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Report on testing of integration into the European Geological Data Infrastructure (EGDI)

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EXECUTIVE REPORT SUMMARY

One of the main goals of Work Package 5 is the integration of updated mineral occurrence, mine sites and the electronic Minerals Yearbook information. There has been a European-wide effort to update, supplement and harmonise data from many providers which can now be viewed on the European Geological Data Infrastructure, EGDI.

This report describes how data that have been collected from the national data providers are integrated into EGDI database system and displayed on the web portal. A dedicated MINTELL4EU viewer has been designed and developed as part of the EGDI web-GIS environment. The process of testing the data integration and how the data are displayed is also covered in this report. In summary, the information contained within this report is comprehensive and will enable future addition of data and general maintenance of the system.

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1 INTRODUCTION

MINTELL4EU is one of the geoscientific research projects under the GeoERA programme on the theme of raw materials.

The MINTELL4EU viewer, Fig. 1, allows users to see the location of mineral resources and mines within Europe and Greenland as well data from the electronic Minerals Yearbook up to 2019. Information is divided by two themes and these include:

1. Mineral Resources,
2. Electronic Minerals Yearbook.

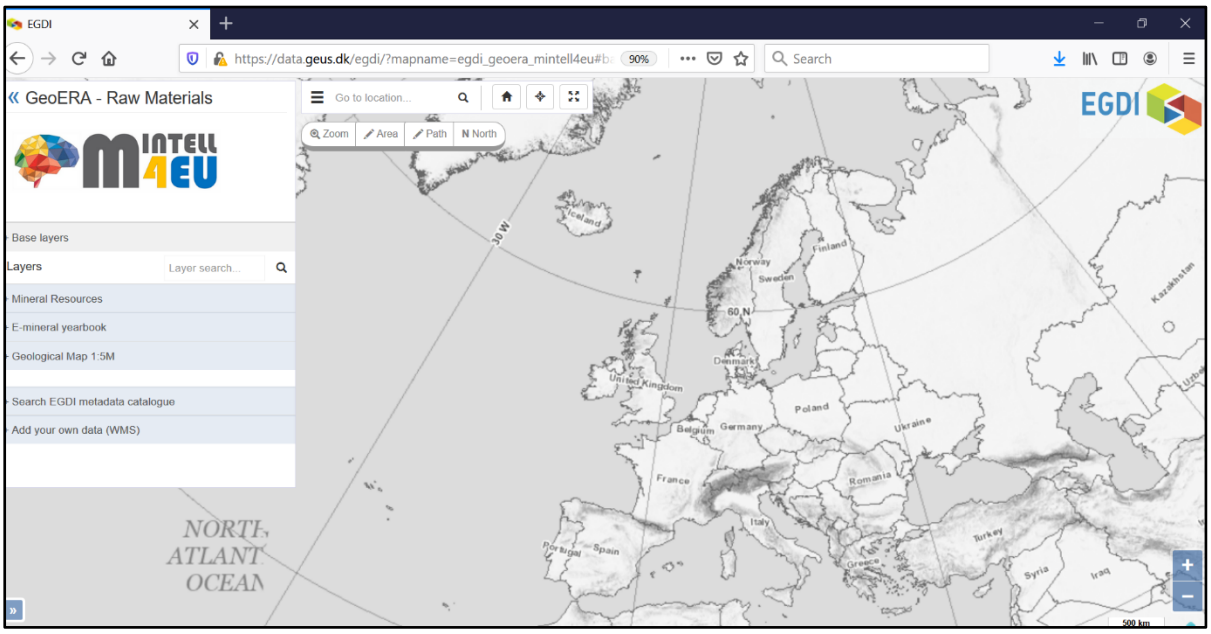

Figure 1: The MINTELL4EU viewer

The Mineral Resources theme shows data on mineral occurrences, occurrence areas, mines and tourist mine sites:

The Mineral Occurrences theme layer partly builds on data that were collected by the previous Minerals4EU and RESEERVE projects. Within the MINTELL4EU project, some of these data have been updated and supplemented into a single dataset. The layer displays the different commodity groups by deposit size and it is possible to select data to be displayed by deposit size, commodity group or by commodity. Commodities that are included in EU's list of critical raw materials (2020)[1] are additionally visualised in a separate layer for the convenience of interested users.

The Mines layer displays the location of open and closed mines as well as mines under development. Users can display mines based on commodity, operational status or type

[1] COM(2020) 474 – Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability.

of mining activity. The Tourist Mine Site layer shows the location of historical mines that have been developed into tourist attractions.

The electronic Minerals Yearbook theme include layers showing statistics for European countries on commodity production, import and export, documented mineral reserves and resources, some categories as of the United Nations Framework Classification (UNFC). Users can create commodity-specific maps by selecting a commodity and a year from 2004 to 2019 and create time series for multiple countries for a given commodity type.

2 DATA INTEGRATION TO THE INFORMATION PLATFORM

This section of the report describes how the data was integrated into the different thematic layers on the information platform.

2.1 Mineral resources

Tabular and spatial data are harvested from national databases of 36 European data providers covering 31 countries. Harvesting routines, quality assurance and guidance are performed by the Geological Survey of Slovenia, GeoZS. Data are stored in a central MIN4EU database, which is integrated into the existing European Geological Data Infrastructure (EGDI) platform. The mineral resource data is visualized and made searchable on the portal through an integrated application server as shown in **Fejl! Henvisningskilde ikke fundet.**. The figure also illustrates how data are disseminated through various channels such as WMS- and API interfaces.

