MINERAL INTELLIGENCE FOR EUROPE

Deliverable D5.4

Review and data exchange prototype(s)

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GENERAL INTRODUCTION

The European Union has identified security of supply, improvement in environmental management and resource efficiency as key challenges for the raw materials sector. Data regarding the location and spatial distribution of primary and secondary raw materials, with respect to exploration, exploitation, production and trade activities, underpin decision making in government and industry. Given the dynamic character of such data, regular updates of comprehensive, reliable and harmonized information across borders are required. The overall aim of MINTELL4EU is to improve the European Knowledge Base on raw materials as there are several sources of non-harmonized data with different coverages developed for different purposes during national and international projects over recent decades. All data are shared at the European Geological Data Infrastructure, EGDI.

Tasks include updating the electronic Minerals Yearbook produced in the Minerals4EU project as well as extending the spatial coverage and quality of data currently in the Minerals Inventory. Furthermore, MINTELL4EU aims to increase the degree of harmonization, communication and interaction between existing data platforms, with the ambition of reaching a fully operational and reliable data knowledge management system, fulfilling the European needs and taking into account the Raw Materials Information System (RMIS) of the European Union. Finally, the applicability of the UNFC classification system for obtaining more accurate Pan-European mineral inventories are tested through a large number of case studies on different commodities across Europe.

MINTELL4EU has 27 partners each representing a national or regional geological survey organisation from 25 European countries.

EXECUTIVE REPORT SUMMARY

This report describes the steps that were undertaken to integrate data from the MIN4EU database into the Raw Materials Information System (RMIS) of the European Commission Joint Research Centre (EC JRC), including the review of technical solutions and feeding data flow. Furthermore, the test on integrating MIN4EU data into the European Plate Observing System (EPOS) is also briefly described.

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1 OVERVIEW

In order to increase the level of harmonization, communication and interaction between existing raw materials data platforms, MINTELL4EU aims to create a fully operational and reliable data knowledge management system that meets European needs. Furthermore, the interaction with other data platforms such as the European Plate Observing System EPOS as well as with the Raw Materials Information System (RMIS) of the Joint Research Centre (JRC) (Figure 1) was an important task.

The latter was the biggest task and here the main idea was to feed the MIN4EU data into the RMIS system via different technical solutions, e.g., Web Map Services (WMS) or Web Feature Services (WFS) or even via a dedicated Application Programming Interface (API) often used for complex structured data, e.g., to allow a user to specify the fields/data to be retrieved and their format so that they can be directly integrated into a client application. Also refer to deliverables D5.1, D5.5 and D5.6 for more information on these initial plans. After several meetings and discussions between the RMIS team at JRC and MINTELL4EU experts and considering the technical requirements of the system as well as useful datasets/data types for RMIS/Raw Materials (and Country) Profiles, it was decided not to use any of the solutions initially envisaged. Instead, it was found more adapted for JRC to embed an interactive map into two separate pages of the RMIS website (https://rmis.jrc.ec.europa.eu/) with access to MINTELL4EU data. Chapter 2 here after describes how this solution was implemented.

Figure 1. *RMIS home page*

2 RMIS REQUIREMENTS AND IMPLEMENTATION

Together with RMIS experts at JRC, MINTELL4EU WP5 team started by compiling the content that would be relevant and could be accessible through the RMIS, i.e., a list of information and data with potential added value for RMIS applications and related purposes. This content was sorted by topic to clarify which data from the MIN4EU database could meet these requirements. JRC was mainly interested in structured data, but it was agreed that data quality was of key importance.

Technical issues and specifications for linking data and information or transferring them into RMIS were also addressed, taking into account the technical requirements of RMIS. The background of RMIS and general IT-related recommendations were used to define these technical requirements. (https://rmis.jrc.ec.europa.eu/uploads/Technical_guidelines_for_knowledge_transfers_into_RMIS.pdf).

Currently, RMIS does not have a central database facility, but rather specific, discrete datasets (in different formats) connected to the different tiles/subtitles/sections. This is a pragmatic approach that allows RMIS to represent different data in different formats at different tiles. It was suggested that data linked to the MINTELL4EU scope could be initially placed in the following tiles of the RMIS website (https://rmis.jrc.ec.europa.eu/):

- Critical Raw Materials. Data needed for supply risk calculation for Material Factsheets.
- Raw Materials Scoreboard & Monitoring > Raw Materials Scoreboard.
- Raw Materials' Profiles (various).
- EU Country Profiles > Resources/Reserves.

