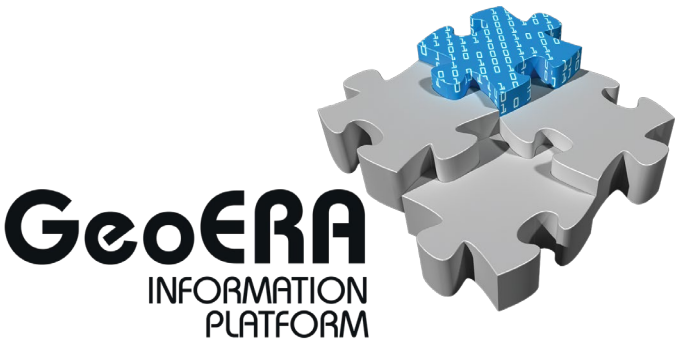

Deliverable 2.1.1

First report highlighting the potential synergies and overlaps between the projects in terms of geoinformation.

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Version: 30-06-2019

This report is part of a project that has received funding by the European Union's Horizon 2020 research and innovation programme under grant agreement number 731166.

Deliverable Data		
Deliverable number	D2.1.1	
Dissemination level	Public	
Deliverable name	First report highlighting the potential synergies and overlaps between the projects in terms of geoinformation.	
Work package	WP2, User Requirements	
Lead WP/Deliverable beneficiary	David García Moreno	
Deliverable status		
Submitted (Author(s))	26/06/2019	Margarita Patricia Sanabria Pabón, Romain Darnault, László Sőrés, Lidia Quental, Ane Bang-Kittilsen, David García Moreno.
Verified (WP leader)	30/06/2019	David García Moreno
Approved (Coordinator)	11/07/2019	Jørgen Tulstrup

GENERAL INTRODUCTION

The GeoERA Information Platform project (GIP-P) is established to support the 14 geoscientific projects (GSPs) comprised within GeoERA in organising and disseminating the geoinformation generated within their frameworks. The GIP-P is entitled to safeguard the results of the research performed by the various GeoERA projects in terms of geospatial data, reports and structured databases. This will be done by extending the current European Geological Data Infrastructure (EGDI), so that it can display and share the results from the various GeoERA projects with citizens, researches and/or stakeholders.

The different GeoERA projects deal with multiples aspects of geosciences in the fields of groundwater, raw materials, and geo-energy. These projects will thus be generating a variety of products, which will require specific functionalities to be developed to store, show and share them properly. It is thus important that the GIP-P has a good understanding of the products that each project will generate, and the functionalities required to show them properly. This is assured by Work Package 2 (WP2), which coordinates the interactions between the various GeoERA projects and the GIP-P.

EXECUTIVE REPORT SUMMARY

Despite the diversity and multidisciplinary of the various GeoERA projects, all of them address geological topics. Hence, different projects might produce similar or complementary geoinformation. It is thus likely that some overlap occurs between the geoinformation produced by the different projects. That is especially true for projects delivering data from the same or neighbouring areas.

If the potential overlaps between projects in terms of geoinformation are identified beforehand, they could be transformed into synergies. The present report aims to highlight the possible overlaps and potential synergies that could be established between different GeoERA projects.

GeoERA

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DEFINITIONS

GeoERA: Establishing the European Geological Surveys Research Area to deliver a Geological Service for Europe

Functionality: the range of operations that can be run on a computer or other electronic system.

Product: A deliverable produced by a project, which will be delivered to EGDI to make it available to end users. Types of products:

- "GIS data": raster and vectors (ESRI shapefile, GRID, etc.).
- Web services: WMS, WFS and ATOM.
- Documents: PDF, text files, images, papers, etc.
- Other data: XLS, CSV, TXT, etc.

Attributes: information associated with a geographic feature in GIS. Attributes are usually stored in tables linked to the feature by a unique identifier.

Geoinformation (equivalent to spatial data and geodata): information concerning phenomena implicitly or explicitly associated with a location within Earth.

Geological model: A digital representation of portions of the earth's crust based on geophysical and geological observations.

ABBREVIATIONS

EGDI: European Geological Data Infrastructure

PM: project month

GIP-P: GeoERA Information Platform Project

GSPs: Geoscientific projects within GeoERA

WP: work package

3DGEO-EU (in tables abbreviated as 3D): 3D geomodelling for Europe.

GARAH (in tables abbreviated as GA): Geological Analysis and Resource Assessment of selected Hydrocarbon systems.

GeoConnect³d (in tables abbreviated as Ge³): Cross-border, cross-thematic multiscale framework for combining geological models and data for resource appraisal and policy support.

HIKE (in tables abbreviated as HI): Hazard and Impact Knowledge for Europe.

HotLime (in tables abbreviated as Hot): Mapping and Assessment of Geothermal Plays in Deep Carbonate Rocks – Cross-domain Implications and Impacts

MUSE (in tables abbreviated as MU): Managing Urban Shallow Geothermal Energy.

HOVER (in tables abbreviated as HO): Hydrological processes and Geological settings over Europe controlling dissolved geogenic and anthropogenic elements in groundwater of relevance to human health and the status of dependent ecosystems.

RESOURCE (in tables abbreviated as RE): Resources of groundwater harmonized at cross-border and pan- European scale.

TACTIC (in tables abbreviated as TA): Tools for Assessment of Climate change Impact on groundwater and adaptation Strategies.

VoGERA (in tables abbreviated as Vo): Vulnerability of Shallow Groundwater Resources to Deep Subsurface Energy-Related Activities.

EuroLithos (in tables abbreviated as Eur): European Ornamental stone resources.

FRAME (in tables abbreviated as FR): Forecasting and Assessing Europe's Strategic Raw Materials needs

MINDeSEA (in tables abbreviated as MS): Seabed Mineral Deposits in European Seas: Metallogeny and Geological Potential for Strategic and Critical Raw Materials.

Mintell4EU (in tables abbreviated as Mt): Mineral Intelligence for Europe.

1 INTRODUCTION

The GeoERA program consists of 14 geoscientific projects (GSPs), which are grouped in 3 different geological themes (Geo-energy, Raw Materials and Groundwater), and 1 information platform project (GIP-P). The latter is entitled to establish a common platform for organising and disseminating the digital results from the various GSPs. In this report, we refer to the geoscientific projects as GSPs or as GeoERA projects or just as projects.

The various GSPs will collect and produce mainly (although not exclusively) geological data. Hence, it is quite likely that different projects utilize and/or produce similar or complementary geoinformation. This may lead to overlaps, which, if identified in time, could be converted into synergies. For example, projects generating similar data can rely on one another to define concepts or to complement the information they provide on a given parameter. In addition, identifying potential overlaps and synergies between projects will help homogenizing and harmonizing the various vocabularies used by the different GeoERA projects, as common IDs, names, etc. can be used to refer to the products and attributes shared by different projects.

The present report aims to highlight the overlaps between projects in terms of geoinformation in order to identify possible synergies that could be established between them. The term geoinformation is defined in this report as the information generated by the projects at specific locations. The geoinformation can thus be given by the spatial data (e.g., maps, grids, etc.) shown in the GIS viewers or in the attributes associated with them.

In this report, we do not discuss the functionalities, as the different functionalities currently available at EGDI and those requested by the projects were already mapped and analysed in deliverables D2.2.1 and D2.3.1. We do not discuss possible overlaps between project vocabularies and/or metadata either. That is so because the overlaps that could occur between the different project vocabularies and/or between the metadata associated with the projects' products can be derived from the overlaps highlighted in this report. That is, if the geoinformation provided by a product produced by a given project overlaps with the geoinformation provided by a product generated by another project, it is very likely that there will be some overlap between the vocabularies used by those two projects, as well as between the metadata associated with their products.

2 GEOINFORMATION: POTENTIAL OVERLAPS AND SYNERGIES

The different GSPs use and produce information directly or indirectly linked to geoscience (e.g., lithologic data, hydrological data, land use, etc.). Moreover, all GeoERA projects will generate data at national and/or supranational scale within Europe, with many projects providing data from the same areas (see Figure 1 and ANNEX B). Therefore, there is a high probability that different projects generate similar or complementary geoinformation from the same or neighbouring areas. This is especially true for projects included in the same GeoERA theme, as they focus on similar topics.

The identification of overlaps between different GeoERA projects might help establishing synergies between them. For example, the outputs from some projects (e.g., HIKE's fault database, lithological information from Eurolithors, etc.) could be utilized to generate or complement the information given by other projects (e.g., 3DGEO-EU structural models). Consequently, it is very important to identify the geoinformation that the various projects

will provide, as well as the spatial distribution of the areas from where each project will generate data.

2.1. GEOINFORMATION

The various GeoERA projects will generate several products providing different types of geoinformation, which may be shown directly in the GIS viewers (maps, raster, grids, etc.) or in their associated attributes. In this report, we also consider as geoinformation the reports that will be generated by VoGERA, because the data and results discussed in them are linked to specific pilot areas.

Table 1 shows the list of geoinformation that the various GSPs will provide. The various entries of that list are derived from descriptions of the spatial data (products and attributes) that each project will provide to EGDI. This table is based on information furnished by the projects to WP2 coordinator in June 2019 (PM12) and that gathered by the authors of deliverable D2.2.1 between October 2018 and January 2019. The products and attributes from which the different geoinformation categories have been derived can be consulted in ANNEX A. Note that the products and attributes provided in that ANNEX are preliminary; projects are still defining them.

We have grouped the geoinformation in 61 different categories. Some of these categories, such as lithology, hydrogeology and geothermal properties, encompassed many different datatypes. These data are grouped together because we consider that the information generated by them is complementary to one another and could lead to overlaps or the establishment of synergies. For example, a project that would like to generate a geological cross-section or 3D model from a certain location could use borehole data from another project in which the width and the lithology of an aquifer or aquitard unit is specified.

The first thing that stands out from Table 1 is that only 23 geoinformation categories out of 61 are shared by more than 2 projects. Table 1 also shows that the Geo-energy projects are the ones that have more categories in common. Indeed, 14 categories are shared by 2 or more Geo-energy projects. Whereas, only 5 categories are shared by 2 or more Groundwater projects and 2 or more Raw Material projects.

According to Table 1, several projects grouped in different GeoERA themes may also produce similar or complementary geoinformation. Consequently, there is a relatively high risk that some overlap occurs between two or more GeoERA projects, independently of the theme in which they have been grouped. Here below we list some of the most obvious potential overlaps derived from the analysis of Table 1 (see also ANNEX A):

- All GeoERA projects but 3 will provide lithostratigraphic data. It is thus quite likely that these GeoERA projects generate similar products or include similar and/or complementary lithostratigraphic information in their attributes. Hence, synergies could be established between the projects producing these data from the same or neighbouring areas.

- All Groundwater projects and 3 Geo-energy projects will generate hydrogeological data. Hence, it is likely that some overlap occurs between these

projects, especially among those producing data from the same or neighbouring areas.

- All Geo-energy projects will produce information on the structure and activity of geological structures (e.g., faults). They may therefore provide similar or complementary geoinformation in their products and/or in some of the attributes associated with them. Part of this overlap has already been identified and turned into synergies; i.e., all Geo-energy projects will utilize or refer to HIKE fault database to name and characterise faults.

- All Geo-energy projects but HIKE will produce information on geothermal properties, geothermal use and/or the geothermal potential of specific areas. Hence, even though these projects do not necessarily target the same depths, it is quite likely that they produce data complementary to one another in their products and/or associated attributes.

- All Raw Material projects will produce data on mine locations, mining activity, mineral occurrences, mineralogy and geochemistry. Hence, it is likely that these projects generate similar or complementary information from some areas. This is especially true for the projects delivering data from onshore areas; i.e., Mintell4EU, FRAME and Eurolithos.

Table 1. Geoinformation categories derived from the various spatial data (products and attributes) that each GeoERA project will generate (See ANNEX A for more information). Light yellow cells: categories shared by more than 2 projects. 3D, GA, Ge3, etc.: abbreviations of GSPs names (see abbreviation section of this report).

*Hydrogeological data: water levels, water protection zones, over-pressured and/or artesian groundwater areas, outlines groundwater bodies, depth water table, hydraulic properties of aquifers (conductivity, productivity, etc.), groundwater composition/chemistry, groundwater temperature, maps of groundwater N travel time, groundwater age, sand vulnerability classes, spring water chemistry, reservoir properties, groundwater barrier, specific thermal capacity, specific yield, aquifer pressure, recharge capacity index, Hydrological time series, etc.

**Geothermal properties: thermal anomalies, geothermal gradient, heat transfer rate, heat flow, thermal conductivity, geothermal energy potential.

***Data on hydrocarbons: basin outline, porosity, permeability, play outline, hydrocarbon fields, exploration wells (also in well measurements), thickness of the base of the gas hydrate stability zone…

	Geo-energy theme						Groundwater theme				Raw Materials theme				
Geo-information	**3D**	**GA**	**Ge³**	**HI**	**Hot**	**MU**	**HO**	**RE**	**TA**	**Vo**	**Eur**	**FR**	**Mt**	**MS**	**N° of projects per geo-information category**
lithostratigraphic data, geological maps, profiles, 3D geological models, etc.	X	X	X	X	X	X	X	X			X	X		X	11
Hydrogeological data*			?		X	X	X	X	X	X					7
Data on geological structures (fault, folds, activity, geometry, kinematics, etc.)	X	X	X	X	X	X				?					7
Wells/boreholes (locations, logs, measurements, etc.)	X	X			X	X	X								5
Geothermal properties**	X	X	X		X	X									5
Seismic data and/or interpretations: horizons, seismic-stratigraphic	?	X	X		?									X	5

	Geo-energy theme						Groundwater theme				Raw Materials theme				
Geo-information	3D	GA	Ge^3	HI	Hot	MU	HO	RE	TA	Vo	Eur	FR	Mt	MS	N° of projects per geo-information category
analyses, seismic anomalies, etc.															
Structural data (3D models, structural measurements, etc.)	X	X	X	X											4
onshore mining sites and mining activity						X					X	X	X		4
Mineralogical data		X									?	X		X	4
porosity and permeability data	X	X			X			X							4
Onshore mineral occurrences											X	X	X		3
Geochemical data											X	X		X	3
groundwater resources and uses						X	X	X							3
Groundwater chemistry and hydrochemical data					X	X	X								3
deep geothermal exploitation			?		X										2
extent/depth of salt-fresh water	X								?						2
temperature gradient					X	X									2
Groundwater Vulnerability to Pollution							X			X					2

	Geo-energy theme						Groundwater theme				Raw Materials theme				
Geo-information	**3D**	**GA**	**Ge³**	**HI**	**Hot**	**MU**	**HO**	**RE**	**TA**	**Vo**	**Eur**	**FR**	**Mt**	**MS**	**N° of projects per geo-information category**
data on hydrocarbons and hydrocarbon reservoirs* **	**X**	**X**													**2**
Seismicity			**X**	**X**											**2**
Groundwater pollution and water quality							**X**			**X**					**2**
temperature distribution (surface and subsurface)					**X**	**X**									**2**
Water depth (points)		**X**												**X**	**2**
Salinity		**X**													**1**
thermal load (close/open systems)						**X**									**1**
Thermal maturity		**X**													**1**
Groundwater Vulnerability to climate									**X**						**1**
Thermal Energy Storage						**X**									**1**
Potential shallow geothermal use and geothermal energy potential						**X**									**1**
Total organic carbon		**X**													**1**
offshore Location of mineral occurrences, mining sites and activity														**X**	**1**
Topographic information (ground								**X**							**1**

	Geo-energy theme						Groundwater theme				Raw Materials theme				
Geo-information	**3D**	**GA**	**Ge^3**	**HI**	**Hot**	**MU**	**HO**	**RE**	**TA**	**Vo**	**Eur**	**FR**	**Mt**	**MS**	**N° of projects per geo-information category**
elevation, DTM, etc.)															
Geomorphologic data														**X**	**1**
Sedimentologic data														**X**	**1**
information on Karsts						**X**									**1**
Bathymetric/backscatter data														**X**	**1**
Existing Geothermal uses						**X**									**1**
Land uses						**X**									**1**
Metallogenic maps – offshore														**X**	**1**
Zones with restrictions to drilling						**X**									**1**
Landfills, contaminated areas						**X**									**1**
Landslides						**X**									**1**
Emerging Organic contaminants in Ground water							**X**								**1**
Confidence level in aquifer parameters								**X**							**1**
Precipitation data (annual rainfall, etc.)									**X**						**1**
Electrical conductivity						**X**									**1**
Food risk						**X**									**1**

	Geo-energy theme						Groundwater theme				Raw Materials theme				
Geo-information	**3D**	**GA**	**Ge^3**	**HI**	**Hot**	**MU**	**HO**	**RE**	**TA**	**Vo**	**Eur**	**FR**	**Mt**	**MS**	**N° of projects per geo-information category**
Magnetometry, Gravimetry and other Geophysical Methods														**X**	**1**
Time models	**X**														**1**
subsurface velocity	**X**														**1**
Surface and subsurface anthropogenic infrastructures						**X**									**1**
Gas seeps (CO2, etc.)			**X**												**1**
Seafloor temperature		**X**													**1**
Fishing activities		**X**													**1**
Ornamental stones: mining sites and quarries											**X**				**1**
Ornamental stones end use											**X**				**1**
Physical properties of stones											**X**				**1**
Onshore Metallogenic maps												**X**			**1**
Onshore Predictivity, prospectivity and exploration maps of raw materials												**X**			**1**
Offshore Exploration data and maps														**X**	**1**
Mining waste												**X**			**1**

2.2. SPATIAL DISTRIBUTION OF GEOINFORMATION

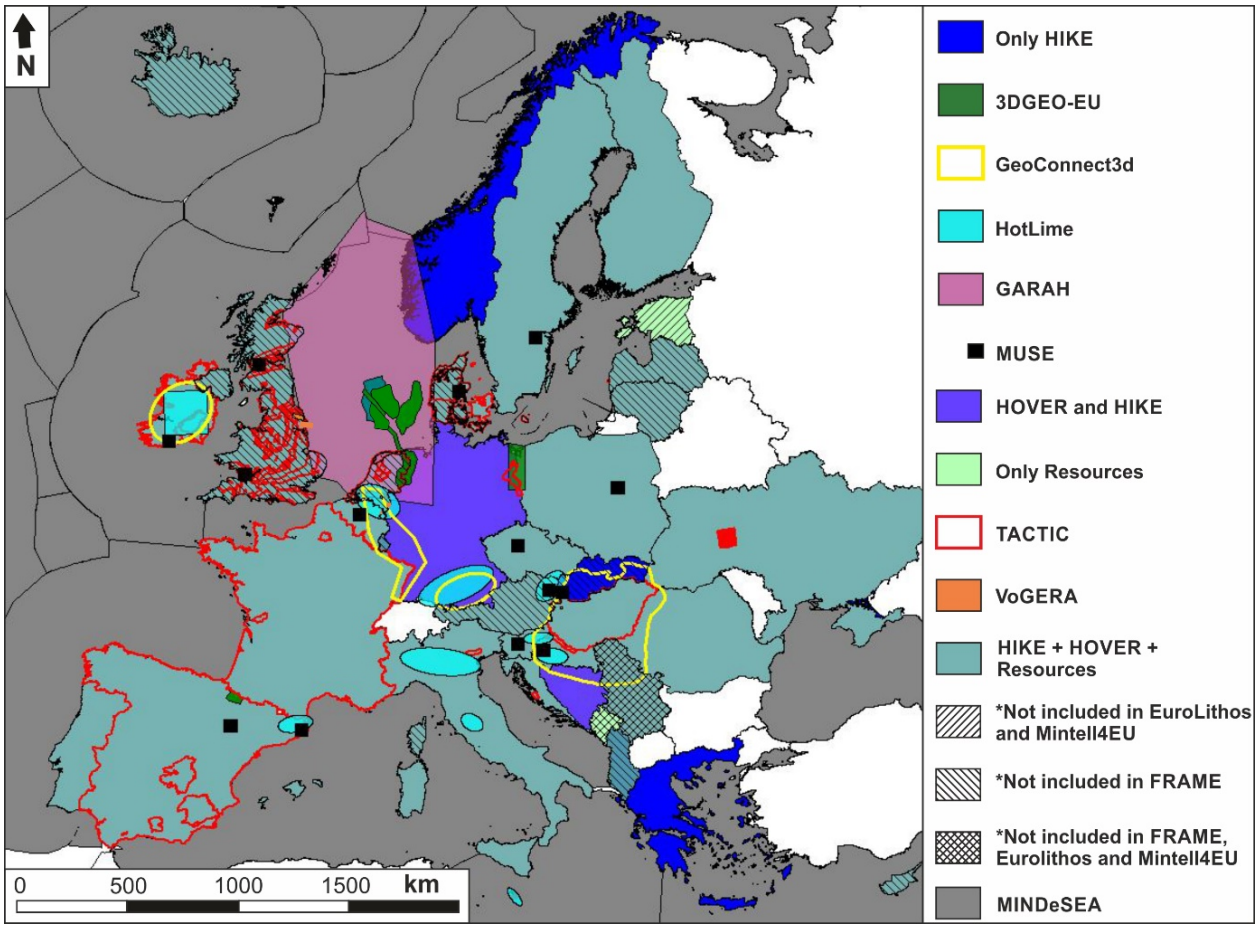

Figure 1. Spatial distribution of the areas from where the different GeoERA projects will produce geoinformation (see ANNEX B). *All coloured countries are partners of Eurolithos, FRAME and Mintell4EU; the only ones that are not included in those projects are the ones filled up with lines (see legend). Note that the countries contributing to the different GeoERA projects also include islands and territories outside the European continent administered by European countries.

The various GeoERA projects will produce data at national and/or supranational scale within Europe, with many projects collecting/providing data from the same areas. Some of the projects will also generate data from specific "pilot" areas located within one or several European countries (Figure 1).

The projects providing data at European scale are (see ANNEX B): HIKE, HOVER, Resources, Eurolithos, FRAME, MINDeSEA (offshore), TACTIC and Mintell4EU. The projects providing data exclusively from local and/or regional-scale areas and/or from specific countries are: 3DGEO-EU, GeoConnect^{3}d, HotLime, MUSE, VoGERA, and GARAH.

Here below, we highlight some of the most obvious potential overlaps that could occur due to the spatial distribution of the areas targeted by the different GeoERA projects (see also Figure 1 and ANNEX B).

(1) European scale

Apart from a few exceptions (see Figure 1), Eurolithos, FRAME, Mintell4EU, HIKE, HOVER Resources and TACTIC will provide data from the same European countries. There may therefore be an overlap between the geoinformation provided by some of their products (see Table 1 and Annex A).

(2) Regional and local scales

a. The Belgian/Dutch boundary

HotLime, GeoConnect^{3}d, VoGERA, HOVER, RESOURCES and GARAH will conduct studies along the Belgian/Dutch political boundary or in its immediate vicinity. That area is also known for comprising one of the most active fault zones of north-western Europe, i.e., the Roer Valley Graben. Hence, HIKE will produce data from there too. Furthermore, there are several historical coal mining sites and some currently active quarries of ornamental stones in Belgium. Meaning that some of the Raw Materials project (e.g., Eurolithos) may produce data from the vicinity of that area too. Finally, some of the study areas of 3DGEO-EU, TACTIC and MUSE are located within a 200-km radius of that boundary. Therefore, it is extremely likely that some overlap occurs between those GeoERA projects in that area. For instance:

- All the projects mentioned above will produce lithological information on the different geological formations of that area.
- GeoConnect^{3}d, GARAH, HIKE, HotLime and VoGERA will generate data on faults. Collaborations between GeoConnect^{3}d, GARAH, HIKE and HotLime have already been foreseen to use the same fault database (i.e., that from HIKE). It would however be recommendable that other projects producing data on this topic crosscheck their information with HIKE database too.
- GeoConnect^{3}d and HIKE will also analyse the activity of faults, providing data on earthquakes, etc. Importantly, Belgian and Dutch seismological national centres do not process these data in the same way. Hence, there may be some divergences between the data provided by each institution for the same seismic event. Both projects are currently aware of this issue.
- GeoConnect^{3}d, 3DGEO-EU and GARAH will produce geological/structural models. Their study areas are not located exactly in the same place, although they are sufficiently close to comprise geological structures and/or formations that relate to one another in terms of regional geology. Hence, it might be interesting to crosscheck the various geological models that each of these projects will produce in case cross-correlations can be established.
- The study areas of HotLime, VoGERA and GeoConnect^{3}d situated along the Belgian/Dutch boundary appear to overlap one another at some locations. Consequently, some overlap may occur between them in terms of geoinformation.

- Finally, MUSE, HOVER and Resources will produce data from Belgium. Consequently, some overlap may occur between them in this area, in particular between products providing hydrogeological data.

b. North Sea

GARAH, MINDeSEA and 3DGEO-EU will be delivering data from the North Sea. GARAH and 3DGEO-EU will both deliver geological and structural data, suggesting that there may be some overlap between the geoinformation provided by these projects. This possible overlap appears to have been already identified, as these projects share a pilot area in the southern North Sea.

Overlaps and synergies could also exist between GARAH or 3DGEO-EU and MINDeSEA. Indeed, MINDeSEA will provide lithological and structural data in some of its products (e.g., metallogenic maps), as well as in some of the attributes associated with them (see ANNEX A). Therefore, some of the products derived from this project might overlap or (most likely) complement the information given by GARAH and/or 3DGEO-EU in some areas.

c. The Polish/German boundary

Pilot areas from 3DGEO-EU and TACTIC cover the same area along this boundary. In addition, Germany and Poland are partners of HIKE, HOVER and Resources. There may therefore be some overlap between the geoinformation that these projects will provide from this area.

d. Great Britain

MUSE's and some of TACTIC's study areas in Great Britain are located in the same areas or relatively close to each other. Part of TACTIC's study areas also appear to cover one of the pilot areas of VoGERA, and part of GARAH's study area extends along the eastern coast of Great Britain. In addition, this country participates in the projects HIKE, HOVER, Resources and Eurolithos. There is therefore high probability that some of the products generated by these projects provide similar or complementary geoinformation.

e. Ireland

GeoConnect^{3}d, HotLime, MUSE, HIKE, HOVER, Resources, TACTIC, Eurolithos, FRAME and Mintell4EU will be generating data from Ireland. It is therefore likely that some of the products generated by these projects provide similar or complementary information, resulting in some overlapping.

f. French/Spanish boundary

In the south-eastern extremity of the French/Spanish boundary, a HotLime study area appears to cover or be close to one of the cities participating in MUSE. Therefore, there may be some overlap between the geoinformation generated by these projects, especially between products delivering information on land uses, geothermal parameters, geothermal use, hydrogeology, etc.