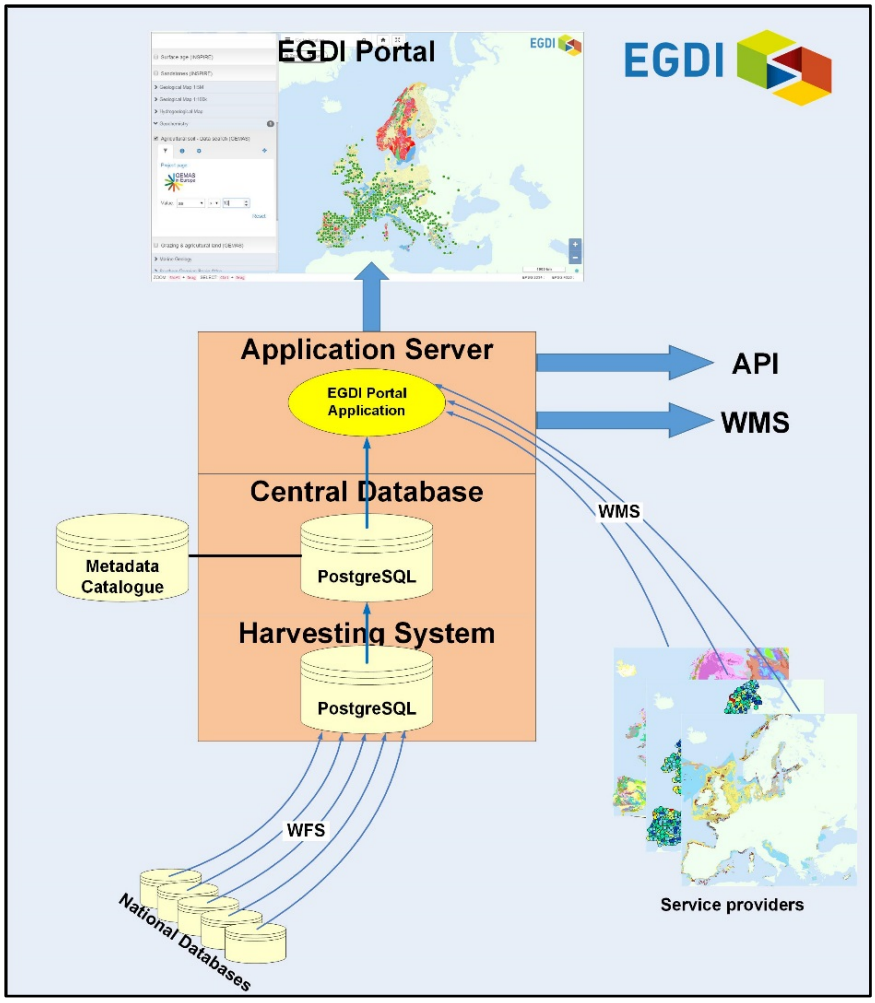

Figure 2: Overview of EGDI architecture showing central and distributed components.

Data on mineral resources are provided by using INSPIRE-compliant Web Feature Services (WFS). GeoZS retrieves all mineral resource data from these WFS's and stores it in one central database. This database has the same structure and code list values as the databases maintained by the data providers. This ensures harmonization of vocabulary and structure of the data. GeoZS then sends an email to GEUS that a new database dump (postgreSQL) is ready at their FTP (ftp.geo-zs.si – *username and password is needed here*) for download. The file contains the latest updated data from each data provider and the file has a timestamp for the release date (timestamp of the data is found in https://harvesting.geo-zs.si/m4eu/count_report? and mark the database including 'M4EU_.....-last successful').

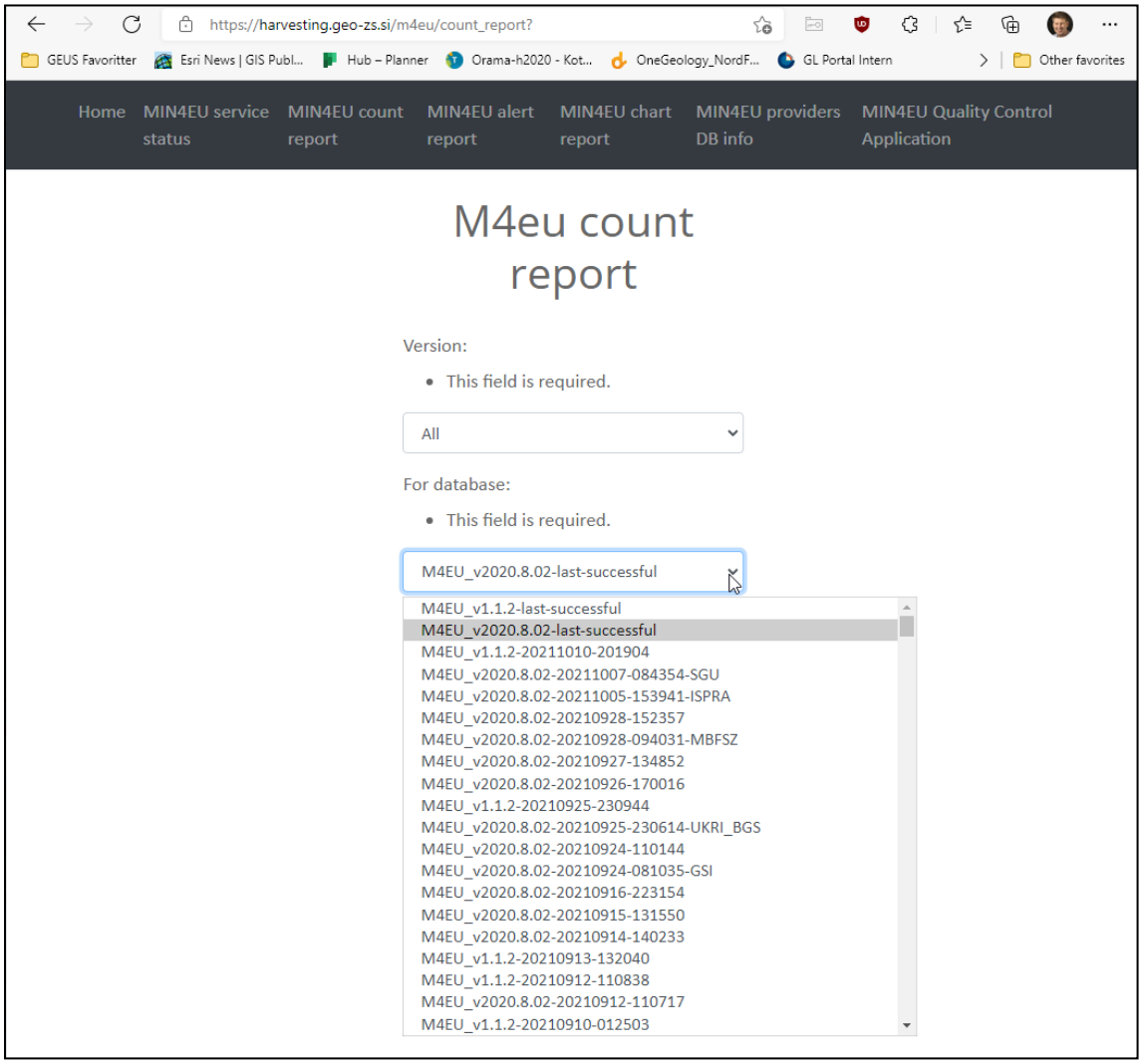

Figure 3: Screenshot from the harvesting process performed by GeoZS.

The file is downloaded at GEUS and imported into the MIN4EU DB in EGDI using postgres psql in a command prompt (CMD) window. An example on a psql command is:

"C:\Users\fsc\AppData\Local\Programs\pgAdmin 4\v6\runtime\psql" -d <database> -U <user> -h <server> -p <port> < "<path>\M4EU_v2020.8.02-last-successful-with-additional-v1.1.2-providers-data.sql"

The MINTELL4EU viewer displays several datasets addressing raw materials and mines in Europe. The datasets have since 2013 been prepared and collected through a series of projects covering Minerals4EU, EURare, ProSUM, MINTELL4EU, RESEERVE and others and are described in the EGDI metadata catalogue, formerly known as MICKA. (https://egdi.geology.cz/). The datasets are represented by map layers on the portal (Figure 4) and are served from the database through MapServer on the EGDI application server. MapServer is an Open Source platform for publishing spatial data and interactive mapping applications to the web.

