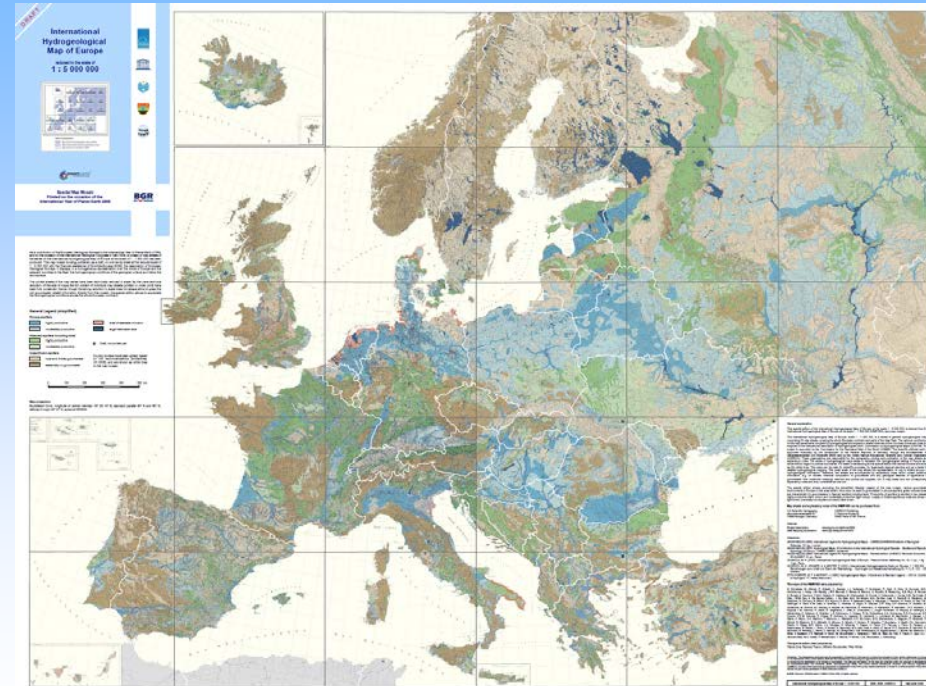
full blue for surface water, springs and karst

violet for groundwater features, e.g. groundwater contours

orange for chemical and thermal features, e.g. thermal and mineral springs

red for man-made changes of the natural GW regime

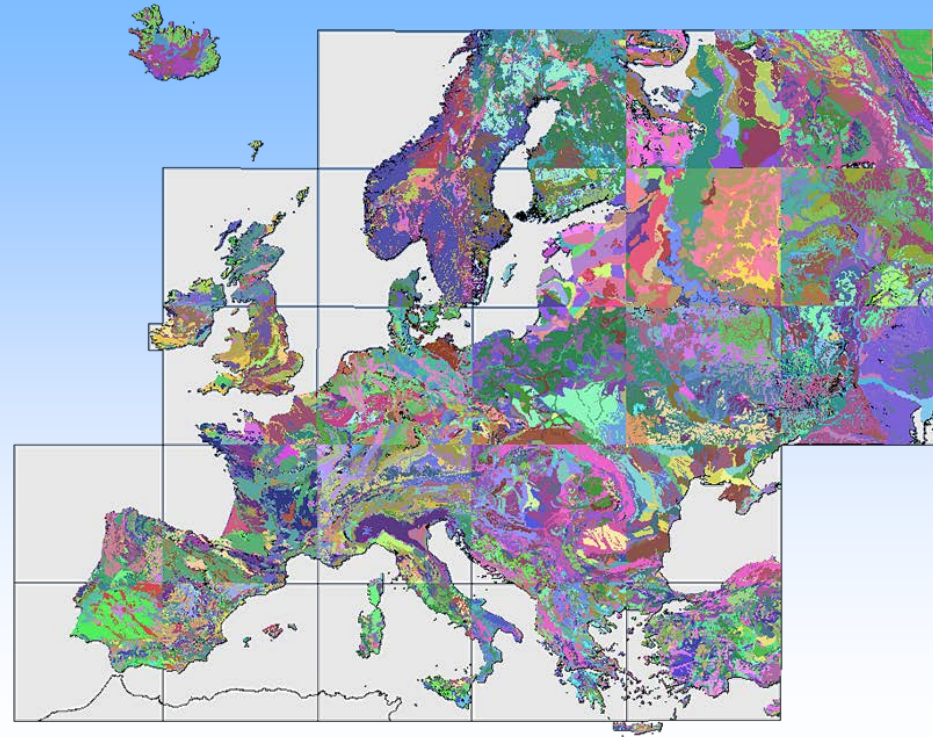
black for geological features, e.g. lithological boundaries, faults



