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Inventory of Geological Maps, Map Data Sets, Models and Services in the EGDI Metadata Catalogue V1

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Executive Summary

This deliverable represents a foundational component of Work Package 6 (WP6) within the Geological Service for Europe (GSEU) project, specifically addressing Task 6.1, which focuses on compiling an inventory of geological maps, map datasets, and 3D geomodels across European Geological Survey Organisations (GSOs). The primary goal is to enable streamlined access to geological data through the European Geological Data Infrastructure (EGDI) Metadata Catalogue and associated databases, adhering to FAIR data principles.
The report outlines the methodologies used for data collection, leveraging interactive questionnaires to gather metadata from 35 countries for 230 geological maps and 24 countries for 237 3D geomodels. Emphasis was placed on identifying data formats, metadata quality, and accessibility, revealing that while 75% of the maps are in digital vector formats, significant challenges remain, particularly in standardizing and harvesting metadata from GSO repositories. The lack of consistent metadata for 3D geomodels due to limited regulatory guidance (e.g., INSPIRE Directive) underscores the need for tailored solutions.

Key findings include:

1. **Data Gaps and Disparities**: The inventory highlighted regional variability in data availability, scale, and thematic content, with maps predominantly addressing lithology, chronostratigraphy, and tectonic features.
2. **Accessibility Issues**: Only 64% of maps and 10% of 3D geomodels are readily accessible online, underscoring technical and institutional barriers.
3. **Metadata Harmonization**: The absence of uniform metadata profiles complicates integration into EGDI, necessitating manual corrections and bilateral coordination with GSOs.

To address these challenges, the project has developed an EGDI Inventory Database to complement the Metadata Catalogue, capturing detailed, domain-specific attributes that enhance searchability and utility. Collaboration with WP7 has resulted in designing data management tools and a user interface to support ongoing metadata refinement. Additionally, the establishment of a network of National Metadata Coordinators aims to institutionalize harvesting processes and ensure long-term sustainability.

The inventory process is ongoing, with future stages focused on deepening metadata descriptions, standardizing 3D geomodel formats, and integrating advanced search functionalities. This work is critical for fostering cross-border harmonization of geological data, enabling comprehensive geoscientific analyses to support sustainable resource management and environmental protection. Deliverable D6.2, scheduled for 2026, will further refine and expand upon these efforts.

Abbreviations

DOI	Digital Object Identifier
EC	European Commission
EGDI	European Geological Data Infrastructure
EGS	EuroGeoSurveys
EU	European Union
FAIR	Findability – Accessibility – Interoperability - Reuse
GMMEG	Geological Mapping and Modelling Expert Group
GSE	Geological Service for Europe
GSEU	Geological Service for Europe project
GSO	Geological Survey Organisation
H2020	Horizon 2020
SIEG	EuroGeoSurveys Spatial Information Expert Group
T6.1	GSEU project WP6 Task 6.1
WP	Work Package

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1. Introduction

WP6 of the GSEU Project aims to develop an information base in the form of scientific standards, technical tools, and workflows that will enable the integration of existing information on the European onshore and offshore subsurface as a basis for all applied geoscientific challenges facing Europe. This will be achieved by collecting information on existing geological maps and 3D geomodels, creating a data model for multi-scale 2D and 3D subsurface data, and developing new and improved scientific vocabularies, workflows and toolkits for 3D geomodelling and visualisation. Task 6.1 of WP6, which this report addresses, is dedicated to the collection of information on existing geological maps, both in digital and analogue versions, and on 3D geomodels. The digital versions of the maps are referred to as "*map datasets*" in the rest of this report.

Virtually all areas of applied research aimed at securing natural resources and protecting the environment require basic information on the geological composition of the subsurface environment, represented in basic geological maps and 3D geomodels. It is therefore fundamental to be aware of the existence of these data sources and to have easy and up-to-date access to them. However, the reality is that the current methods of discovering the existence of such data and maps are not very efficient. The options are to search using standard web browsers or to study paper publications or library catalogues, which are sometimes not even available online. Although the European INSPIRE Geoportal https://inspire-geoportal.ec.europa.eu/srv/eng/catalog.search#/home has significantly improved the situation, making small-scale geological maps available to users, it does not provide detailed geological maps at different scales, analogue maps or 3D geomodels. Looking at the content of EGDI, only small scale maps (1:5,000,000, 1:1,000,000) are currently available for viewing or downloading in the Basic Geology section https://www.europe-geology.eu/scientific-themes/basic-geology/. There are a number of records describing geological maps in the EGDI Metadata Catalogue https://metadata.europe-geology.eu/, but there is often a problem with the metadata being out-of-date. They have not been systematically added to EGDI, but rather have come from the long ago ended OneGeology-Europe project or are the result of voluntary work by EGS members. There are about 50 3D models in EGDI, most of them are the result of the GeoERA GIP-P project, some were provided within the EPOS TCS GIM consortium, several others are the result of specific projects. However, this is not a systematic selection, it is not known how many 3D geomodels exist in the information systems of individual GSOs.

It is evident that there is a large gap in knowledge regarding the availability of these data. For this reason, and as part of the activities of the EuroGeoSurveys Geological Mapping and Modelling Expert Group (GMMEG), a specific survey was carried out in which members were asked to provide a first brief inventory of existing geological maps in their own organisations. This activity took place in 2021 and is a valuable input for T6.1 as well (see Chapter 3.3.). The main outcome of this activity was the formulation of the need to create a sustainable, easy to use and up-to-date system of evidence of existing geological maps that could be searched and displayed or downloaded within EGDI.

To address this need and improve the situation, WP6 Task 6.1 has been aiming to establish a long-term sustainable system for cataloguing existing geological maps and 3D geomodels. The solution is to develop an inventory of as much information as possible to facilitate the search, enable subsequent cross-border harmonisation (not within the scope of this project) and to make the relevant data FAIR (Findable, Accessible, Interoperable, and Reusable). The collected information will be mostly stored in the form of metadata in the EGDI Metadata Catalogue. Information that will not be compatible with the future Metadata Catalogue attribute profile, such as (most of) the information on the 3D geomodel, will

be stored in a separate EGDI Inventory Database. The Metadata Catalogue and Inventory Database will be interlinked. The involvement of as many GSOs as possible is crucial, as the information should be as complete as possible and continuously maintained and updated within the evolving GSE. For the creation and subsequent management and use of this solution, dedicated databases, maintenance and service tools and the necessary organisational support for its future operation have also been progressively developed in EGDI. More detailed information on the overview of the situation and the approach chosen is available in Chapter 3.

The data collection is split into two themes, which are being worked on separately: Geological maps and 3D geomodels. First, basic information was collected for both of these themes, while in the next stage more detailed information was prepared. Questionnaires were developed to facilitate the initial metadata collection. For further updates, a user interface is being created in cooperation with the EGDI Group (WP7 of GSEU). Currently, a revision of the collected data is being conducted. Many errors, missing data and inconsistencies have already been found and are now being corrected in cooperation with Task 6.1 partners.

In order to ensure effective data processing in EGDI, requirements for the development of the information infrastructure were defined in cooperation with WP7, and possible procedures have been tested. Collaboration with WP7 is underway and the workflow of the whole process is being discussed, on data acquisition, data transfer into EGDI structures, metadata update, search using the customised EGDI Data Search, ranking and filtering of records, and displaying and downloading the data. The options for further updating and long-term management of the inventory are also discussed. More is described in Chapter 6.

This is an ongoing activity, and this first report describes the baseline situation at the start of T6.1 work, the process and methods for collecting and processing the information and the next steps planned for its effective use.

2. Acronyms and Definitions

EGS
EuroGeoSurveys
https://eurogeosurveys.org/

GSEU Project
Geological Service for Europe Project that aims to develop pan-European data and information services in Europe, establish the European Centre of Excellence on Sustainable Resource Management, develop the geological data infrastructure - building on the existing EGDI, provide a common European Geological Knowledge Base Platform and strengthen the network of national and regional GSOs.
https://www.geologicalservice.eu/

Map Datasets
Geological maps in digital form, usually in a GIS format.

WP6 of GSEU
Work Package 6 within GSEU Project plans to develop a framework of information, scientific standards, technical tools, and workflows that will enable the integration of existing information about Europe's onshore and offshore subsurface as a basis for all applied geoscientific challenges facing Europe.

Task 6.1 of WP6
Task of WP6 dedicated to the collection of information on geological maps, datasets and 3D geomodels, which are a basic and essential source of geological information and often serve as a necessary basis for all derived applied geoscience products and data.

WP7 of GSEU (the EGDI Group)
Work Package 7 within GSEU supports the GSEU Work Packages 2-6 in delivering the results requested from them by organising, safeguarding, standardising, and disseminating the specific data products they will be producing and implementing new necessary functionality presently not available in EGDI.

EGDI
The European Geological Data Infrastructure is a collaborative initiative aimed at facilitating the sharing, integration, and accessibility of geological information across Europe. It serves as a comprehensive platform that brings together geological data from various sources, including national geological surveys, research institutions, and other geological organisations.
https://www.europe-geology.eu/

EGDI Map Viewer
EGDI online application for visualising and querying spatial data registered in EGDI.

EGDI Metadata Profile
The EGDI Metadata profile is a set of descriptive attributes compatible with the international standard EN ISO 19115:2003(E) and extended also for the basic description of 3D geomodel.

EGDI Data Search

EGDI application that allows users to discover and access available datasets, view their metadata and select, display and download subsets of elements from multiple datasets. At the time of writing this report, a trial version is available at the address https://info.igme.es/searchsystemtest/en/egdi .

EGDI Metadata Catalogue
This EGDI application is the central access point to standardised metadata on digital structured geological data across Europe. It allows searching for information about data sources (metadata) that are maintained and provided by the European Geological Survey organisations. It is based on the MIcKA system, v. 7, which allows the user to work with metadata of spatial data in accordance with international standards (ISO, OGC and INSPIRE). Metadata are managed centrally in a database, edited and viewed through a web interface, and published through a standardised catalogue service. https://metadata.europe-geology.eu/.

EGDI Inventory Database
A specific database in EGDI that stores the defined results of inventories of existing data sources. It currently contains data from the inventory of geological maps. In the next phase of work, data from the 3D geomodels inventory will be added. It is expected to be extended with the results of other thematic data inventories, for example in the field of GeoEnergy.

Geological Map
For the purposes of T6.1, a “geological map” is understood to be a map of “basic geological” information, disregarding of its source (analogue or digital) or its format. It shows and explains the geological architecture of the surface and subsurface of the Earth’s crust. The term “basic geology“ is described in EGDI: “These datasets and products (...) show and explain the geological architecture of the surface and subsurface of the Earth’s crust. Model information comprises lithology, lithostratigraphic units, age (of rocks and events), structural elements (e.g. faults and thrusts), geomorphological features, lithotectonic units, and others.“ (https://www.europe-geology.eu/scientific-themes/basic-geology/). Geological maps can be available in various formats: analogue (printed, manuscripts, etc.), raster (scanned, exported from vector maps, etc.) vector digital maps in various GIS formats, etc.

Geological Mapping and Modelling Expert Group (GMMEG)
One out of ten Expert Groups of EuroGeoSurveys which presently exist.

3D Geomodel / 3D Geological Models
For the purpose of T6.1, a 3D geological model refers to digital 3D models that describe the subsurface based on units defined primarily by lithology, lithostratigraphy, age or lithotectonic affiliation.

Manuscript
For the purpose of T6.1, manuscript is any map drawn by hand, i.e. not printed or reproduced in any other way.

Metadata
Metadata is "data about data", in this context meaning information that describes spatial datasets and spatial data services and enables their discovery and use.

3. State of the Art Overview

In order to achieve the objectives described in the Introduction, an inventory of as much information as possible has been carried out. The collected information has been processed in the form of metadata in the EGDI Metadata Catalogue in order to make the relevant data FAIR and also in the “Inventory database” in EGDI, where the specific information describing the map and 3D geomodel resources will be stored. The latter database will be linked to relevant metadata in the EGDI Metadata Catalogue. The results and experience gained from the previous GMMEG activity were analysed and used to prepare the Geological Map Inventory.

3.1. Scope of the Inventory

Geological maps and 3D geomodels can be made available in many different ways, e.g. as Web Map Services (WMS), Web Feature Services (WFS), image services, in web applications, as formal data publications (with DOI) in a research data repository, as files in various formats ready for download on a less formalised basis, etc. Task 6.1 attempts to cover all of these.

The term “geological“ in the phrase “geological maps, datasets and 3D geomodels“ may be understood in a very general and broad way, including topics from applied geoscientific disciplines such as hydrogeology, mineral resources, etc. For the purpose of T6.1, however, we understand “geological“ in the sense of “basic geology“ as described for this “scientific theme“ in EGDI.