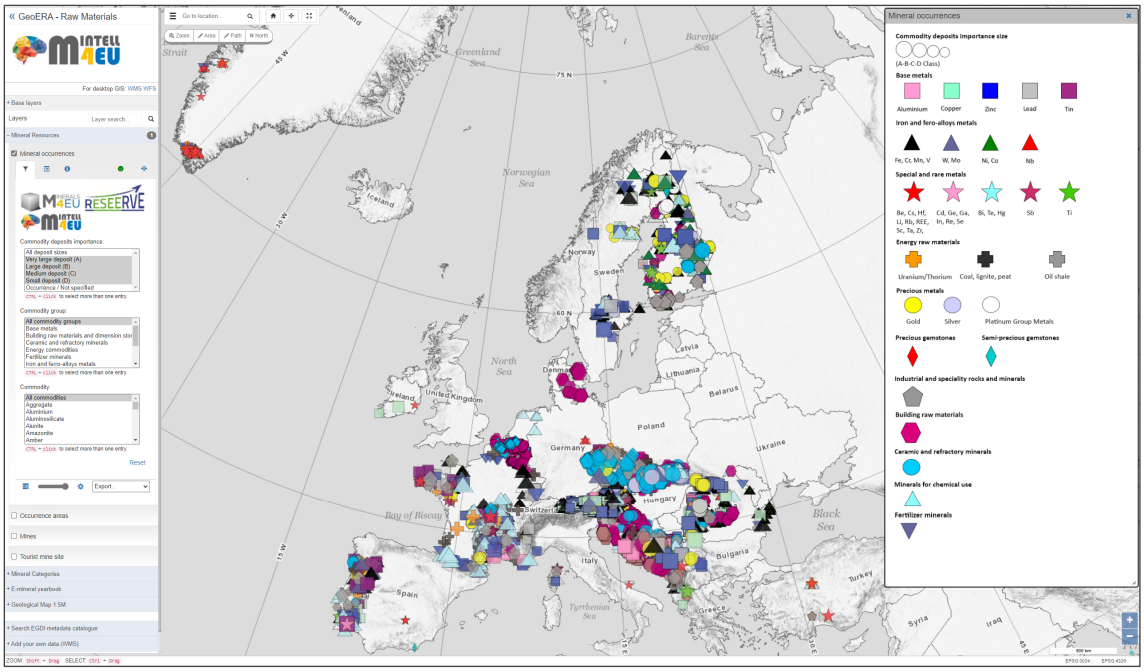

Figure 4. MINTELL4EU Portal showing the mineral occurrence dataset according to the INSPIRE data specification on mineral resources.

The individual web layers on the portal are defined with their own specific MapServer definition used by the map engine to display the spatial and tabular data. This MapServer layer definition contains the connection and SQL query to the central database and provides the data source and specified attributes of the layer. For each value from the data query that is not intended to be displayed in the attribute table, a '_hidden' syntax ensures that these are not displayed.

The symbology is based on INSPIRE with additional information added from the MINTELL4EU workgroup described in the INSPIRE legend section. Information about the colours and types of symbols that are used by the INSPIRE specification for mineral resources are included in the commoditygroup table of the MIN4EU database.

The query in the MapServer definition uses this information to create dynamic symbolization on the maps shown on the Portal.

Further logic is also incorporated such as geometric transformation which computes the geometric centre of a dataset that contains either polygons or multi-polygons and returns the centroid point of the geometry's envelope. In order to make sure that all the symbols for the larger commodity deposits for the importance group do not overlap the smaller ones, an order by statement ensures that the larger deposits are always drawn behind the smaller ones on the map. This statement is shown in Appendix 1.

2.2 Electronic Minerals Yearbook

The electronic Minerals Yearbook data model (Figure 5) comprises three data types:

1. Trade data per commodity, per year, per country (the purple colour table);
2. Reserve, resource, exploration data per commodity, per year, per country (the cyan coloured tables);
3. Code list tables (the grey coloured tables).

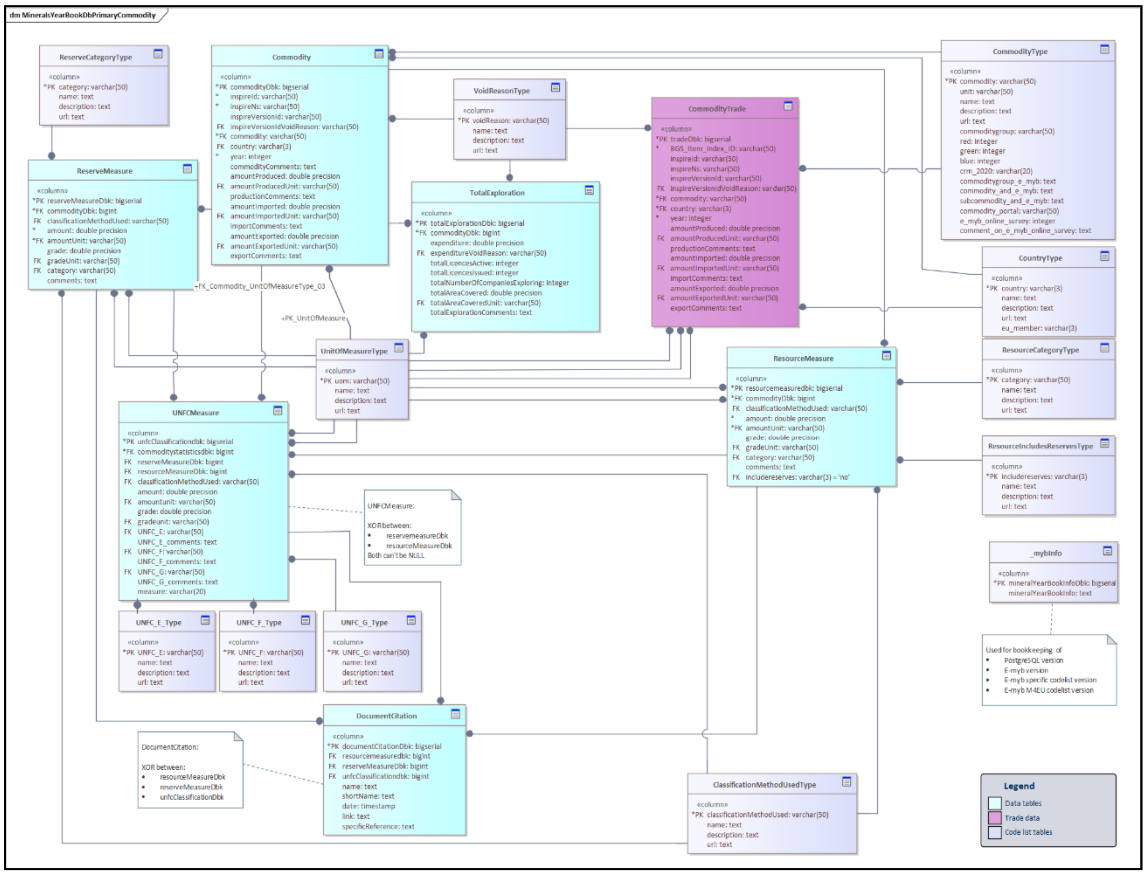

Figure 5: Schematic view of the electronic Minerals Yearbook data model.