Spain also participates in HOVER, TACTIC, Resources, HIKE, Eurolithos, FRAME and Mintell4EU. Hence, there may be some overlap with the geoinformation generated by these projects too.

g. Southern Germany

In southern Germany, the study areas of HotLime and GeoConnect^{3}d cover almost the same region. Therefore, there may be some overlap between the geoinformation that these projects will generate from this area. In addition, Germany participates in HOVER and HIKE, meaning that some overlap may also exist between the geoinformation generated by these two projects and/or between them and the data generated by the other two.

h. The Pannonian Basin (Hungary, western Slovakia, south-eastern Poland, western Ukraine, western Romania, northern Serbia, north-eastern Croatia, north-eastern Slovenia, and eastern Austria)

The Pannonian Basin contains several pilot areas of GeoConnect^{3}d, HotLime, MUSE, TACTIC, VoGERA, HOVER, Resources and Eurolithos. In addition, Mintell4EU, FRAME and HIKE will deliver geoinformation from several of the countries located within that basin. Hence, it is likely that overlaps occur among the geoinformation that these GeoERA projects will produce in this area. Especially, there is high potential of overlaps across projects with products providing information on hydrogeology, lithology, faults and tectonic activity.

CONCLUSION

The present report shows that, despite the wide diversity of data that the various GeoERA projects will produce, it is relatively likely that some overlap occurs between them in terms of geoinformation. It is therefore important that each GeoERA project is aware of the type of geoinformation that other projects will produce, as well as the areas from which each project will deliver data. Ideally, the potential overlaps highlighted in this report should be converted into synergies by sharing information and establishing collaborations between projects.

Potential synergies and overlaps between projects will be again discussed in WP2 deliverables D 2.1.2 *"A data delivery plan (PM27) describing which data sets the different GSPs plan to finally deliver to the GIP*", and D 2.1.3 *"Second Report (PM35) wrapping-up the synergies and overlaps highlighted between the projects in terms of geoinformation*."

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GIP-P deliverable D 2.2.1: First report describing the requirements to the Information Platform by the Geo-energy, Groundwater and Raw Materials themes. January 2019 (PM6)

GIP-P deliverable D 2.3.1: First report mapping and describing the needed extensions to EGDI directly related to the task 2.2. March 2019 (PM9).

ANNEX A: PRELIMINARY PRODUCTS AND ATTRIBUTES

The products and attributes presented in this annex are preliminary. Indeed, most projects have not yet finished defining the products they will be delivering to EGDI. Certain projects are also more advanced than others in the definition of products, attributes, metadata, etc. That is the reason for the heterogeneity of the data provided in this annex and the different degree of detail given in its various sections.

The final products that each GeoERA project will generate will be described in detail in next D 2.1 deliverable; i.e., "*D 2.1.2. A data delivery plan (PM27) describing which data sets the different GSPs plan to finally deliver to the GIP*."

GEO-ENERGY

A1. 3DGEO-EU (latest update: 28-Jan-2019)

The following data have been gathered from GIP-P D2.2.1 "*First report describing the requirements to the Information Platform by the Geo-energy, Groundwater and Raw Materials themes*" (28-Jan-2019).

- 2.5D Time model (xyz)
- 2.5D Velocity maps (xyz)
- 3D Structural model
- 3D Harmonized model of lithostratigraphic layers
- Geothermal properties related to wells (porosity & permeability) + 2D Geothermal property maps
- Example datasets and models containing uncertainty information
- 2D Maps of Cenozoic reservoirs (extent + depth)
- 2D Map of extent & depth of salt/fresh groundwater barrier
- Uncertainty in geo-models
- Fault database (HIKE)

A2. GARAH (latest update: 31-Jan-2019)

The following data have been gathered from GARAH D4.1 "*Preliminary data selection to provide relevant information in assessing hydrocarbon resources in subsurface*".

Product: Basin outline (polygons)

Attributes	Column name (max. 10 characters)	Units	Field type (GIS)
Name	NAME		Text

Product: Formation outline (polygons)

Attributes	Column name (max. 10 characters)	Units	Field type (GIS)
Name	NAME		Text
Country	COUNTRY		Text
Age	AGE		Text
Lithology	LITHOLOGY		Text
Depth top max	DEP_TOP_MAX	Metre (m)	Numerical (Double)
Depth top min	DEP_TOP_MIN	Metre (m)	Numerical (Double)
Thickness	THICK_AGV	Metre (m)	Numerical (Double)
Volume?	VOLUME	Cubic kilo meter (km3)	Numerical (Double)
Net/gross	NET_GROSS	ratio	Numerical (Double)
Porosity	POR_AGV	%	Numerical (Double)
Permeability	PERMEA_AGV	milliDarcies (mD)	Numerical (Double)

Product: Play outline (polygons)

Attributes	Column name (max. 10 characters)	Units	Field type (GIS)
Name	NAME		Text
Country	COUNTRY		Text
Age	AGE		Text

Lithology	LITHOLOGY		Text
Depth top max below sea level	DEP_TOP_MAX	Metre (m)	Numerical (Double)
Depth top min below sea level	DEP_TOP_MIN	Metre (m)	Numerical (Double)
Thickness average	THICK_AGV	Metre (m)	Numerical (Double)
Volume	VOLUME	Cubic kilo meter (km3)	Numerical (Double)
Net/gross	NET_GROSS	ratio	Numerical (Double)
Porosity	POR_AGV	%	Numerical (Double)
Permeability	PERMEA_AGV	milliDarcies (mD)	Numerical (Double)
Salinity	SALINITY		Numerical (Double)
TOC content	TOC	**%**	Numerical (Double)
TOC type	TOC_TYPE		Text
Thermal maturity	THERM_MAT		Text
Mineralogy	MINERALOGY		Text
Pressure regime	PRESS_REG		Text
Structural complexity	STRUC_COMP		Text
Hydrocarbon content	HC_TYPE		Text
Play status	PLAY _STAT		Text

Product: Exploration wells (points)

Attributes	**Column name (max. 10 characters)**	**Units**	**Field type**
Name	NAME		Text
Latitude	LAT		Coordinate
Longitude	LONG		Coordinate
x-utm	X_UTM		Coordinate
y-utm	Y_UTM		Coordinate
UTM zone	UTM_ZONE		Text
Country	COUNTRY		Text
Year	YEAR		Numerical (Short integer)
Depth (below sea level)	DEPTH	Meter (m) Feet?	Numerical (Double)
Hydrocarbon content*	HC_CONT	Oil, condensate, gas or mixed	Text
Operational status	OPR_STATUS		Text

Product: Hydrocarbon fields (polygons)

Attributes:	Column name (max. 10 characters)	Units	Field type (GIS)
Name	NAME		Text
Country	COUNTRY		Text
On or offshore	ON_OFFSHOR		Text
Age	AGE		Text
Formation	FM		Text
Lithology	LITHOLOGY		Text
Discovery year	DISCOV_Y		Numerical (Double)
Hydrocarbon content*	HC_CONT	Oil, condensate, gas or mixed	Text
Status	STATUS	Pending production, Producing, depleted, abandon	Text
Operator	OPERATOR		Text
Operational status	OPR_STATUS		Text

Product: Faults (lines)

Attributes	Column name (max. 10 characters)	Units	Field type
Name	NAME		Text

Product: Geothermal gradients

Attributes	Column name (max. 10 characters)	Units	Field type (GIS)
ID name	ID		Text
Data source	SOURCE		Text
Latitude	LAT	DD	Double
Longitude	LONG	DD	Double
Water depth	DEPTH	Meters	Long integer signed
Heat flow	HEATFLOW	mW m-2	Double
Thermal Conductivity	T_CONDUC	W m-1 K-1	Double
Geothermal Gradient	GEO_GRAD	mK m-1	Double
Geothermal Gradient - 2	GEO_GRAD2	Celsius/ 100 m	Double

Product: Seafloor temperature (points)

Attributes	Column name (max. 10 characters)	Units	Field type (GIS)
ID name	ID		Text
Data source	SOURCE		Text
Latitude	LAT	DD	Double
Longitude	LONG	DD	Double
Water depth	DEPTH	Meters	Long integer signed
Seafloor temperature	TEMP_SF	Celsius	Double
Comments	COMMENTS		Text

Product: Gas hydrates below seafloor (points)

Attributes	Column name (max. 10 characters)	Units	Field type (GIS)
ID name	ID		Text
Cruise	CRUISE		Text
Method	METHOD		Text
Latitude	LAT	DD	Double
Longitude	LONG	DD	Double
Water depth	DEPTH	Meter	Long integer signed
Depth below seafloor	DEPTH_BSF	Meter	Long integer signed
Data source	SOURCE		Text
Institution	INSTITUT		Text
Contact name	CONTACT_N		Text
E_mail	EMAIL		Text
References	REFS		Text
Comments	COMMENTS		Text

Product: Gas hydrates below seafloor (polygons)

Attributes	Column name (max. 10 characters)	Units	Field type (GIS)
ID name	ID		Text
Cruise	CRUISE		Text
Method	METHOD		Text
Area	AREA	km2	Double

Seismic anomaly type	ANOMAL_TYP		Text
Data source	SOURCE		Text
Institution	INSTITUT		Text
Contact name	CONTACT_N		Text
E_mail	EMAIL		Text
References	REFS		Text
Comments	COMMENTS		Text

Product: Gas hydrates below seafloor (lines)

Attributes	Column name (max. 10 characters)	Units	Field type (GIS)
ID name	ID		Text
Cruise	CRUISE		Text
Method	METHOD		Text
Data source	SOURCE		Text
Seismic anomaly type	ANOMAL_TYP		Text
Institution	INSTITUT		Text
Contact name	CONTACT_N		Text
E-mail	EMAIL		Text
References	REFS		Text
Comments	COMMENTS		Text

Product: Gas hydrates below seafloor (points)

Attributes	Column name (max. 10 characters)	Units	Field type (GIS)
ID name	ID		Text
Cruise	CRUISE		Text
Method	METHOD		Text
Latitude	LAT	DD	Double
Longitude	LONG	DD	Double
Data source	SOURCE		Text
Seafloor depth	DEPTH_S_M	Meter	Double
Depth of anomaly TWT bsl	D_BSl_TWT	Second	Double
Depth of anomaly TWT bsf	D_BSF_TWT	Second	Double
Seismic anomaly type	ANOMAL_TYP		Text

Institution	INSTITUT		Text
Contact name	CONTACT_N		Text
E-mail	EMAIL		Text
References	REFS		Text
Comments	COMMENTS		Text

Product: Gas stability map (lines)

Attributes	Column name (max. 10 characters)	Units	Field type (GIS)
Thickness of the Base of Gas Hydrate Stability Zone	BGHSZ	Meter	Double

Product: Horizon interpretations (lines)

Attributes	Column name (max. 10 characters)	Units	Field type GIS)
ID	ID		Text
Name	NAME		Text

Product: Fishing activities (polygons)

Attributes	Column name (max. 10 characters)	Units	Field type (GIS)
Name	NAME		Text
Activity type	TYPE		Text

A3. GeoConnect^{3}d (latest update: 26-June-2019)

The following data have been gathered from GIP-P D2.2.1 "*First report describing the requirements to the Information Platform by the Geo-energy, Groundwater and Raw Materials themes*" (28-Jan-2019). This information has been complemented by an update sent by GeoConnect^{3}d on June 2019.

WP3: Roer-to-Rhine

Product: Faults (a simplified version of the fault database of Hike)

Attribute	Field name	Format	Description
Shapefile	N/A	Geometry	Georeferenced polylines (2D and 3D)

Attribute	Field name	Format	Description
Object ID	FID	Number	Unique object identifier, sequential numbering starting with 0; automatically generated with shapefile
Concept ID	conceptID	Text (100)	Unique concept identifier will be replaced by the concept's vocabulary URI
Name	name	Text (40)	Name of the object
Reference surface	refSurface	Text (100)	For 2D objects only: qualitative reference for the elevation / z coordinate needs to be provided (e.g. DTM, top of basement etc.)
Time of activity	timing	Text (200)	Comma separated list including the tectonic phase(s) during which the fault was active
Fault type	faultType	Text (200)	Type of fault mapped (e.g. normal, reverse, thrust, strike-slip etc); number of entries will be the same as time(s) of activity
Dip direction	dipDir	Date	Dip direction of fault
Scientific reference	reference	Text (200)	URL or DOI
Extra information	notes	Text (200)	Other information about the fault

Product: Geological units

Attribute	Field name	Format	Description
Shapefile	N/A	Geometry	Georeferenced objects (2D and 3D)
Object ID	FID	Number	Unique object identifier, sequential numbering starting with 0; automatically generated with shapefile
Concept ID	conceptID	Text (100)	Unique concept identifier will be replaced by the concept's vocabulary URI
Name	name	Text (40)	Name of the object
Reference surface	refSurface	Text (100)	For 2D objects only: qualitative reference for the elevation / z coordinate needs to be provided (e.g. DTM, top of basement etc.)
Scientific reference	reference	Text (200)	URL or DOI
Extra information	notes	Text (200)	Other information about the object

Other WP3 products:

- 2D/3D structural/geological models – attributes not foreseen at this stage

- Geomanifestations (i.e., seismicity, gas, fluid, heat flow, etc.) – final products and attributes are still being defined.
- Evaluation of deep geothermal exploitation? – not yet defined

WP4: Pannonian Basin (attributes are still being defined)

- 3D structural geological models
- 3D fault plane surfaces
- Voxel models, derived traffic light maps from a propriety of the model
- Seismic data
- Information on transport of fluids and heat for geothermal purposes

A4. HIKE (latest update: 09-May-2019)

The following data was shared by HIKE to GIP-P/WP2 on May 9th, 2019.

Product: Faults

Attribute	Abbr.	attribute keyword in English	Comments
Country ID*	CNTRY_REG	AT	following ISO 3166-alpha2 (prefix = origin of the data provider)
		DE-BY	
		…	
ID*	ID	AT-(country-specific ID)	automatically generated, coming from the original database.
		DE-BY-(country-specific ID)	
		…	
Local Name	NAME	…	any English translation of local names is avoided
Link to project vocabulary	VOC_LINK	…	geographic description of the fault (system/domain/etc..)
Type of reference	REF_TYPE	surface	*Surface* is when the top of the fault coincides with the earth's surface. *Top of the fault* and *Base of the fault* do not relate to any specific depth or any
		top of the fault	
		base of the fault	

Attribute	Abbr.	attribute keyword in English	Comments
		base of faulted unit	stratigraphic unit. In case of *Base of faulted unit,* a *Surface of reference* should be defined. In case of *Specified Depth,* a *Depth of the representation line* should be defined
		top of faulted unit	
		specified depth	
Surface of reference	REF_SURF	reference to Stratigraphic Table 2017	Should only be defined if *Type of reference = base of faulted unit/top of faulted unit*
		n/a	
Depth of representation line [m]	DEPTH	e.g. 550	Should only be defined if *Type of reference = specified depth*
Surface of reference*	REF_SURF	surface	
		Quaternary	
		Tertiary	
		Zechstein	
		…	
		depth to faulted unit	
		…	
Top/Base	TOP_BASE	Top	Can only be defined if Surface of reference ≠ depth to faulted unit
		Base	
Depth to faulted unit [m]	DEPTH	e.g. 550	Can only be defined if Surface of reference = depth to faulted unit
Evaluation method	EVAL_METH	direct observation	geosciml
		observed at depth	
		inferred	
		n/a	

Attribute	Abbr.	attribute keyword in English	Comments
Observation method	OBSERV_METH	1D resistivity survey	INSPIRE, multiple entries possible
		2D resistivity survey	
		2D seismic survey	
		3D seismic survey	
		3D resistivity survey	
		airborne geophysical survey	
		ground magnetic survey	
		ground gravity survey	
		borehole logging survey	
		CPT survey	
		frequency domain EM Survey	
		georadar survey	
		magnetotelluric survey	
		seismological survey	
		sonar survey	
		time-domain EM survey	
		VSP survey	
		observed borehole material	
		observed outcrop	

Attribute	Abbr.	attribute keyword in English	Comments
		inferred projection between observed locations	
		n/a	
Principle fault type	FLT_TYPE	normal fault	INSPIRE
		right normal fault	
		left normal fault	
		reverse fault	
		right reverse fault	
		left reverse fault	
		strike slip fault	
		dextral strike slip fault	
		sinistral strike slip fault	
		thrust fault	
		detachment fault	
		horizontal fault	
		extraction fault	
		pure extraction fault	
		mixed extraction fault	
		oblique slip fault	
		scissor fault	
		wrench fault	
		n/a	
Chronostratigraphic age of	Y_A_Unit	Jurassic	Additional attribute for fault that is truncated by an
		n/a	

Attribute	Abbr.	attribute keyword in English	Comments
the youngest faulted unit			unconformity (TRUNC_TOP) should be part of expert data
Maximum displacement [km]	KIN_DISPL_MAX		elaborated attributes on movement are under discussion (essential or expert data). To be concluded.
Sense of movement	FLT_MOVE_SENSE	detachment	geosciml
		dextral	
		generic_decollement	
		no_movement_sense	
		normal	
		normal_dextral	
		normal_sinistral	
		reverse	
		reverse_dextral	
		reverse_sinistral	
		sinistral	
		thrust	
		thrust_decollement	
Determination of the fault offset	KIN_DISPL_TYPE	palaeogeography	
		crosscutting (?)	
		well/seismic interpretation	
		paleoseismicity	
		displacement on maps	
		seismicity	
		sediment structures	
		paleostress	

Attribute	Abbr.	attribute keyword in English	Comments
		field observation	
		microfabrics	
Dip	DIP_ANGLE	vertical (90°-85°)	Accurate numbers for direction as well as variation in direction are expert data
		steep (85°-60°)	
		intermediate (60°-30°)	
		flat (30°-5°)	
		horizontal (5°-0°)	
		n/a	
Dip direction	DIP_DIREC	N	Accurate numbers for direction as well as variation in direction are expert data
		NNE	
		NE	
		ENE	
		E	
		ESE	
		SE	
		SSE	
		S	
		SSW	
		SW	
		WSW	
		W	
		WNW	
		NW	
		NNW	
Strike	STRIKE	N-S	Accurate numbers for direction as well as variation in direction are expert data
		NNE-SSW	
		NE-SW	

Attribute	Abbr.	attribute keyword in English	Comments
		ENE-WSW	
		E-W	
		WNW-ESE	
		NW-SE	
		NNW-SSE	
References	REF	Geological map of Bavaria 1: 500 000	discussion is not concluded. Reference is probably part of the dataset metadata, but it requires that the dataset is a consistent set of faults (of same origin which might result in data providers providing more than one dataset). Should it be possible to define reference in the metadata of the dataset? All faults then inherit this reference unless a specific reference for an individual fault overwrites the reference of the dataset. To be discussed.
		unpublished data LfU	
Active fault (seismogenic)	ACT_FLT	Yes	
		No	
		n/a	
Capable fault	CAP_FLT	Yes	
		No	
		n/a	
3D-Geometry available	3D_FLT	Yes	This will be subject of discussion.
		No	
		n/a	
Related to exploration (minerals, oil	EXPL_FLT	Yes	The use(fulness) of this attribute will be discussed
		No	

Attribute	Abbr.	attribute keyword in English	Comments
& gas, geothermal, groundwater)		n/a	
Natural or induced seismic activity along the fault	NAT_IND	NATURAL INDUCED	In case of active fault
(Maximum) magnitude	MAGNITUDE		In case of active fault, Richter magnitude scale
Reoccurrence interval of seismic activity	REOC_ITV		
Net-slip	NET_SLIP		in meters
Horizontal throw (component of the net-slip)	HOR_THROW		in meters
Vertical throw (component of the net-slip)	VER_THROW		in meters
strike-slip	STRIKE_SLIP		in meters
Dip-slip	DIP_SLIP		in meters
Rake	RAKE		Rake is usually used by seismologists indicating the geometry of seismic slip vectors. it could change from 0 to 180 for strike-slip/reverse faults, and from 0 to -180 for strike-slip/normal faults. Pitch is used by structural geologists (especially in microtectonic and stress state analyses) and varies from 0 to
Pitch	PITCH		

Attribute	Abbr.	attribute keyword in English	Comments
			90 indicating the sense of faulting. Rake completes the right-hand role conv. Pitch associates Azimuth/Dip conv. As one should use Trend/plunge for Dip-direction/dip conv. Rake is more comfortable for computer programs, while pitch is easily measured in the field. Source: https://www.researchgate.net/post/Whats_the_basic_differences_between_rake_and_pitch_in_faults_and_if_they_are_same_than_why_we_used_as_different_terms
Length of fault (horizontal)	LENGTH_HOR		in meters
Truncate at the top by an unconformity	TRUNC_TOP		

A5. HOTLIME (latest update: 28-May-2019)

The following data have been gathered from GIP-P D2.2.1 "*First report describing the requirements to the Information Platform by the Geo-energy, Groundwater and Raw Materials themes*" (28-Jan-2019). The information available from that report has been completed with some clarifications emailed by HotLime to GIP-P/WP2 on May 28th, 2019.

Products (Products formats have not been defined yet):

- boreholes,
- wells,
- temperature maps
- basin outlines
- geothermal gradients,
- horizon interpretations,
- 4D faults (linked to HIKE fault database) and tectonic information,
- groundwater chemistry and bulk permeability,
- lithological (lithology, thickness, etc. of geological units)
- outlines of formations

- physicochemical properties of the rock bodies: temperature distribution, porosity and permeability defining the net/gross of aquifer intervals and their top and bottom seal
- hydrochemical data
- temperature gradients,
- bulk thermal conductivity,
- heat transfer rate,
- synthesis maps

The attributes that will be associated with the different products in EGDI have not been defined yet. Currently, only the attributes for 2.5D grid data on hot lime layers have been tentatively defined. These are:

  - depth of top hot lime layer [m],
  - gross thickness of the layer [m],
  - net-thickness of the layer [m], porosity [%],
  - permeability [m^2],
  - facies type (text),
  - total dissolved solids of hot lime layer fluid [mg/L],
  - temperature at top of layer [°C],
  - bulk volumetric heat capacity of the layer [J/m^3 K],
  - heat in place, a.k.a. stored heat [J].