Data sources for special products such as sub-crop maps (e.g. “top of XY“ maps) are not systematically considered in T6.1, at least if the corresponding metadata are not yet ready for integration. The same applies to data sources dealing exclusively with anthropogenic deposits and landforms. On the other hand, data sources for structural information (e.g. fault databases), quaternary geology and bedrock maps are considered in T6.1.

The extent to which historical maps should be included in T6.1 has been carefully considered. A wealth of legacy geological maps is held by many European national GSOs. These maps are relevant to the history of science and in many cases also contain many details of interest for modern geological research (e.g. location of fossil localities and of historic mining infrastructure, former geomorphological features that have been destroyed by human activity, etc.). In addition, legacy maps are also very important for a deep understanding of local and regional geological terminology. Nevertheless, for pragmatic reasons it was decided to limit the collection of information to the most recently published maps and datasets at particular scales. However, if metadata of legacy maps are already available in national metadata catalogues there is no reason to exclude or filter them, e.g. for queries in EGDI.

In Task 6.1 only information on published geological maps is collected, so manuscripts and archival materials are excluded, with the same exception noted above for legacy maps: If metadata for unpublished materials are already available in national metadata catalogues, there is no reason to exclude them.

T6.1 follows the subsidiarity principle: Information on paper maps, including image formats of these maps, will generally not be collected if these maps have been digitised and made available in vector format, e.g. in an INSPIRE-compliant web service or as a data publication in a registered research data repository. The original paper maps are then referenced in the metadata of their vectorised versions.

The term “geological models”, or “3D geomodels”, refers to digital models that describe the subsurface on the basis of units defined primarily by lithology, lithostratigraphy, age or lithotectonic affiliation. At this stage, there are no specific requirements as to which models should be included in the inventory. Priority will be given to geological models covering large areas, but local or applied-geoscientific models will also be considered valuable and thus included. The term “3D geomodels” has been coined by people (mainly geologists) who create 3D geological models, people who call themselves “geomodellers”.

Collecting information on 3D geomodels presented a number of additional specific challenges, as there are still no generally accepted metadata standards for this type of information. INSPIRE does not impose a strict obligation to provide metadata for this type of data. As a result, many GSOs do not include metadata about the existing 3D geological models in their own metadata catalogues.

In addition to geological maps, map datasets and 3D geomodels, existing metadata catalogues are considered, as they contain sources of basic geological information. These metadata catalogues can be national or international. In the best case, such metadata catalogues are INSPIRE compliant, allowing easy access and harvesting of metadata into the EGDI Metadata Catalogue or inclusion in searches. However, this is often not the case, which makes the process technically challenging. As harvesting the metadata helps to avoid duplication of work and make it easier to update, it is included in the Task 6.1 workflow.

3.2. Defining Metadata and the EGDI Metadata Catalogue

INSPIRE defines metadata as “information that describes spatial data sets and spatial data services and enables their discovery, inventory and use” (https://inspire.ec.europa.eu/glossary/Metadata:3). A more general definition provided by ISO 19115 is "data about data".

Within the EGDI platform there are two catalogues for storing metadata: The EGDI Metadata Catalogue (https://metadata.europe-geology.eu/) and the EGDI Document Repository (https://www.europe-geology.eu/data-tools/document-repository/).

The EGDI Metadata Catalogue is the central access point to metadata describing in a standardised way identified data resources and other selected information relevant to EGDI. Only digital and structured information (e.g. spatial and non-geographic datasets or series of dataset and spatial data services such as Web Map Services (WMS), Web Feature Services (WFS), multidimensional models or other digital products (web applications, etc.)) is described by metadata in this catalogue.

As the EGDI Metadata Catalogue is the primary source of all information about the data relevant to the EGDI, it is clear that the information collected must be available and continuously updated in the form of metadata. Where metadata already exist in the GSO national metadata catalogue, efforts will be made to ensure that it is harvested and not just duplicated.

However, the situation with individual metadata catalogues is complex and setting up harvesting routines requires considerable effort. Sometimes, unfortunately, it is not even possible. The EGS has set up a network of National Metadata Coordinators for this purpose. In the future, it will be possible to use national metadata catalogues directly for searching, but a lot of detailed work and harmonisation is still needed. More details are given in Chapter 5.1.

Metadata of unstructured documents are stored and maintained in the EGDI Document Repository and uploaded via an Administration Module.

The EGDI metadata attributes are defined in the EGDI Metadata Profile, which complies with the metadata requirements of the INSPIRE Directive and the EN ISO 19115:2003(E). The detailed list of metadata elements is described in Chapter 5.1.

For the purposes of this inventory of geological maps, map datasets and 3D geomodels, it was agreed that more detailed domain-specific description of individual data sources would also be collected as part of the campaigns as this was considered important for effective searching and filtering. In fact, this extra information is also descriptive metadata that go beyond the content of the metadata profile. As they are relatively numerous and very domain-specific, it was decided not to include them to the EGDI Metadata Profile, but to store them in a specific EGDI inventory database linked to the EGDI Metadata Catalogue. A detailed list of attributes is described in Chapter 4.1.

3.3. Analysis of Data Collected under the GMMEG Map Inventory Activity

This chapter analyses and presents the results of an activity to inventory the geological maps of Europe, carried out by the GMMEG under the informal title “GAP Analysis”. This activity preceded the GSEU project and its results, while not published, form the basis for the work in Task 6.1. As stated above, during this activity a specific survey was conducted in which members were asked to provide a first brief inventory of existing geological maps in their own organisations.

For this activity, a Microsoft Excel template was used to find out information about the geological maps that are available in most of the EGS member countries.

In the first part of the table, general information such as contact details, data type and format were collected. The aim was to find out how many geological maps were already in digital form and available online as a web service. The question about the existence of manuscripts was important if this was the only existing format of the map. In the case of detailed map data published as map series, the percentage of coverage was inquired.

The second part of the table contained attributes related to the thematic content of the maps that were identified as the most important and common on geological maps, such as age (chronostratigraphy), lithology, lithostratigraphy and tectonics.

After several months of data collection, the Gap Analysis was carried out. Information was collected from 34 countries (Figure 3-1). The final list contained 223 records of geological maps at scales from 1:5,000 to 1:3,000,000. Seven countries did not provide data: Three EGS members (Montenegro, Republic of North Macedonia, Kosovo) and 4 non-EGS members (Iceland, Bulgaria, Belarus, Moldova).

The first step in the analysis was to define the level of detail of the maps according to the scale at which they were produced. The maps were divided into 7 scale groups: 3 groups of detailed maps and 4 groups of overview maps (actual scale ranges are given) (Figure 3-2):

1 – Very detailed, local scale: from 1:5.000 to 1:25.000
2 – Detailed: from 1:40.000 to 1:75.000
3 – Medium detailed: from 1:80.000 to 1:100.000

4 – Overview maps, detailed: from 1:200.000 to 1:300.000
5 – Overview maps: from 1:400.000 to 1:600.000
6 – Small scale overview maps: from 1:1.000.000 to 1:1.500.000
7 – Very small-scale overview maps: from 1:2.000.000 to 1:3.000.000

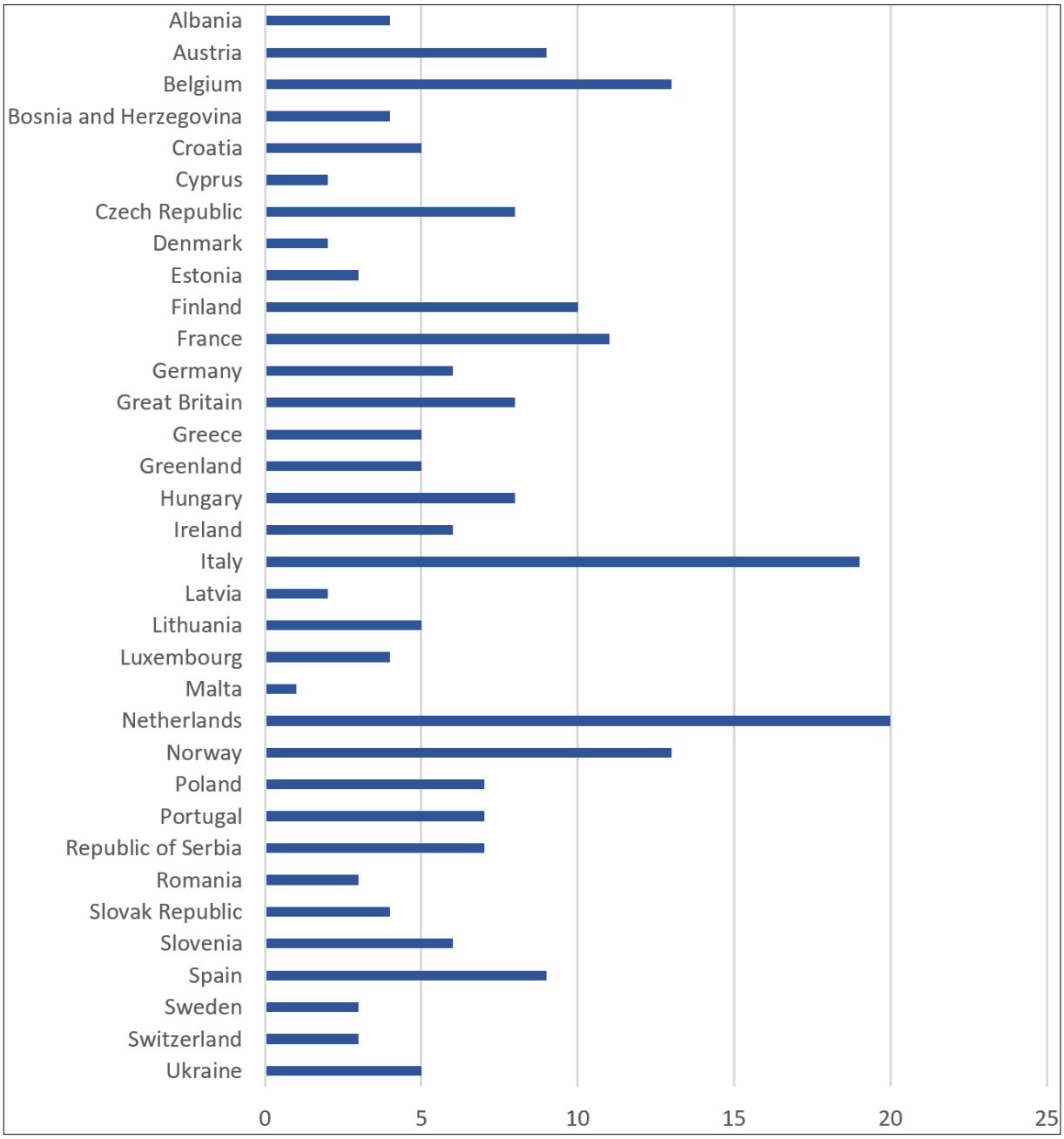

Figure 3-1: Number of Geological Maps by Country

There were also several maps without a defined scale. This group requires further explanation, so it was decided to omit them at this stage of the analysis.