The trade data is collected and maintained by the British Geological Survey (BGS) and they have set up a WFS service:

Description of the WFS service http://ogc2.bgs.ac.uk/mintell/
WFS service for download http://ogc2.bgs.ac.uk/cgi-bin/mintell/ows (e.g. by QGIS)

The BGS WFS service with trade data is downloaded using QGIS to export it to an Excel spreadsheet. This spreadsheet is uploaded to EGDI using a GeoKettle ETL software.

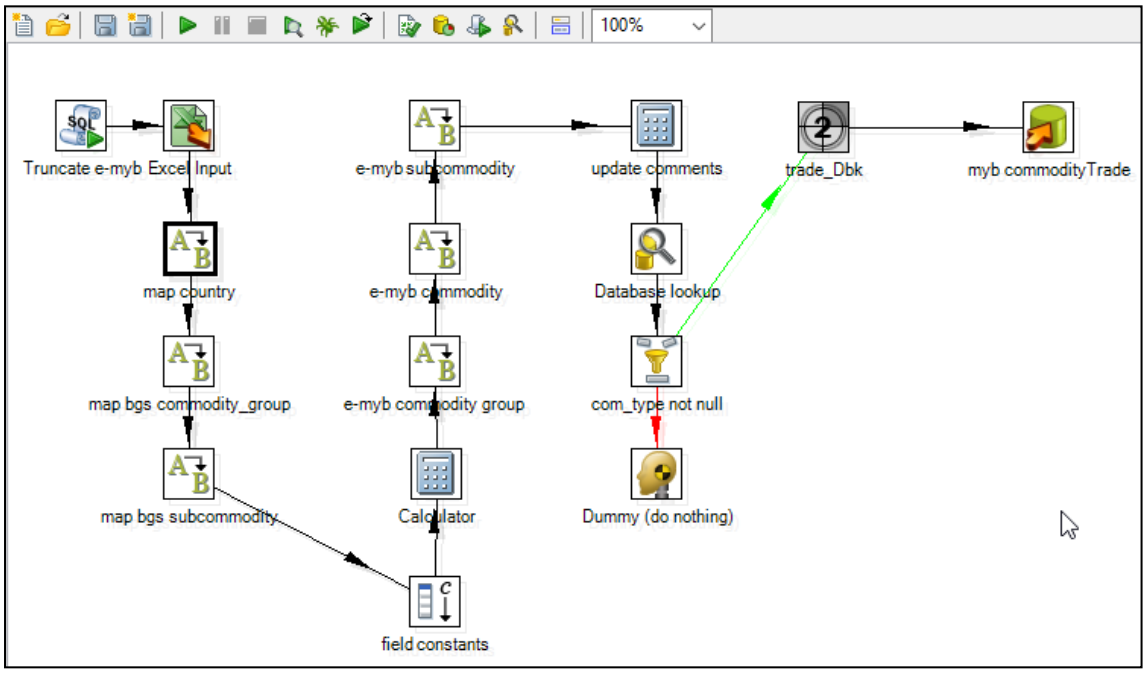

Figure 6: Screenshot of the process of preparing electronic Minerals Yearbook trade data

The reserve, resource and exploration data per commodity, per year, per country is received as a pg_dump backup-file from GeoZS. The data from this file are loaded in a local Postgres database using PG Admin and then exported to a file containing SQL insert statements using the following script in a command prompt window:

```
"C:\Users\fsc\AppData\Local\Programs\pgAdmin 4\v6\runtime\pg_dump" -h localhost -p <port> -d <database> -a -F p -b -v -x --column-inserts --disable-triggers -f "<path>\myb20210930.sql" ^
-t myb.commodity ^
-t myb.countryfacility ^
-t myb.countrywaste ^
-t myb.documentcitation ^
-t myb.reservemeasure ^
-t myb.resourcemeasure ^
-t myb.totalexploration ^
-t myb.unfcmeasure ^
-t myb.wasteflow
```

This insert SQL file is loaded into MIN4EU database using PG_Admin SQL window (Figure 7).

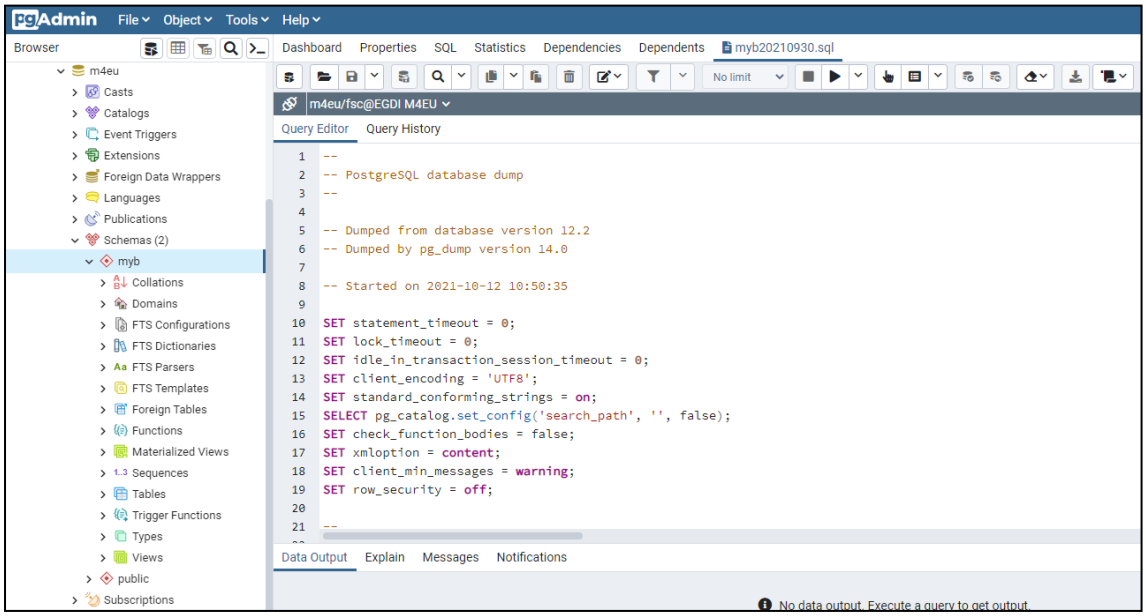

Figure 7: Screenshot from PG Admin showing the MIN4EU database being locally restored.

In addition, a table containing spatial geometries of country borders is included to visualize the electronic Minerals Yearbook data on the web map (Figure 8).