However, as the RMIS is in a constant process of development with new sections appearing all the time, and the same situation applying to the MIN4EU data, a solution was chosen by which embedded viewers were developed specifically for RMIS. These display the same data as at MINTELL4EU viewer and show the latest updated dataset on mineral occurrences and mines across Europe

In between, GEUS created some special Web Map views on selected minerals - mineral occurrences and mines (e.g., aluminium, chromium, cobalt, gold, lithium, niobium, and silver)- to illustrate what MINTELL4EU could provide, e.g., for the 'Raw Material Profiles' sub-page in RMIS describing minerals. As described above, these maps were designed as 'live' maps, i.e., the data are continuously updated as new data are obtained from the data providers.

The proposed map legend includes symbols as defined by INSPIRE (triangles, squares, circles, etc.) representing the commodity; the size of the symbol gives an indication on the 'importance' of the occurrence (size of the reserve).

If there is a dense population of mines in an area, these can be represented as clusters at the European level, but when zoomed in, they appear as individual mines represented by coloured circles with a symbol indicating whether the mine is closed, in operation or under development.

It was noted that some data are not available for all countries. For example, in several countries, the national legislation does not allow the size of a resource to be indicated (the map indicates that the deposit is present, but not how large it is) or the location of an operating mine to be shown, as this may be confidential as part of the mining company's concession rights. Countries that do not share mine information could be shaded in some way. It is the individual countries (data providers) that select what they share with MIN4EU, and their responsibility that data are of sufficient quality and elaboration.

Since this data publication on RMIS as a display consumes contents from the EGDI (European Geological Data Infrastructure) as a provider, various aspects have been considered for linking the above-mentioned maps:

A. Embedding directly on these RMIS description pages (IFrame technology with links to an EGDI server) - the map appears as it would on the RMIS website;
B. When opening a new window, the user remains on the RMIS website, but the new window appears as it would on the EGDI viewer;
C. Direct the user to the embedded EGDI viewer (e.g., a viewer developed in the present MINTELL4EU project) so the user can display other and different datasets.

After a thorough review of the technical specifications of RMIS, it was found that it is not possible (for the time being) to embed viewers as proposed above under “A” and “B”, as RMIS does not allow connections to third-party systems.

Finally, it was agreed by the RMIS and MINTELL4EU counterparts to use the "C” option - a connection to the EGDI viewer with all locations and commodities, as this is the most convenient and representative for both sides.

The map has been slightly adapted from a template to suit the RMIS needs:

- Omitting the external selector (URL router) and replacing it with a fixed URL string (unique link). This makes the map application more versatile, unrestricted, and useful for embedment at different modules or pages of RMIS.
- Introducing a simple and clear page menu with (only) two selectable categories of items or functions (Countries and Commodities): in the form of drop-down lists with multiple selections, allowing different combinations of countries and commodity levels.
- Activation of automatic zooming and centering on the selected geo-feature (country).

As a result, the dedicated EGDI viewer is now integrated into two separate tiles of the RMIS website (Figure 2):

- Tile "Resilience, Autonomy, ..." (https://rmis.jrc.ec.europa.eu/?page=geological-data-54d4aa)

- Tile "Raw Material Profiles" (https://rmis.jrc.ec.europa.eu/?page=geological-data-157d8a)

These two RMIS sections are very similar, with slight variations in the text highlighting what is shown on the map, in copy here after:

"The interactive map shows in two separate layers mineral occurrences and mine locations with basic attributes throughout the European Union (partial coverage of 21 EU Member States). To view the mineral occurrences and/or the mining sites for a specific raw material and EU country, please click on the "**Minerals Inventory"** to see the sub-layers **"Mineral Occurrences"** and **"Mines".**
The layer "**Mineral Occurrences**" shows the location of individual, or several minerals potentially suited for raw material extraction. They are shown per raw material (commodity) and classified according to the importance of the deposit.
The layer "**Mines**" shows mining sites of any operational status (operating, under development, or not operating). The data differentiates the various mining activities, like underground mining, open pit mining etc.
The map is an adapted version of EuroGeoSurveys' European Geological Data Infrastructure (EGDI) Mineral Resources dataset developed by GeoERA project Mineral Intelligence for Europe (Mintell4EU).