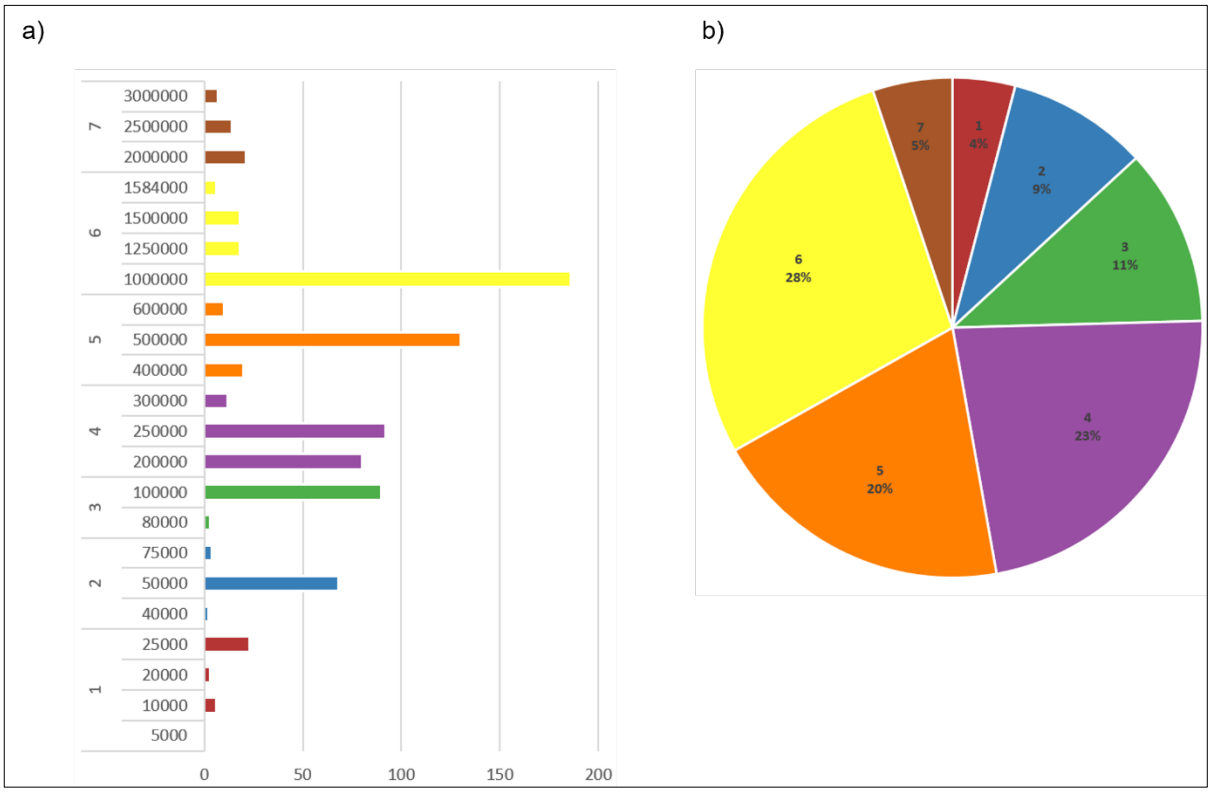

Figure 3-2: 7 Groups of Geological Maps by Scale with Details of Scale Denominators Indicated (a) and Percentage of Groups in Total (b)

Further analysis was based on groups of scales. This helped to identify which level of the detail of the data was most commonly available and which required further work to cover the whole of Europe (Figure 3-3).

The data collected was analysed in terms of content and format. It was found that most of the geological maps were available in various GIS formats. In terms of map content, lithology was the most common attribute, present in more than 80% of the maps. Chronostratigraphy and tectonic boundaries are other parameters frequently shown on maps. The least common parameter is lithostratigraphy.

The second step was to analyse the relation of attributes (age, lithology, tectonic boundaries, lithostratigraphy) and scales.

The GMMEG geological map inventory does not include international maps and map data sets at smaller scales. The IGME5000 https://www.bgr.bund.de/EN/Themen/Sammlungen-Grundlagen/GG_geol_Info/Karten/Europa/IGME5000/IGME_Project/IGME_Projectinfo.html and IQUAME2500 https://www.whymap.org/EN/Themen/Sammlungen-Grundlagen/GG_geol_Info/Projekte/laufend/IQUAME/IQUAME2500_en.html projects have produced two well-known and widely available maps and map datasets at 1:5.000.000 and 1:2.500.000 scales respectively, which are almost fully harmonised between countries.

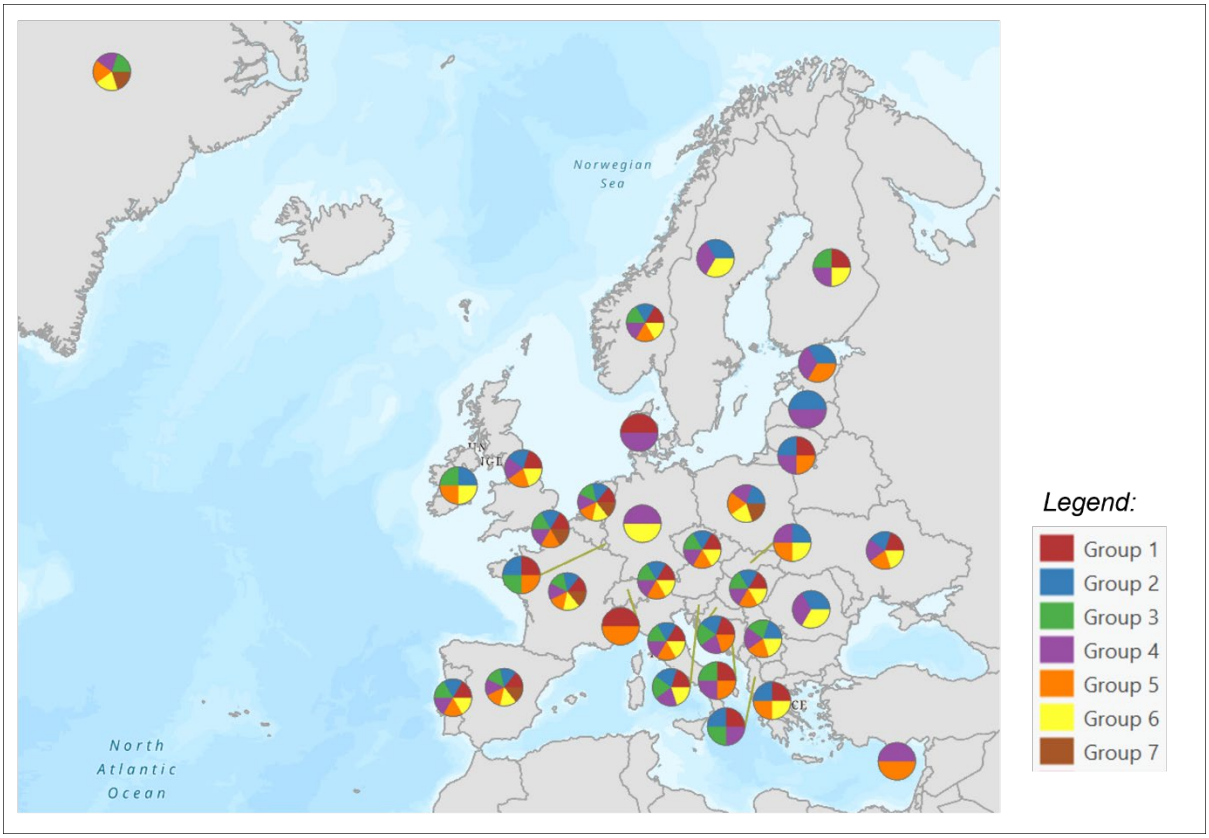

Figure 3-3: Coverage of Europe with Geological Maps Divided into 7 Scale Groups

The OneGeology-Europe project, mentioned in the inventory, was based on distributed data and web services. The result was a 1:1.000.000 scale geological map of Europe (however without full coverage), which is like a geological jigsaw puzzle, the pieces of which are national geological maps. An updated version of this map was harvested and made available in EGDI (https://maps.europe-geology.eu/#baslay=baseMapGEUS&extent=339533.7684003925,1155970,8165446.2315996075,5309410&layers=onegeoeuro_surface_lithology). The results of the OneGeology-Europe project are available on the OneGeology Global Portal (https://portal.onegeology.org/OnegeologyGlobal/).

In summary, the most complete coverage of Europe with geological maps is available at the scales 1:40.000-1:75.000 and 1:200.000-1:300.000 (Groups 2 and 4), which include map series that are under continuous development. Overview maps at scales of 1:1.000.000-2.000.000 (Group 6) cover entire countries. In terms of map series, the 1:200.000-1:300.000 scale (Group 4) seems to be available in most countries and could form the basis for regional studies.

The analysis also showed that lithology was the most popular attribute across all the groups analysed. Lithostratigraphy is most often described on detailed map series at scales greater than 1:300.000.

The information collected is a valuable product that has been analysed as background information for T6.1. The results of the analysis have helped to define the content and scope of the T6.1 inventory and can help to identify errors. It has become clear that a more sustainable solution, such as that described in following chapters, is needed to make better use of the results of such inventories.

4. Inventory of Geological Maps and 3D Geomodels

The inventory of geological maps and 3D geomodels is intended to facilitate the search for existing information sources and access to them in the European context. It is a fundamental tool to reinforce the objective of WP6 of the GSEU project.

The inventory is the source of the information required by the EGDI Data Search and the EGDI Map Viewer to provide the users with the results they are looking for. The inventory has been collected from all organisations involved in the GSEU project.

Each attribute describing a specific quality, property or characteristic of the geological maps and 3D geomodels in the inventory is transferred to the EGDI Metadata Catalogue and the EGDI Inventory Database.

The collection of information has been divided into two “phases”. In Phase1 we collect attributes related to geological maps, and in Phase 2 we collect attributes related to 3D geomodels. Within each phase, two “stages” have been defined. Stage1 focuses on obtaining a first set of basic data, and Stage 2 aims to complete the full set of attributes and to resolve errors.

Efforts have been made to complete the definition of all attributes collected in Stage 1 of each phase. These attributes have been fully defined and can be found in sections 4.1.1 and 4.1.2. For Stage 2 of each phase, work is underway to define additional attributes that will help to deepen the description of the data, make their use more efficient, link them to the thematic vocabularies developed in other tasks of WP6, and optimise the retrieval of the data through the EGDI search tool.

The first stage was completed through information collection campaigns using online questionnaires sent to each of the GSOs participating in the GSEU project.

4.1. Defining Inventory Attributes

In the case of geological maps and map datasets (referred to as “inventory items”), attributes have been grouped (see Figure 4-1):

- General Identification Information: attributes that contain general information about the inventory item
- Metadata Information: attributes that collect the information necessary for cataloguing the inventory item. This is the information required to provide metadata according to the EGDI Metadata Profile, INSPIRE and ISO 19115 standards
- Manuscript Data Information: attributes that collect information about the original source of the geological dataset
- Data Access and Source: attributes that allow a description of how the data can be accessed
- Data Harmonisation: attributes that collect information on the status of the inventory item with respect to applicable standards
- Thematic Attribute Data: attributes that store relevant information related to the geological thematic aspects of the inventory item