A6. MUSE (latest update: 09-May-2019)

The following data has been extracted from MUSE deliverable *"D5.1 White Book of the web platform related to MUSE".*

Products/parameters	Category	format	Unit	attributes
Specific annual thermal load (closed systems)	closed-loop potential	raster		Float (Value in SI units)
Outline of groundwater bodies suitable for open loop systems	open-loop potential	raster		Boolean (yes, no)
Specific annual thermal load -open systems	open-loop potential	raster		Float (Value in SI units)
Anthropogenic lines: Linear infrastructure (electricity, pipelines, …)	conflict map	vector lines		Type: text
Areas suited for groundwater disposal to surface waters or municipal drains	open-loop potential	raster	Text	Boolean (yes, no)

Products/parameters	Category	format	Unit	attributes
Average subsurface temperature	closed-loop potential	raster	degC	Float (Value in SI units)
average temperature	open-loop potential, closed-loop potential	vector points	degC	date of measurement
Bulk thermal conductivity (for a specific depth interval)	closed-loop potential	raster	W/m/K	Float (Value in SI units)
Decision support map for the use of shallow geothermal technologies	general information	raster	Text	?
Dept to water table	open-loop potential	raster	m	Float (Value in SI units)
Effective groundwater temperature	open-loop potential	raster	degC	Float (Value in SI units)
Existing geological profiles and cross-sections	geology	vector lines		Origin: text
Existing subsurface infrastructure	conflict map	raster	Text	Type: text
Fault systems	conflict map	vector lines	Text	Type: text
field thermal conductivity	closed-loop potential	vector points	W/m/K	Float (Value in SI units)
Flood risk	conflict map	raster	Text	Text (High, Medium, Low)
geothermal energy potential	open-loop potential, closed-loop potential	raster	?	Boolean (yes, no)?
Groundwater temperature	open-loop potential	raster (ICGC) point GBA	degC	Float (Value in SI units)
Groundwater zones of problematic chemistry	conflict map	raster	Text	Type: text

Products/parameters	Category	format	Unit	attributes
Heat transfer rate	closed-loop potential	raster	W/m	Float (Value in SI units)
Hydraulic conductivity	open-loop potential	raster	m/d	Float (Value in SI units)
Hydraulic productivity	open-loop potential	raster	l/s	Float (Value in SI units)
Hydraulic transmissivity	open-loop potential, geothermal storage	raster	m^2/d	Float (Value in SI units)
Hydraulically separated groundwater bodies	conflict map	raster	Text	Boolean (yes, no)
Interval thermal conductivities derived from TRT measurements	closed-loop potential	vector points		Float (Value in SI units)
Karst areas including cavities	conflict map	raster	Text	Boolean (yes, no)
karst features	conflict map	vector		Kast Feature: text?
Landfills, contaminated areas	conflict map	raster	Text	Type: text: (landfill, spill), Certainty. text :(detected, expected)
Landslides	conflict map	vector	Text	Boolean (yes, no)?
Lithology of a specific geological unit	Geology	raster	Text	Lithology, text. From national or international codelist
Location of existing geothermal utilizations	conflict map	vector points	Text	Type (text from codelist)
Location of existing other groundwater use than for geothermal reasons	conflict map	vector points	Text	Type: text, ID: text (i public)
Mining areas	conflict map	raster	Text	Boolean (yes, no)

Products/parameters	Category	format	Unit	attributes
Natural reserves and protection areas	conflict map	raster	Text	Type: text
Net aquifer thickness	open-loop potential	raster	m	Float (Value in SI units)
Outline of groundwater bodies suitable for Aquifer Thermal Energy Storage (ATES)	geothermal storage	raster	Text	Boolean (yes, no)
Overpressured or artesian groundwater areas	conflict map	raster	Text	Boolean (yes, no)
Specific thermal capacity - closed loop systems	closed-loop potential	raster	MW/ha	Float (Value in SI units)
Specific thermal capacity - open loop systems	open-loop potential	raster	kW/ha	Float (Value in SI units)
Specific yield	open-loop potential	raster	m3/h/m	Float (Value in SI units)
Subsurface temperature profiles	open-loop potential, geothermal storage	vector points	degC	?? Origin: text
Surface temperature	closed-loop potential	raster	degC	Float (Value in SI units)
temperature at different depths in boreholes	closed-loop potential	vector points	degC	Float (Value in SI units), Date: date of measurement? depth (m) decimal, BoreholeID (text)
Temperature gradient	closed-loop potential	raster	°C/100m	Float (Value in SI units)
Thermal conductivity of unsaturated sediments	closed-loop potential	vector points	W/m/K	Float (Value in SI units)
Thermal productivity	open-loop potential	raster	degC	Float (Value in SI units)
Top of a geological unit	Geology	raster	m above sea level	Float (Value in SI units), Unit: text

Products/parameters	Category	format	Unit	attributes
				from national codelist
Traffic light map closed loop system	general information	raster	Text	Possibilities: text or integer for (green, yellow, red), "What_to_do": text
Traffic light map open loop system	general information	raster	Text	Possibilities: text or integer for (green, yellow, red), "What_to_do": text
Water level	open-loop potential	vector points	m b. sea-level	Float (Value in SI units)
Water protection zones	conflict map	raster	Text	Type: text
Aquifer pressure	geothermal storage	raster	Text	Float (Value in SI units)
Electrical conductivity (average)	general information	raster		Float (Value in SI units)
Recharge Capacity Index	conflict map	raster	Text	Index: integer?
Zones with restrictions to drilling	conflict map	raster	Text	Text (specific description of the restriction)

GROUNDWATER

A7. HOVER (latest update: May-2019)

The information presented here has been extracted from HOVER D2.2a *"Data requirements for data to EGDI".*

WP3 Hydro-geochemistry and health products

Product descriptions

Title and description		**Thermal and natural mineral waters in Europe**	**Report on mineral and thermal waters in participating countries**	**European exposure maps of selected elements (and indicators)**
Product Type	**Georeferenced Information** Vector / raster	vector		vector
	Not Georeferenced Information		X	
Data sources		specific questionnaire Data collection questionnaire	Reports and contribution from participants	Specific questionnaires, output of Task
Spatial dimension		polygon (1km x 1km) based on https://www.eea.europa.eu/data-and-maps/data/eea-reference-grids-2	Not relevant	polygon (1km x 1km) based on https://www.eea.europa.eu/data-and-maps/data/eea-reference-grids-2
Temporal dimension	**static**	X	Not relevant	x
	dynamic: real time (yes/no)		Not relevant	
Scale		1:1,500,000	Not relevant	1:1,500,000
Coverage		participating countries in WP3	participating countries in WP3	participating countries in WP3 or pilot countries for WP3.2 to WP3.4
Projection system.		ETRS_1989_LAEA	Not relevant	ETRS_1989_LAEA
Delivery Format to EGDI	**Web services** (WMS, WFS, WCS, etc.)	WMS		WMS
	Files uploaded (shapefiles,			

	ESRI GRID, ASCII, etc.)			
	Not Georeferenced information (PDF, JPG; TXT, etc.)		PDF	
Metadata:	**Metadata provider** (IGME, GBA, etc.)	GBA	Not relevant	GBA
	Metadata collection (Harvesting/direct editing)	directing editing	Not relevant	directing editing

Main layer: Name of water source and general information

Attribute	Field	unit	type	explanation
N1	name of source		Text	name of source from the list of recognized natural mineral waters, otherwise a name for the thermal water source
N2	official name of natural mineral water		Text	Please, provide the trade description from the list of recognized natural mineral waters; not relevant for thermal waters
N3	country		Text	
G1	classification		Choose from list*	
G2	location		choose country specific grid cell ID	download country specific grids from https://www.eea.europa.eu/data-and-maps/data/eea-reference-grids-2
G3	type of water source		Choose from list*	
G4	intended use 1		Choose from list*	

G5	intended use 2		Choose from list*	
G6	intended use 3		Choose from list*	
G7	yield class	l/s	Choose from list*	extraction allowed by water law

Second layer: Aquifer information

Attributes	Field	unit	type	explanation
B1	If borehole: true vertical depth	m	number	below terrain
B2	If borehole: screen or open hole: FROM (true vertical depth)	m	number	below terrain
B3	If borehole: screen or open hole: TO (true vertical depth)	m	number	below terrain
B4	Aquifer media type		choose ID from INSPIRE code list	http://inspire.ec.europa.eu/codelist/AquiferMediaTypeValue
B5	Aquifer type		choose ID from INSPIRE code list	http://inspire.ec.europa.eu/codelist/AquiferTypeValue
B6	Lithology of the aquifer 1		choose ID from INSPIRE code list	http://inspire.ec.europa.eu/codelist/LithologyValue
B7	Proportion, lithology of the aquifer 1		choose from CGI Geoscience codelist	http://resource.geosciml.org/classifier/cgi/proportionterm
B8	Lithology of the aquifer 2		choose ID from INSPIRE code list	http://inspire.ec.europa.eu/codelist/LithologyValue

Attributes	Field	unit	type	explanation
B9	Proportion, lithology of the aquifer 2		choose from CGI Geoscience codelist	http://resource.geosciml.org/classifier/cgi/proportionterm
B10	Lithology of the aquifer 3		choose ID from INSPIRE code list	http://inspire.ec.europa.eu/codelist/LithologyValue
B11	Proportion, lithology of the aquifer 3		choose from CGI Geoscience codelist	http://resource.geosciml.org/classifier/cgi/proportionterm
B12	Aquifer, younger age		choose ID from INSPIRE code list	http://inspire.ec.europa.eu/codelist/GeochronologicEraValue/
B13	Aquifer, older age		choose ID from INSPIRE code list	http://inspire.ec.europa.eu/codelist/GeochronologicEraValue/

Third layer: Groundwater age information

Attributes	Field	unit	type	explanation
A1	groundwater age		Choose from list*	

Fourth layer: Hydrochemistry

Attributes	Field	unit	type	explanation
H1	Temperature class	°C	Choose from list*	water temperature at the outlet
H2	Total dissolved solid class	g/l	Choose from list*	
H3	Specific conductivity	µS/cm; 25°C	Number/Text	representative hydrochemical analysis
H4	pH		Number/Text	representative hydrochemical analysis

Attributes	Field	unit	type	explanation
H5	Redox potential (Eh)	mV	Number/Text	representative hydrochemical analysis
H6	Oxygen (O2)	mg/l	Number/Text	representative hydrochemical analysis
H7	Sodium (Na)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H8	Potassium (K)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H9	Calcium (Ca)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H10	Magnesium (Mg)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H11	Strontium (Sr)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H12	Barium (Ba)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H13	Iron (Fe total)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H14	Manganese (Mn total)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H15	Ammonium (NH4)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H16	Bicarbonate (HCO3)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H17	Carbonate (CO3)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H18	Fluoride (F)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H19	Chloride (Cl)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H20	Bromide (Br)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H21	Iodide (I)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL

Attributes	Field	unit	type	explanation
H22	Sulphate (SO4)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H23	Nitrate (NO3)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H24	Hydrogen Sulphide (HS)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H25	Aluminium (Al)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H26	Antimony (Sb)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H27	Arsenic (As)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H28	Beryllium (Be)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H29	Lead (Pb)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H30	Cadmium (Cd)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H31	Caesium (Cs)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H32	Chrome (Cr)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H33	Cobalt (Co)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H34	Copper (Cu)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H35	Lithium (Li)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H36	Molybdenum (Mo)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H37	Nickel (Ni)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H38	Mercury (Hg)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL

Attributes	Field	unit	type	explanation
H39	Rubidium (Rb)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H40	Selenium (Se)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H41	Uranium (U)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H42	Vanadium (V)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H43	Zinc (Zn)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H44	Tin (Sn)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H45	m-Silic acid (H2SiO3)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H46	o-Boric acid (H3BO3)	mg/l	Number/Text	representative hydrochemical analysis, if under detection limit: <DL
H47	gas phase dominance	dominance	Choose from list*	

Fifth Layer: Comments

Attributes	Field	unit	type	explanation
C1	free comment		text	

*Lists to choose from for relevant fields

G1	G3	G4 to G6	G7	A1	H1	H2	H43
classification	**type of water source**	**intended use**	**yield class**	**groundwater age**	**temperature class**	**total dissolved solid class**	**gas phase dominance**
thermal water source	single well	bottled natural mineral water	<5	younger than 60 years	<15	<1	Methane (CH4)
natural mineral water (Directive 2009/54/EC)	well group	natural mineral water publicly available	5-25	older than 60 years	15-20	1-7,5	Carbon dioxide (CO2)
mineral water (national law recognition)	single artesian well	thermal water for balneology	>25	older than 10.000 years	20-30	>14,5	Nitrogen (N2) including noble gases
	artesian well group	thermal water for heating		older than 11.500.000 years	30-40		
	single captured spring	thermal water for electricity production			40-50		
	captured spring group				50-60		
	single gallery				60-70		
	gallery group				70-80		
					80-90		
					90-100		
					>100		

WP4 Linking aquifer microbial ecology and diversity to contaminant transforming processes at groundwater-surface water transition zones.

Product descriptions

Title and description		**Reports on 4-6 pilot sites in Denmark, France, Latvia (and Ireland?)**
Product Type	**Georeferenced Information** Vector / raster	Yes, related to location of pilot
	Not Georeferenced Information	
Data sources		Mainly GEUS and BRGM labs
Spatial dimension		Polygon < 0.01 km2 per pilot? So probably represented as a point with X, Y, Z in relevant European map and projection
Temporal dimension	**static**	x
	dynamic: real time (yes/no)	
Scale		
Coverage		4-6 pilot sites
Projection system.		As requested,
Delivery Format to EGDI	**Web services** (WMS, WFS, WCS, etc.)	Very simple – WMS?
	Files uploaded (shapefiles, ESRI GRID, ASCII, etc.)	
	Not Georeferenced information (PDF, JPG; TXT, etc.)	Reports linked to coordinates / map
Metadata:	**Metadata provider** (IGME, GBA etc .)	GEUS, BRGM, GSI, LEGMC, IGR(?)
	Metadata collection (Harvesting/direct editing)	Direct editing

WP5 Nitrate and pesticides transport from soil to groundwater receptors

Product description

Title and description		Conceptual models of nitrate transport in the unsaturated zone	Geo-referenced reports of denitrification potential mapping	Nitrate concentrations in groundwater	Travel times for nitrate in the unsaturated zone	Nitrate stored in the unsaturated zone
Product Type	**Georeferenced Information** Vector / raster	Vector	Vector		Raster	Raster
	Not Georeferenced Information					
Data sources		Hydrogeological map of Europe	WP5 partner reports and country shapefiles			
Spatial dimension		polygon	polygon		raster map	NetCDF
Temporal dimension	**static**	X	X		X	X
	dynamic: real time (yes/no)					
Scale		1:1,500,000	1:1,500,000		1:1,500,000	1:1,500,000
Coverage		Pan European	Pan European		Pan European	Pan European
Projection system.		EPSG 4326	EPSG 4326		EPSG 4326	EPSG 4326
Delivery Format to EGDI	**Web services** (WMS, WFS, WCS, etc.)					
	Files uploaded (shapefiles, ESRI GRID, ASCII, etc.)	Shapefile + report	Shapefile		ASCII grid	NetCDF
	Not Georeferenced information (PDF, JPG; TXT, etc.)	PDF format for the report?				
Metadata:	**Metadata provider** (IGME, GBA, etc.)	BGS	BRGM		BGS	BGS

	Metadata collection (Harvesting/direct editing)	Direct editing	Direct editing		Direct editing	Direct editing

Product: Conceptual models of nitrate transport in the unsaturated zone

Name of the attribute	Description	Unit	Data type
Conceptual model	Classification of which conceptual model of nitrate transport in the unsaturated zone applies based on link to report		string

Product: Geo-referenced reports of denitrification potential mapping

Name of the attribute	Description	Unit	Data type
Name of study	Name of the denitrification potential mapping study linked to accessible report		string

Product: Travel times for nitrate in the unsaturated zone

Name of the attribute	Description	Unit	Data type
Unsaturated zone travel time	Estimates of unsaturated zone travel time for nitrate based on conceptual models developed in HOVER WP5 Task 1 and depth to groundwater table data	years	number

Product: Nitrate stored in the unsaturated zone

Name of the attribute	Description	Unit	Data type
Nitrate stored in the unsaturated zone	Estimates of nitrate stored in the unsaturated zone based on conceptual models developed in HOVER WP5 Task 1, depth to groundwater table data and nitrate leaching data.	kt N/ha	number

WP6 Groundwater Age Distributions and residence times in European aquifers ("GADIS")

Product descriptions

Title and description		Database structure for storage of probably 10-15 environmental tracers (mainly isotopes)	Maps and cross sections, potentially one or two examples of 3D representations	Reports
Product Type	**Georeferenced Information** Vector / raster	Database allowing for storage of georeferenced tracer analyses for wells varying in space and time	x	(x)
	Not Georeferenced Information			
Data sources		Existing databases at surveys + additional data from researchers' personal databases	GEUS and others?	GEUS and probably 8-10 other partners
Spatial dimension		Mainly OD - 1D		
Temporal dimension	**static**	x	x	
	dynamic: real time (yes/no)			
Scale		vary	1:20.000 - 1:100.000?	
Coverage		?	Selected pilots	Selected pilots
Projection system.			As requested	As requested
Delivery Format to EGDI	**Web services** (WMS, WFS, WCS, etc.)	Simple – WMS?	Simple – WMS?	
	Files uploaded (shapefiles, ESRI GRID, ASCII, etc.)	x	x	
	Not Georeferenced information (PDF, JPG; TXT, etc.)		X (potentially)	Pdf report (hopefully georeferenced)

Metadata:	**Metadata provider** (IGME, GBA etc.)	Mainly GEUS, BRGM, TNO, but potentially all partners	GEUS, BRGM? TNO? and possibly 6-7 other partners	GEUS, BRGM, TNO, MBFZS + others?
	Metadata collection (Harvesting/direct editing)	Partly harvesting, partly direct editing.	Partly harvesting, partly direct editing.	Mainly direct editing

Product: Groundwater age distribution for well fields and regional aquifers in 0D-3D

Name of the attribute	Description	Unit	Data type
Groundwater mean age	Model and/or tracer estimated mean groundwater age	years	Integer
Groundwater age intervals for regional aquifers	Age intervals to be defined; e.g., tentative classes: 0-70 70-500 500-1000 1000-10.000 >10.000	years	String?
Groundwater age intervals for well fields	Tentative classes: 0-10 10-25 25-70 70-200 >200	years	String?

WP7 Harmonized vulnerability to pollution mapping of the upper aquifer Product descriptions

Product descriptions

Title and description		European Groundwater Vulnerability Map to Pollution	Groundwater Vulnerability Map to Pollution in Pilot Areas	2D schematic cross section of the aquifer indicating aquifer vulnerability	Report I on Comparison of internationally commonly applied index methodologies for assessing the vulnerability of the upper aquifer to pollution	Report II on Compilation of the examination results of the data sets of input data for the respective methodologies assessing vulnerability of the upper aquifer to pollution	Report III on Delivery of cross sections and maps of extend of selected aquifers in specific national pilot areas
Product Type	**Georeferenced Information** Vector / raster	Raster	Raster				
	Not Georeferenced Information			x	X	X	X
Data sources		According to questionnaire	According to questionnaire	Not defined yet			
Spatial dimension		Not defined yet, depending on selected input data	Ranging from 50m X 50m to 10km X 10km	Not defined yet			
Temporal dimension	**static**	X		x			
	dynamic: real time (yes/no)						
Scale		1:1,500,000	Ranging from 1:50,000 to 1:1,000,000	Not defined yet			
Coverage		Pan-European (participating WP partners)	Respective Pilot Areas	In selected pilot areas			

Projection system.		WGS_1984_Web_Mercator_Auxiliary_Sphere EPSG: 3857	To be determined				
Delivery Format to EGDI	**Web services** (WMS, WFS, WCS, etc.)	WMS	WMS	WMS and/or WFS			
	Files uploaded (shapefiles, ESRI GRID, ASCII, etc.)						
	Not Georeferenced information (PDF, JPG; TXT, etc.)			JPG or similar	PDF	PDF	PDF
Metadata:	**Metadata provider** (IGME, GBA etc .)	BGR, ICGC	Respective Geological Surveys of the Pilot Areas	Respective Geological Surveys of the selected Pilot Areas			
	Metadata collection (Harvesting/direct editing)	Harvesting	Harvesting	Harvesting			

Product: European Groundwater Vulnerability Map to Pollution according to DRASTIC

Name of the attribute	Description	Unit	Data type
DRASTIC_Value	Calculated DRASTIC Index	-	Integer
DRASTIC_Classes	Vulnerability to Pollution classes: Very low Low Medium High	-	String

Name of the attribute	Description	Unit	Data type
	Very high		

Product: Groundwater Vulnerability Map to Pollution in Pilot Areas.
Attributes have not been defined yet.

Product: 2D schematic cross section of the aquifer indicating aquifer vulnerability in pilot areas.
Attributes have not been defined yet.

WP8 Effective monitoring of emerging contaminants (ECs).

Product descriptions

Title and description		European map that synthesizes the state of knowledge on the presence of selected ECs in groundwater	Critical review report of European monitoring results for organic emerging contaminants	Report with recommendations for monitoring of key parameters with reference to environmental context, geological setting and risk assessment	Report describing new sampling analyses and interlaboratory tests directed towards potential hotspots for emerging contaminants transport
Product Type	Georeferenced Information Vector / raster				
	Not Georeferenced Information	Information associated to the centroid of each MS	X	X	X
Data sources		Questionnaires			
Spatial dimension		Different graph provided depending on the zoom scale			
Temporal dimension	static	X			
	dynamic: real time (yes/no)				
Scale		1:1,500,000			

Coverage		Pan-European (participating WP partners)			
Projection system.					
Delivery Format to EGDI	**Web services** (WMS, WFS, WCS, etc.)				
	Files uploaded (shapefiles, ESRI GRID, ASCII, etc.)				
	Not Georeferenced information (PDF, JPG; TXT, etc.)	Selected pictures to be shown on the map depending on the zoom scale	PDF	PDF	PDF
Metadata:	**Metadata provider** (IGME, GBA etc.)	WP8 participants			
	Metadata collection (Harvesting/direct editing)	?			

Product: European map that synthesizes the state of knowledge on the presence of selected ECs in groundwater.

Numbers and graphs are displayed in the pan-European map for each country. They appear on the map depending on the zoom: from just several groundwater sites to more detailed lists of compounds when the user zooms in on a specific country

Name of the attribute	Description	Unit	Data type
State of the surveillance of ECs in national groundwater	Number of groundwater sites where ECs have been sought over the last 10 years.	Number per year (to be fixed by the WP8 partners)	Histograms Number of sites per year (to be discussed)
Type of ECs sought	Number of molecules sought in groundwater per family type (Pharmaceuticals, industrial, personal care products…)		Radial or camembert graph

Name of the attribute	Description	Unit	Data type
Occurrence of ECs in groundwater	Quantification frequency of selected ECs in GW		Frequency associated to individual molecules

Product: hydrogeological map of Europe.

A8. RESOURCE (latest update: May-2019)

The information presented here has been extracted from Resources D6.1 "*Template that can be used by all participating surveys to collect the required data, Pan-EU Groundwater Resources Map*".

WP6 PAN-EU GW RESOURCE MAP

Product: Pan European groundwater resources map

The pan-EU map is based on the INSPIRE shapefile grid over Europe (https://www.eea.europa.eu/data-and-maps/data/eea-reference-grids-2). The cell-id's correspond to the existing 10x10 km INSPIRE shapefile grid over Europe. INSPIRE Code lists and vocabularies will be used on record level whenever possible, with additional codes where necessary

The coordinate system of this grid is ETRS89, with the Lambert Azimuthal Equal Area projection (LAEA).

Main layer

Attributes	Description	Unit	Data type
cell-id	Unique identifier for each grid cell.	NA	
Altitude_surface_level	Average altitude relative to the EU height reference level EVRF2007 (European Vertical Reference Frame).	meters	number
GW_level	Average depth to the groundwater level (depth of unsaturated zone) below the surface level.	meters	number

Attributes	Description	Unit	Data type
Label_dynamic	Label describing dynamics of the groundwater level. S=Static, K=Karst systems with seasonal groundwater level fluctuation, R=Recovery after mining, P=Groundwater depletion by pumping	NA	Text
GW_level_amplitude	If the groundwater level is dynamic, the amplitude	meters	Number
Unsat_lithology	Simplified lithology of the unsaturated zone	NA	Text
Total_depth_active_layers	This indicates the maximum depth of the layers that are defined are of importance considering the freshwater volume.	meters	number
Label_maximum_depth_active_layers	In this column you can indicate what is used as a label for the maximum depth of the active layers. H=Hydrogeological boundary, C= Based on chloride concentration T=Based on TDS concentration E=Based on EC	NA	Text

Rest of the layers

Name of the attribute	Description	Unit	Data type
cell-id	Unique identifier for each grid cell.		
LX_top	The height of the top of the layer in reference to surface level	meter	number
LX_bottom	The height of the bottom of the layer in meters below surface level.	meter	number
LX_aquifer	If layer is an aquifer	NA	Text (Y/N)
LX_aquitard	if the layer is an aquitard	NA	Text (Y/N)

Name of the attribute	Description	Unit	Data type
LX_lithology	Description of the simplified lithology	NA	
LX_extent	Percentage of the cell that is covered by the layer.		number
LX_Confidence_label_delineation	Describes the confidence level for the estimation of layer's depth and extent. EJ = Expert Judgement, MOD = Based on subsurface model, BH = Based on boreholes	NA	Text
LX_Porosity	Porosity indicated with two decimals		number
LX_kh	Horizontal conductivity in m/d	m/d	number
LX_KV	Vertical conductivity in m/d	m/d	number
LX_Confidence label_hydraulic_parameters	Indicates the confidence level of the hydraulic parameters. EJ = Expert Judgement, MOD = Based on subsurface model, BH = Based on boreholes		
LX_Paleo	indicating if the groundwater in the layer is Paleogenic	NA	Text (Y/N)
LX_Artesian	Label indicating if the aquifer is confined/unconfined/Confined artesian (C, U, CA).	NA	Text
LX_Thermal	Label indicating if the aquifer is (natural) thermal or not.	NA	Text (Y/N)

A9. TACTIC (latest update: 28-Jan-2019)

Data extracted from GIP-P D2.2.1 "*First report describing the requirements to the Information Platform by the Geo-energy, Groundwater and Raw Materials themes)"*

WPs	Data type	Format and other information
WP3 Integrated groundwater - surface water assessment	Documents	Not yet defined

WPs	Data type	Format and other information
WP4 Assessing groundwater recharge and vulnerability	Map displaying aquifer vulnerability to climate	
	Pan-European net-precipitation and groundwater recharge maps multiple layers with mean, monthly, annual data etc.	
WP5 Assessment of salt-/sea water intrusion status and vulnerability	Documents	
WP6 Groundwater adaptation strategies	Documents	

A10. VOGERA (latest update: Jan-2019)

Information extracted from VoGERA D2.1 "*Data Management Plan*."

The data generated by VoGERA will comprise the following reports:

- Technical report on evidence for potential pathways for groundwater contamination from sub-surface energy activities and data collection plan (D3.1)
- Technical report on the characterization of potential pathways and effects on fluid in the pilot areas (D3.2)
- Groundwater vulnerability assessments for pilot study sites (D3.3)
- Expanded diagrams of conceptual models identifying potential pathways for industrial activity in the deep sub-surface and shallow groundwater vulnerability (D 4.1)
- Common methodology for characterising the vulnerability of shallow groundwater to deep industrial activities (D 4.2)
- The conceptual models of the pathways and the specific (potential) impacts of deep energy activities for groundwater resources at the pilot sites.

RAW MATERIALS

A11. EUROLITHOS (latest update: 21-June-2019)

The following data have been gathered from EuroLithos D6.1 "*Data and information structure for the knowledge platform on European ornamental stone resources*". This information has been completed by a series of emails exchanged with Eurolithos in May and June of 2019.

The spatial data that Eurolithos will use is already built into Minerals4EU; i.e., points and polygons with properties according to Inspire and Minerals4EU. However, they will be extended with fields for adding unique names for stone types.

Minerals4EU database is used in a heterogeneous way for dimension stones. That is:

- Several countries have not delivered any information for dimension stone at all.
- Several countries have delivered only a few of their dimension stone occurrences.
- The commodity code-list is not suitable.
- Similar dimension stone occurrences are registered in varied ways.

In addition, in order to create a European plot for dimension stone resources, there is the need of:

1. Better guidelines to define which information must be incorporated in the Minerals4EU deliveries and how that must be done.
    - EuroLithos will initiate this.
2. The addition of some minor extensions for product types to the existing Minerals4EU model/DB.