same geometry

Data situation IHME 1500 lithology

- 25 Sheets with specific lithological taxonomy
- Digital geometric dataset +/- harmonized
- Semantic dataset: 1290 classes
- Geometric dataset: 1287 classes
- 1244 geometric classes can be related to 1057 English lithological descriptions from semantic dataset as of 12/11



Task: Aggregation of spatially and semantically related sheet classes as a basis for the development of a generic lithological taxonomy

Constraints for aggregation of sheet classes

- Individual description of sheet lithological classes comprises lithological, genetic, abstract, stratigraphic and local terminologies
- Aggregation of sheet classes is conducted solely on geometrical class properties (e.g., spatial relationships and sizes of sheet-specific classes)
- Geometrical data structure is maintained (e.g., sheet-specific polygon classes are not levered)
- Existing taxonomy is maintained (e.g., no new class descriptions are introduced)
- Polygons lacking lithological descriptions are not classified as of 12/11
- Aggregation workflow allows for incorporation of additional classes and tracking of aggregation levels without loose of information

Lithology class aggregation: Level I

Generation of intersection-free classes over the whole mapped area

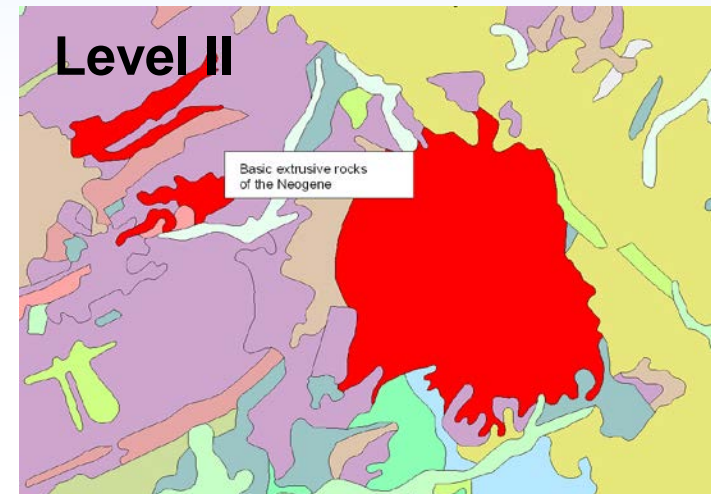
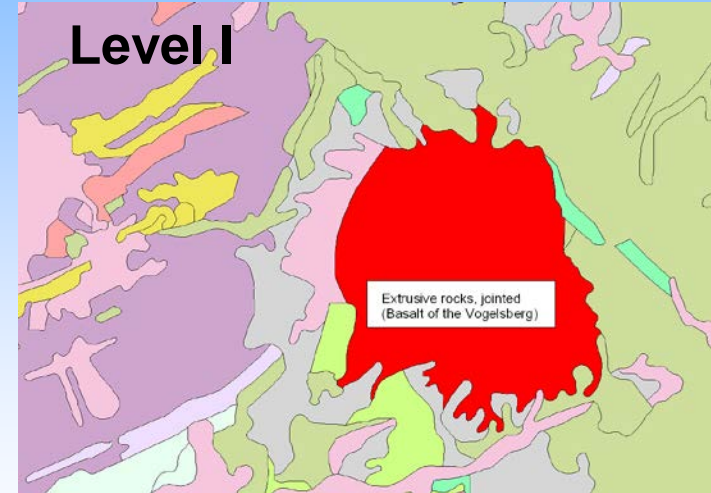
- Aggregation of sheet classes with high taxonomic similarity only separated by map borders
- Class descriptions assigned from largest class avoiding local/stratigraphic/genetic descriptions when possible
- Results in 751 classes at Level I