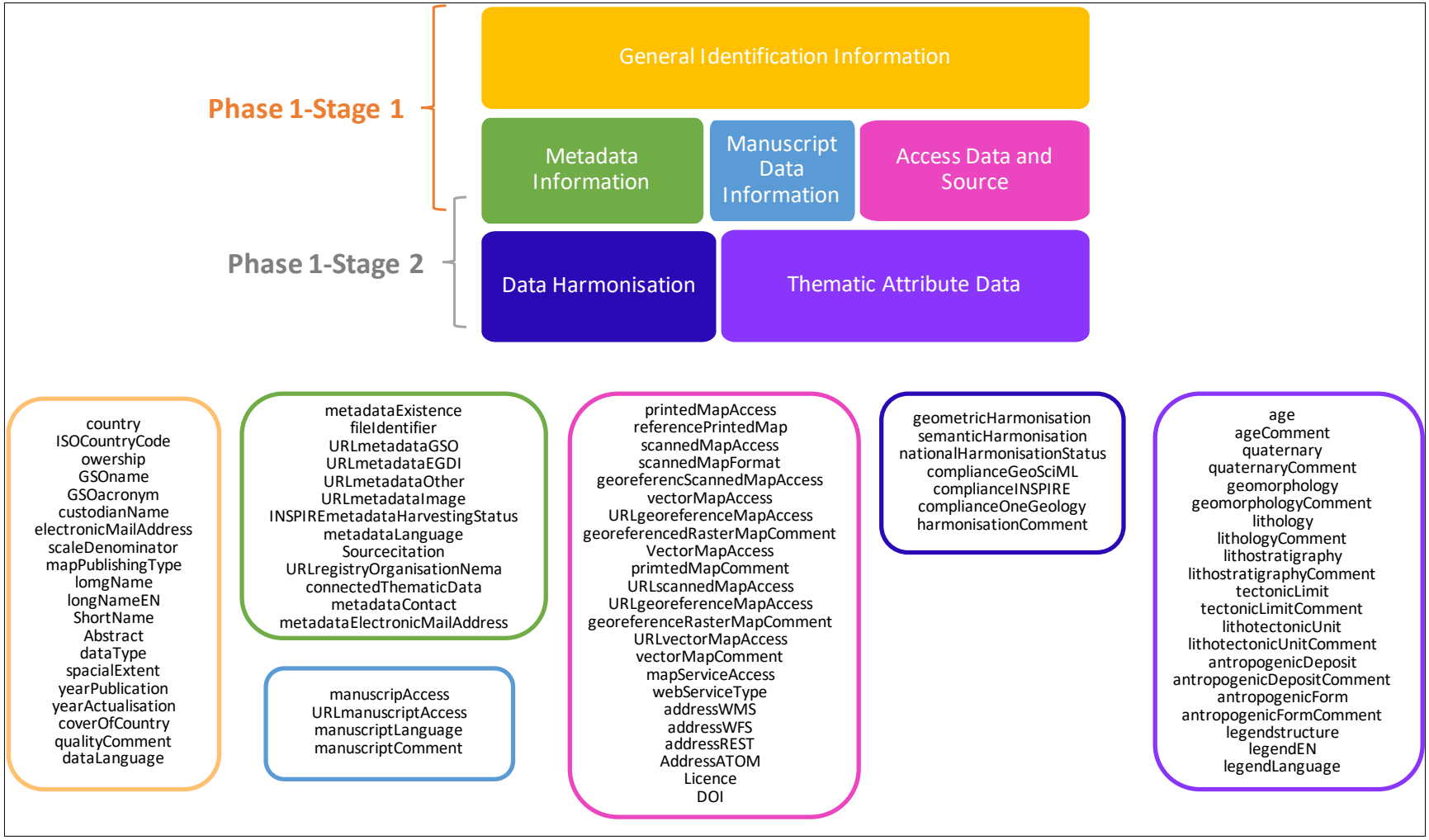

Figure 4-1: Schematic View of Attributes – Geological Maps Inventory

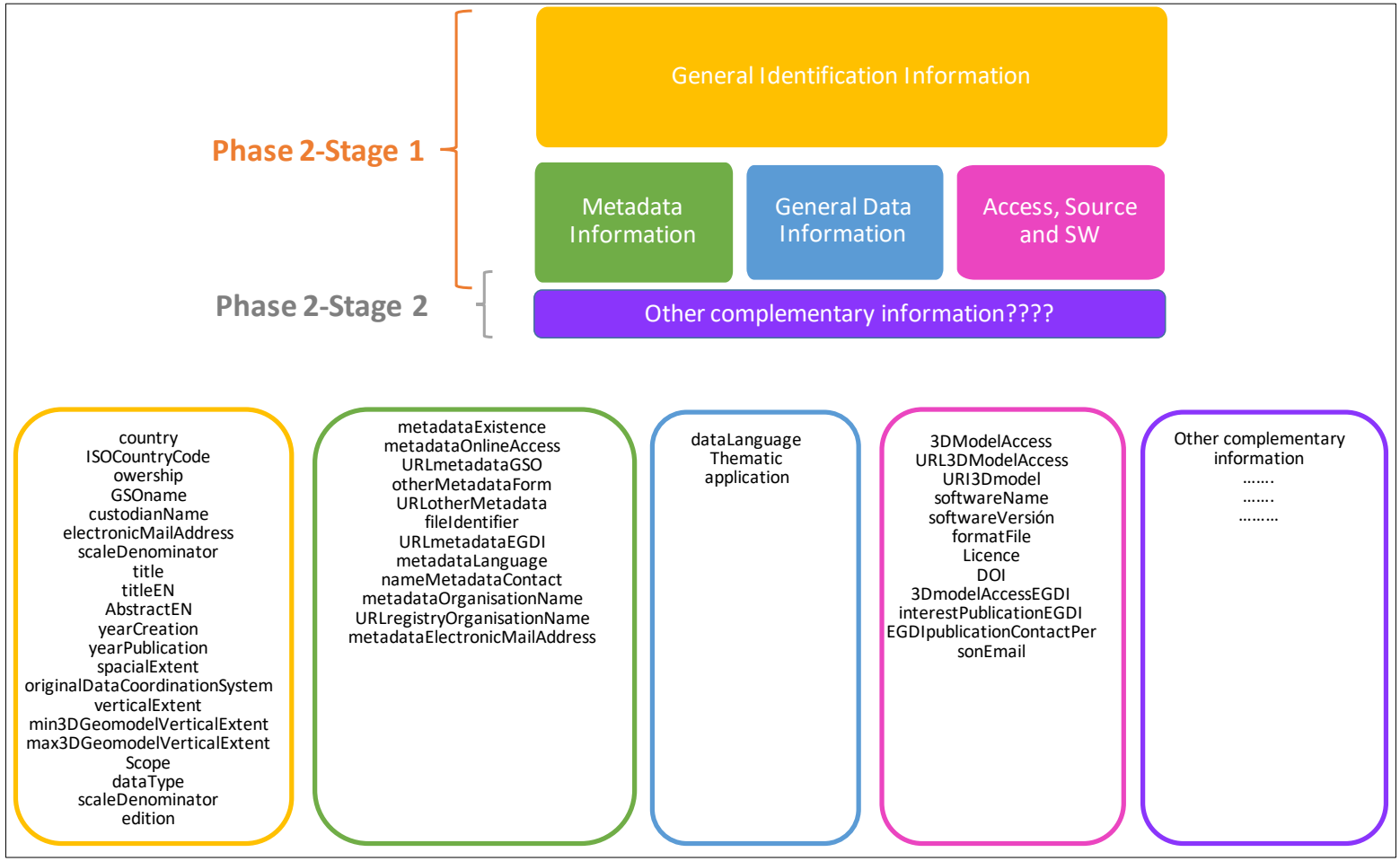

Figure 4-2: Schematic View of Attributes – 3D Geomodels Inventory

The first four groups of attributes provide information for the identification and general description of the dataset. Most of these attributes are collected in Stage 1.

The last two groups of attributes describe the level of standardization of the datasets and support effective searching. The attributes will be collected in Stage 2.

In the case of 3D geomodels, attributes have been divided in a similar way (see Figure 4-2).

- General Identification Information: attributes that allow collection of general information about the 3D geomodel
- Metadata Information: attributes that collect the information necessary for cataloguing the 3D geomodel. This is the information required to provide metadata according to the EGDI Metadata Profile
- General Data Information: attributes that collect information about the thematic content and use of the 3D geomodel
- Data Access, Source and Software: attributes that allow a description of how the data can be accessed

The attributes grouped in first four groups provide information for the identification and general description of the dataset. All the attributes in these groups are collected in Stage 1.

In addition, new attributes will be defined in Stage 2, referred to as 'other supplementary information' in Figure 4-2. The attributes to be defined for this new package will be aimed at deepening the description of the dataset, complementing the previous information collected in Stage 1, including attributes related to the thematic content of the 3D models and supporting effective searching.

Unlike the maps and map datasets, where EGDI already contains extensive metadata, the information on 3D models is being newly introduced into the EGDI environment. The exact way of integrating these attributes into EGDI therefore still needs to be designed.

4.1.1. Attributes of Inventory

Complete lists of the attributes of geological maps and map dataset defined in Stage 1 of Phase 1 related to inventory items are given below.
Each attribute in the table has several components:

- Attribute Name: Contains the name by which the attribute is known
- Attribute Description/Comment: For each attribute, a description of its meaning has been included. It may also include explanatory information about the content, what information is expected to be received, whether the answers belong to a list of controlled values and in some cases an example of use
- EGDI Metadata Profile Item: Where applicable the EDGI metadata profile item to which the attribute corresponds is listed
- ISO Metadata Profile Item: Where applicable the ISO 19115 Metadata Profile Item to which the attribute corresponds is listed

The detailed list, together with the complete lists of 3D geomodel, of the attributes defined in Stage 1 of Phase 2 are given below is given in the related Annex.

4.2. Development of the Questionnaires

To start the data collection, questionnaires for Stage 1 of each phase were created using MS Forms. The aim was to create a very user-friendly tool for the initial data entry. The results of the questionnaires were exported to Excel files and are used to check existing metadata or to create new metadata records. At a later stage individual columns will be converted into records in the EGDI Inventory Database.

The main objective of the first stage of the inventory campaigns was to identify existing geological maps, map datasets and 3D geomodels by collecting basic information about them, as defined in 4.1.1 and 4.1.2. In order to better characterise the identified maps and map datasets, the second stage of the inventory campaigns will collect additional information on the same maps and datasets using different technologies developed by WP7.

The design of the web form was an iterative process. First, the general scheme of the maps and map datasets questionnaire was created (Figure 4-3), starting with general information about the country name, GSO and title of the inventory item being described. The scheme then moves on to questions about vector data (the most important in the inventory), printed maps, image formats and manuscripts. The last section contains contact information, questions and comments. Based on the detailed scheme (see attachment Annex1), the questionnaire Web form (see attachment Annex2) was developed.

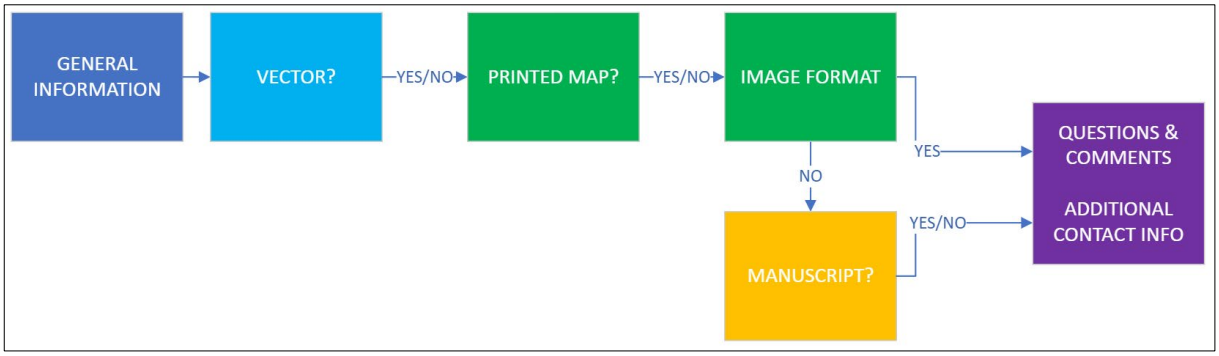

Figure 4-3: Schema of the Questionnaire for Collecting Basic Information on Geological Maps and Map Datasets

A first version of the questionnaire was tested by Task 6.1 team members. Based on their comments, the questionnaire was revised, tested again, and modified again. As MS Forms is a very simple tool, it was a challenge to design a questionnaire that would allow obtaining the most complete information about the existing geological maps and 3D geomodels with simple questions.

The same procedure was followed for the inventory of 3D geomodels. Based on the general scheme (Figure 4-4) the detailed scheme (see attachment Annex3) of the questionnaire (see Annex) was prepared.
Based on the experience with the GMMEG map inventory drop-down menus with code lists were included in the questionnaire to minimise typing errors.

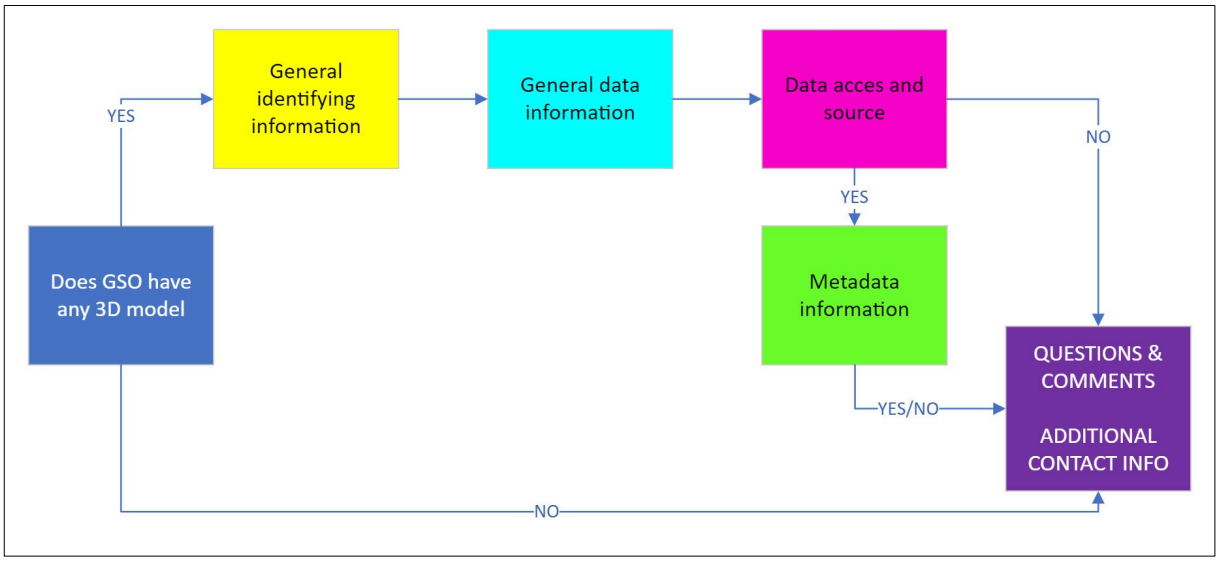

Figure 4-4: Schema of the Questionnaire for Collecting Basic Information on 3D Geomodels

4.3. Inventory Campaigns

The actual data collection of geological maps and map data, as well as 3D geomodels, is organised in partial campaigns in order to minimise the time required by each partner.