The existing commodity code-list is not enough to describe dimension stone products. But it could be used as described here:

Product: Dimension Stone

ProductName	Lithology	Colour	?
Code-list 1: Based on EN12440	Minerals4EU code-list	Code-list 2: Proposal from EuroLithos	

Example of Rock Classification according to EN 12670 & EN 12407

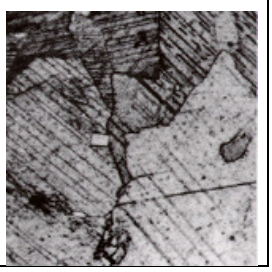
Country:	***GREECE***
No.	***1***

Igneous Rocks	List	Sedimentary Rocks	List	Metamorphic Rocks	List
Plutonic Rocks	--	Arkose	--	Amphibolite	--
Ultrabasic Rocks	--	Carbonates according to dolomite content	--	Calc-schist	--
Volcanic Rocks	--	Greywackes	--	Eclogite	--
Pyroclastic Rocks	--	Limestones	--	Epidotite	--

Igneous Rocks	List	Sedimentary Rocks	List	Metamorphic Rocks	List
Diabase		Marls	--	Feldspathite	--
		Sandstones	--	Gneiss	--
		Shales	--	Granulite	--
		Gypsum		Greenschist	--
		Calcarenite		Leptite	--
		Chalk		Marble	Calcitic marble
				Micacite chloritite	--
				Migmatite	--
				Ophicalcite	--
				Phyllite	--
				Quartzite	--
				Schist & Slate	--
				Serpentinite	--

The products will be linked to "product sheets"; see here below examples of these product sheets:

Petrographic description of stones

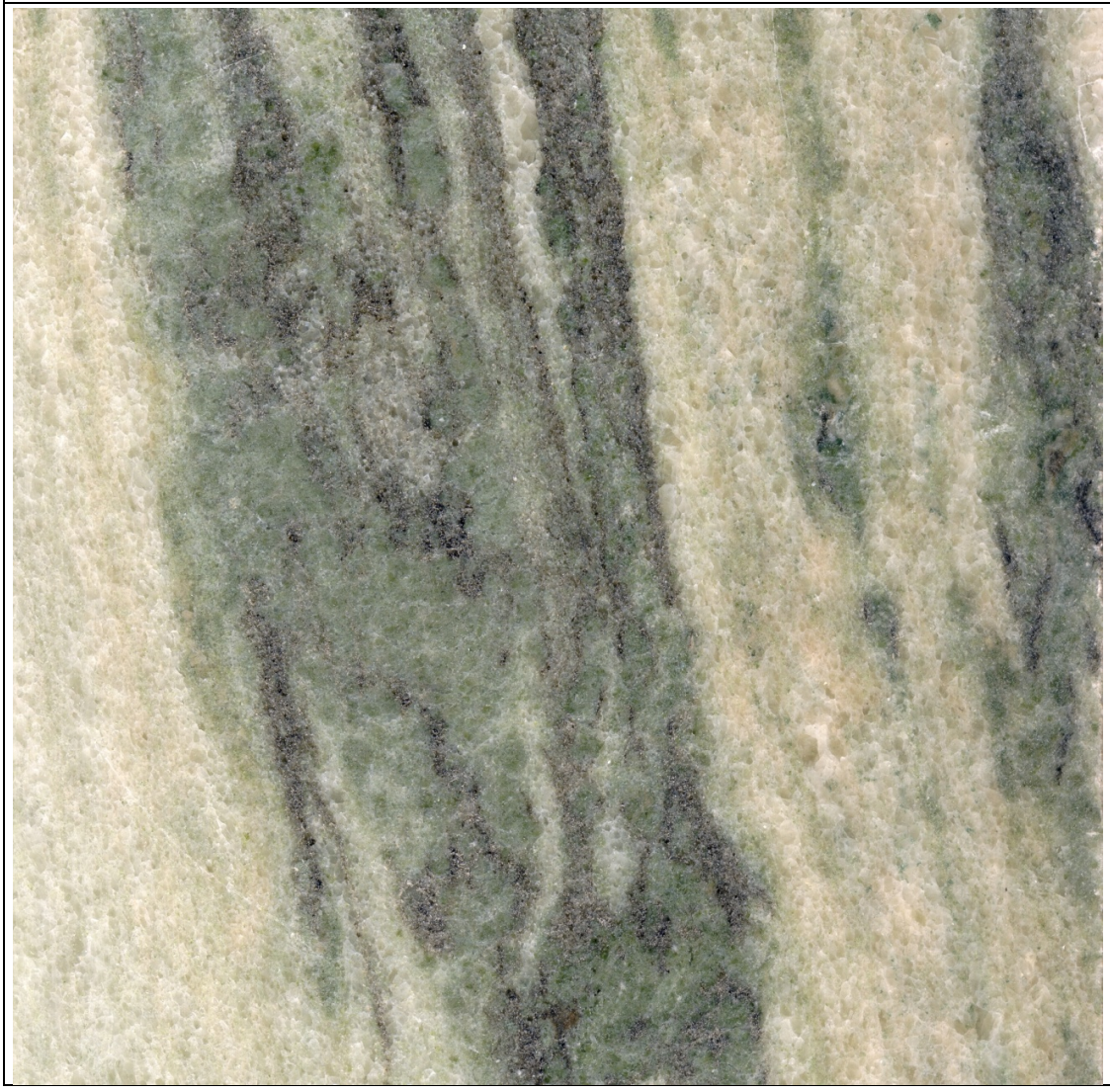
Petrographic examination (EN 12407)			
No	**Macroscopic description**	**Microscopic description**	**Thin section photographic record**
2.	Green marble, medium and uniformly grained, with dark-green and brownish veining.	Medium grained calcitic marble containing a significant amount of dolomite, with granoblastic texture.	Parallel to the anisotropy planes (N+…x15) 

Photographic record of the Stones

(Note: The pictures should be presented without size reduction and should correspond to a surface area of 150 x 150 mm, at least)

2.	**Name of natural stone (EN 12440):**	Verde Viana
	Petrological family:	Calcitic marble
	Country:	Portugal

(Surface area: 150 x 150 mm)



Eurolithos products:

Product: Ornamental stones (Points)

Attributes	description
Name of place	Quarry name or other geographic
Stone name	Unique traditional name(s)
Alternative stone names	Other commercial or trade names
Deposit type	Dimension stone
Deposit Group	Bulk rock material
Enduse potential	Building and dimension stone
Commodity type	basalt dimension stone granite greenstone limestone marble miscellaneous dimension stones onyx sandstone slate
Lithology	LithologyValue (INSPIRE geology)
Mineral Occurrence type	Deposit, prospect, occurrence
Geologic event	Minerals4EU
Mine status	Minerals4EU
Mining activity type (CGI)**	Minerals4EU
Exploration activity type (CGI)**	Minerals4EU
Resource Category (CGI)*	Minerals4EU
Reserve Category (INSPIRE)**	Minerals4EU
Endowments**	Minerals4EU
Documents**	Minerals4EU
Remarks**	Minerals4EU

Product: Ornamental stones (Polygons)

Attributes	Description: geological units or provinces carrying important stone resources
Name of unit	Name of geological unit or province
Type of unit	Nappe, formation, group, province
Stone name	Unique traditional name(s)
Alternative stone names	Other commercial or trade names
Deposit type	Dimension stone
Deposit Group	Bulk rock material
Enduse potential	Building and dimension stone
Commodity type	basalt dimension stone granite greenstone limestone marble miscellaneous dimension stones onyx sandstone slate
Lithologies	LithologyValue (INSPIRE geology)
Geologic event	Minerals4EU
Mine status	Minerals4EU
Documents**	Minerals4EU
Remarks**	Minerals4EU

**Optional.

Key identity properties of unique stone types
ID
Name of natural stone (According to EN 12440)
Alternative names
Classification (EN 12670 and Inspire Lithology)
Petrological family/group (EN 12670 & EN 12407 and INSPIRE)
Typical colour
Place of origin
Country

Physical properties of stones
Apparent density (EN 1936), kg/m3
Open porosity (EN 1936), % vol

Water absorption at atmospheric pressure (EN 13755), % wt
Uniaxial Compressive strength (EN 1926), MPa
Flexural strength under concentrated load (EN 12372), Mpa
Freeze-thaw resistance, 48 cycles *(Flexural strength after 48 freeze-thaw cycles (EN 12371 & EN 12372)),* MPa
Abrasion resistance (EN 14157 – Method B), mm3
Breaking load at dowel hole (EN 13364), N
Rupture energy (EN 14158), Joule
Laboratory reference
Sample reference

Geochemical information
SiO_2 (%)
Al_2O_3 (%)
Fe_2O_3 (%)
CaO (%)
MgO (%)
MnO (%)
K_2O (%)
Na_2O (%)
LOI (%)
V (ppm)
Cr (ppm)
Mn (ppm)
Co (ppm)
Ni (ppm)
Cu (ppm)
Zn (ppm)
As (ppm)
Sr (ppm)
Cd (ppm)
Ba (ppm)
Pb (ppm)
Be (ppm)
Rb (ppm)
Bi (ppm)
U (ppm)
Sc (ppm)
Y (ppm)
Th (ppm)
Sb (ppm)

Ta (ppm)
Nb (ppm)
Sample ID
Sample ID
Laboratory reference

A12. FRAME (latest update: 28-Jan-2019)

The following data have been gathered from GIP-P D2.2.1 "*First report describing the requirements to the Information Platform by the Geo-energy, Groundwater and Raw Materials themes*" (28-Jan-2019). The final products and attributes are still being defined by the various FRAME partners.

WP3: Critical and Strategic Raw Materials Map of Europe

- Metallogenic map
- Predictivity map
- Prospectivity maps
- Mineral Occurrences and Mines update for CRM

WP4: CRM in phosphate deposits and associated black shales

- Mineral Occurrences and Mines update for phosphate deposits and associated
- New geological, chemical-mineralogical and geochronological data for some deposits

WP5: Energy Critical Elements

- Potential and prospectivity maps
- Mineral Occurrences and Mines update for natural graphite, lithium and cobalt

WP6: Conflict free Nb-Ta for the EU

- Mineral Occurrences and Mines update for Nb-Ta mineralisation

A13. MINDESEA (latest update: June-2019)

The following data have been gathered from GIP-P D2.2.1 "*First report describing the requirements to the Information Platform by the Geo-energy, Groundwater and Raw Materials themes*" (28-Jan-2019) and a series of EXCEL files sent by MINDeSEA to GIP-P/WP2 in October 2018 and June 2019.

***Note:** attributes of polygon and point data are the same with the difference that point data also include geographic information (Lat/Long).

Product: Exploration data (Polygons & Points)

Attributes	Field name	Format	Information
OBJECT ID	FID	Number	Feature ID. An internally generated identification number for each feature. Automatically generated within shape file.
Shape	SHAPE	Geometry	Polygon
Cruise Name	CRUISE	Text (40)	Cruise expedition
Research Vessel	R_V	Text (40)	Name
Leg Number	LEG_N	Number (Double)	Number of legs within the cruise
Cruise Start Date	CRU_START	Date	yyyy-mm-dd
Cruise End Date	CRU_END	Date	yyyy-mm-dd
Scientific Report	SCI_REP	Text (100)	URL or DOI
Country Code	CODE	Text (2)	Two letter country code (see INSPIRE CODE: CountryType)
Administration	ADM	Text (40)	Legal status following the division of the Law of the Sea Convention: Territorial sea, Exclusive Economic Zone (EZZ), Continental shelf or International Area
Geographical Area	GEO_AREA	Text (40)	Atlantic Ocean, Mediterranean Sea, etc.
Sector	SECTOR	Text (100)	Canary Island Seamount Province, Aeolian Islands, Gulf of Bothnia, etc.
Year of Database Entry	YEAR	Short Integer	2018, 2019, etc.
Date of Database Update	UPDATE	Date	dd/mm/yyyy (Date of last update of attributes)
Exploration	EXPLOR	Text (250)	Works performed: bathymetry and geophysical surveys, sampling, underwater video, mining processing, etc.
Multibeam	MULTIBEAM	Text (100)	If multibeam data are available. If yes= URL
Backscatter	BACKSC	Text (100)	If backscatter data are available. If yes= URL

Attributes	Field name	Format	Information
Sub-bottom profiler	SUBBOTTOM	Text (100)	If sub-bottom profiler data are available. If yes= URL
Seismic	SEISMIC	Text (100)	If seismic data are available. If yes= Type an URL
Magnetometry	MAGNETOMER	Text (100)	If magnetometer data are available. If yes= URL
Gravimetry	GRAVIMETER	Text (100)	If gravimeter data are available. If yes= URL
Other Methods	OTHER_M	Text (100)	add as many fields as needed
Deposit Types	DEPOSIT_TY	Text (500)	Keywords describing briefly the types of deposits located (geological setting, morphology and structure, rocks/sediments surrounding the ore and minerals of the ore)
Sampling devices	SAMPLING_D	Text (250)	Box core, corer, dredge, ROV, other
Data Scale	SCALE	Text (100)	Specify the scale in which the exploration has been performed
Exploration Extent	EXPL_KM2	Number (Double)	Area of the exploration (Sq. Km)
Maximum Water Depth (m)	MAX_DEPTH	Number (Double)	Maximum depth to seafloor from sea surface
Minimum Water Depth (m)	MIN_DEPTH	Number (Double)	Minimum depth to seafloor from sea surface
Operator	OPERATOR	Text (250)	Research, exploration or operating agency/company
Location of samples	SAMP_LOC	Text (250)	Storage location on land
Data Provider	DATA_PROVI	Text (150)	Name of organisation providing data
Data Provider Contact	DATA_CONT	Text (150)	The data providing organisation/institute contact details – email is required

Attributes	Field name	Format	Information
Gallery	GALLERY	Text (100)	Images of the exploration performed (geophysics, sampling, underwater video or photography, etc.)
References	REFERENCES	Text (500)	Bibliographic references (DOI and/or Author, Year & Title if you wish)
Comments	COMMENTS	Text (500)	Any additional noteworthy comments or observations

Product: Marine Placers (Polygons & Points)

Attributes	FIELDNAME	Format	Information
OBJECTID	FID	Number	Feature ID. An internally generated identification number for each feature. Automatically generated within shape file.
Shape	SHAPE	Geometry	Polygon and Points
Latitude*	LATITUDE	Number (Double)	Degrees N
Longitude*	LONGITUDE	Number (Double)	Degrees W/ Degrees E
Country Code	CODE	Text (2)	Two letter country code (see INSPIRE CODE: CountryType)
Administration	ADM	Text (40)	Legal status following the division of the Law of the Sea Convention: Territorial Sea (TS), Exclusive Economic Zone (EEZ), Extended Continental shelf (ECS) or the Area (A)
Geographical Area	GEO_AREA	Text (100)	Atlantic Ocean, Mediterranean Sea, etc..
Sector	SECTOR	Text (100)	Canary Island Seamount Province, Aeolian Islands, Gulf of Bothnia, etc.
Occurrence/Deposit name	DEPOS_NAME	Text (40)	Name of occurrence/ deposit
Mineral Occurrence Type	OCURR_TY	Text (40)	see INSPIRE CODES: OccurrenceTypeType

Attributes	FIELDNAME	Format	Information
Year of Database Entry	YEAR_DB	Short Integer	2018, 2019, etc.
Date of Database Update	UPDATE_	Date	dd/mm/yyyy (Date of last update of attributes)
Deposit Group	DEPOSIT_G	Text (100)	Sediment-related deposits, hydrothermal deposits, volcanogenic deposits, magmatic deposits, metamorphism-related deposits (see INSPIRE CODES: DepositGroupType)
Deposit Type	DEPOSIT_TY	Text (100)	**Shoreline or Marine Placer -** this exact wording must be entered in bold type (see INSPIRE CODE: DepositTypeType)
Setting	SETTING	Text (250)	Description of geological setting (see INSPIRE CODE: EventEnvironmentType)
Geomorphic Features	GEOMORPH	Text (250)	Geomorphology of area of phosphate deposit occurrence (Epeiric/Continental margin/Seamount/Insular; if known)
Event environment	EVENT_ENVI	Text (250)	Environment of formation of the mineral deposit (see INSPIRE CODE: EventEnvironmentValue)
Depositional environment	DEPOSITION	Text (250)	Environment of deposition of marine placers: fluvial, aeolian, glaciogenic, beach-nearshore
Formation	FORMATION	Text (15)	Autochthonous or allochthonous deposit
Source	SOURCE	Text (40)	Possible source rock (onshore or offshore) derived from literature
Source type	SOURCE_TY	Text (10)	Source type of deposit: primary or secondary
Host Rock	HOST_ROCK	Text (250)	Substrate rock or sediment surrounding the ore deposit (see INSPIRE CODE: LithologyType)

Attributes	FIELDNAME	Format	Information
Metallic Commodity	METAL_COMM	Text (100)	Including precious and non-precious metals (see INSPIRE CODE: CommodityType)
Other Metals	OTHER_ME	Text (100)	See INSPIRE CODE: CommodityType
Commodity Group	COMM_G	Text (100)	Base metals, precious metals, energy metals, technological metals (see INSPIRE CODE: CommodityType, parents column K)
Ore Minerals	ORE_MIN	Text (250)	Principal minerals/commodities (see INSPIRE CODE: MineralNameType)
Gangue Minerals	GANGUE	Text (250)	Non-economic minerals (see INSPIRE CODE: MineralNameType)
Ore mineral distribution	ORE_DISTR	Text (250)	Brecciated, banded, micro-layered, etc. (see INSPIRE CODE: ShapeType)
Alteration	ALTER_	Text (250)	Alteration minerals formed during/after the process of mineralization (see INSPIRE CODES: AlterationDegreeType, AlterationDsitributionType, AlterationTypeType)
Morphology	MORPH	Text (250)	Shape and internal structure (thickness) of the mineral deposit (see INSPIRE CODE: FormType)
Texture	TEXT	Text (250)	Replacement, bioclastic, banded, columnar, mottled, etc.
Geochemistry	GEOCHEM	Text (100)	Yes or no (link to geochemistry table)
Number of samples	N	Short Integer	Number of analysed samples
Al %	Al_pc	Number (Double)	Average concentration, dry wt
Ca %	Ca_pc	Number (Double)	Average concentration, dry wt
Co %	Co_pc	Number (Double)	Average concentration, dry wt

Attributes	FIELDNAME	Format	Information
Cu %	Cu_pc	Number (Double)	Average concentration, dry wt
Fe %	Fe_pc	Number (Double)	Average concentration, dry wt
Mn %	Mn_pc	Number (Double)	Average concentration, dry wt
Ni %	Ni_pc	Number (Double)	Average concentration, dry wt
Si %	Si_pc	Number (Double)	Average concentration, dry wt
Ti %	Ti_pc	Number (Double)	Average concentration, dry wt
Au (ppm)	**Au_ppm**	Number (Double)	Average concentration, dry wt
Ce (ppm)	**Ce_ppm**	Number (Double)	Average concentration, dry wt
Cr (ppm)	**Cr_ppm**	Number (Double)	Average concentration, dry wt
Dy (ppm)	**Dy_ppm**	Number (Double)	Average concentration, dry wt
Er (ppm)	**Er_ppm**	Number (Double)	Average concentration, dry wt
Eu (ppm)	**Eu_ppm**	Number (Double)	Average concentration, dry wt
Gd (ppm)	**Gd_ppm**	Number (Double)	Average concentration, dry wt
Ho (ppm)	**Ho_ppm**	Number (Double)	Average concentration, dry wt
La (ppm)	**La_ppm**	Number (Double)	Average concentration, dry wt
Lu (ppm)	**Lu_ppm**	Number (Double)	Average concentration, dry wt
Mo (ppm)	**Mo_ppm**	Number (Double)	Average concentration, dry wt

Attributes	FIELDNAME	Format	Information
Nb (ppm)	**Nb_ppm**	Number (Double)	Average concentration, dry wt
Nd (ppm)	**Nd_ppm**	Number (Double)	Average concentration, dry wt
Pb (ppm)	**Pb_ppm**	Number (Double)	Average concentration, dry wt
Pm (ppm)	**Pm_ppm**	Number (Double)	Average concentration, dry wt
Pr (ppm)	**Pr_ppm**	Number (Double)	Average concentration, dry wt
Pt (ppm)	**Pt_ppm**	Number (Double)	Average concentration, dry wt
Sc (ppm)	**Sc_ppm**	Number (Double)	Average concentration, dry wt
Sm (ppm)	**Sm_ppm**	Number (Double)	Average concentration, dry wt
Sn (ppm)	**Sn_ppm**	Number (Double)	Average concentration, dry wt
Tb (ppm)	**Tb_ppm**	Number (Double)	Average concentration, dry wt
Te (ppm)	**Te_ppm**	Number (Double)	Average concentration, dry wt
Ti (ppm)	**Ti_ppm**	Number (Double)	Average concentration, dry wt
Tl (ppm)	**Tl_ppm**	Number (Double)	Average concentration, dry wt
Tm (ppm)	**Tm_ppm**	Number (Double)	Average concentration, dry wt
V (ppm)	**V_ppm**	Number (Double)	Average concentration, dry wt
W (ppm)	**W_ppm**	Number (Double)	Average concentration, dry wt
Y (ppm)	**Y_ppm**	Number (Double)	Average concentration, dry wt

Attributes	FIELDNAME	Format	Information
Yb (ppm)	**Yb_ppm**	Number (Double)	Average concentration, dry wt
Zn (ppm)	**Zn_ppm**	Number (Double)	Average concentration, dry wt
Zr (ppm)	**Zr_ppm**	Number (Double)	Average concentration, dry wt
REE (Total %)	REE_pc	Number (Double)	Average concentration, dry wt
Other Elements	OTHER_E	Number (Double)	Average concentration, dry wt (add as many fields as needed)
Analytical technique	TECHNIQUE	Text (50)	Technique used (AAS, ICP-MS, ICP-AES, XRF etc.) (see INSPIRE CODE: AnalyticalMethodTypeType)
Deposit Size	SIZE	Text (100)	Magnitude of the mineral deposit calculated according to ProMine (unknown, occurrence, small, medium, large, very large) (see INSPIRE CODE: ImportanceType)
Resources	RESOURCE	No. Double	Resources in Mt
Reserves	RESERVE	No. Double	Reserves in Mt
Mined Tonnage	MIN_T	No. Double	in Mt
Total Tonnage	TOTAL_T	No. Double	in Mt
Remaining Tonnage	REM_T	No. Double	in Mt
Resource Reporting Standard/ compliancy	RES_REP	Text (100)	PERC, JORC, NI43-101, etc. (see INSPIRE CODE: ClassificationMethodUsedType)
Reference for Tonnage Assessment	REF_T	Text (40)	Company ordering the assessment
Data Scale	SCALE	Text (100)	Specify the scale in which the deposit has been mapped and delivered
Status	STATUS	Text (250)	e.g. under exploration, research, identified deposits, hypothetical

Attributes	FIELDNAME	Format	Information
			deposits, etc. (see INSPIRE CODE: MineStatusType)
Operator	OPERATOR	Text (250)	Research, exploration or operating agency/company
Exploration Type	EXPLOR_TY	Text (250)	Exploration techniques employed to describe the mineral deposit (see INSPIRE CODE: ExplorationActivityTypeType)
Cruises	CRUISES	Text (250)	Cruises identification
Sampling Methods	SAMPLING_M	Text (250)	Type of method to recover samples (dredge, ROV…)
Sites Number	SITES_NO	Text (250)	Sampling sites identification
Data Provider	DATA_PROVI	Text (150)	Name of organisation providing data
Data Provider Contact	DATA_CONT	Text (150)	The data providing organisation/institute contact details – email is required
Data Holder	DATA_HOLD	Text (150)	Name of the data holder organisation
Deposit Extent	DEPOS_KM2	No. Double	Area of deposit (Sq. Km)
Depth to Deposit (m)	DEPTH_TO_D	No. Double	Depth to deposit from sea surface
Fauna	FAUNA	Text (100)	Type of fauna (e.g. corals…)
Description	DESCRIPT	Text (500)	Deposit summary and metallogenetic model
Gallery	GALLERY	Text (100)	Images on the mineralization (geophysical, sampling, textural features, paragenesis, etc.)
References	REFERENCES	Text (500)	Link to bibliographic references (DOI and/or Author, Year & Title if you wish)
Comments	COMMENTS	Text (500)	Any additional noteworthy comments or observations

Product: Phosphorites (Polygons & Points)

Attributes	FIELDNAME	Format	Information
OBJECTID	FID	Number	Feature ID. An internally generated identification number for each feature. Automatically generated within shape file.
Shape	SHAPE	Geometry	Polygon
Latitude*	LATITUDE	Number (Double)	Decimal degrees N
Longitude*	LONGITUDE	Number (Double)	Degrees W/ Degrees E
Country Code	CODE	Text (2)	Two letter country code (see INSPIRE CODE: CountryType)
Administration	ADM	Text (40)	Legal status following the division of the Law of the Sea Convention: Territorial Sea (TS), Exclusive Economic Zone (EEZ), Extended Continental shelf (ECS) or the Area (A)
Geographical Area	GEO_AREA	Text (100)	Atlantic Ocean, Mediterranean Sea, etc.
Sector	SECTOR	Text (100)	Canary Island Seamount Province, Aeolian Islands, Gulf of Bothnia, etc.
Occurrence/Deposit name	DEPOS_NAME	Text (40)	Name of occurrence/ deposit
Mineral Occurrence Type	OCURR_TY	Text (40)	see INSPIRE CODES: OccurrenceTypeType
Year of Discovery	YEAR_DIS	Short Integer	2001, 2016, etc.
Year of Database Entry	YEAR_DB	Short Integer	2018, 2019, etc.
Date of Database Update	UPDATE_	Date	dd/mm/yyyy (Date of last update of attributes)
Deposit Group	DEPOSIT_G	Text (100)	Sediment-related deposits, hydrothermal deposits, volcanogenic deposits, magmatic deposits, metamorphism-related deposits (see INSPIRE CODES: DepositGroupType)