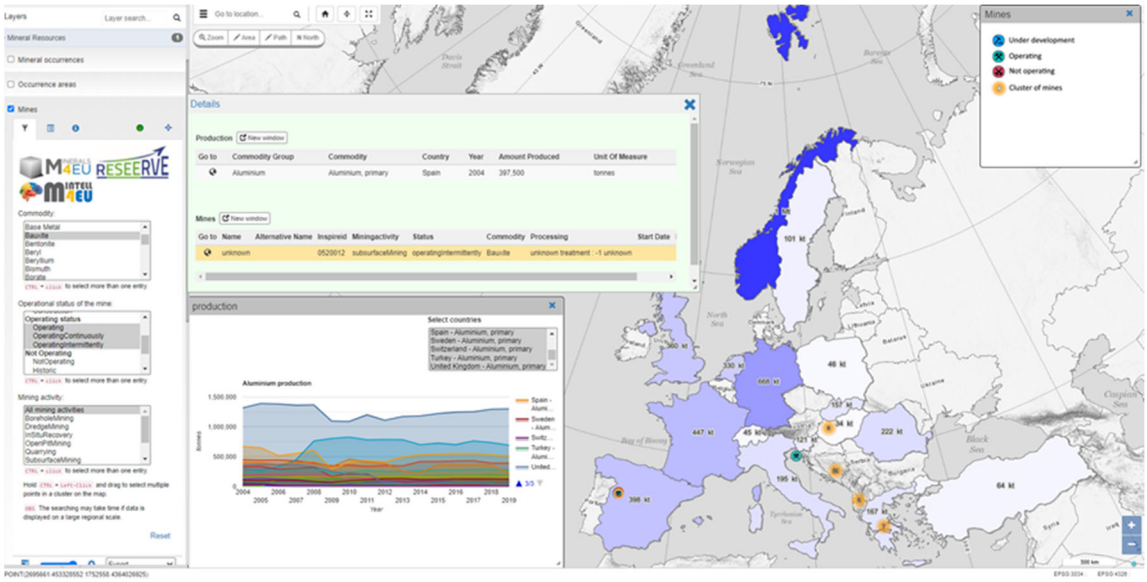

Figure 8: Example of electronic Minerals Yearbook aluminium production data from 2004 presented on the MINTELL4EU viewer.

3 METADATA

For each service, the layer definition setup refers to the associated metadata for the dataset, which is registered in the EGDI metadata catalogue.

```
"ows_inspire_metadataurl_format" "application/xml"
"ows_inspire_metadataurl_href" "https://egdi.geology.cz/record/basic/572a0113-efd0-408d-9a1b-4c640a010855?language=eng"
"ows_metadataurl_href" "https://egdi.geology.cz/record/basic/572a0113-efd0-408d-9a1b-4c640a010855?language=eng"
"ows_metadataurl_type" "FGDC"
"ows_metadataurl_format" "text/xml"
```

The metadata can be accessed directly from the service layer on the web portal by clicking on the description icon where a brief description is given (Figure 9). Clicking further on the *New* tab will open the official EGDI metadata page https://egdi.geology.cz/ for the respective dataset.

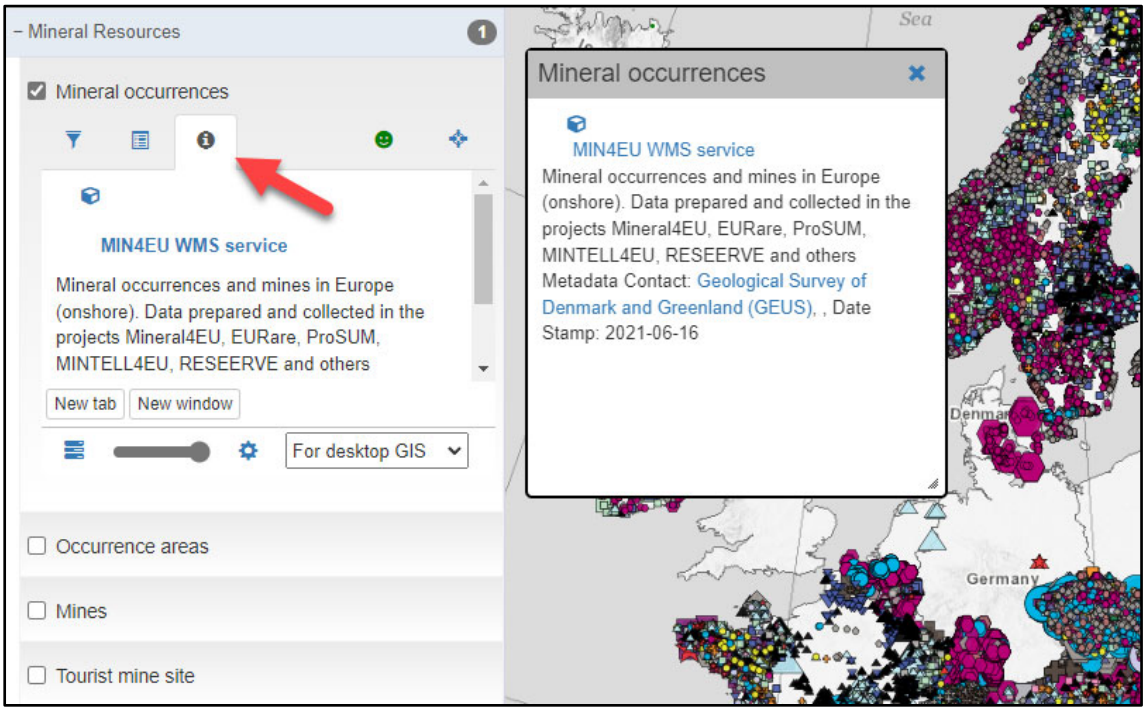

Figure 9. Metadata description for each individual service can be accessed directly from the layer on the web portal.

4 THE LEGEND OF THE MINERAL OCCURRENCE LAYER

The legend of the mineral occurrence layer is based on the document D2.8.III.21 INSPIRE Data Specification on Mineral Resources –Technical Guidelines (https://inspire.ec.europa.eu/id/document/tg/mr), with additional information and corrections added from the MINTELL4EU workgroup. These additions include updated classifications on commodity groups and new symbology.
The INSPIRE legend is recreated using Adobe Photoshop 2021 where symbols, labels and text have been redrawn. The graphic legend is then exported as a PNG file and uploaded to the portal on the application server and displayed with the layer through the MapServer definition setup (Figure 10).