Lithology class aggregation: Level II

Elimination of island classes and very small classes

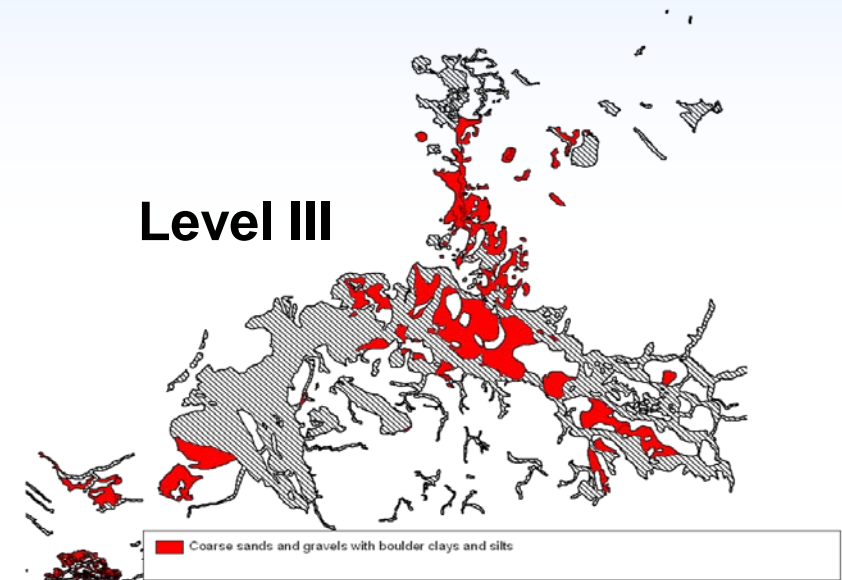
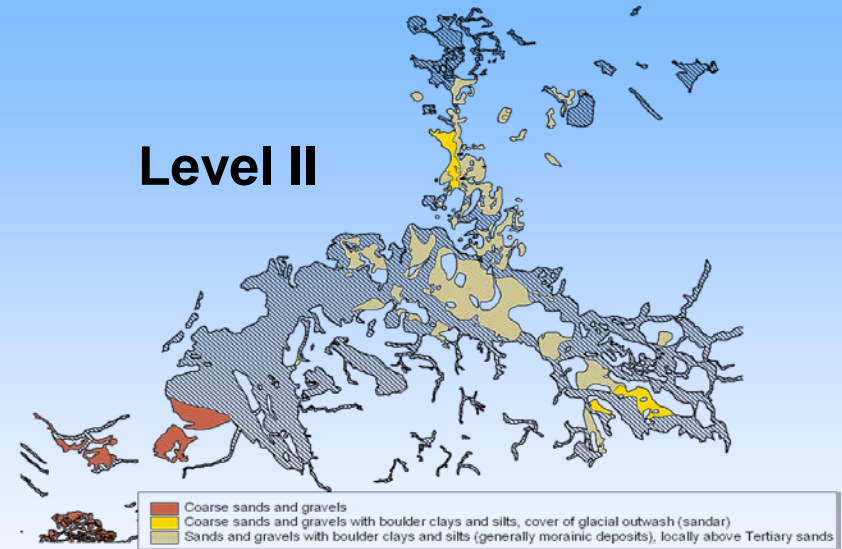
- Sheet classes consisting of only one polygon (island classes) are merged with larger regional classes of similar taxonomy
- Sheet classes $< 100 \text{ km}^2$ are merged with larger regional classes of similar taxonomy
- All treated classes represent local varieties of regional lithologies
- Results in 685 classes at Level II