Attributes	FIELDNAME	Format	Information
Deposit Type	DEPOSIT_TY	Text (100)	SedimentaryPhosphorite - this exact wording must be entered in bold type (see INSPIRE CODE: DepositTypeType)
Deposit Sub Type	DEP_SUB_TY	Text (100)	Sub-type: Nodular/Bioclastic/Phosphatisation
Setting	SETTING	Text (250)	Description of geological setting (see INSPIRE CODE: EventEnvironmentType)
Geomorphic Features	GEOMORPH	Text (250)	Geomorphology of area of phosphate deposit occurrence (Epeiric/Continental margin/Seamount/Insular; if known)
Age	AGE	Text (250)	Age of the mineral deposit and host rock (see INSPIRE CODE: NamedAgeType)
Host Rock	HOST_ROCK	Text (250)	Substrate rock or sediment surrounding the ore deposit (see INSPIRE CODE: LithologyType)
Metallic Commodity	METAL_COMM	Text (100)	Including precious and non-precious metals (see INSPIRE CODE: CommodityType)
Other Metals	OTHER_ME	Text (100)	See INSPIRE CODE: CommodityType
Commodity Group	COMM_G	Text (100)	Base metals, precious metals, energy metals, technological metals (see INSPIRE CODE: CommodityType, parents column K)
Ore Minerals	ORE_MIN	Text (250)	Principal minerals/commodities (see INSPIRE CODE: MineralNameType)
Gangue Minerals	GANGUE	Text (250)	Non-economic minerals (see INSPIRE CODE: MineralNameType)
Ore mineral distribution	ORE_DISTR	Text (250)	Brecciated, banded, micro-layered, etc. (see INSPIRE CODE: ShapeType)

Attributes	FIELDNAME	Format	Information
Alteration	ALTER_	Text (250)	Alteration minerals formed during/after the process of mineralization (see INSPIRE CODES: AlterationDegreeType, AlterationDsitributionType, AlterationTypeType
Morphology	MORPH	Text (250)	Shape and internal structure (thickness) of the mineral deposit (see INSPIRE CODE: FormType)
Texture	TEXT	Text (250)	Replacement, bioclastic, banded, columnar, mottled, etc.
Geochemistry	GEOCHEM	Text (100)	Yes or no (link to geochemistry table)
Number of samples	N	Short Integer	Number of analysed samples
SiO_2 %	SiO2__pc	Number (Double)	Average concentration, dry wt
TiO_2 %	TiO2__pc	Number (Double)	Average concentration, dry wt
Al_2O_3 %	Al2O3__pc	Number (Double)	Average concentration, dry wt
Fe_2O_3 %	Fe2O3__pc	Number (Double)	Average concentration, dry wt
MnO %	MnO__pc	Number (Double)	Average concentration, dry wt
MgO %	MgO__pc	Number (Double)	Average concentration, dry wt
CaO %	CaO__pc	Number (Double)	Average concentration, dry wt
Na_2O %	Na2O__pc	Number (Double)	Average concentration, dry wt
K_2O %	K2O__pc	Number (Double)	Average concentration, dry wt
P_2O_5 %	P2O5_pc	Number (Double)	Average concentration, dry wt
LOI %	LOI_pc	Number (Double)	Average concentration, dry wt
TOTAL %	TOTAL_pc	Number (Double)	Average concentration, dry wt
F (ppm)	F_ppm	Number (Double)	Average concentration, dry wt
Cl (ppm)	Cl_ppm	Number (Double)	Average concentration, dry wt
Th (ppm)	Th_ppm	Number (Double)	Average concentration, dry wt
U (ppm)	U_ppm	Number (Double)	Average concentration, dry wt
Y (ppm)	Y_ppm	Number (Double)	Average concentration, dry wt

Attributes	FIELDNAME	Format	Information
La (ppm)	La_ppm	Number (Double)	Average concentration, dry wt
Ce (ppm)	Ce_ppm	Number (Double)	Average concentration, dry wt
Pr (ppm)	Pr_ppm	Number (Double)	Average concentration, dry wt
Nd (ppm)	Nd_ppm	Number (Double)	Average concentration, dry wt
Pm (ppm)	Pm_ppm	Number (Double)	Average concentration, dry wt
Sm (ppm)	Sm_ppm	Number (Double)	Average concentration, dry wt
Eu (ppm)	Eu_ppm	Number (Double)	Average concentration, dry wt
Gd (ppm)	Gd_ppm	Number (Double)	Average concentration, dry wt
Tb (ppm)	Tb_ppm	Number (Double)	Average concentration, dry wt
Dy (ppm)	Dy_ppm	Number (Double)	Average concentration, dry wt
Ho (ppm)	Ho_ppm	Number (Double)	Average concentration, dry wt
Er (ppm)	Er_ppm	Number (Double)	Average concentration, dry wt
Tm (ppm)	Tm_ppm	Number (Double)	Average concentration, dry wt
Yb (ppm)	Yb_ppm	Number (Double)	Average concentration, dry wt
Lu (ppm)	Lu_ppm	Number (Double)	Average concentration, dry wt
REE (Total %)	REE_pc	Number (Double)	Average concentration, dry wt
Other Elements	OTHER_E	Number (Double)	Average concentration, dry wt (add as many fields as needed)
Analytical technique	TECHNIQUE	Text (50)	Technique used (AAS, ICP-MS, ICP-AES, XRF etc.) (see INSPIRE CODE: AnalyticalMethodTypeType)
Deposit Size	SIZE	Text (100)	Magnitude of the mineral deposit calculated according to ProMine (unknown, occurrence, small, medium, large, very large) (see INSPIRE CODE: ImportanceType)
Grade	GRADE	Text (250)	Specify assessments of grade (mean content of phosphorous (P); calcium (Ca); yttrium (Y); rare earth elements (REEs) wt%) or resource potential, if applicable

Attributes	FIELDNAME	Format	Information
Resources	RESOURCE	No. Double	Resources in Mt
Reserves	RESERVE	No. Double	Reserves in Mt
Mined Tonnage	MIN_T	No. Double	in Mt
Total Tonnage	TOTAL_T	No. Double	in Mt
Remaining Tonnage	REM_T	No. Double	in Mt
Resource Reporting Standard/ compliancy	RES_REP	Text (100)	PERC, JORC, NI43-101, etc. (see INSPIRE CODE: ClassificationMethodUsedType)
Reference for Tonnage Assessment	REF_T	Text (40)	Company ordering the assessment
Data Scale	SCALE	Text (100)	Specify the scale in which the deposit has been mapped and delivered
Status	STATUS	Text (250)	e.g. under exploration, research, identified deposits, hypothetical deposits, etc. (see INSPIRE CODE: MineStatusType)
Operator	OPERATOR	Text (250)	Research, exploration or operating agency/company
Exploration Type	EXPLOR_TY	Text (250)	Exploration techniques employed to describe the mineral deposit (see INSPIRE CODE: ExplorationActivityTypeType)
Cruises	CRUISES	Text (250)	Cruises identification
Sampling Methods	SAMPLING_M	Text (250)	Type of method to recover samples (dredge, ROV…)
Sites Number	SITES_NO	Text (250)	Sampling sites identification
Data Provider	DATA_PROVI	Text (150)	Name of organisation providing data
Data Provider Contact	DATA_CONT	Text (150)	The data providing organisation/institute contact details – email is required
Deposit Extent	DEPOS_KM2	No. Double	Area of deposit (Sq. Km)

Attributes	FIELDNAME	Format	Information
Depth to Deposit (m)	DEPTH_TO_D	No. Double	Depth to deposit from sea surface
Fauna	FAUNA	Text (100)	Type of fauna (e.g. corals…)
Description	DESCRIPT	Text (500)	Deposit summary and metallogenetic model
Gallery	GALLERY	Text (100)	Images on the mineralization (geophysical, sampling, textural features, paragenesis, etc.)
References	REFERENCES	Text (500)	Link to bibliographic references (DOI and/or Author, Year & Title if you wish)
Comments	COMMENTS	Text (500)	Any additional noteworthy comments or observations

Products: Crusts (Polygons & Points)

Attributes	FIELDNAME	Format	Information
OBJECTID	FID	Number	Feature ID. An internally generated identification number for each feature. Automatically generated within shape file.
Shape	SHAPE	Geometry	Polygon
Latitude*	LATITUDE	Number (Double)	Degrees N
Longitude*	LONGITUDE	Number (Double)	Degrees W/ Degrees E
Country Code	CODE	Text (2)	Two letter country code (see INSPIRE CODE: CountryType)
Administration	ADM	Text (40)	Legal status following the division of the Law of the Sea Convention: Territorial Sea (TS), Exclusive Economic Zone (EEZ), Extended Continental shelf (ECS) or the Area (A)
Geographical Area	GEO_AREA	Text (100)	Atlantic Ocean, Mediterranean Sea, etc..
Sector	SECTOR	Text (100)	Canary Island Seamount Province, Aeolian Islands, Gulf of Bothnia, etc.

Attributes	FIELDNAME	Format	Information
Occurrence/Deposit name	DEPOS_NAME	Text (40)	Name of occurrence/ deposit
Mineral Occurrence Type	OCURR_TY	Text (40)	see INSPIRE CODES: OccurrenceTypeType
Year of Discovery	YEAR_DIS	Short Integer	2001, 2016, etc.
Year of Database Entry	YEAR_DB	Short Integer	2018, 2019, etc.
Date of Database Update	UPDATE_	Date	dd/mm/yyyy (Date of last update of attributes)
Deposit Group	DEPOSIT_G	Text (100)	Sediment-related deposits, hydrothermal deposits, volcanogenic deposits, magmatic deposits, metamorphism-related deposits (see INSPIRE CODES: DepositGroupType)
Deposit Type	DEPOSIT_TY	Text (100)	SedimentaryManganese -this exact wording must be entered in bold type (see INSPIRE CODE: DepositTypeType)
Setting	SETTING	Text (250)	Description of geological setting (see INSPIRE CODE: EventEnvironmentType)
Geomorphic Features	GEOMORPH	Text (250)	Geomorphology of area of FeMn crust occurrence
Age	AGE	Text (250)	Age of the mineral deposit and host rock (see INSPIRE CODE: NamedAgeType)
Host Rock	HOST_ROCK	Text (250)	Substrate rock or sediment surrounding the ore deposit (see INSPIRE CODE: LithologyType)
Metallic Commodity	METAL_COMM	Text (100)	Including precious and non-precious metals (see INSPIRE CODE: CommodityType)
Other Metals	OTHER_ME	Text (100)	See INSPIRE CODE: CommodityType
Commodity Group	COMM_G	Text (100)	Base metals, precious metals, energy metals, technological metals (see INSPIRE CODE: CommodityType, parents' field)

Attributes	FIELDNAME	Format	Information
Ore Minerals	ORE_MIN	Text (250)	Principal minerals/commodities (see INSPIRE CODE: MineralNameType)
Gangue Minerals	GANGUE	Text (250)	Non-economic minerals (see INSPIRE CODE: MineralNameType)
Ore mineral distribution	ORE_DISTR	Text (250)	Brecciated, banded, micro-layered, etc. (see INSPIRE CODE: ShapeType)
Alteration	ALTER_	Text (250)	Alteration minerals formed during/after the process of mineralization (see INSPIRE CODES: AlterationDegreeType, AlterationDsitributionType, AlterationTypeType
Morphology	MORPH	Text (250)	Shape and internal structure (thickness) of the mineral deposit (see INSPIRE CODE: FormType)
Texture	TEXT	Text (250)	Banded, columnar, mottled, etc.
Geochemistry	GEOCHEM	Text (100)	Link to Geochemistry table
Number of samples	N	Short Integer	Number of analysed samples
SiO_2 %	SiO2__pc	Number (Double)	Average concentration, dry wt
TiO_2 %	TiO2__pc	Number (Double)	Average concentration, dry wt
Al_2O_3 %	Al2O3__pc	Number (Double)	Average concentration, dry wt
Fe_2O_3 %	Fe2O3__pc	Number (Double)	Average concentration, dry wt
MnO %	MnO__pc	Number (Double)	Average concentration, dry wt
MgO %	MgO__pc	Number (Double)	Average concentration, dry wt
CaO %	CaO__pc	Number (Double)	Average concentration, dry wt
Na_2O %	Na2O__pc	Number (Double)	Average concentration, dry wt
K_2O %	K2O__pc	Number (Double)	Average concentration, dry wt
P_2O_5 %	P2O5__pc	Number (Double)	Average concentration, dry wt
LOI %	LOI__pc	Number (Double)	Average concentration, dry wt
TOTAL %	TOTAL__pc	Number (Double)	Average concentration, dry wt
Co %	Co__pc	Number (Double)	Average concentration, dry wt

Attributes	FIELDNAME	Format	Information
Ni %	Ni__pc	Number (Double)	Average concentration, dry wt
Cu %	Cu__pc	Number (Double)	Average concentration, dry wt
Zn (ppm)	Zn_ppm	Number (Double)	Average concentration, dry wt
Nb (ppm)	Nb_ppm	Number (Double)	Average concentration, dry wt
Mo (ppm)	Mo_ppm	Number (Double)	Average concentration, dry wt
Sc (ppm)	Sc_ppm	Number (Double)	Average concentration, dry wt
V (ppm)	V_ppm	Number (Double)	Average concentration, dry wt
Bi (ppm)	Bi_ppm	Number (Double)	Average concentration, dry wt
Te (ppm)	Te_ppm	Number (Double)	Average concentration, dry wt
W (ppm)	W_ppm	Number (Double)	Average concentration, dry wt
Pd (ppb)	Pd_ppb	Number (Double)	Average concentration, dry wt
Pt (ppb)	Pt_ppb	Number (Double)	Average concentration, dry wt
Rh (ppb)	Rh_ppb	Number (Double)	Average concentration, dry wt
Ru (ppb)	Ru_ppb	Number (Double)	Average concentration, dry wt
Tl (ppm)	Tl_ppm	Number (Double)	Average concentration, dry wt
Pb (ppm)	Pb_ppm	Number (Double)	Average concentration, dry wt
Y (ppm)	Y_ppm	Number (Double)	Average concentration, dry wt
La (ppm)	La_ppm	Number (Double)	Average concentration, dry wt
Ce (ppm)	Ce_ppm	Number (Double)	Average concentration, dry wt
Pr (ppm)	Pr_ppm	Number (Double)	Average concentration, dry wt
Nd (ppm)	Nd_ppm	Number (Double)	Average concentration, dry wt
Pm (ppm)	Pm_ppm	Number (Double)	Average concentration, dry wt
Sm (ppm)	Sm_ppm	Number (Double)	Average concentration, dry wt
Eu (ppm)	Eu_ppm	Number (Double)	Average concentration, dry wt
Gd (ppm)	Gd_ppm	Number (Double)	Average concentration, dry wt
Tb (ppm)	Tb_ppm	Number (Double)	Average concentration, dry wt
Dy (ppm)	Dy_ppm	Number (Double)	Average concentration, dry wt

Attributes	FIELDNAME	Format	Information
Ho (ppm)	Ho_ppm	Number (Double)	Average concentration, dry wt
Er (ppm)	Er_ppm	Number (Double)	Average concentration, dry wt
Tm (ppm)	Tm_ppm	Number (Double)	Average concentration, dry wt
Yb (ppm)	Yb_ppm	Number (Double)	Average concentration, dry wt
Lu (ppm)	Lu_ppm	Number (Double)	Average concentration, dry wt
REE (Total %)	REE_pc	Number (Double)	Average concentration, dry wt
Other Elements	OTHER_E	Number (Double)	Average concentration, dry wt (add as many fields as needed)
Analytical technique	TECHNIQUE	Text (50)	Technique used (AAS, ICP-MS, ICP-AES, XRF etc.) (see INSPIRE CODE: AnalyticalMethodTypeType)
Deposit Size	SIZE	Text (100)	Magnitude of the mineral deposit calculated according to ProMine (unknown, occurrence, small, medium, large, very large) (see INSPIRE CODE: ImportanceType)
Grade	GRADE	Text (250)	Specify assessments of grade (Mean content of manganese (Mn); iron (Fe); cobalt (Co); nickel (Ni); copper (Cu) wt%) or resource potential, if applicable
Resources	RESOURCES	No. Double	Resources in Mt
Reserves	RESERVES	No. Double	Reserves in Mt
Mined Tonnage	MIN_T	No. Double	in Mt
Total Tonnage	TOTAL_T	No. Double	in Mt
Remaining Tonnage	REM_T	No. Double	in Mt
Resource Reporting Standard/ compliancy	RES_REP	Text (100)	PERC, JORC, NI43-101, etc. (see INSPIRE CODE: ClassificationMethodUsedType)
Reference for Tonnage Assessment	REF_T	Text (40)	Company ordering the assessment

Attributes	FIELDNAME	Format	Information
Data Scale	SCALE	Text (100)	Specify the scale in which the deposit has been mapped and delivered
Status	STATUS	Text (250)	e.g. under exploration, research, identified deposits, hypothetical deposits, etc. (see INSPIRE CODE: MineStatusType)
Operator	OPERATOR	Text (250)	Research, exploration or operating agency/company
Exploration Type	EXPLOR_TY	Text (250)	Exploration techniques employed to describe the mineral deposit (see INSPIRE CODE: ExplorationActivityTypeType)
Cruises	CRUISE	Text (250)	Cruises identification
Sampling Methods	SAMPLING_M	Text (250)	Type of method to recover samples (dredge, ROV…)
Sites Number	SITES_NO	Text (250)	Sampling sites identification
Data Provider	DATA_PROVI	Text (150)	Name of organisation providing data
Data Provider Contact	DATA_CONT	Text (150)	The data providing organisation/institute contact details – email is required
Deposit Extent	DEPOS_KM2	No. Double	Area of deposit (Sq. Km)
Depth to Deposit (m)	DEPTH_TO_D	No. Double	Depth to deposit from sea surface
Fauna	FAUNA	Text (100)	Type of fauna (e.g. corals…)
Description	DESCRIPT	Text (500)	Deposit summary and metallogenetic model
Gallery	GALLERY	Text (100)	Images on the mineralization (geophysical, sampling, textural features, paragenesis, etc.)
References	REFERENCES	Text (500)	Link to bibliographic references (DOI and/or Author, Year & Title if you wish)
Comments	COMMENTS	Text (500)	Any additional comments or observations

Product: Polymetallic Nodules (Points)

Attributes	FIELDNAME	Format	Information
OBJECTID	FID	Number	Feature ID. An internally generated identification number for each feature. Automatically generated within shape file.
Shape	SHAPE	Geometry	Points
Latitude	LAT	Number (Double)	Degrees N
Longitude	LON	Number (Double)	Degrees W/ Degrees E
Country Code	CODE	Text (2)	Two letter country code (see INSPIRE CODE: CountryType)
Administration	ADM	Text (40)	Legal status following the division of the Law of the Sea Convention: Territorial Sea (TS), Exclusive Economic Zone (EEZ), Extended Continental shelf (ECS) or the Area (A)
Geographical Area	GEO_AREA	Text (100)	Atlantic Ocean, Mediterranean Sea, etc.
Sector	SECTOR	Text (100)	Canary Island Seamount Province, Aeolian Islands, Gulf of Bothnia, etc.
Occurrence/Deposit name	DEPOS_NAME	Text (40)	Name of occurrence/ deposit
Mineral Occurrence Type	OCURR_TY	Text (40)	see INSPIRE CODES: OccurrenceTypeType
Year of Discovery	YEAR_DIS	Short Integer (5)	2001, 2016, etc.
Year of Database Entry	YEAR_DB	Short Integer (5)	2018, 2019, etc.
Date of Database Update	UPDATE_	Date	dd/mm/yyyy (Date of last update of attributes)
Deposit Group	DEPOSIT_G	Text (100)	Sediment-related deposits, hydrothermal deposits, volcanogenic deposits, magmatic deposits, metamorphism-related deposits (see INSPIRE CODES: DepositGroupType)

Attributes	FIELDNAME	Format	Information
Deposit Type	DEPOSIT_TY	Text (100)	SedimentaryManganese -this exact wording must be entered in bold type (see INSPIRE CODE: DepositTypeType)
Setting	SETTING	Text (250)	Description of geological setting (see INSPIRE CODE: EventEnvironmentType)
Geomorphic Features	GEOMORPH	Text (250)	Geomorphology of area of FeMn crust occurrence
Age	AGE	Text (250)	Age of the mineral deposit and host rock (see INSPIRE CODE: NamedAgeType)
Host Rock	HOST_ROCK	Text (250)	Substrate rock or sediment surrounding the ore deposit (see INSPIRE CODE: LithologyType)
Metallic Commodity	METAL_COMM	Text (100)	Including precious and non-precious metals (see INSPIRE CODE: CommodityType)
Other Metals	OTHER_ME	Text (100)	See INSPIRE CODE: CommodityType
Commodity Group	COMM_G	Text (100)	Base metals, precious metals, energy metals, technological metals (see INSPIRE CODE: CommodityType, parents column K)
Ore Minerals	ORE_MIN	Text (250)	Principal minerals/commodities (see INSPIRE CODE: MineralNameType)
Gangue Minerals	GANGUE	Text (250)	Non-economic minerals (see INSPIRE CODE: MineralNameType)
Ore mineral distribution	ORE_DISTR	Text (250)	Brecciated, banded, micro-layered, etc. (see INSPIRE CODE: ShapeType)
Alteration	ALTER_	Text (250)	Alteration minerals formed during/after the process of mineralization (see INSPIRE CODES: AlterationDegreeType, AlterationDsitributionType, AlterationTypeType

Attributes	FIELDNAME	Format	Information
Morphology	MORPH	Text (250)	Shape and internal structure (thickness) of the mineral deposit (see INSPIRE CODE: FormType)
Texture	TEXT	Text (250)	Banded, columnar, mottled, etc.
Geochemistry	GEOCHEM	Text (100)	Yes, or not (link to geochemistry table)
Number of samples	N	Short Integer (5)	Number of analysed samples
SiO_2 %	SiO2__pc	Number (Double)	Average concentration, dry wt
TiO_2 %	TiO2__pc	Number (Double)	Average concentration, dry wt
Al_2O_3 %	Al2O3__pc	Number (Double)	Average concentration, dry wt
Fe_2O_3 %	Fe2O3__pc	Number (Double)	Average concentration, dry wt
MnO %	MnO__pc	Number (Double)	Average concentration, dry wt
MgO %	MgO__pc	Number (Double)	Average concentration, dry wt
CaO %	CaO__pc	Number (Double)	Average concentration, dry wt
Na_2O %	Na2O__pc	Number (Double)	Average concentration, dry wt
K_2O %	K2O__pc	Number (Double)	Average concentration, dry wt
P_2O_5 %	P2O5__pc	Number (Double)	Average concentration, dry wt
LOI %	LOI__pc	Number (Double)	Average concentration, dry wt
TOTAL %	TOTAL__pc	Number (Double)	Average concentration, dry wt
Co %	Co__pc	Number (Double)	Average concentration, dry wt
Ni %	Ni__pc	Number (Double)	Average concentration, dry wt
Cu %	Cu__pc	Number (Double)	Average concentration, dry wt
Zn (ppm)	Zn_ppm	Number (Double)	Average concentration, dry wt
Nb (ppm)	Nb_ppm	Number (Double)	Average concentration, dry wt
Mo (ppm)	Mo_ppm	Number (Double)	Average concentration, dry wt
Sc (ppm)	Sc_ppm	Number (Double)	Average concentration, dry wt
Ba (ppm)	Ba_ppm	Number (Double)	Average concentration, dry wt
V (ppm)	V_ppm	Number (Double)	Average concentration, dry wt
Bi (ppm)	Bi_ppm	Number (Double)	Average concentration, dry wt

Attributes	FIELDNAME	Format	Information
Te (ppm)	Te_ppm	Number (Double)	Average concentration, dry wt
W (ppm)	W_ppm	Number (Double)	Average concentration, dry wt
Pd (ppb)	Pd_ppb	Number (Double)	Average concentration, dry wt
Pt (ppb)	Pt_ppb	Number (Double)	Average concentration, dry wt
Rh (ppb)	Rh_ppb	Number (Double)	Average concentration, dry wt
Ru (ppb)	Ru_ppb	Number (Double)	Average concentration, dry wt
Tl (ppm)	Tl_ppm	Number (Double)	Average concentration, dry wt
Pb (ppm)	Pb_ppm	Number (Double)	Average concentration, dry wt
Y (ppm)	Y_ppm	Number (Double)	Average concentration, dry wt
La (ppm)	La_ppm	Number (Double)	Average concentration, dry wt
Ce (ppm)	Ce_ppm	Number (Double)	Average concentration, dry wt
Pr (ppm)	Pr_ppm	Number (Double)	Average concentration, dry wt
Nd (ppm)	Nd_ppm	Number (Double)	Average concentration, dry wt
Pm (ppm)	Pm_ppm	Number (Double)	Average concentration, dry wt
Sm (ppm)	Sm_ppm	Number (Double)	Average concentration, dry wt
Eu (ppm)	Eu_ppm	Number (Double)	Average concentration, dry wt
Gd (ppm)	Gd_ppm	Number (Double)	Average concentration, dry wt
Tb (ppm)	Tb_ppm	Number (Double)	Average concentration, dry wt
Dy (ppm)	Dy_ppm	Number (Double)	Average concentration, dry wt
Ho (ppm)	Ho_ppm	Number (Double)	Average concentration, dry wt
Er (ppm)	Er_ppm	Number (Double)	Average concentration, dry wt
Tm (ppm)	Tm_ppm	Number (Double)	Average concentration, dry wt
Yb (ppm)	Yb_ppm	Number (Double)	Average concentration, dry wt
Lu (ppm)	Lu_ppm	Number (Double)	Average concentration, dry wt
REE (Total %)	REE_pc	Number (Double)	Average concentration, dry wt
Other Elements	OTHER_E	Number (Double)	Average concentration, dry wt (add as many fields as needed)