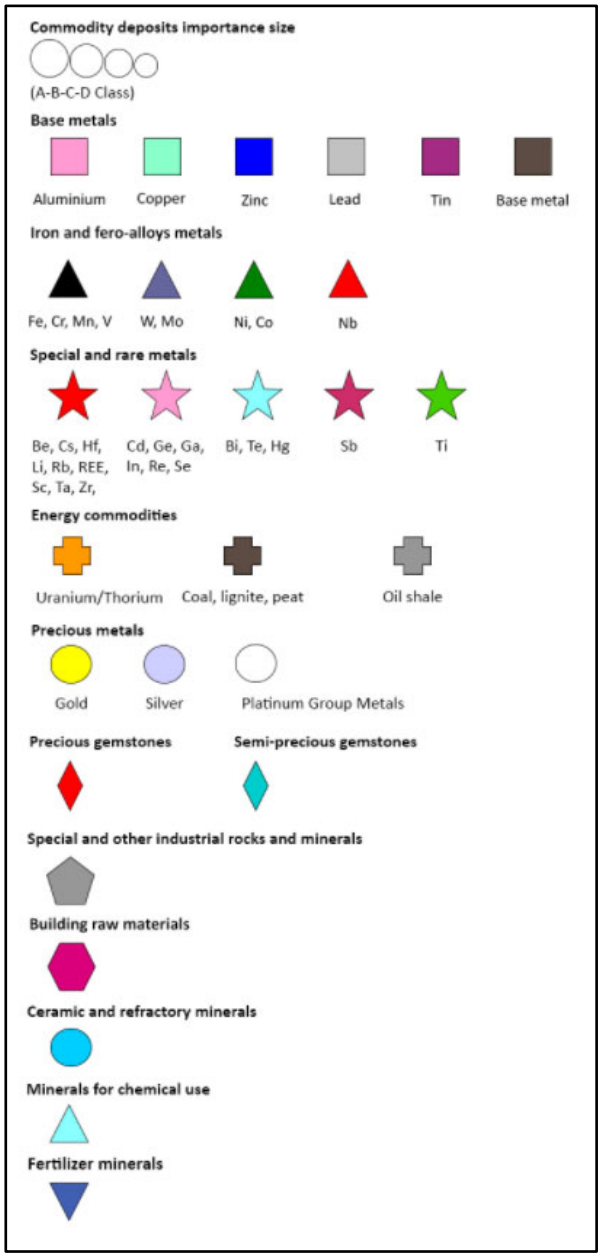

Figure 10: Mineral occurrence legend

5 SERVICE VALIDATION

To ensure that a user can get more information about the status of the web service, a service indicator status has been created with a smiley scheme as seen on Figure 81.

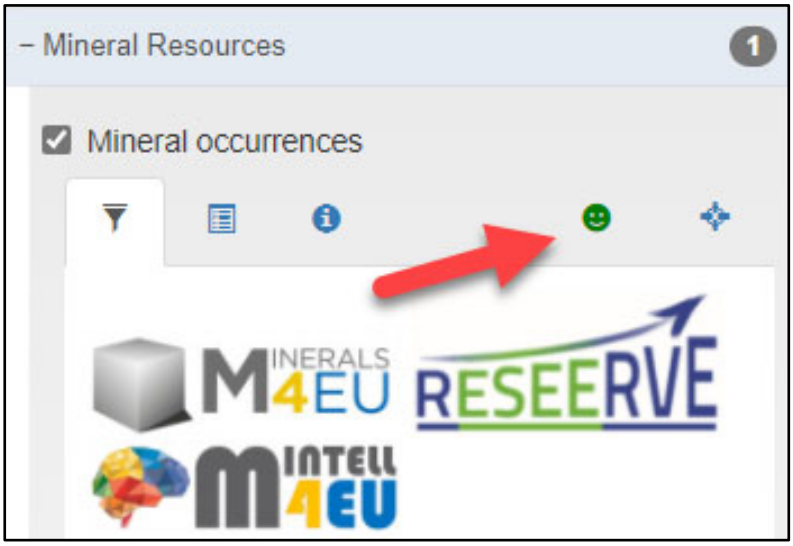

Figure 8. A smiley service indicates the health status of the service. Clicking on the smiley will open a web page with more detailed information.

The smiley scheme is an underlying monitoring system with a procedure that validates the individual services based on a set of parameters, including response time, availability, and access to the EGDI metadata catalogue. The monitoring system lists and monitors the uptime of all services that are registered on the EGDI portal (https://data.geus.dk/egdi/?mapname=egdi).

By clicking on the smiley icon, the user can get access to a more comprehensive service status description on a separate web page (Figure 12). This information includes the date for the last service check as well as a graph displaying response time and status over time for the last two weeks.

The system provides a way for users to discover all the services registered in EGDI and their individual status. It makes it easier for service maintainers to get an overview of the health of the registered services as seen on Figure 103.

The full monitoring system for all registered services on the EGDI Portal can be accessed through https://data.geus.dk/egdi_monitor_smiley/MonitorSmiley.html.

The smiley monitoring system is documented on the EGDI GitLab https://geusgitlab.geus.dk/egdi/monitorsmiley

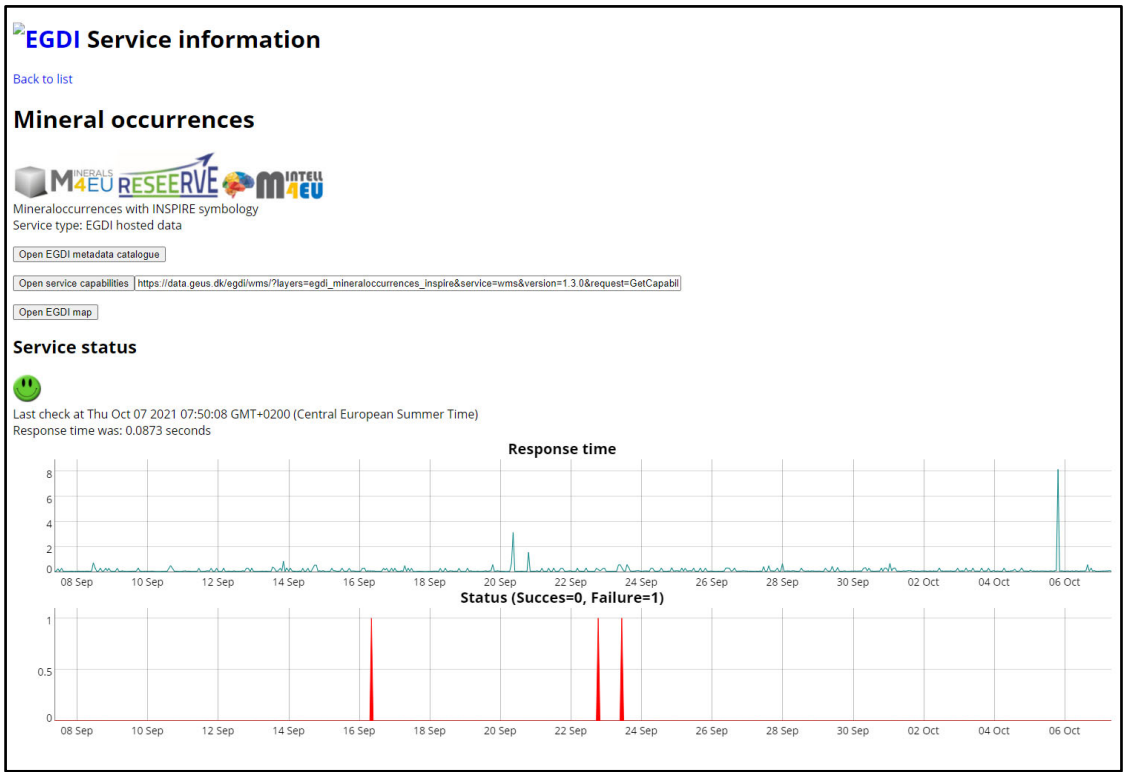

Figure 92. Individual service status description for the Mineral occurrences.