Lithology class aggregation: Level III

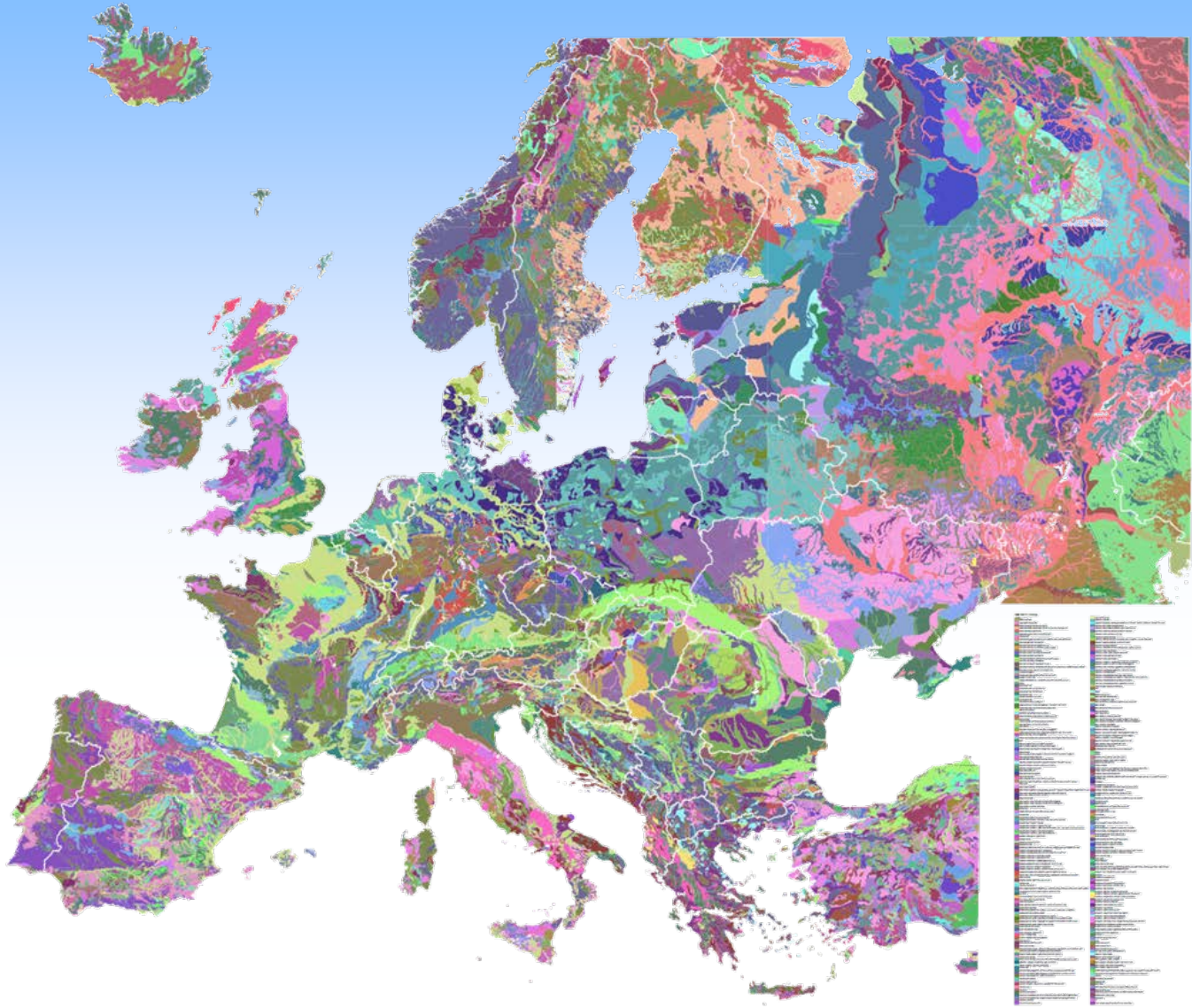
Aggregation for aquifer-types (not finished by 12/11)