Attributes	FIELDNAME	Format	Information
Analytical technique	TECHNIQUE	Text (50)	Technique used (AAS, ICP-MS, ICP-AES, XRF etc.) (see INSPIRE CODE: AnalyticalMethodTypeType)
Abundance (Kg/m2)	ABUND	No. Double	Abundance of the polymetallic nodules expressed as kg/m2
Deposit Size	SIZE	Text (100)	Magnitude of the mineral deposit calculated according to ProMine (unknown, occurrence, small, medium, large, very large) (see INSPIRE CODE: ImportanceType)
Grade	GRADE	Text (250)	Specify assessments of grade (Mean content of manganese (Mn); iron (Fe); cobalt (Co); nickel (Ni); copper (Cu) wt%) or resource potential, if applicable
Resources	RESOURCES	No. Double	Resources in Mt
Reserves	RESERVES	No. Double	Reserves in Mt
Mined Tonnage	MIN_T	No. Double	in Mt
Total Tonnage	TOTAL_T	No. Double	in Mt
Remaining Tonnage	REM_T	No. Double	in Mt
Resource Reporting Standard/ compliancy	RES_REP	Text (100)	PERC, JORC, NI43-101, etc. (see INSPIRE CODE: ClassificationMethodUsedType)
Reference for Tonnage Assessment	REF_T	Text (40)	Company ordering the assessment
Data Scale	SCALE	Text (100)	Specify the scale in which the deposit has been mapped and delivered
Status	STATUS	Text (250)	e.g. under exploration, research, identified deposits, hypothetical deposits, etc. (see INSPIRE CODE: MineStatusType)
Operator	OPERATOR	Text (250)	Research, exploration or operating agency/company

Attributes	FIELDNAME	Format	Information
Exploration Type	EXPLOR_TY	Text (250)	Exploration techniques employed to describe the mineral deposit (see INSPIRE CODE: ExplorationActivityTypeType)
Cruises	CRUISE	Text (250)	Cruises identification
Sampling Methods	SAMPLING_M	Text (250)	Type of method to recover samples (dredge, ROV…)
Sites Number	SITES_NO	Text (250)	Sampling sites identification
Data Provider	DATA_PROVI	Text (150)	Name of organisation providing data
Data Provider Contact	DATA_CONT	Text (150)	The data providing organisation/institute contact details – email is required
Deposit Extent	DEPOS_KM2	No. Double	Area of deposit (Sq. Km)
Depth to Deposit (m)	DEPTH_TO_D	No. Double	Depth to deposit from sea surface
Fauna	FAUNA	Text (100)	Type of fauna (e.g. corals…)
Description	DESCRIPT	Text (500)	Deposit summary and metallogenetic model
Gallery	GALLERY	Text (100)	Images on the mineralization (geophysical, sampling, textural features, paragenesis, etc.)
References	REFERENCES	Text (500)	Link to bibliographic references (DOI and/or Author, Year & Title if you wish)
Comments	COMMENTS	Text (500)	Any additional comments or observations

Product: Seafloor Massive Sulphide deposits (points)

Attributes	FIELDNAME	Format	Information
OBJECTID	FID	Number	Feature ID. An internally generated identification number for each feature. Automatically generated within shape file.
Shape	SHAPE	Geometry	Point

Attributes	FIELDNAME	Format	Information
Latitude	LATITUDE	Number (Double)	Degrees N
Longitude	LONGITUDE	Number (Double)	Degrees W/ Degrees E
Country Code	CODE	Text (2)	Two letter country code (see INSPIRE CODE: CountryType)
Administration	ADM	Text (40)	Legal status following the division of the Law of the Sea Convention: Territorial Sea (TS), Exclusive Economic Zone (EEZ), Extended Continental shelf (ECS) or the Area (A)
Geographical Area	GEO_AREA	Text (100)	Atlantic Ocean, Mediterranean Sea, etc.
Sector	SECTOR	Text (100)	Canary Island Seamount Province, Aeolian Islands, Gulf of Bothnia, etc.
Occurrence/Deposit name	DEPOS_NAME	Text (40)	Name of occurrence/ deposit
Mineral Occurrence Type	OCURR_TY	Text (40)	see INSPIRE CODES: OccurrenceTypeType
Year of Discovery	YEAR_DIS	Short Integer	2001, 2016, etc.
Year of Database Entry	YEAR_DB	Short Integer	2018, 2019, etc.
Date of Database Update	UPDATE_	Date	dd/mm/yyyy (Date of last update of attributes)
Deposit Group	DEPOSIT_G	Text (100)	MarineVolcanicAssociation- this exact wording must be entered in bold type (see INSPIRE CODE: DepositGroupType). Mineral deposits formed in a marine volcanic environment. Magmatic and hydrothermal fluids react with sea water for giving volcanogenic massive sulphides (VMS), which are at the origin stratiform deposits of Cu, Zn, Pb, Ag, Au.

Attributes	FIELDNAME	Format	Information
Deposit Type	DEPOSIT_TY	Text (40)	Choose between MaficVolcanismMassiveSulphide and BimodalFelsicVolcanism -this exact wording must be entered in bold type (see INSPIRE CODE: DepositTypeType)
Hydrothermal activity	HYDR_ACT	Text (40)	Active, inactive
Distance from rift or active vent sites	RIFT-DIST	Number (Double)	Distance in km
Age	AGE	Text (250)	Age of the mineral deposit and host rock (see INSPIRE CODE: NamedAgeType)
Host Rock	HOST_ROCK	Text (250)	Substrate rock or sediment surrounding the ore deposit (see INSPIRE CODE: LithologyType)
Metallic Commodity	METAL_COMM	Text (100)	Including precious and non-precious metals (see INSPIRE CODE: CommodityType)
Other Metals	OTHER_ME	Text (100)	See INSPIRE CODE: CommodityType
Commodity Group	COMM_G	Text (100)	Base metals, precious metals, energy metals, technological metals (see INSPIRE CODE: CommodityType, parents column K)
Ore Minerals	ORE_MIN	Text (250)	Principal minerals/commodities (see INSPIRE CODE: MineralNameType)
Gangue Minerals	GANGUE	Text (250)	Non-economic minerals (see INSPIRE CODE: MineralNameType)
Ore mineral distribution	ORE_DISTR	Text (250)	Brecciated, banded, micro-layered, etc. (see INSPIRE CODE: ShapeType)
Alteration	ALTER_	Text (250)	Alteration minerals formed during/after the process of mineralization (see INSPIRE CODES: AlterationDegreeType, AlterationDsitributionType, AlterationTypeType
Structure	STRUCT	Text (250)	stockwork, chimney, debris flow, etc.

Attributes	FIELDNAME	Format	Information
Morphology	MORPH	Text (250)	Shape and internal structure (thickness) of the mineral deposit (see INSPIRE CODE: FormType)
Texture	TEXT	Text (250)	Banded, columnar, mottled, etc.
Genetic type	GEN_TY	Text (250)	e.g. Hannington classification
Geochemistry	GEOCHEM	Text (100)	Yes or no (link to geochemistry table)
Number of samples	N	Short Integer (5)	Number of analysed samples
SiO_2 %	SiO2__pc	Number (Double)	Average concentration, dry wt
TiO_2 %	TiO2__pc	Number (Double)	Average concentration, dry wt
Al_2O_3 %	Al2O3__pc	Number (Double)	Average concentration, dry wt
Fe_2O_3 %	Fe2O3__pc	Number (Double)	Average concentration, dry wt
MnO %	MnO__pc	Number (Double)	Average concentration, dry wt
MgO %	MgO__pc	Number (Double)	Average concentration, dry wt
CaO %	CaO__pc	Number (Double)	Average concentration, dry wt
Na_2O %	Na2O__pc	Number (Double)	Average concentration, dry wt
K_2O %	K2O__pc	Number (Double)	Average concentration, dry wt
P_2O_5 %	P2O5__pc	Number (Double)	Average concentration, dry wt
SO_2 %	$SO_{2__pc}$	Number (Double)	Average concentration, dry wt
Ag (ppm)	Ag_ppm	Number (Double)	Average concentration, dry wt
Au (ppm)	Au_ppm	Number (Double)	Average concentration, dry wt
Ba (ppm)	Ba_ppm	Number (Double)	Average concentration, dry wt
Bi (ppm)	Bi_ppm	Number (Double)	Average concentration, dry wt
Co (ppm)	Co_ppm	Number (Double)	Average concentration, dry wt
Cr (ppm)	Cr_ppm	Number (Double)	Average concentration, dry wt
Cu (ppm)	Cu_ppm	Number (Double)	Average concentration, dry wt
Ga (ppm)	Ga_ppm	Number (Double)	Average concentration, dry wt
Ge (ppm)	Ge_ppm	Number (Double)	Average concentration, dry wt
In (ppm)	In_ppm	Number (Double)	Average concentration, dry wt

Attributes	FIELDNAME	Format	Information
Li (ppm)	Li_ppm	Number (Double)	Average concentration, dry wt
Mo (ppm)	Mo_ppm	Number (Double)	Average concentration, dry wt
Nb (ppm)	Nb_ppm	Number (Double)	Average concentration, dry wt
Ni (ppm)	Ni_ppm	Number (Double)	Average concentration, dry wt
Pd (ppm)	Pd_ppm	Number (Double)	Average concentration, dry wt
Pt (ppm)	Pt_ppm	Number (Double)	Average concentration, dry wt
Rh (ppm)	Rh_ppm	Number (Double)	Average concentration, dry wt
Pb (ppm)	Pb_ppm	Number (Double)	Average concentration, dry wt
Sb (ppm)	Sb_ppm	Number (Double)	Average concentration, dry wt
Sc (ppm)	Sc_ppm	Number (Double)	Average concentration, dry wt
Se (ppm)	Se_ppm	Number (Double)	Average concentration, dry wt
Sn (ppm)	Sn_ppm	Number (Double)	Average concentration, dry wt
Ta (ppm)	Ta_ppm	Number (Double)	Average concentration, dry wt
Te (ppm)	Te_ppm	Number (Double)	Average concentration, dry wt
Th (ppm)	Th_ppm	Number (Double)	Average concentration, dry wt
U (ppm)	U_ppm	Number (Double)	Average concentration, dry wt
V (ppm)	V_ppm	Number (Double)	Average concentration, dry wt
W (ppm)	W_ppm	Number (Double)	Average concentration, dry wt
Y (ppm)	Y_ppm	Number (Double)	Average concentration, dry wt
Zn (ppm)	Zn_ppm	Number (Double)	Average concentration, dry wt
Zr (ppm)	Zr_ppm	Number (Double)	Average concentration, dry wt
La (ppm)	La_ppm	Number (Double)	Average concentration, dry wt
Ce (ppm)	Ce_ppm	Number (Double)	Average concentration, dry wt
Pr (ppm)	Pr_ppm	Number (Double)	Average concentration, dry wt
Nd (ppm)	Nd_ppm	Number (Double)	Average concentration, dry wt
Pm (ppm)	Pm_ppm	Number (Double)	Average concentration, dry wt
Sm (ppm)	Sm_ppm	Number (Double)	Average concentration, dry wt

Attributes	FIELDNAME	Format	Information
Eu (ppm)	Eu_ppm	Number (Double)	Average concentration, dry wt
Gd (ppm)	Gd_ppm	Number (Double)	Average concentration, dry wt
Tb (ppm)	Tb_ppm	Number (Double)	Average concentration, dry wt
Dy (ppm)	Dy_ppm	Number (Double)	Average concentration, dry wt
Ho (ppm)	Ho_ppm	Number (Double)	Average concentration, dry wt
Er (ppm)	Er_ppm	Number (Double)	Average concentration, dry wt
Tm (ppm)	Tm_ppm	Number (Double)	Average concentration, dry wt
Yb (ppm)	Yb_ppm	Number (Double)	Average concentration, dry wt
Lu (ppm)	Lu_ppm	Number (Double)	Average concentration, dry wt
Analytical technique	TECHNIQUE	Text (50)	Technique used (AAS, ICP-MS, ICP-AES, XRF etc.) (see INSPIRE CODE: AnalyticalMethodTypeType)
Mine Status	STATUS	Text (40)	see INSPIRE CODE: MineStatusType
Mining Activity Type	MINING_TY	Text (40)	see INSPIRE CODE: MiningActivityTypeType
Deposit Size	SIZE	Text (100)	Magnitude of the mineral deposit calculated according to ProMine (unknown, occurrence, small, medium, large, very large) (see INSPIRE CODE: ImportanceType)
Grade	GRADE	Text (250)	Specify assessments of grade (Mean content of manganese (Mn); iron (Fe); cobalt (Co); nickel (Ni); copper (Cu) wt%) or resource potential, if applicable
Resources	RESOURCES	No. Double	Resources in Mt
Reserves	RESERVES	No. Double	Reserves in Mt
Mined Tonnage	MIN_T	No. Double	in Mt
Total Tonnage	TOTAL_T	No. Double	in Mt
Remaining Tonnage	REM_T	No. Double	in Mt

Attributes	FIELDNAME	Format	Information
Resource Reporting Standard/ compliancy	RES_REP	Text (100)	PERC, JORC, NI43-101, etc. (see INSPIRE CODE: ClassificationMethodUsedType)
Reference for Tonnage Assessment	REF_T	Text (40)	Company ordering the assessment
Data Scale	SCALE	Text (100)	Specify the scale in which the deposit has been mapped and delivered
Exploration Activity Type	EXPLOR_TY	Text (250)	see INSPIRE CODE: ExplorationActivityTypeType
Operator	OPERATOR	Text (250)	Research, exploration or operating agency/company
Cruises	CRUISE	Text (250)	Cruises identification
Sampling Methods	SAMPLING_M	Text (250)	Type of method to recover samples (dredge, ROV…)
Data Provider	DATA_PROVI	Text (150)	Name of organisation providing data
Data Provider Contact	DATA_CONT	Text (150)	The data providing organisation/institute contact details – email is required
Deposit Extent	DEPOS_KM2	No. Double	Area of deposit (Sq. Km)
Depth to Deposit (m)	DEPTH_TO_D	No. Double	Depth to deposit from sea surface
Fauna	FAUNA	Text (100)	Type of fauna (e.g. corals…)
Description	DESCRIPT	Text (500)	Deposit summary and metallogenetic model
Gallery	GALLERY	Text (100)	Images on the mineralization (geophysical, sampling, textural features, paragenesis, etc.)
References	REFERENCES	Text (500)	Link to bibliographic references (DOI and/or Author, Year & Title if you wish)
Comments	COMMENTS	Text (500)	Any additional comments or observations

A14. MINTELL4EU (latest update: 27-June-2019)

The following data have been gathered from GIP-P D2.2.1 “First report describing the requirements to the Information Platform by the Geo-energy, Groundwater and Raw Materials themes” (28-Jan-2019), and from an email sent by Mintell4EU to GIP-P/WP2 on June 27th, 2019.

Mintell4EU has a complex, relational structure (harvested from each country into a central harvesting database), which is denormalized before visualisation. Two overall types of geospatial information will be delivered:

Product: Points representing mineral occurrences and mines in Europe and Greenland.

Attributes	Example
id_hidden	333491
country	FR
name	FRA-03651
depositgro	metasomatic replacement or hydrothermal shear or vein
commoditie	antimony
commodit_1	antimony
significan	deposit
miningacti	underground mining
rgb	140 47 0

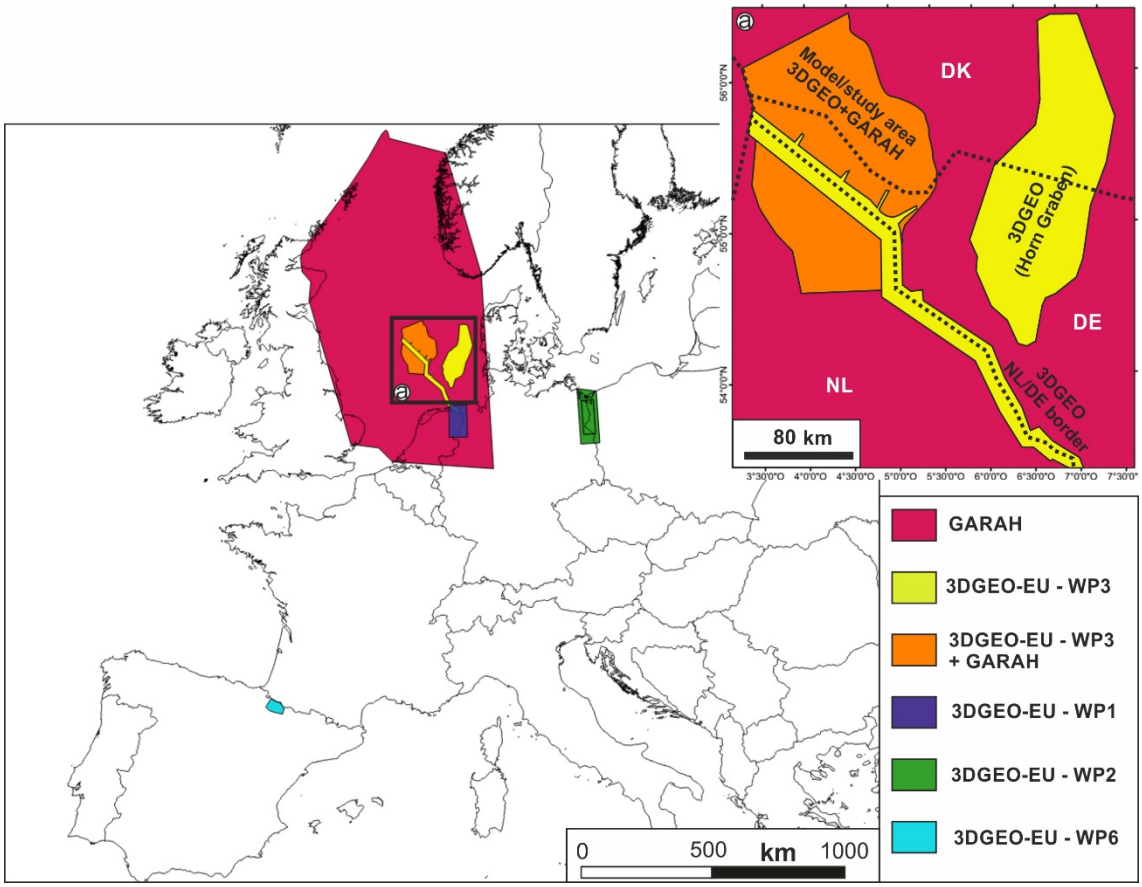
Product: Mineral statistics at country level.

ANNEX B: SPATIAL DISTRIBUTION OF COUNTRIES AND PILOT AREAS FROM WHERE PROJECTS WILL BE DELIVERING DATA

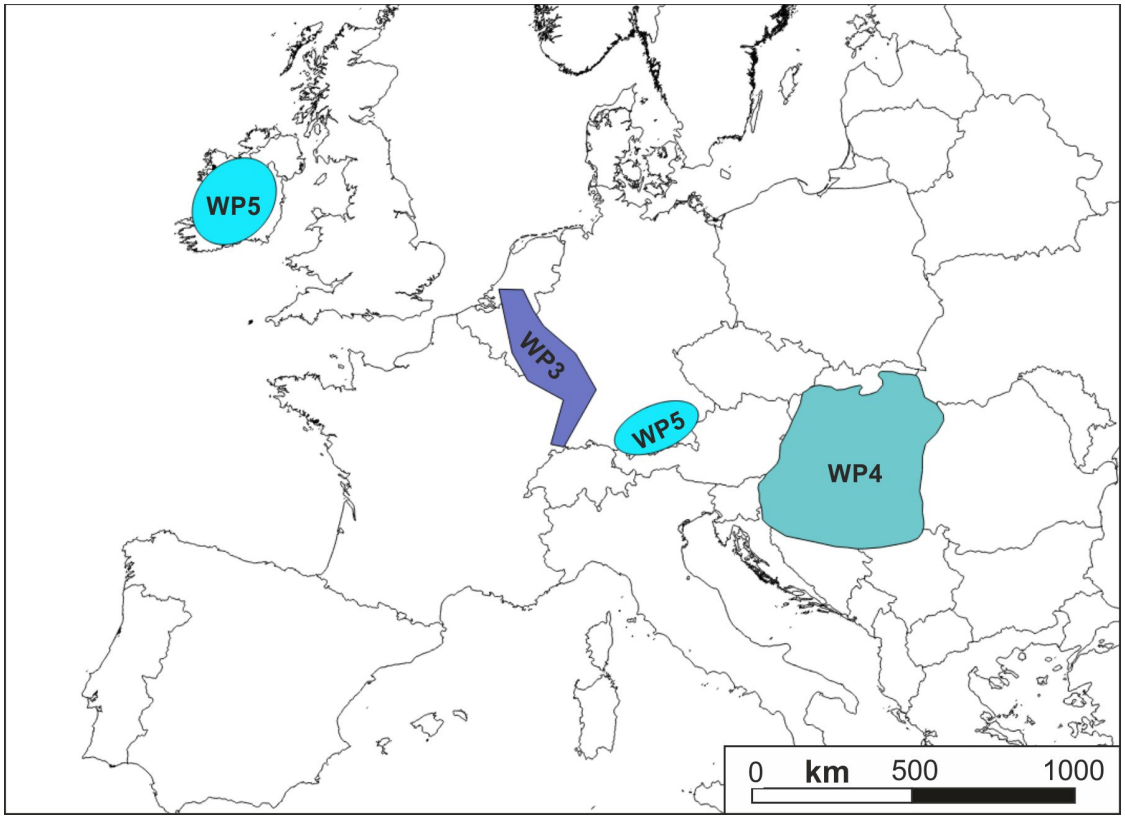
The maps presented in this annex have been constrained from information sent by the various GeoERA projects in June 2019.

Note that the countries contributing to the different GeoERA projects also include islands and territories outside the European continent administered by European countries.