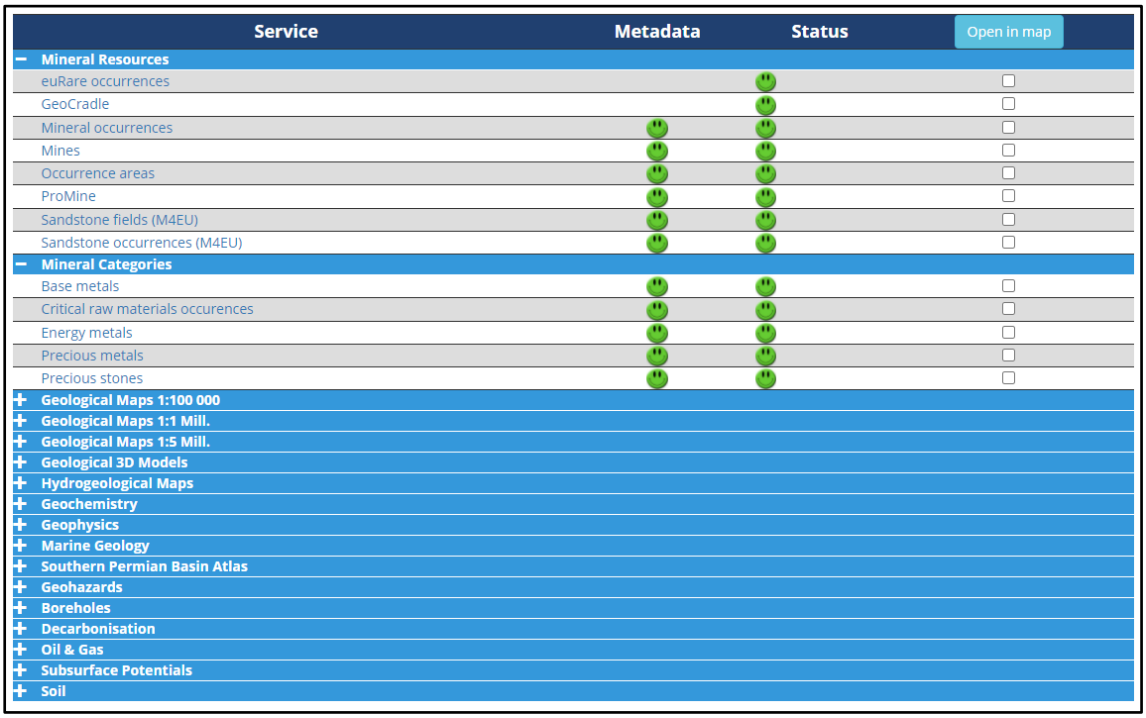

Figure 103. Smiley monitoring system: list of all individual services registered on the EGDI Portal.

6 TESTING THE DATA INTEGRATION

This section of the report describes how the data integration has been tested, which issues were discovered and how they have been rectified.

6.1 Mineral resources

The Mineral Resources layer was tested visually to make sure that all the different types of deposits were displayed and that they had the correct symbol. A new symbol for titanium, consisting of a green star had to be added to the legend as this was not included in the INSPIRE document describing the symbology of the different commodities.

A new symbol of a dark grey square for base metal deposits was added to the legend to display the polymetallic base metal deposits in the Carpathian Mountains of Romania (Figure 14). The commodity for these deposits was registered as base metals rather than the most important commodity which was done by the other data providers.

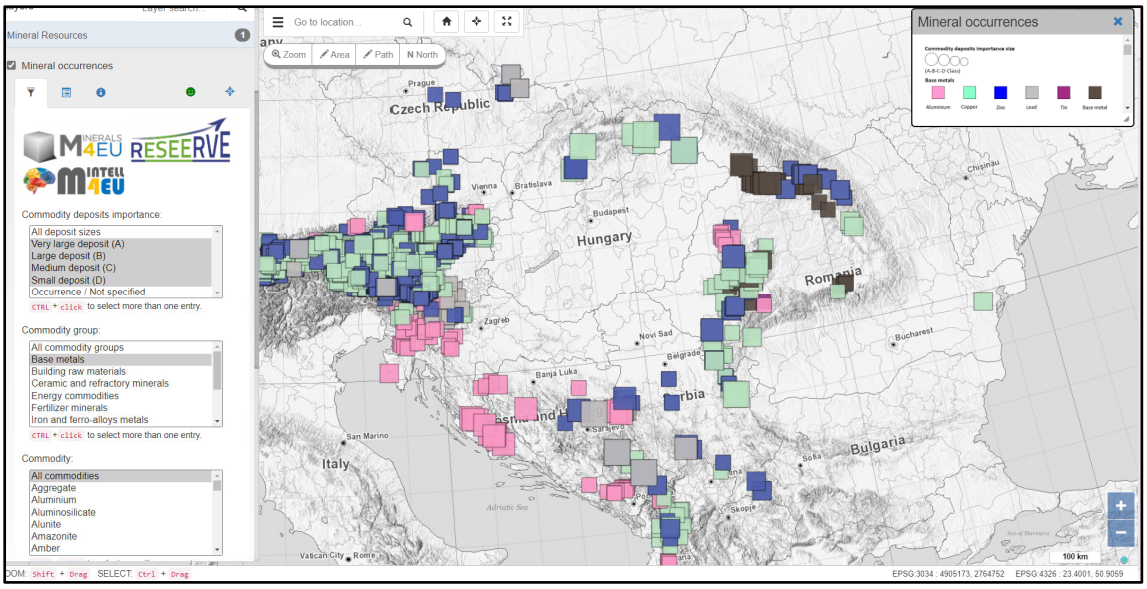

Figure 114: Screenshot of the Portal showing base metal deposits in Romania.

6.2 Electronic Minerals Yearbook

The electronic Minerals Yearbook data is symbolized similarly to the visualization of the data collected for the mineral yearbook during the Minerals4EU project (2013–2015). For production, import and export, a colour schema from white to blue is chosen for indicating whether a country has produced, imported or exported a lot or a little of a given commodity. Note that the colour refers to the maximum value of a certain commodity in a group. For reserves and resources, the colour yellow or orange is used to indicate the presence of a reserve or resource for a given commodity in a country. Orange indicates that information was gathered during the Minerals4EU project. For the UNFC layer it is possible to select the feasibility status for a given commodity.

7 CONCLUSIONS

The overall process of integrating data for the different theme layers has largely been successful and MINTELL4EU results are a significant advancement from earlier projects.