All campaigns require the full commitment of a team that must be ready to communicate with partners, answer questions and support them in their work. Bilateral meetings or individual email communication with WP T6.1 partners and national metadata coordinators are an inevitable follow-up to each campaign. From previous experience, it is clear that all records entered must be carefully checked and any deficiencies or inconsistencies found must be corrected. Processing such cleansed data is a demanding and responsible task. This experience should be considered when developing the organisational framework for a sustainable continuation of this work.

Inventory of Geological Maps and Map Datasets Phase 1 Stage 1

For the first phase of information collection, basic attributes (see section 4.1.1) were selected. The campaign to collect this from partners was organised during August to October 2023. During the review of the records, some errors, ambiguities and missing information were identified and clarifications will be made with individual partners. Ultimately, each map and dataset collected will require a metadata record in EGDI. Relevant metadata from the GSO metadata catalogues will be progressively added to the EGDI Metadata Catalogue and missing metadata will be created with the support of WP7 in the next work period.

Inventory of Geological Maps and Map Datasets Phase 1 Stage 2

For the next stage of the inventory, detailed attributes describing already identified maps and map data have been proposed and described. A user interface for filling in selected attributes is being developed in collaboration with WP7. In early 2025, when the tool will be operational, it is expected that a campaign will be launched to collect data from partners using the tool.

Inventory of 3D Models Phase 2 Stage 1

Basic attributes were defined to describe existing geological 3D models in the inventory (see section 4.1.2). A questionnaire was developed to facilitate the completion of selected attributes. A campaign to collect data from partners using this questionnaire was organised during April to June 2024.

Preparation work on Inventory of 3D Geomodels Phase 2 Stage 2

For the next stage of the inventory, detailed attributes describing the 3D geomodels identified in the previous period have been proposed and described. A user interface for filling in these additional attributes is expected to be developed in early 2025 in collaboration with WP7. A campaign to collect data from partners using this tool is expected to take place after it has been tested in 2025.

4.4. Results of the Inventory

The questionnaire in MS Forms allowed the collection of data to be structured in the form of an Excel spreadsheet, where the questions form the headings. The tool automatically adds some additional columns with information, i.e. date and time of form submission. This part of the spreadsheet was omitted from further work. Before starting the analysis of the collected data, erroneous records were first removed, which were considered to be those that contained arbitrary character strings, e.g. 'xxxx', or were reported as erroneous by the respondents. MS Forms also automatically assigns an ID, which is a sequential number.

There were several items identified in the downloaded xlsx file that needed to be checked and manually sorted. For example, the use of code lists resulted in the automatic addition of the ';' character. Unfortunately, the 'any text' options and the addition of manually entered values to the code lists as 'other', as expected, resulted in typos and different ways of writing the same values. All such errors need to be corrected before the data can be imported into the database prepared by WP7.

4.4.1. Phase 1 - Inventory of Geological Maps and Map Datasets: Results of Stage 1

The completed first stage of the inventory (see Figure 4-5) was based on the experience of the GMMEG map inventory activity. Many of the ambiguities identified at that time were avoided, but many new issues arose that required verification and clarification.

The first stage of this inventory covered 35 countries. A total of 230 maps were collected, of which 11 were the result of international collaborative projects.

Important note: a preliminary analysis of the data collected during the stage 1 of the inventory revealed errors. For example, we found that some respondents described several maps as a single record. These issues and other ones will be discussed in the stage 2 of the geological map and map data inventory. We plan bilateral meetings.

It was decided to analyse the collected data in a similar way to the GMMEG map inventory activity and to group them by scale (actual scale ranges are given) (see Figure 4-6):

1 – Very detailed, local scale: from 1:10.000 to 1:30.000
2 – Detailed: from 1:50.000 to 1:75.000
3 – Medium detailed: 1:100.000
4 – Overview maps, detailed: from 1:200.000 to 1:350.000
5 – Overview maps: from 1:400.000 to 1:625.000
6 – Small scale overview maps: from 1:1.000.000 to 1:1.500.000
7 – Very small-scale overview maps: from 1:1.750.000 to 1:3.000.000
8 - Very small-scale overview maps: from 1:4.000.000 to 1:5.000.000

Almost 75% of the existing maps belong to group 4, 5, and 6 (Figure 4-17). Group 8 contains international, regional and pan-European maps.

When comparing the results of the GMMEG map inventory activity (Figure 4-1) and the first stage of the T6.1 inventory on geological maps (Figure 4-7), discrepancies were found. Their clarification will be one of the tasks of the second stage of the inventory.
The first stage of the inventory was primarily to identify the geological maps. The first step was to identify the type of data, i.e. whether it was a single map or a series of maps. Based on the information collected, it can be said that the majority are single maps (Figure 4-8). The next question was what percentage of geological maps were available in a digital format, either vector or raster. Analogue data were also asked about, as this information can help to identify general gaps in the availability of data. From the point of view of the FAIR data principle, vector data are the most important, so the accessibility of this type of data was also investigated, as well as whether these data were searchable, i.e. described with metadata made available through GSOs, EGDI or other metadata catalogues.

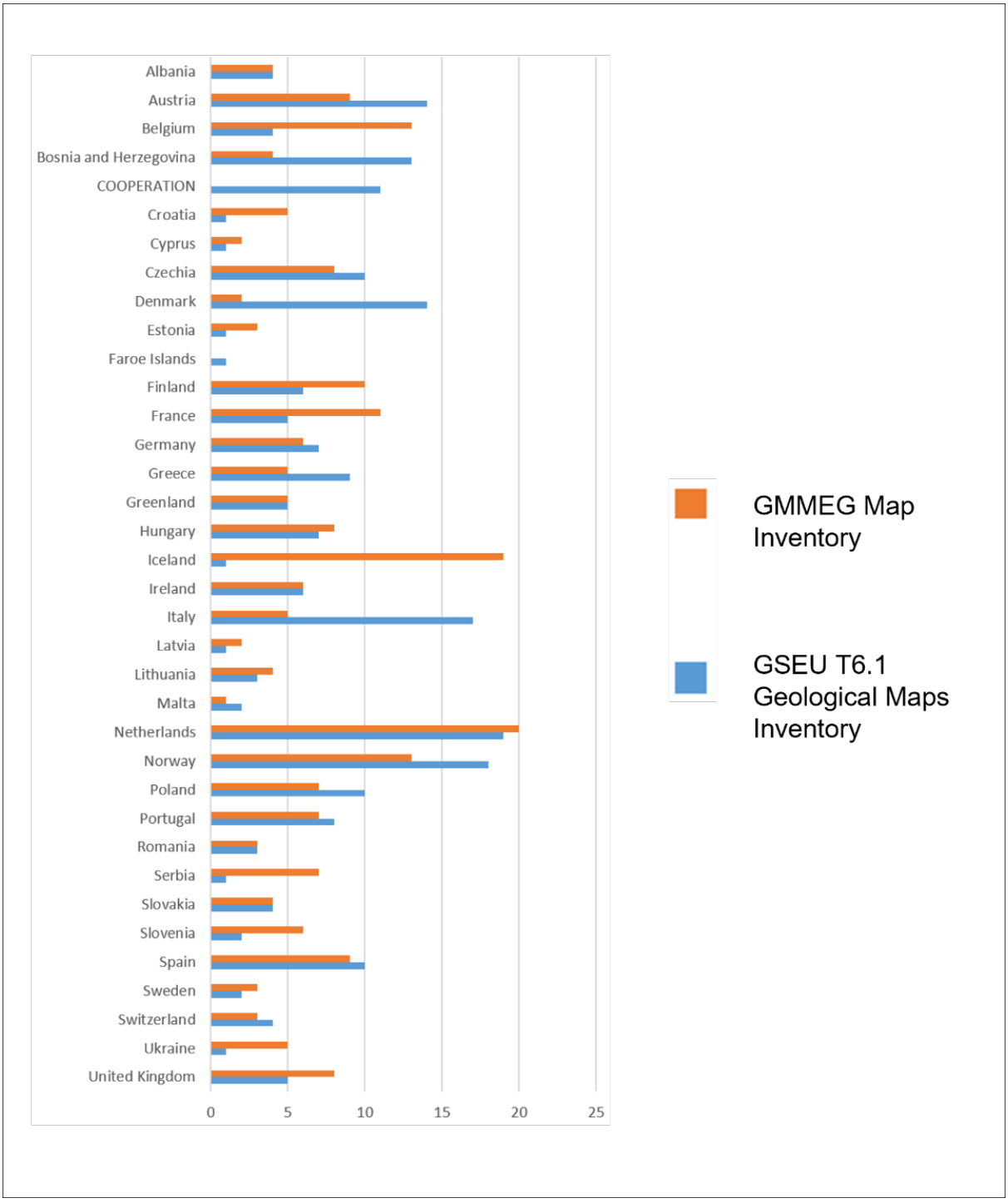

Figure 4-5: Number of Geological Maps by Country, Including Maps Produced through International Cooperation (T6.1 Inventory vs GMMEG Map Inventory)

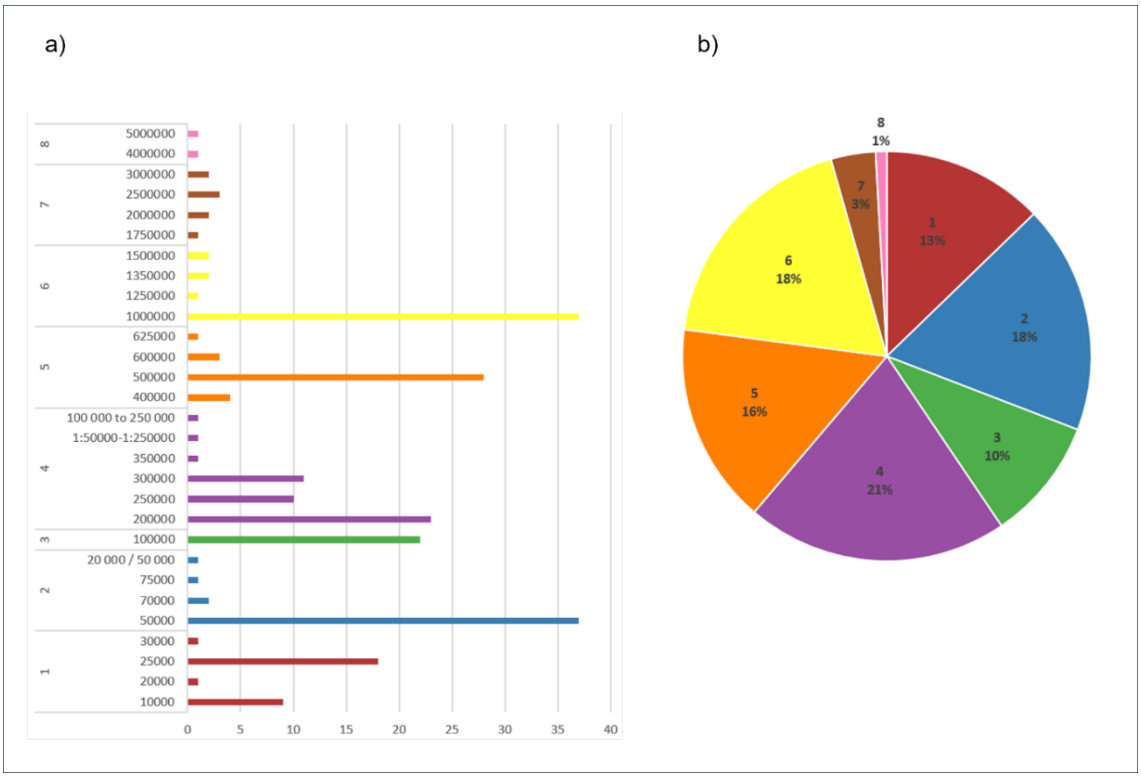

Figure 4-6: 8 Groups of Geological Maps by Scale with Details of Scale Denominators Indicated (a) and Percentage of Groups in Total (b)