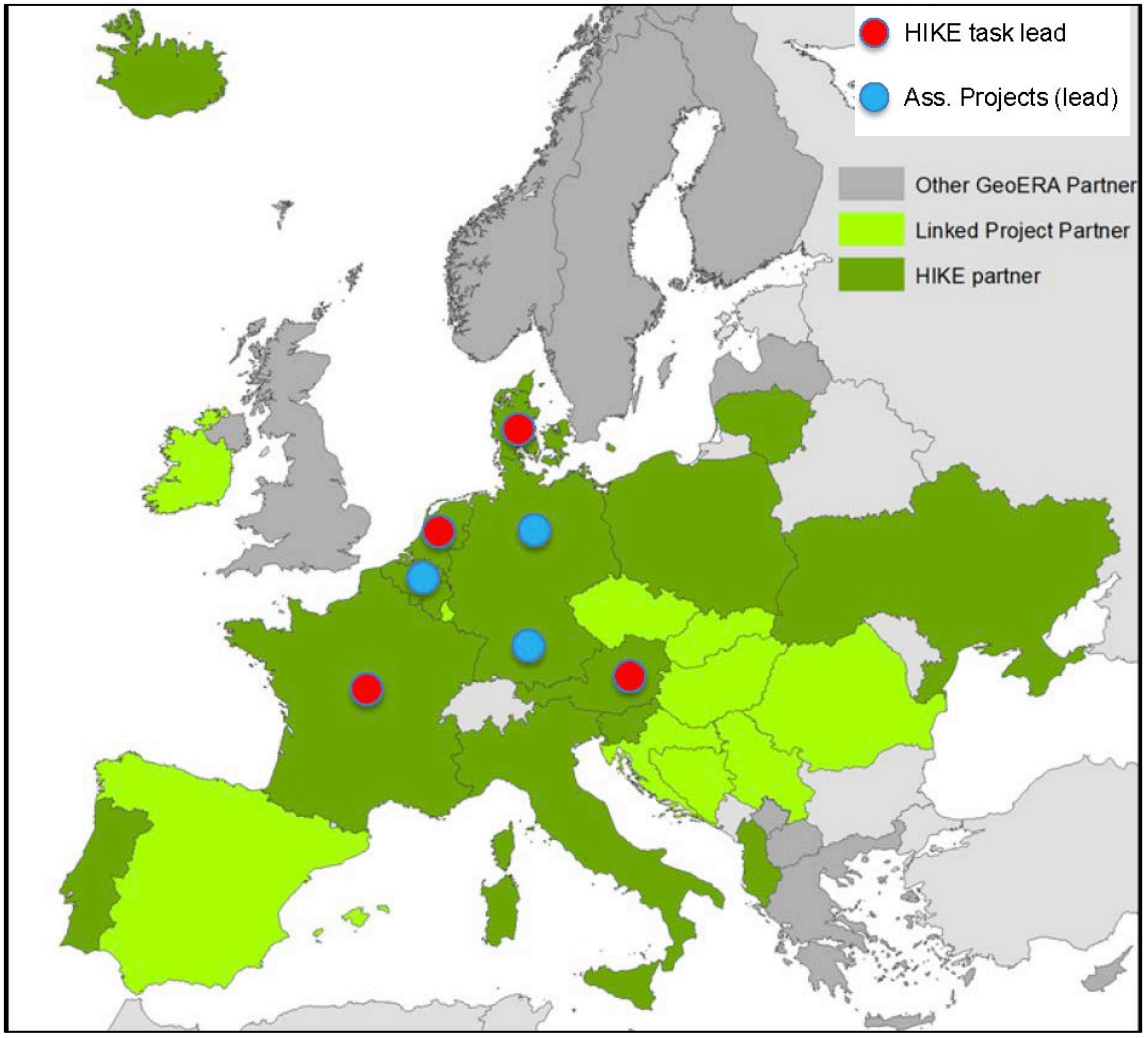
B1. 3DGEO-EU & GARAH



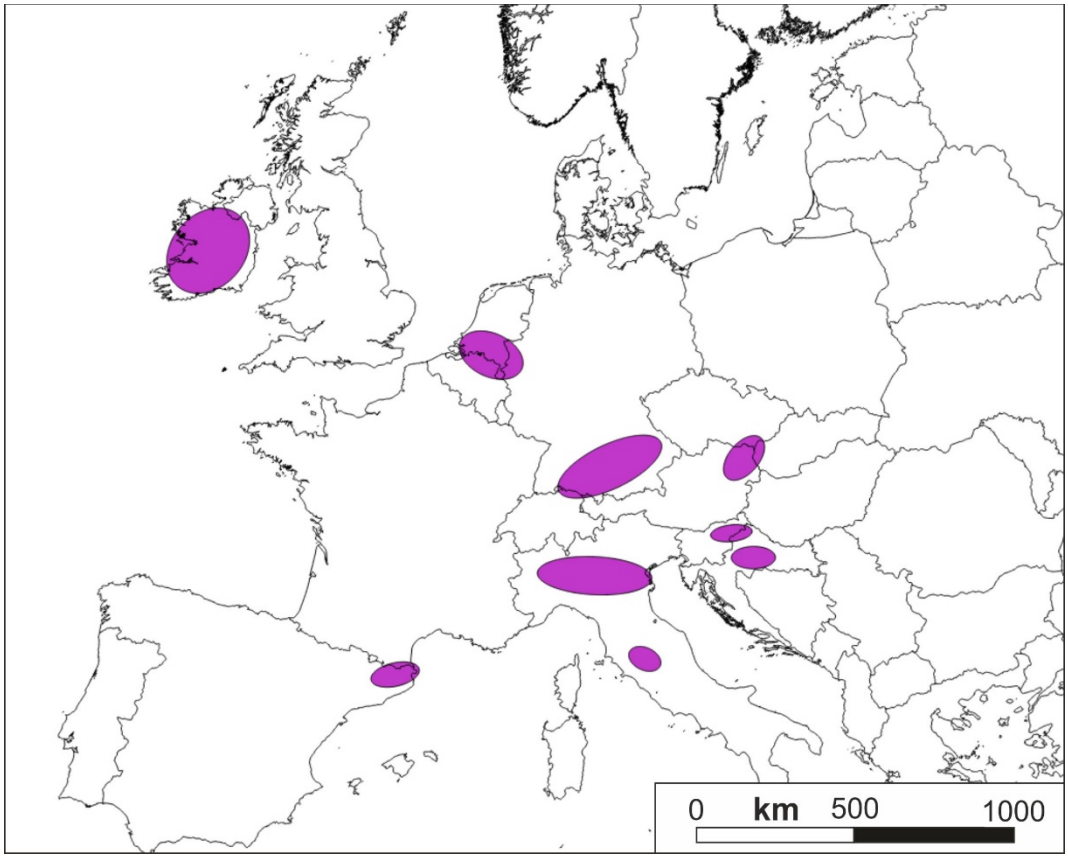
B2. GEOCONNECT3D



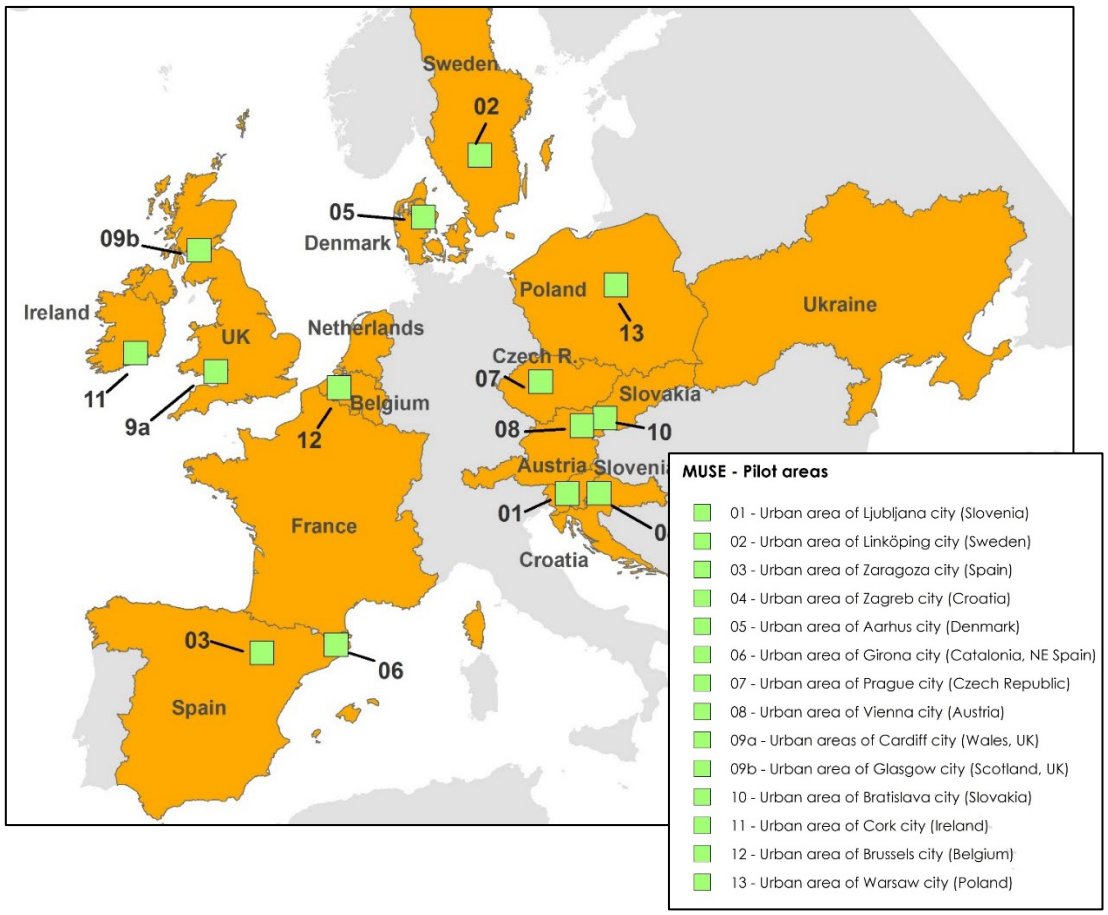
B3. HIKE


HIKE task lead
Ass. Projects (lead)
Other GeoERA Partner
Linked Project Partner
HIKE partner

B4. HOTLIME

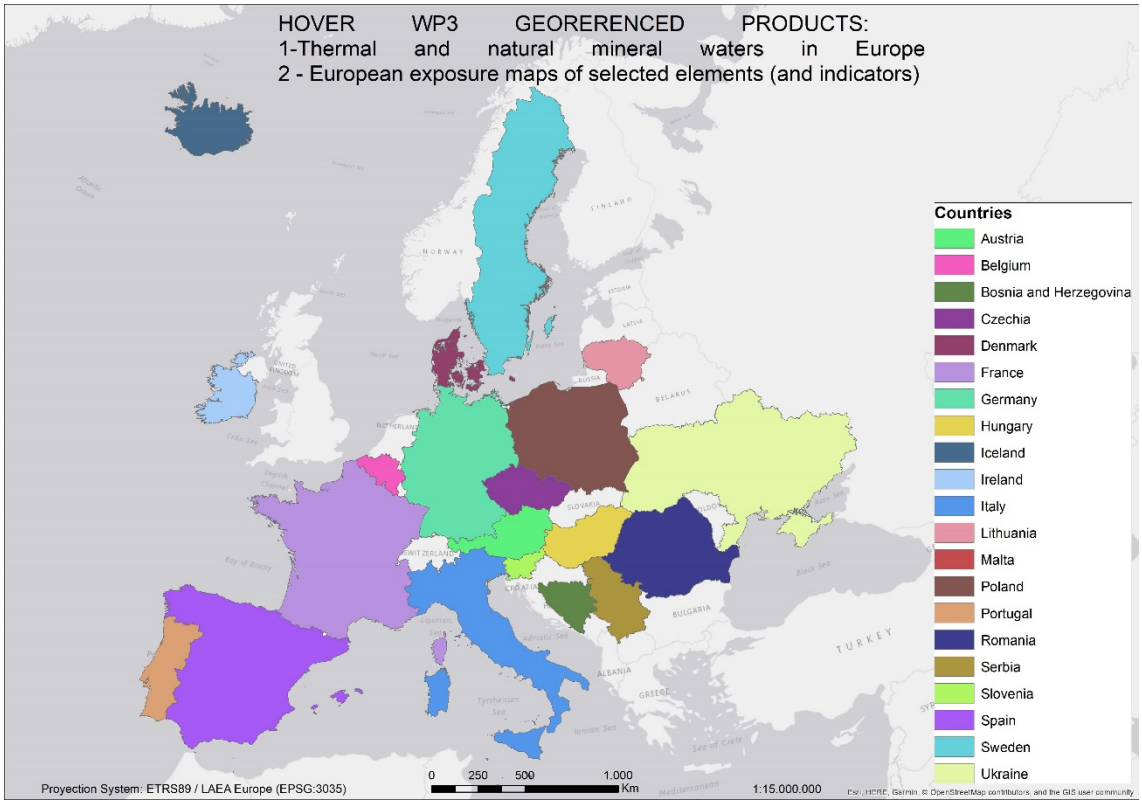


B5. MUSE

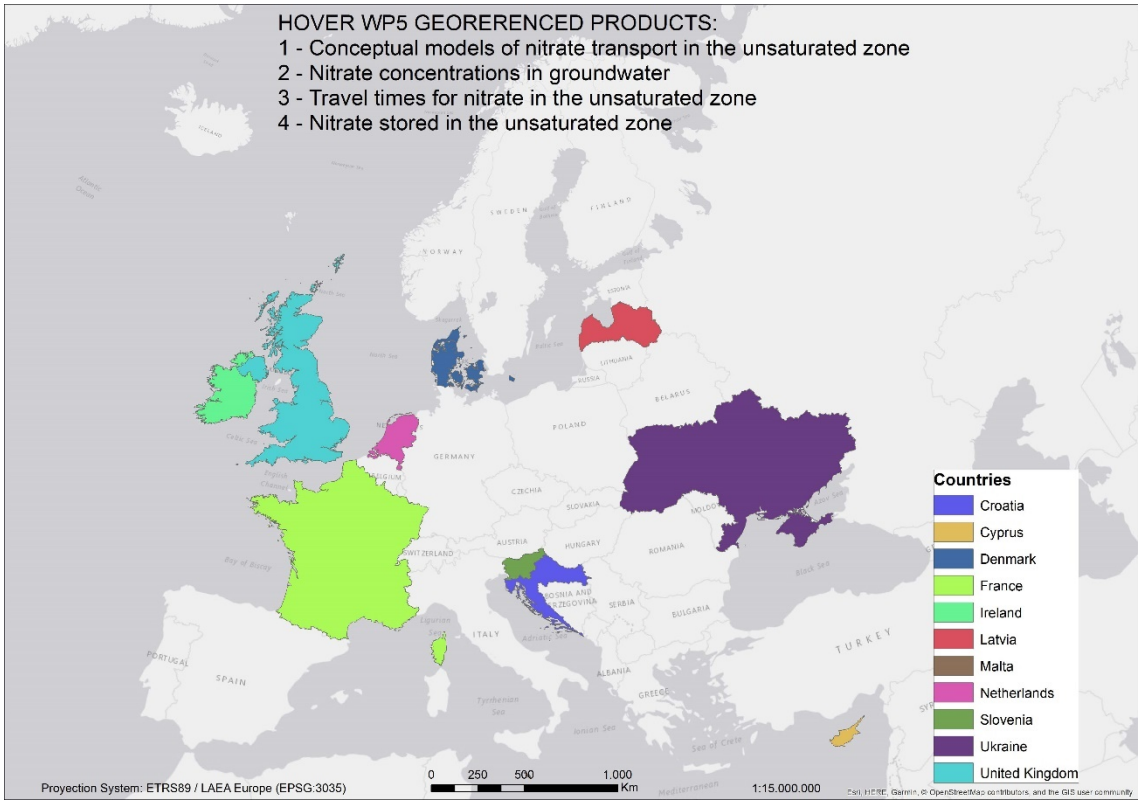

Sweden
02
05
Denmark
09b
Ireland
UK
11
9a
Netherlands
Belgium
12
France
03
Spain
06
Poland
13
Ukraine
Czech R.
07
Slovakia
08
10
Austria
Sloveni
01
Croatia
MUSE - Pilot areas
01 - Urban area of Ljubljana city (Slovenia)
02 - Urban area of Linköping city (Sweden)
03 - Urban area of Zaragoza city (Spain)
04 - Urban area of Zagreb city (Croatia)
05 - Urban area of Aarhus city (Denmark)
06 - Urban area of Girona city (Catalonia, NE Spain)
07 - Urban area of Prague city (Czech Republic)
08 - Urban area of Vienna city (Austria)
09a - Urban areas of Cardiff city (Wales, UK)
09b - Urban area of Glasgow city (Scotland, UK)
10 - Urban area of Bratislava city (Slovakia)
11 - Urban area of Cork city (Ireland)
12 - Urban area of Brussels city (Belgium)
13 - Urban area of Warsaw city (Poland)

B6. HOVER

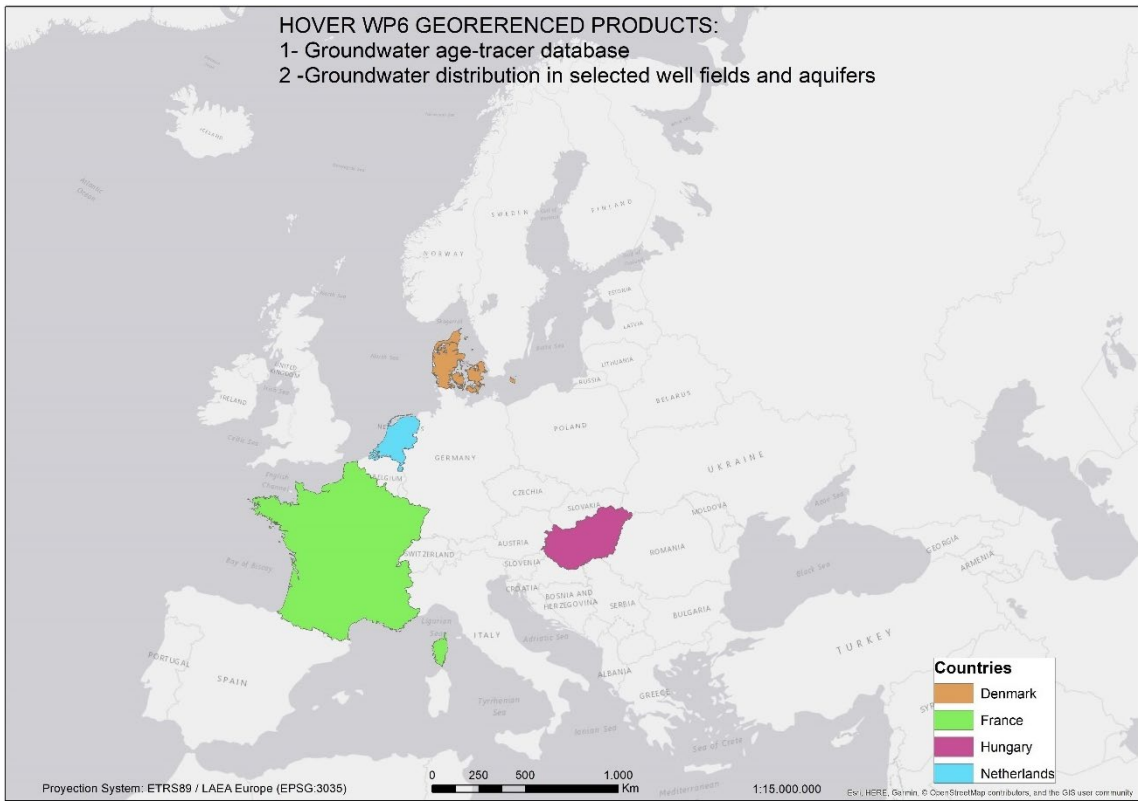
WP3


HOVER WP3 GEORERENCED PRODUCTS:
1-Thermal and natural mineral waters in Europe
2 - European exposure maps of selected elements (and indicators)
Countries
Austria
Belgium
Bosnia and Herzegovina
Czechia
Denmark
France
Germany
Hungary
Iceland
Ireland
Italy
Lithuania
Malta
Poland
Portugal
Romania
Serbia
Slovenia
Spain
Sweden
Ukraine
Proyection System: ETRS89 / LAEA Europe (EPSG:3035)
0 250 500 1.000 Km
1:15.000.000

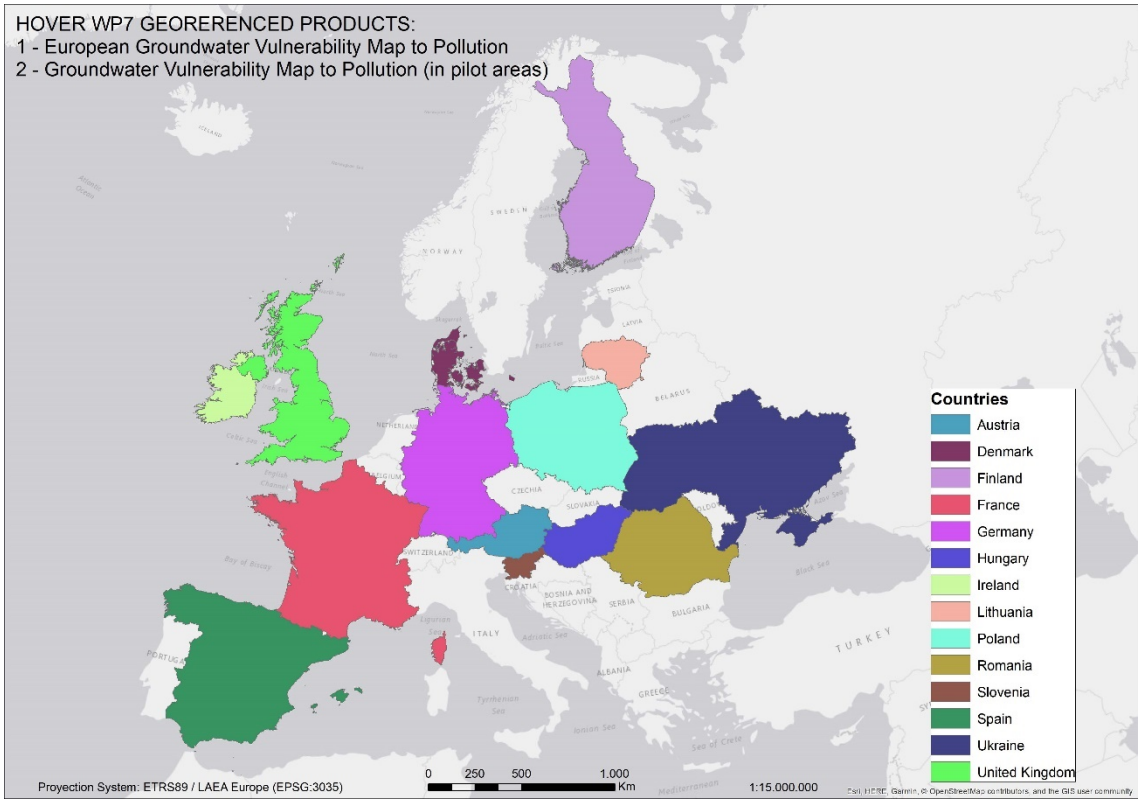
WP5


HOVER WP5 GEORERENCED PRODUCTS:
1 - Conceptual models of nitrate transport in the unsaturated zone
2 - Nitrate concentrations in groundwater
3 - Travel times for nitrate in the unsaturated zone
4 - Nitrate stored in the unsaturated zone
Countries
Croatia
Cyprus
Denmark
France
Ireland
Latvia
Malta
Netherlands
Slovenia
Ukraine
United Kingdom
Proyection System: ETRS89 / LAEA Europe (EPSG:3035)
0 250 500 1.000 Km
1:15.000.000

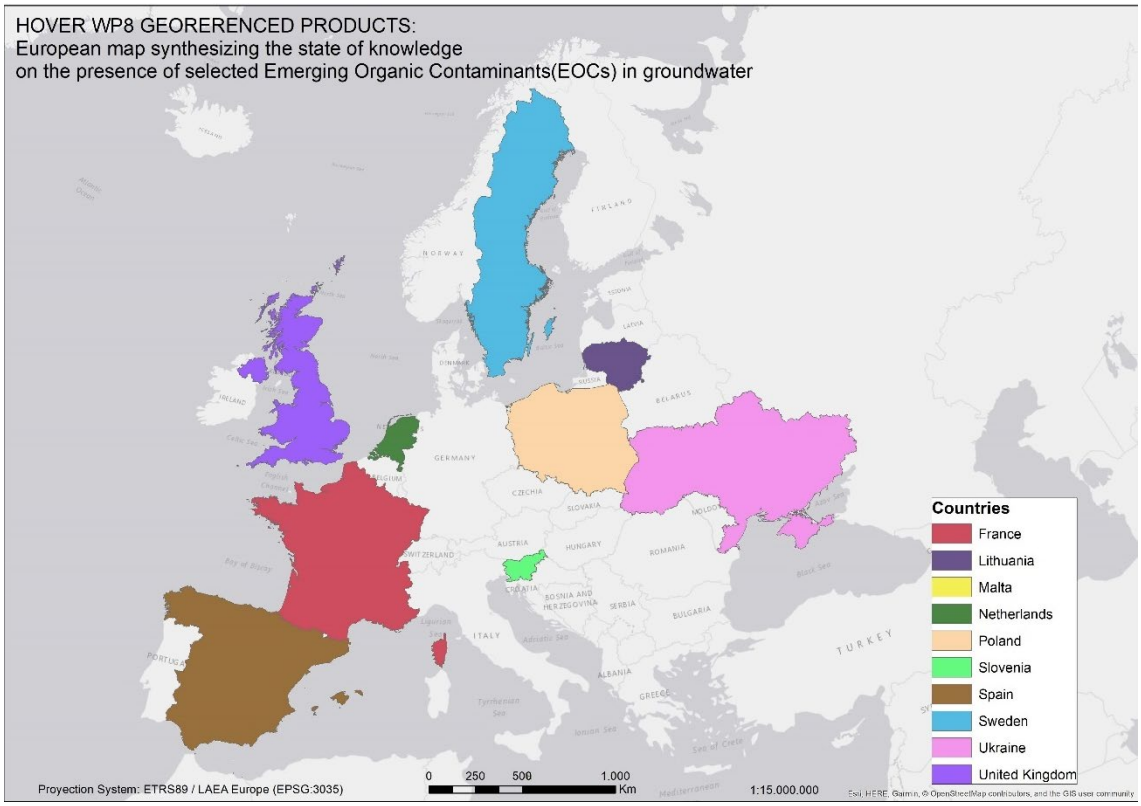
WP6


HOVER WP6 GEORERENCED PRODUCTS:
1- Groundwater age-tracer database
2 -Groundwater distribution in selected well fields and aquifers
Countries
Denmark
France
Hungary
Netherlands
Proyection System: ETRS89 / LAEA Europe (EPSG:3035)
0 250 500 1.000 Km
1:15.000.000

WP7

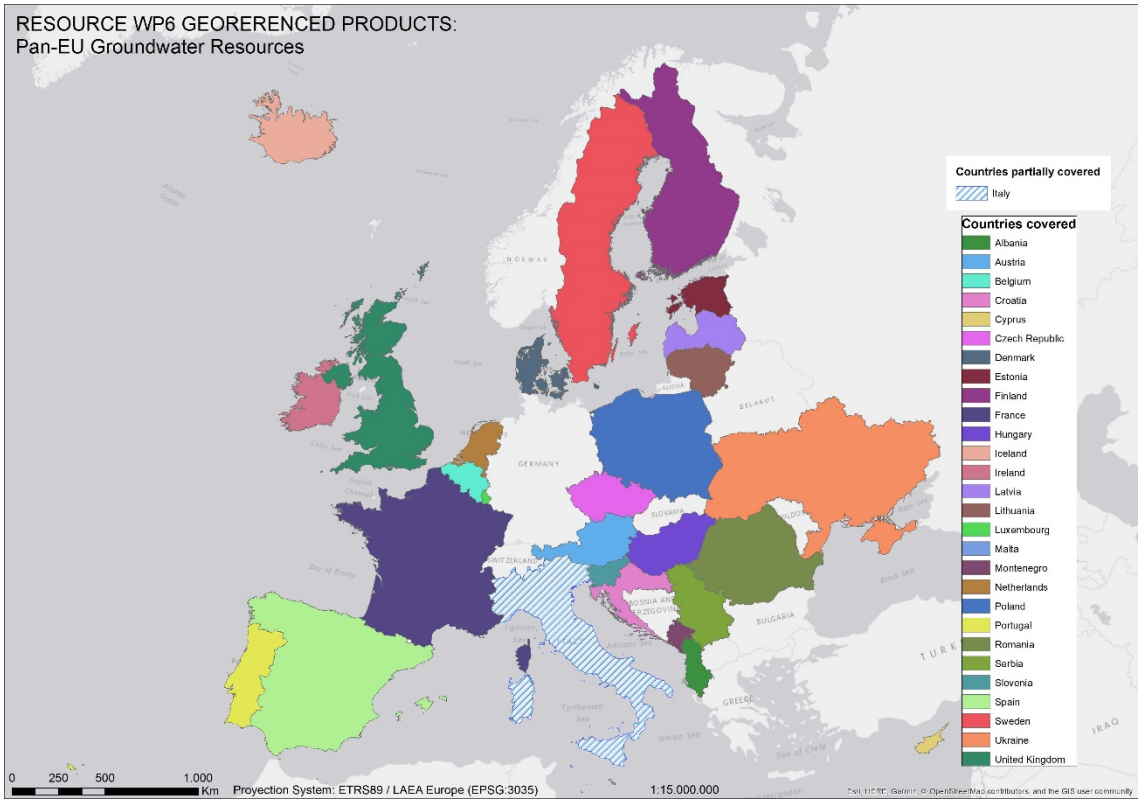

HOVER WP7 GEORERENCED PRODUCTS:
1 - European Groundwater Vulnerability Map to Pollution
2 - Groundwater Vulnerability Map to Pollution (in pilot areas)
Countries
Austria
Denmark
Finland
France
Germany
Hungary
Ireland
Lithuania
Poland
Romania
Slovenia
Spain
Ukraine
United Kingdom
Proyection System: ETRS89 / LAEA Europe (EPSG:3035)
0 250 500 1.000 Km
1:15.000.000