There will always be data harmonisation issues when compiling data from so many national and regional data providers even if the processes of standardising data collection and recording have been ongoing for several years. One of the main challenges of testing the data is that different providers may record the same data in different ways. For example, “apatite” could be recorded as the mineral “apatite” under *Special and other industrial rocks and minerals* or as “phosphate” under *Fertiliser minerals*. Where the same commodity was recorded differently, changes had to be made to the database so that the portal would recognise the two instances as a single commodity.

8 APPENDIX 1

Order statement used to display the point data on the EGDI portal.

```
#########################
# Layer definition setup
#########################

LAYER
 NAME "egdi_mineraloccurrences_inspire"
 GROUP "egdi_portal"
 TYPE POINT
 STATUS ON
 HEADER "templates/wms_header.html"
 TEMPLATE "templates/std_template.html"
 FOOTER "templates/wms_footer.html"
 METADATA
  "ows_title" "egdi_mineraloccurrences_inspire"
  "wms_title" "egdi_mineraloccurrences_inspire"
  "ows_group_title" "egdi_portal"
  "ows_group_abstract" "Mineraloccurrences with INSPIRE symbology"
  "ows_srs" "EPSG:4258 EPSG:4326 EPSG:3034"
  "wms_srs" "EPSG:4258 EPSG:4326 EPSG:3034"
  "gml_geometries" "msGeometry"
  "gml_msGeometry_type" "point"
  "ows_extent" "-15 30 45 75"
  "ows_latlonboundingbox" "-15 30 45 75"
  "gml_featureid" "id_hidden"
  "ows_featureid" "id_hidden"
  "ows_include_items" "all"
  "gml_include_items" "all"
  -- begin egdi metadata url
  "ows_inspire_capabilities" "url"
  "ows_inspire_metadataurl_format" "application/xml"
  "ows_inspire_metadataurl_href" "https://egdi.geology.cz/record/basic/572a0113-efd0-
408d-9a1b-4c640a010855?language=eng"
  "ows_metadataurl_href" "https://egdi.geology.cz/record/basic/572a0113-efd0-408d-9a1b-
4c640a010855?language=eng"
  "ows_metadataurl_type" "FGDC"
  "ows_metadataurl_format" "text/xml"
  -- end egdi metadata url
  -- begin inspire legend graphic figure
  "xms_style" "default"
  "xms_style_default_legendurl_href" "http://data.geus.dk/egdi/get_legend.jsp?layer=1005
5"
  "xms_style_default_legendurl_format" "image/png"
  "xms_style_default_legendurl_width" "600"
  "xms_style_default_legendurl_height" "1300"
  -- end inspire legend graphic figure
 END

############################
# Data connection and query
############################

SELECT
  mo.mineraloccurrencedbk AS id_hidden,
  mo.name AS name,
  ctt.name AS country,
  dgt.name AS deposit_group,
  mo.occurrencetype AS occurrence_type,
  cg.commoditygroup AS commodity_group_hidden,
  cg.name AS commodity_group,
  ct.commodity AS commodity,
  -- begin inspire symbology
  COALESCE(string_agg(distinct impt.importance,','),'occurrence') AS importancelist_hidd
en,
  CASE
   WHEN impt.importance = 'veryLargeDeposit' THEN '25'
   WHEN impt.importance = 'largeDeposit' THEN '20'
```

```
   WHEN impt.importance = 'mediumSizedDeposit' THEN '15'
   WHEN impt.importance = 'smallDeposit' THEN '10'
   WHEN impt.importance = 'occurrence' THEN '5'
   ELSE '5'
  END importance_small_hidden,
  CASE
   WHEN impt.importance = 'veryLargeDeposit' THEN '35'
   WHEN impt.importance = 'largeDeposit' THEN '30'
   WHEN impt.importance = 'mediumSizedDeposit' THEN '25'
   WHEN impt.importance = 'smallDeposit' THEN '20'
   WHEN impt.importance = 'occurrence' THEN '10'
   ELSE '10'
  END importance_large_hidden,
  CASE
   WHEN impt.name IS NULL THEN 'Not specified'
   ELSE impt.name
  END importance,
  string_agg(distinct matt.name,',') AS mining_activity,
  concat(ct.red,' ',ct.green,' ',ct.blue) AS rgb,
  CASE
   WHEN symbol IN ('circle','cross','diamond','triangle','star','pentagon') THEN symbol
   WHEN symbol = 'inverted triangle' THEN 'triangle'
  WHEN symbol = 'square' THEN 'box'
   WHEN symbol = 'hexagon' THEN 'sextagon'
   ELSE 'circle'
  END symbol_hidden,
  CASE
   WHEN symbol = 'inverted triangle' THEN '180'
   WHEN symbol = 'hexagon' THEN '90'
   ELSE '0'
  END symbol_angel,
  -- end inspire symbology
  -- begin define origin of dataset geometry
  CASE
   WHEN st_geometrytype(mo.geometry) IN ('ST_Point','ST_MultiPoint') THEN 'Point dataset
'
   WHEN st_geometrytype(mo.geometry) IN ('ST_Polygon','ST_MultiPolygon') THEN 'Centroid
point calculated from polygon'
  END geometry_origin,
  -- end define origin of dataset geometry
  -- begin calculate centroid point of each polygon dataset
  st_centroid(mo.geometry) AS geom
  -- end calculate centroid point of each polygon dataset
  FROM public.mineraloccurrence mo
  LEFT OUTER JOIN public.miningactivity ma ON mo.mineraloccurrencedbk = ma.mineraloccurr
encedbk
  LEFT OUTER JOIN public.miningactivitytypetype matt ON ma.miningactivitytype = matt.min
ingactivitytype
  LEFT OUTER JOIN public.deposittypetype dtt ON mo.deposittype = dtt.deposittype
  LEFT OUTER JOIN public.depositgrouptype dgt ON mo.depositgroup = dgt.depositgroup
  LEFT OUTER JOIN public.commodity c ON mo.mineraloccurrencedbk = c.mineraloccurrencedbk
  LEFT OUTER JOIN public.commoditytype ct ON c.commodity = ct.commodity
  LEFT OUTER JOIN public.commoditygrouptype cg ON ct.commoditygroup = cg.commoditygroup
  LEFT OUTER JOIN public.countrytype ctt ON mo.country = ctt.country
  LEFT OUTER JOIN public.importancetype impt ON c.importance = impt.importance
  WHERE st_geometrytype(mo.geometry) IN ('ST_Point','ST_MultiPoint','ST_Polygon','ST_Mul
tiPolygon')
  -- begin exclude certain not qualified datasets
  AND ctt.name NOT IN ('United Kingdom', 'Poland')
  AND c.mineraloccurrencedbk IS NOT NULL
  -- end exclude certain not qualified datasets
  GROUP BY
   mo.mineraloccurrencedbk,
   ct.commodity,
   ctt.name,
   impt.importance,
   cg.commoditygroup,
   dgt.name,
   mo.geometry
 ORDER BY importance_small_hidden, importance_large_hidden DESC
```