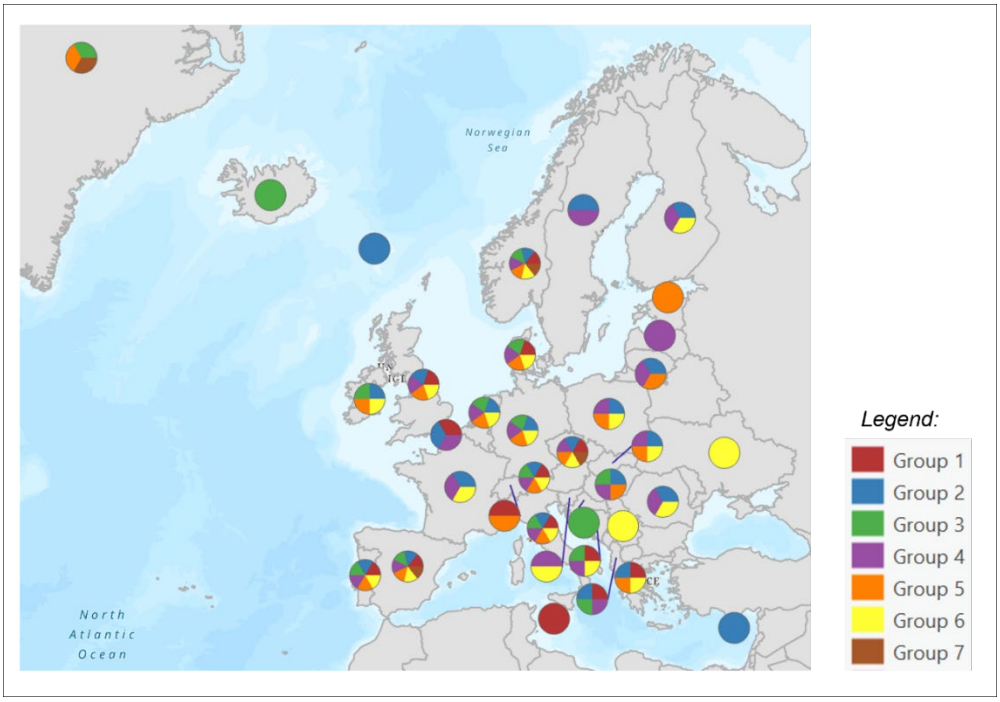

Figure 4-7: Coverage of Europe with Geological Maps Divided into Seven Scale Groups *(Group 8 is omitted, it mainly contains international geological maps)*

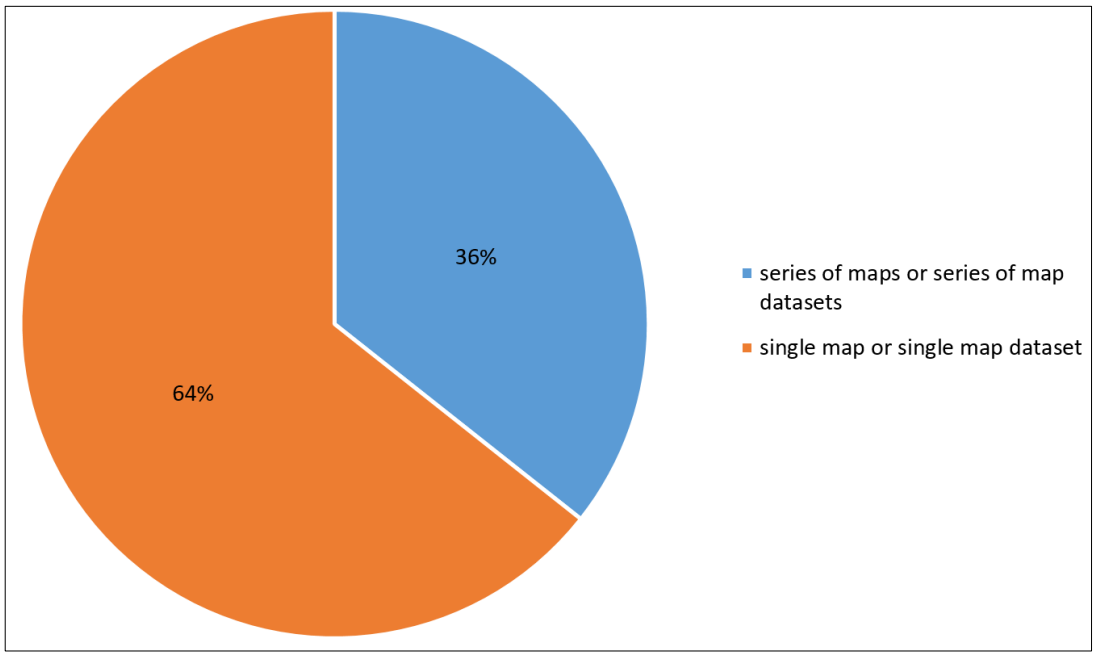

Figure 4-8: Data Types of Geological Maps and Map Datasets

In summary, 230 identified geological maps or map series are available in various forms (vector, image, paper and manuscript), giving a total of 457 individual formats (we can find the same map in different formats). 75% of the 230 inventoried maps are in vector format and representing 38% of all published map formats. Figure 4-9 shows the sum of all vector and image (digital formats) of the maps they represent 64% of all individual occurrences (292 of 457 individual maps). Almost all of the inventoried vector geological maps are accessible online.

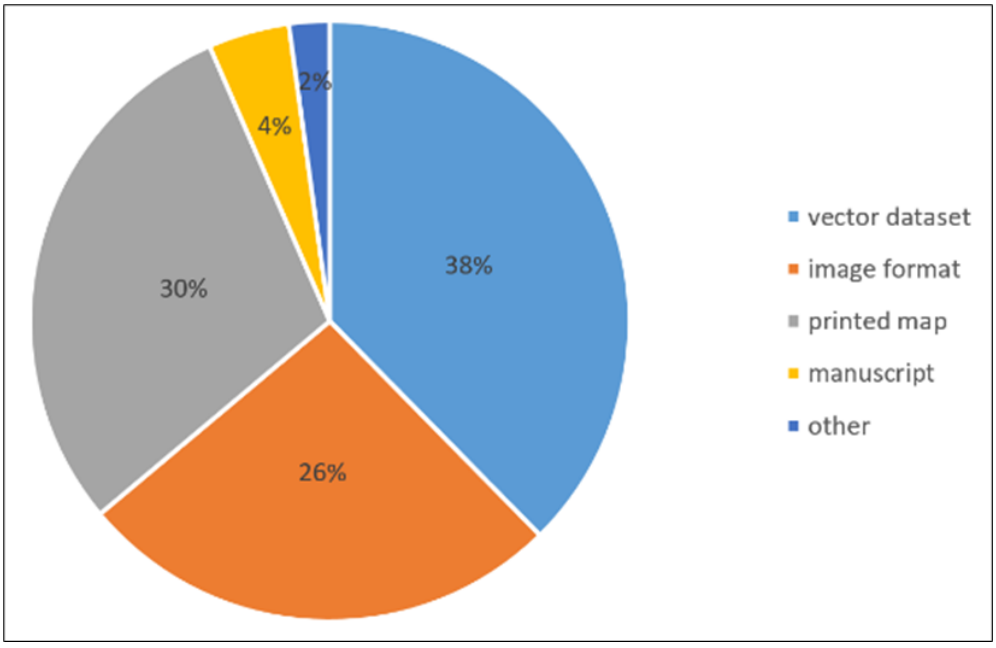

Figure 4-9: Map Publishing Type of all 457 Individual Maps

The compilation showed that not all available vector geological maps are described with metadata in the GSO's metadata catalogue (Figure 4-10). Some of them have metadata published in the EGDI Metadata Catalogue or in other catalogues.

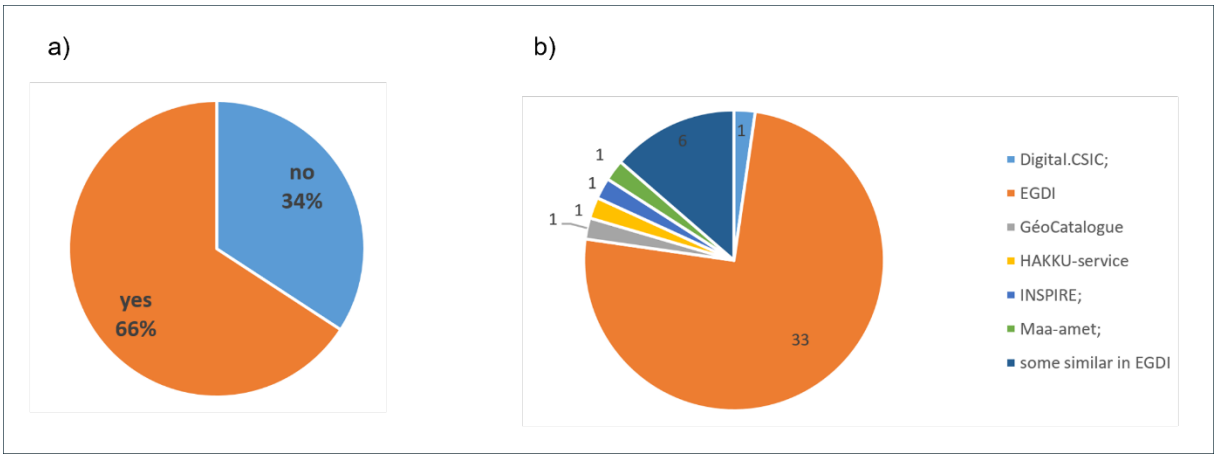

Figure 4-10: Metadata Existence in GSO's Metadata Catalogue (a) or Other Catalogues (b)

When asked about access to a printed map, almost 30% of the maps do not have a printed version (Figure 4-11a) or do not plan to have a printed version (Figure 4-11b).

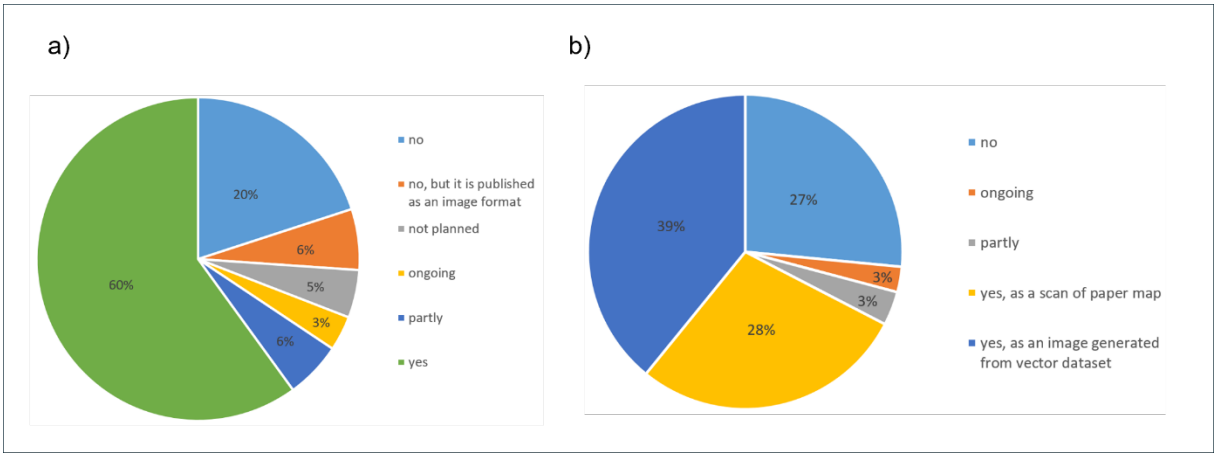

Figure 4-11: Printed (a) and Scanned (b) Maps Access

The most popular file formats for scanned maps are PDF, JPG and TIFF (Figure 4-12a). Based on the data collected, 62% the map scans are georeferenced (Figure 4-12b).

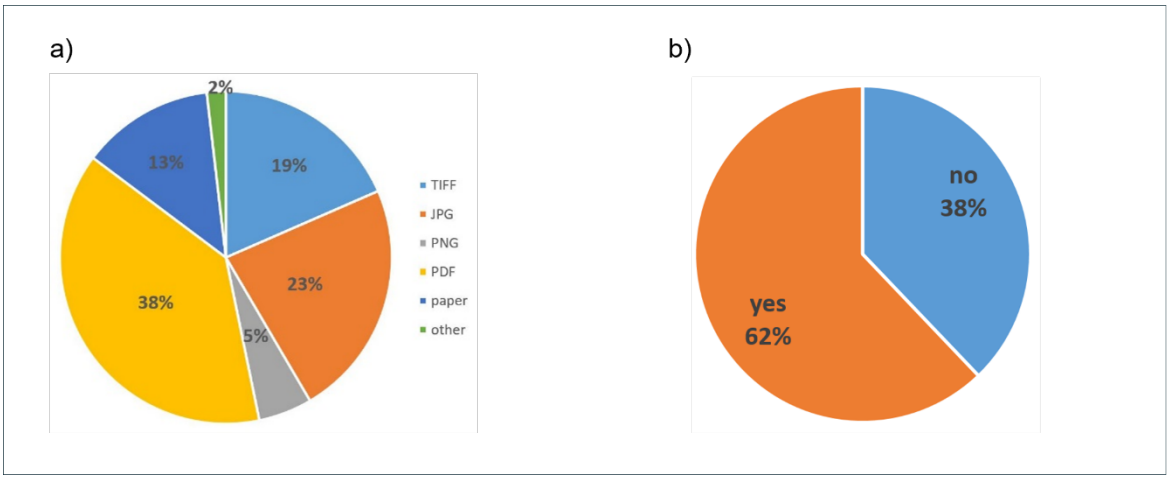

Figure 4-12: Scanned map formats (a) and percentage (b) of georeferenced scanned maps

As the INSPIRE Directive does not require metadata for non-vectorised geological maps, it was decided to collect information on whether geological survey organisations describe these data using metadata. However, it was not expected that almost 50% of this type of data would be searchable in metadata catalogues (Figure 4-13) without external compulsion in the form of EU legislation. This is a very positive sign, as it may indicate an increased awareness of searchability as a key asset of effective data management.