The geographical coverage is expanding over time. The current version (status 3.8.2021) covers all EU member states except Bulgaria, Estonia, Latvia, Lithuania, Luxembourg, Malta. Commodity names, and symbols (colour, shape) are following the INSPIRE regulations. Note that for clarity the mines are shown in an aggregated view: Individual mines can be shown by zooming in at the map.

Disclaimer: The map (and its underlying data) is adapted from the "GIS viewer for Mintell4EU", a GeoERA project. The data set undergo regular updates. The European Commission is not liable for any incorrectness or incompleteness of the data."

Figure 2. *The embedded EGDI viewer to the RMIS web site*

The RMIS web site includes a tile called "Raw Material Knowledge Gateway" where information about different projects at national and European level can be found. The MINTELL4EU project is also presented and can be found via this link: https://rmis.jrc.ec.europa.eu/?page=rmkg (Figure 3).

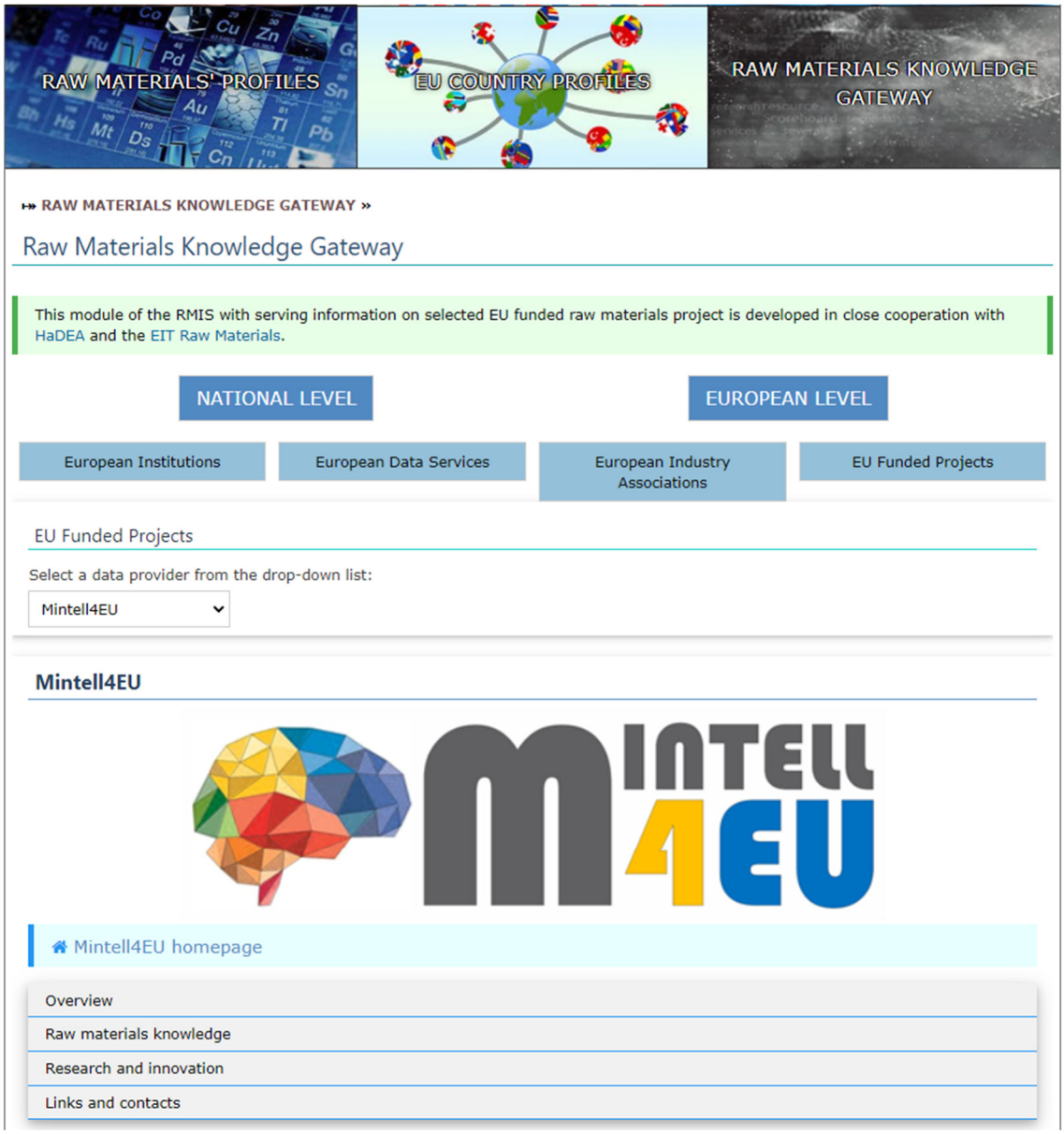

Figure 3. *Information on the MINTELL4EU project at RMIS.*

3 TEST OF INTEGRATION OF MIN4EU DATA INTO EPOS

MIN4EU and EGDI are open for the exchange of data with other platforms.