- IHME 1500 displays six major aquifer-types, geometrically based on the litho-polygons
- Level II classes with highly similar taxonomy belonging to same aquifer types were merged
- Generic classes (i.e., “Sandstones”) were not further merged at this stage
- Results in 282 classes at Level III



Status of the work (12/11)

IHME1500 V2, Lithology



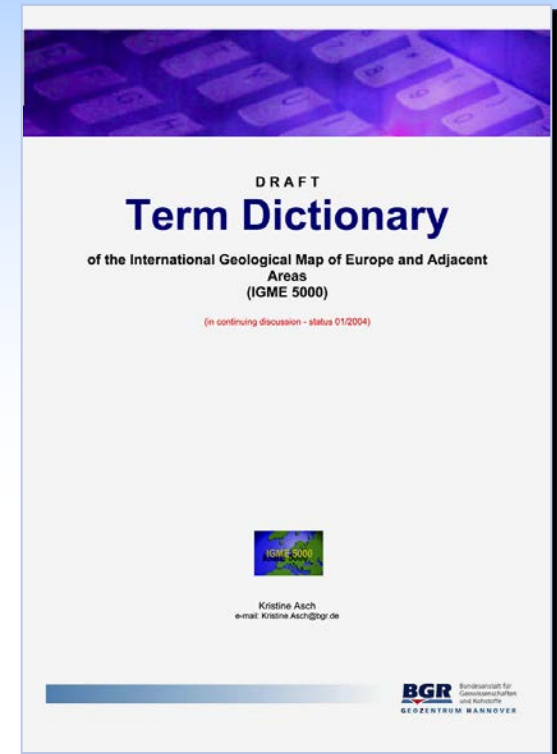
**IHME 1500
lithology
comprising
282 classes**

Work in progress

- The proposed aggregation of sheet-specific lithological classes into 282 generic classes provides a basis for the development of a general lithological taxonomy for the IHME 1500
- Once the digital geometric dataset is complete, missing classes will be introduced into the proposed aggregation scheme
- Even though higher level aggregations seem feasible, this would presumably result in significant reduction of original information
- Based on the Level III aggregation (282 classes), a suitable lithological taxonomy will be developed allowing for best transportation of the semantic information, also considering auxiliary datasets
- For a generalizing taxonomy, ~100 lithological classes are envisaged at the lowest aggregation level

Outlook

- Analysis of the lithological terminology used in the map data base and comparison with those applied in other available geological maps
- Analysis of the need and use of regional hydrogeological and hydrological landscape classifications (to feedback map-internal aggregation rules)



Dictionary of Geological terms
(OneGeologyEurope)

- A generalized IHME 1500 lithology can possibly serve as important background information for the delineation, characterization and harmonization of groundwater bodies over Europe
- IHME 1500 lithology will provide important harmonized information on first-order structural and textural properties of near-surface geologic materials throughout Europe
- It can contribute to several European initiatives requiring harmonized information on the spatial distribution of rock properties
- Cooperation with the newly formed **Task Force on Superficial Deposits (EuroGeoSurveys)**: This new task force will look at existing national data bases related to surface-close lithologies and will integrate these data for Europe

Outlook

The harmonized mapping of lithologies is needed for various applications in Europe, e.g.

- for evaluation and regionalization of Europe-wide geochemical inventories
- to upscale background values for soil and ground water
- to model soil-water percolation and ground water production
- as a parameter for the spatial evaluation of soil threats
- to support harmonization activities related to the development and reporting of groundwater-related data in Europe
- but also as a basic product which extends the existing continent-wide data bases on geology