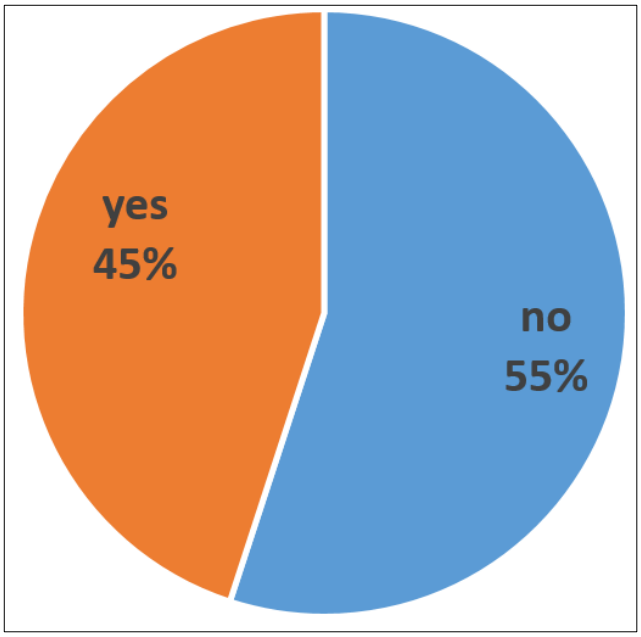

Figure 4-13: Existence of Metadata of Image Data

The final part of the questionnaire concerned the map manuscripts. This information was considered important in terms of potentially filling spatial data gaps. Only 23% of the filled manuscripts are available for public (Figure 4-14a), but most of those these are accessible online (Figure 4-14b).

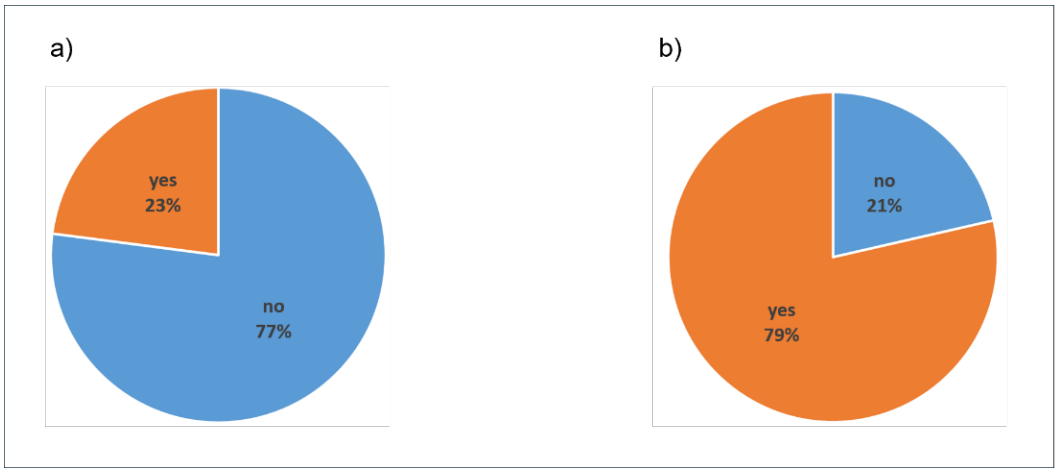

Figure 4-14: Access to Manuscripts in General (a) and Availability of Maps Accessible Online (b)

4.4.2. Phase 2 - Inventory of 3D Geomodels: Results of Stage 1

The 3D geomodel inventory was performed for the first time and there is no reference point, therefore no possibility of comparison with previous results. The 3D models that are included in EGDI will be compared with the collected models and included in the inventory in the next period of work.

Twenty-four countries responded to the first stage of the 3D geomodels inventory (Figure 4-15).

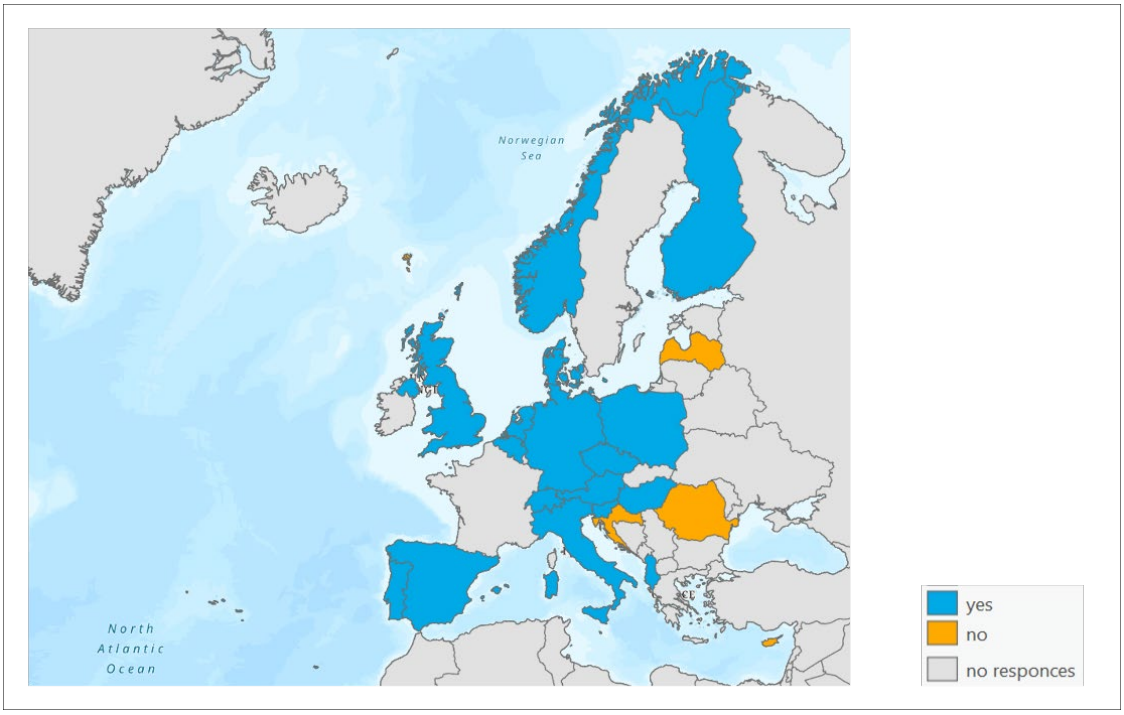

Figure 4-15: Countries involved in 3D Geomodeling (*blue - confirmed existence of 3D geomodels, orange – countries that have no 3D geomodels; grey – no response as of October 2024*)

At the very beginning, respondents were asked about the existence of 3D geomodels. This revealed that 5 of the responders do not have 3D geomodels (Figure 4-16): Croatia, Cyprus, Faroe Islands, Latvia and Romania. A total of 237 3D geomodels were inventoried, of which only one was produced in international cooperation.

The oldest 3D geomodel identified was produced and published by the Geological Survey of Norway in 2003. The name of the 3D geomodel is “Titania Ilmenite” and it is a structural model applied for mineral resources.

Based on the questionnaire results, the majority of 3D geomodels belong to the United Kingdom, Finland, Norway, Poland, the Czech Republic and Austria.

The vast majority, over 90%, of the identified 3D geomodels are regional and local in scope (Figure 4-17a). About 40% of the models do not have an English version (Figure 4-17b).

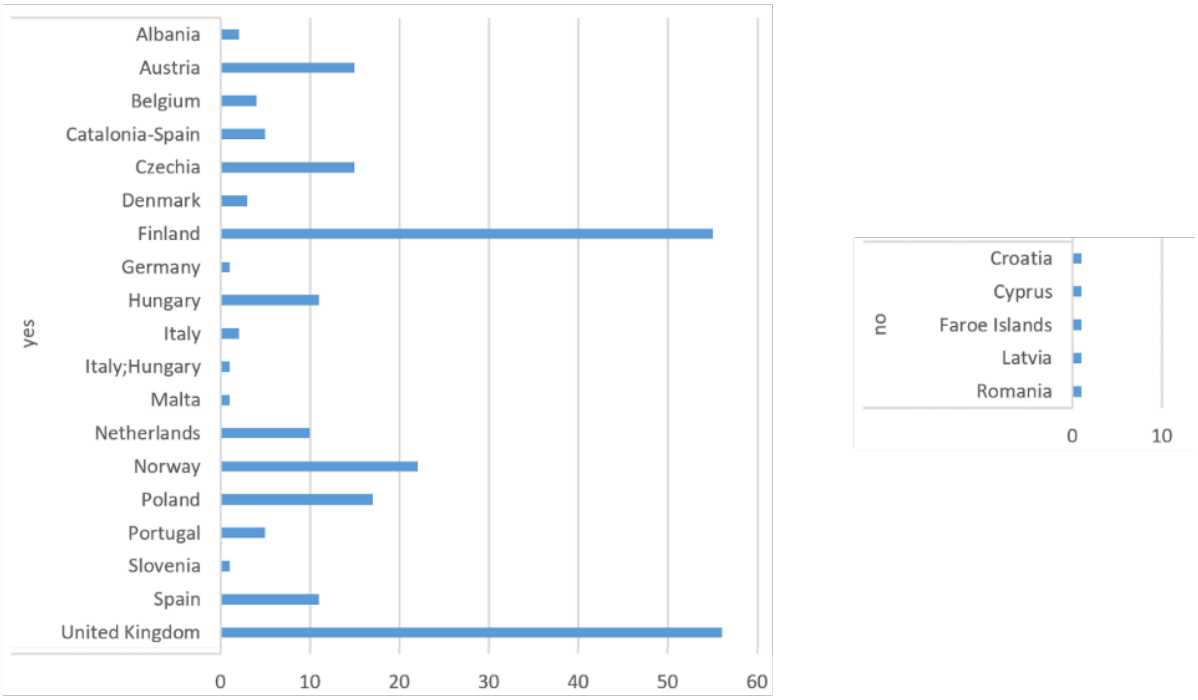

Figure 4-16: Number of Existing 3D Geomodels by Country

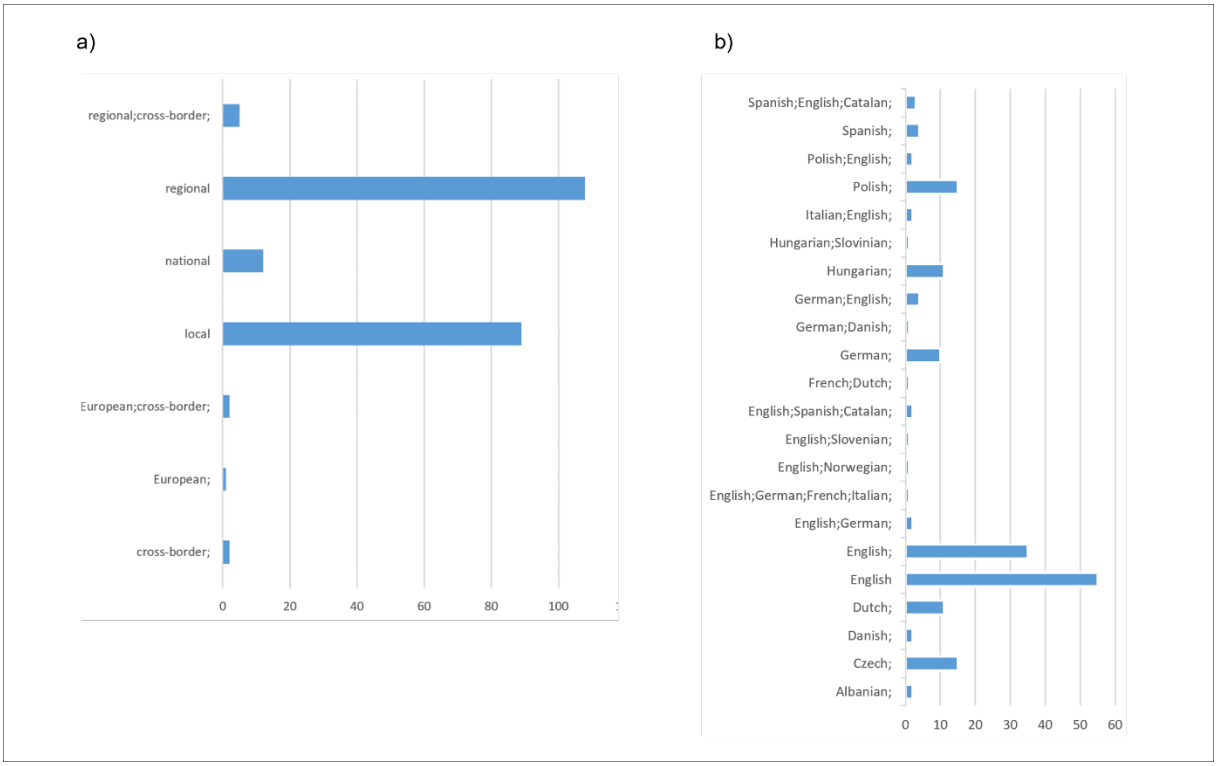

Figure 4-17: 3D Geomodels Scope (a) and Language (b)

An analysis of the aim of the models shows that the most popular models are those for mineral resources, hydrogeology, geothermal energy and geological storage (Figure 4-18). This suggests that the models are being created primarily for practical, rather than research purposes, and also correlates with global trends in the geosciences. Technology development requires raw materials and large water resources, and alternative renewable energy sources such as geothermal energy meet the needs defined by climate change. The models developed by the GSOs are responding to the needs of end users.