The integration of the data service on MIN4EU Mines with the European Plate Observing System Portal, EPOS[1] Portal has been tested in the context of TCS[2] services integrated with the EPOS. An internal EPOS report contains the description of the method of technical testing of the TCS Geological Information and Modelling (GIM) before integration into the ICS[3] with the tests performed for all TCS service endpoints. The report was targeted for the EPOS IT board where the description of the methods is described in the Report on POT TEST #4: Technical testing of TCS services before integration to ICS. The report is not publicly available.

An example of how data on (non-clustered) mines from MIN4EU could be visualised on the EPOS portal is shown in Figure 4.

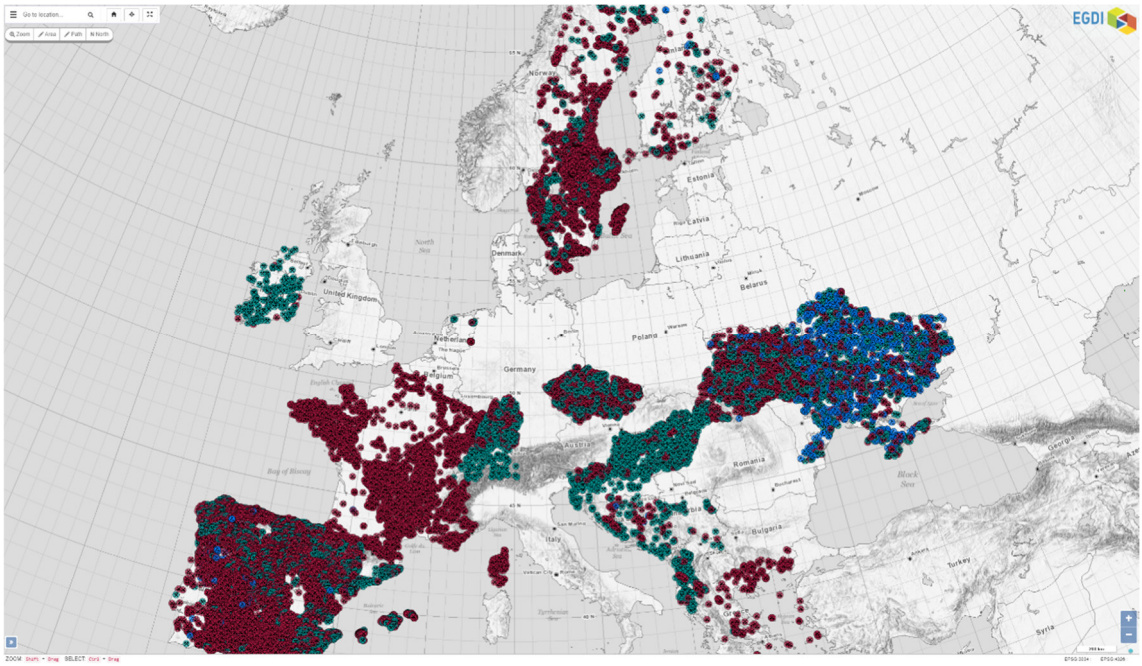

Figure 4. *MIN4EU data, non-clustered mines.*

[1]EPOS, the European Plate Observing System, is a multidisciplinary, distributed research infrastructure that facilitates the integrated use of data, data products, and facilities from the solid Earth science community in Europe.

[2] Thematic Core Service: different geoscientific disciplines as Seismology, Near-Fault Observations, Volcano Observations etc. Thematic Core Services | EPOS (epos-eu.org).

[3] Integrated Core Service: the core of the EPOS e-infrastructure. Integrated Core Services | EPOS (epos-eu.org).