WP8


HOVER WP8 GEORERENCED PRODUCTS:
European map synthesizing the state of knowledge
on the presence of selected Emerging Organic Contaminants(EOCs) in groundwater
Countries
France
Lithuania
Malta
Netherlands
Poland
Slovenia
Spain
Sweden
Ukraine
United Kingdom
Proyection System: ETRS89 / LAEA Europe (EPSG:3035)
0 250 500 1.000 Km
1:15.000.000

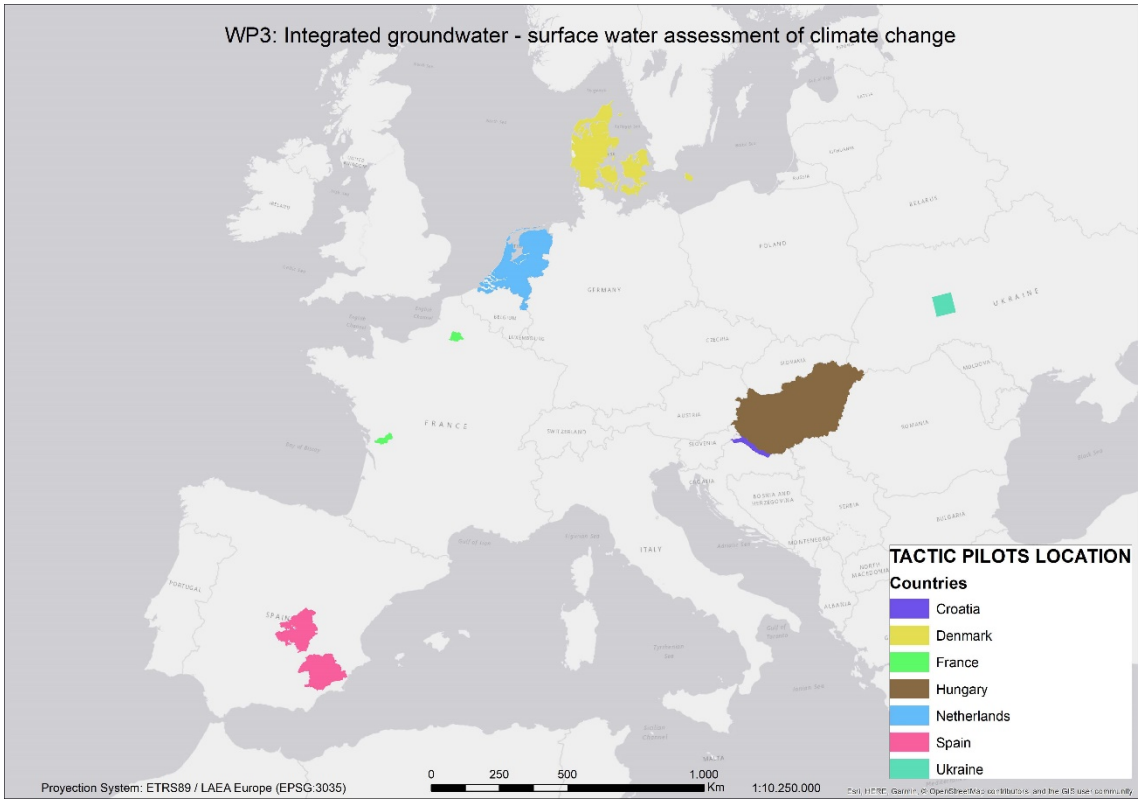
B7. RESOURCES

WP6

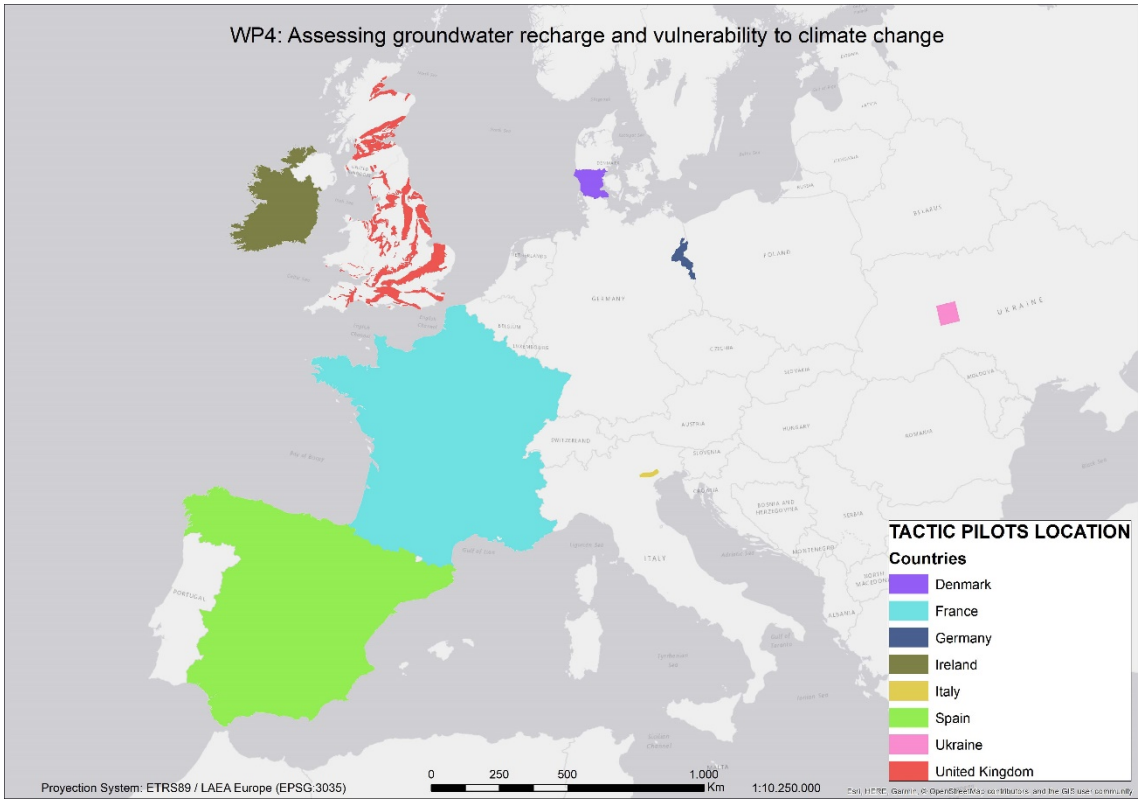


B8. TACTIC

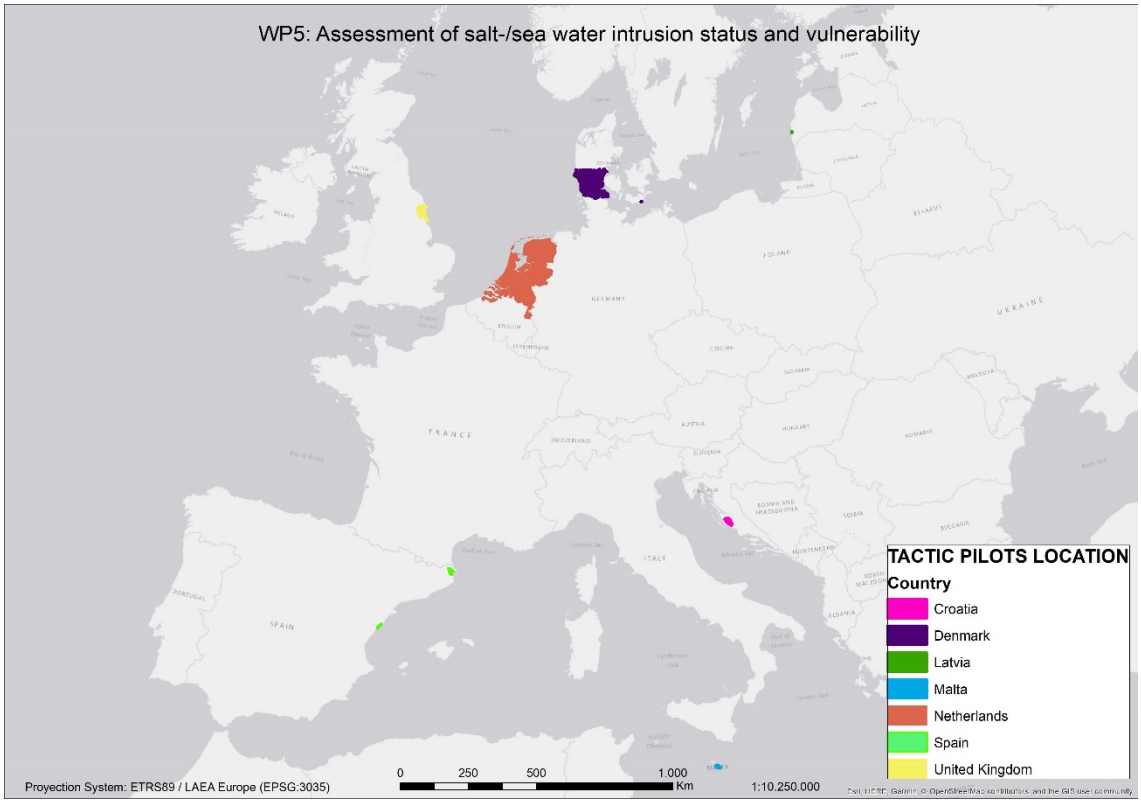
WP3



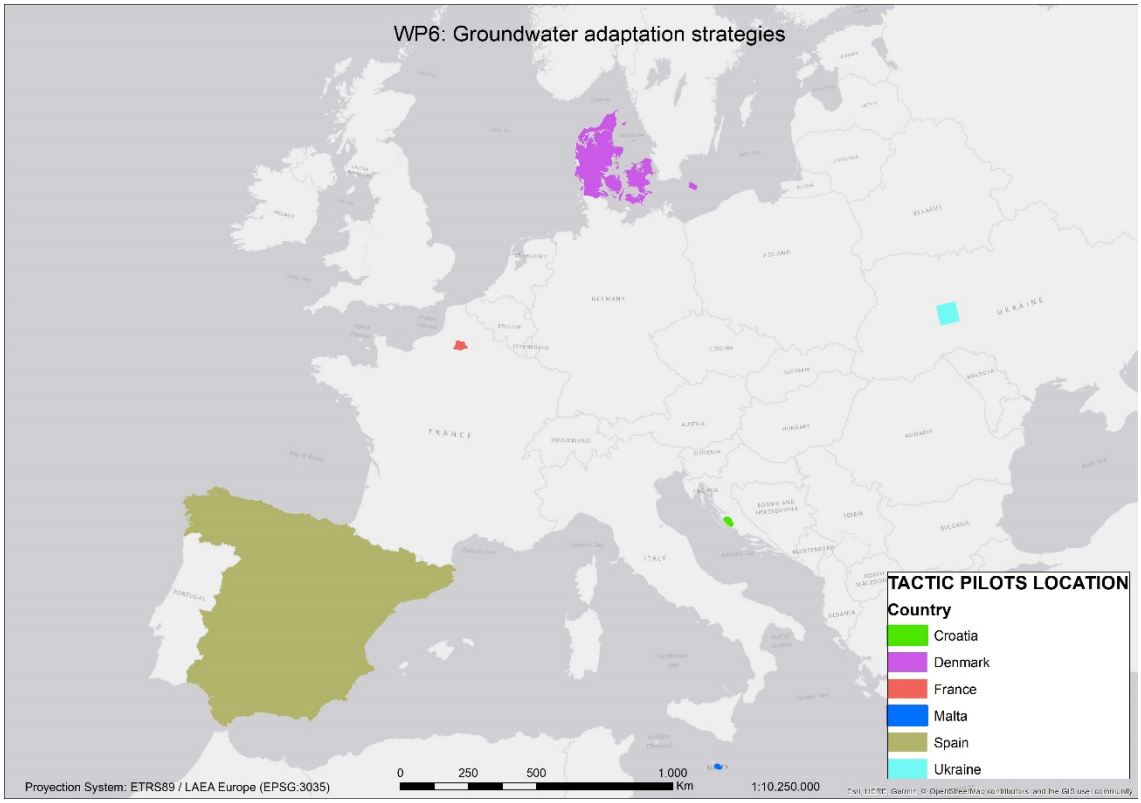
WP4



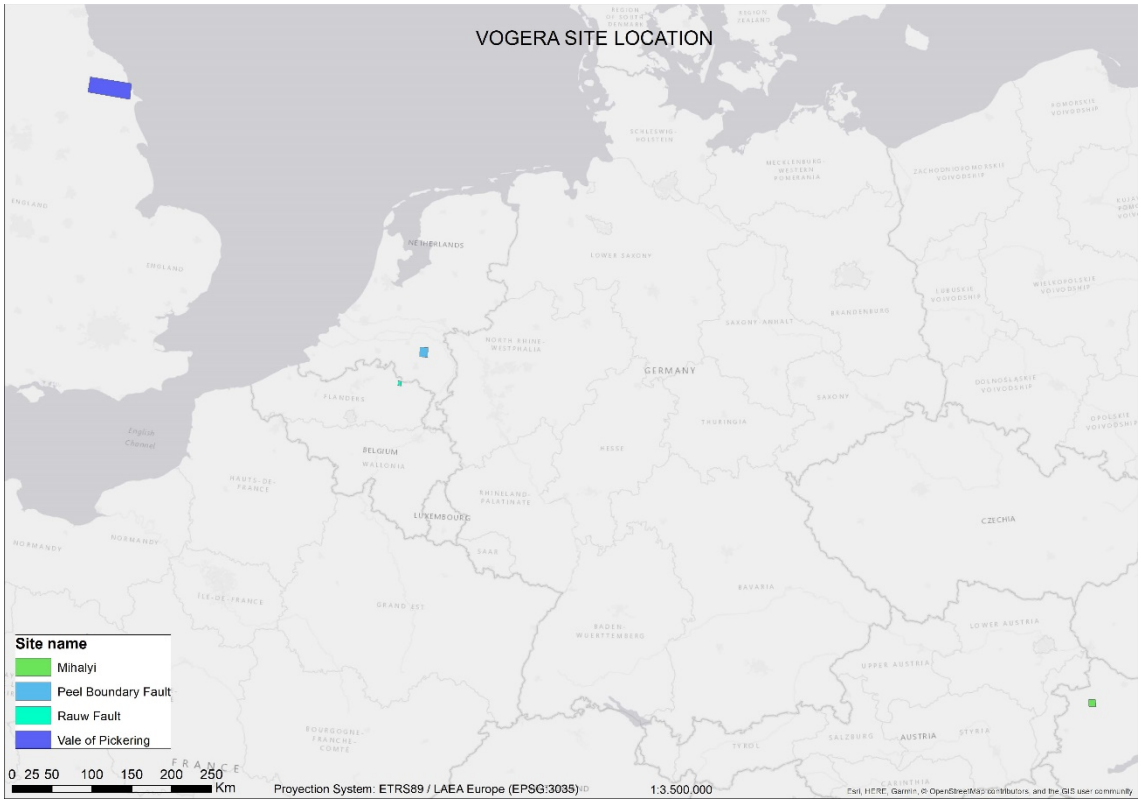
WP5


WP5: Assessment of salt-/sea water intrusion status and vulnerability
TACTIC PILOTS LOCATION
Country
Croatia
Denmark
Latvia
Malta
Netherlands
Spain
United Kingdom
Proyection System: ETRS89 / LAEA Europe (EPSG:3035)
0 250 500 1.000 Km
1:10.250.000

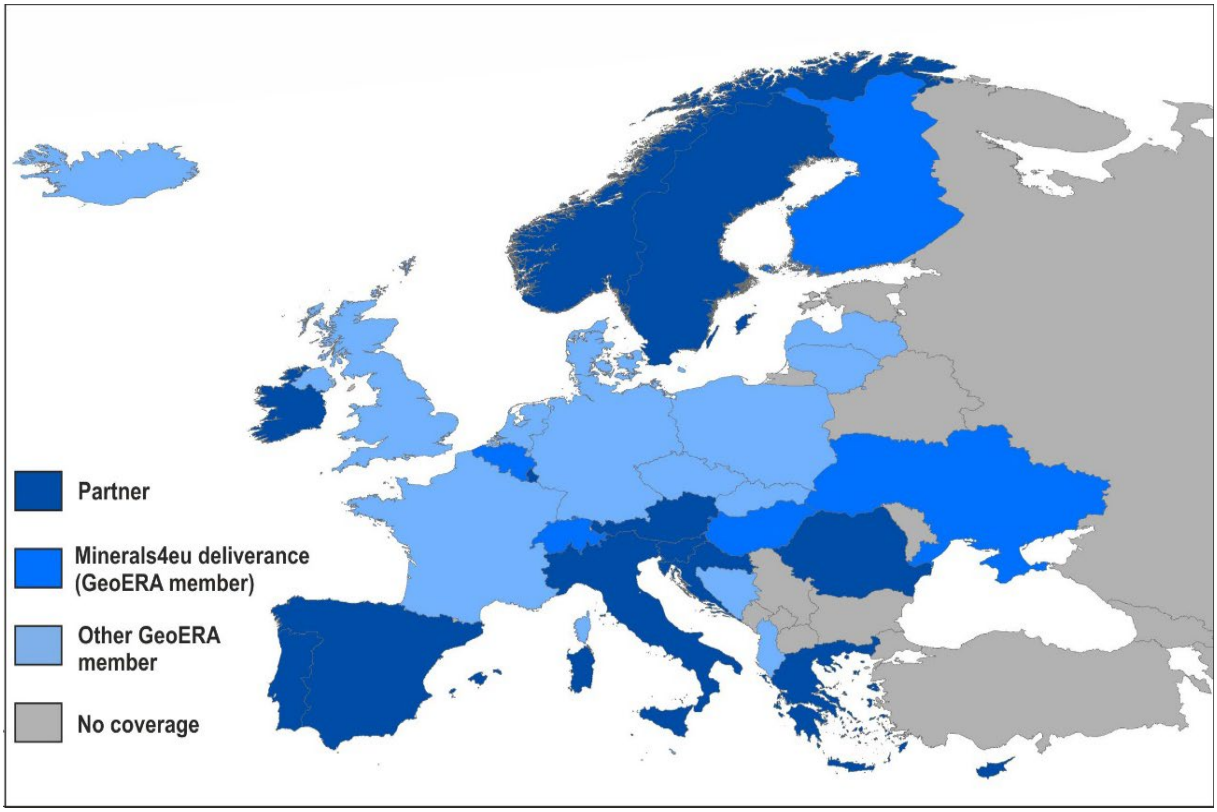
WP6


WP6: Groundwater adaptation strategies
TACTIC PILOTS LOCATION
Country
Croatia
Denmark
France
Malta
Spain
Ukraine
Proyection System: ETRS89 / LAEA Europe (EPSG:3035)
0 250 500 1.000 Km
1:10.250.000

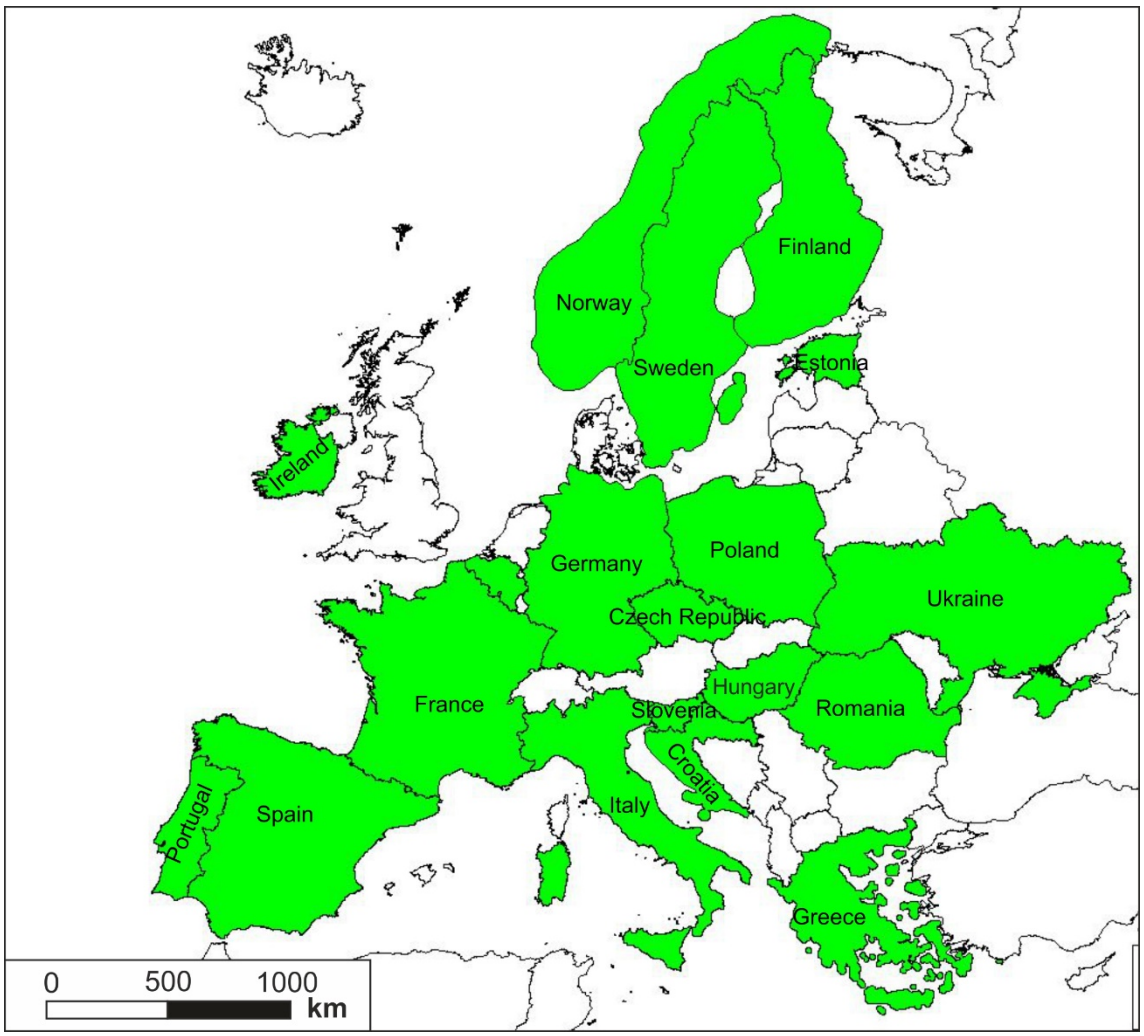
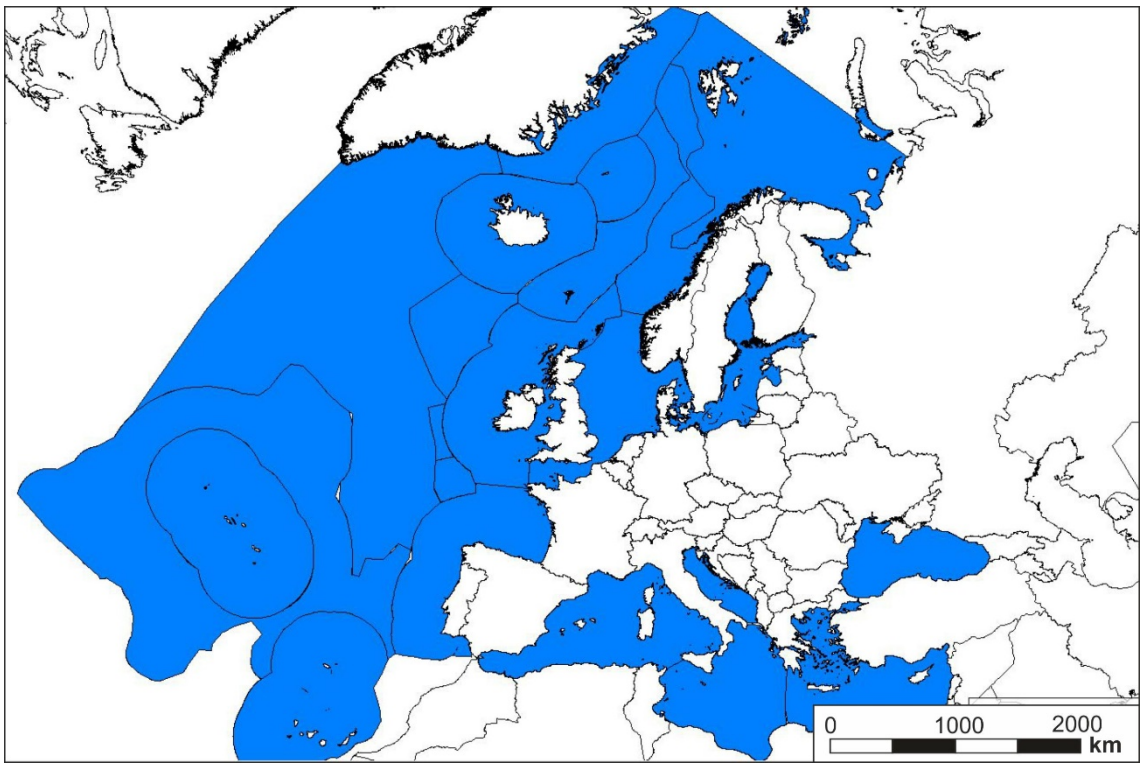
B9. VOGERA


VOGERA SITE LOCATION
Site name
Mihalyi
Peel Boundary Fault
Rauw Fault
Vale of Pickering
0 25 50 100 150 200 250
Km
Proyection System: ETRS89 / LAEA Europe (EPSG:3035)
1:3.500.000
GERMANY
NETHERLANDS
BELGIUM
LUXEMBOURG
CZECHIA
AUSTRIA
FRANCE

B10. EUROLITHOS & MINTELL4EU



B11. FRAME


Finland
Norway
Sweden
Estonia
Ireland
Germany
Poland
Ukraine
Czech Republic
Hungary
France
Slovenia
Romania
Croatia
Spain
Portugal
Italy
Greece
0
500
1000
km

B12. MINDESEA