4 CONCLUSIONS

The dialogue between JRC and EGDI counterparts will continue beyond the lifetime of MINTELL4EU to ensure continuity and allow for additional benefits under the CSA GSE[4] expected to follow GeoERA program. In this respect, we will seek further advanced applications based on the interactions so far.

One of the possible enhancements relates to statistical data. In the 'Raw Materials Profiles', there is aggregated information on resources and reserves at European level, annotating different sources, in some cases the Minerals4EU project that ran from 2013 to 2015. But for a large number of countries, these data have been updated in the electronic Minerals Yearbook, eMYB, as part of the MINTELL4EU project (which also includes aggregated production (import/export) data).

This work was carried out by the British Geological Survey as they have a long history of collecting these data. However, as part of MINTELL4EU, the data were further harmonised, and quality checked and made available online via the EGDI viewer. An example of reserve data collected under the MINTELL4EU project with reference year 2019 can be found here:

https://data.geus.dk/egdi/?mapname=egdi_geoera_mintell4eu#baslay=baseMapGEUS&extent=-1364840,887880,7794350,5939740&layers=minerals_yearbook_reserve (Figure 5).

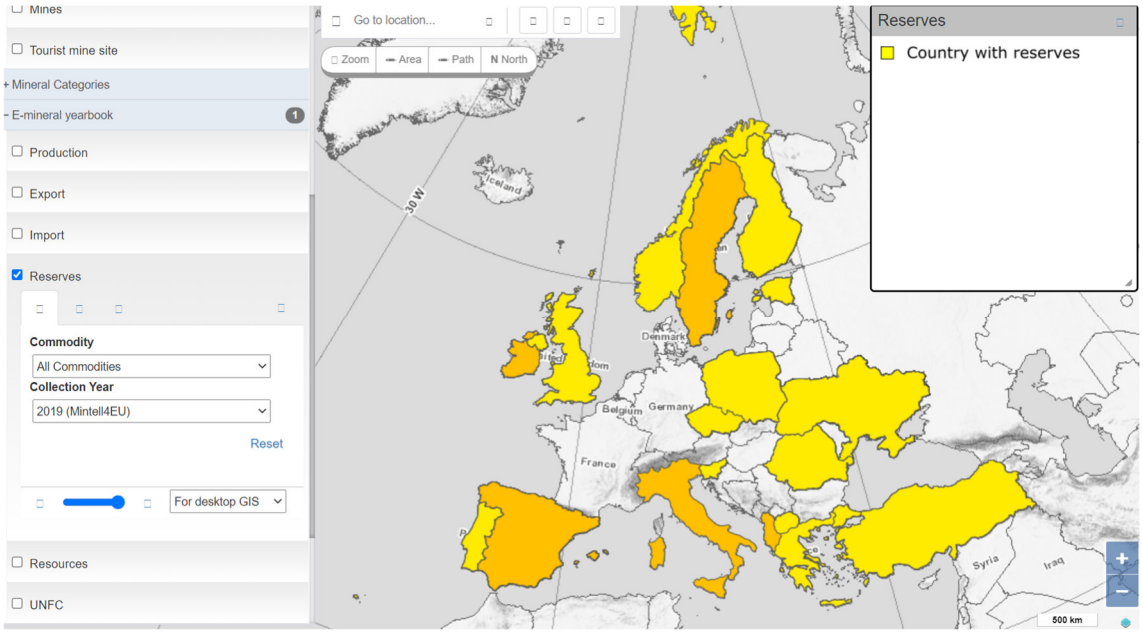

Figure 5. *Electronic Minerals Yearbook data on the EGDI Viewer (example of reserves data, reference year 2019).*

[4] Coordination and Support Action: Geological Service for Europe: a project proposal is being prepared under the leadership of EuroGeoSurveys, the Geological Surveys of Europe; call HORIZON-CL5-2021-D3-02-14: Support to the activities of the European Geological Services.

The Minerals4EU resource and reserve datasets have a reference year of 2011 or up to 2013. A new dataset has been created in MINTELL4EU with a reference year of 2019.
In the future, these data could also be shared with RMIS.

In addition, data from MIN4EU database can also be shared with EPOS or other relevant data platforms as described.

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Technical guidelines for knowledge transfer (https://rmis.jrc.ec.europa.eu/uploads/Technical_guidelines_for_knowledge_transfers_into_RMIS.pdf).