3D geomodels were not only analysed in terms of their use, but GSOs were also asked about the type of model from a thematic perspective. An open-ended question on theme was proposed in the questionnaire with the three most expected answers: structural, sedimentological/facial, petrophysical. As expected, structural and sedimentological models were the most popular. Respondents also gave equally frequent answers regarding anthropogenic, surficial, and bedrock deposits. Petrophysical 3D geomodels are not as common as expected (Figure 4-19).

The next part of the questionnaire concerned metadata. In the case of map data, this is governed by the obligations of the INSPIRE Directive. There is a standardised metadata profile that can be implemented for national purposes. The situation is different for 3D geomodels, as this group of geological studies is not covered by the EU directives. There is no published common metadata profile as an official standard. Therefore, it is up to the GSOs to decide whether and how the models will be described with metadata. The metadata profile developed by the GeoERA project is used for this purpose.
At this stage of the inventory, it was only checked whether the 3D geomodels had metadata (Figure 4-20a), and if so, whether it was available online (Figure 4-20b). All metadata available online is

published in the GSO metadata catalogues. Unfortunately, the collected metadata URLs do not fully comply with EGDI metadata rules. They need to be checked and corrected by the national metadata coordinators.

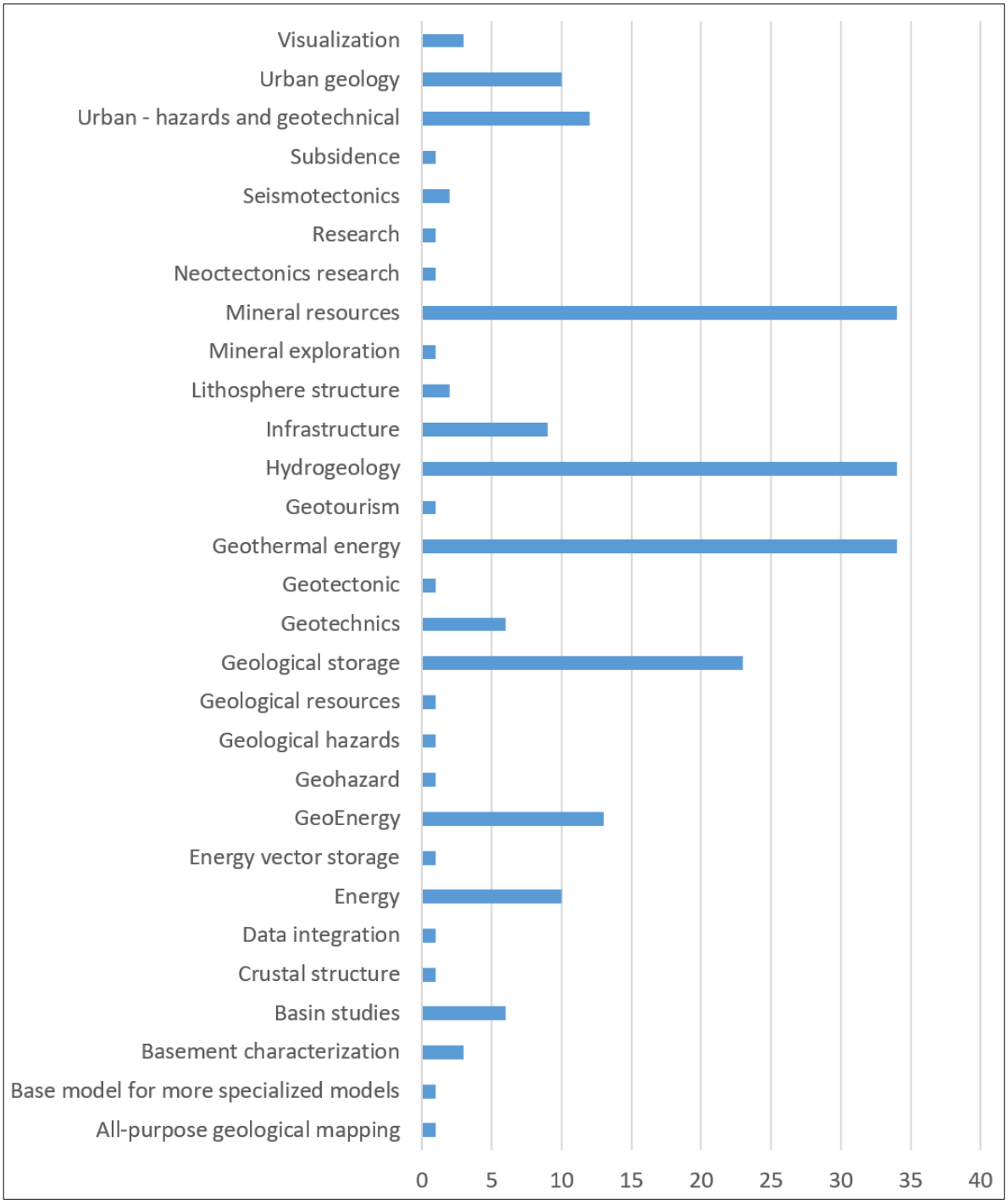

Figure 4-18: The purpose of 3D models

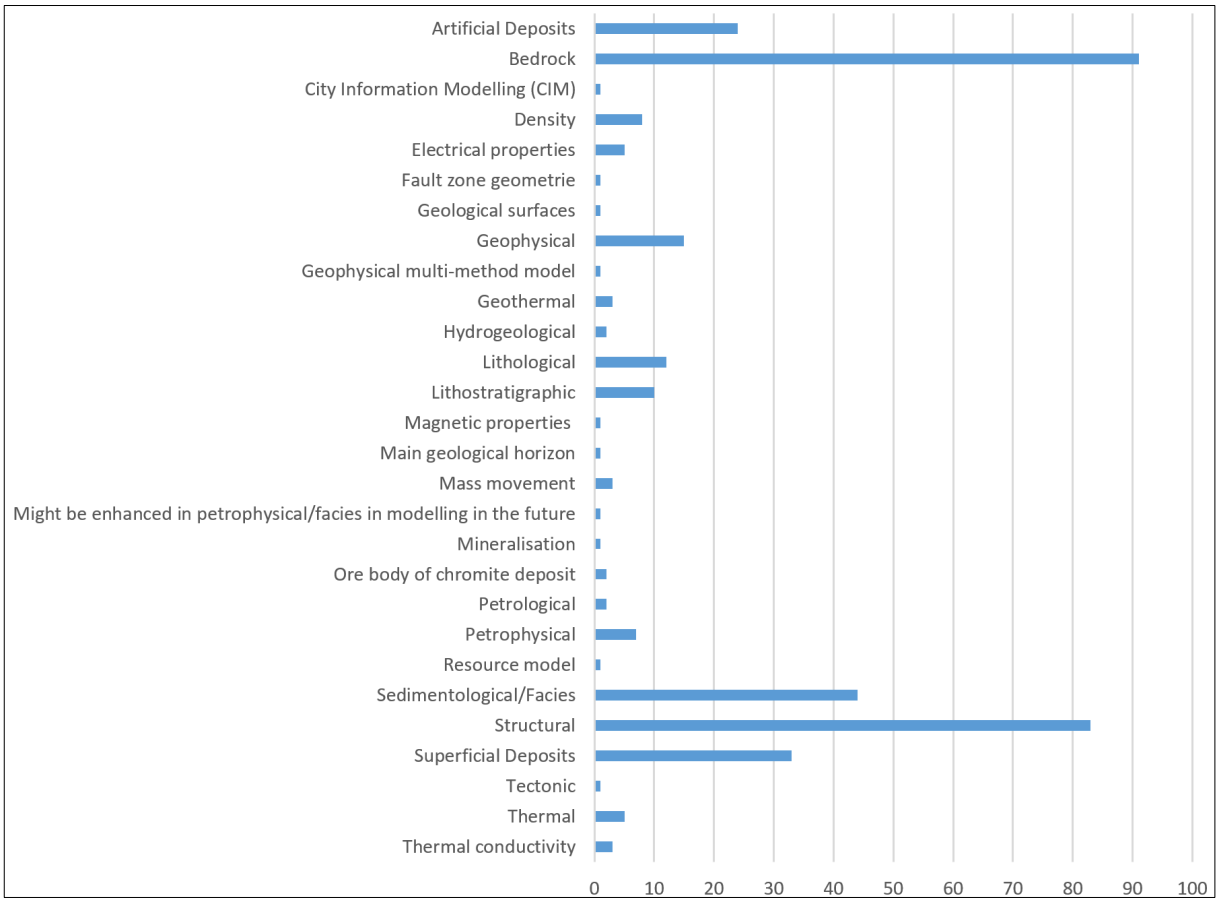

Figure 4-19: Thematic Types of 3D Geomodels

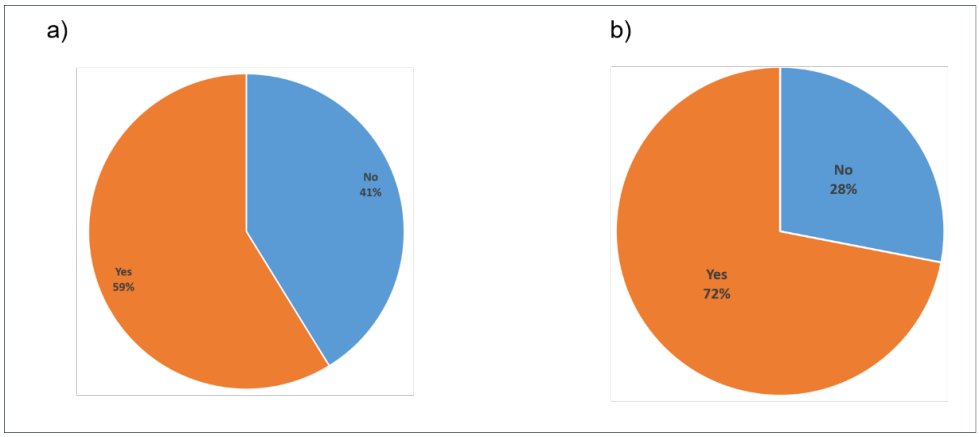

Figure 4-20: Metadata Existence (a) and Online Accessibility (b) of Collected 3D Geomodels

The list of file formats is long and includes many options that mentioned and commented on by respondents (Figure 4-21). The undisputed winner is the TIN format, in which almost 40% of all 3D geomodels are stored. Less common, but also common file formats include DXF, DTM, STR and voxel. The wide range of formats encourages further analysis in this area in the second phase of the inventory exercise. This is a difficult issue in terms of sharing models and presenting them in a 3D viewer.

The most popular software tools are SKUA-GOCAD, MOVE and GSI3D. It was expected that Surpac, GDM-Layer, GemPY, Loop3D, Visual Karsys and PZero would be among the applications used to develop 3D geomodels. None of the geological surveys use these solutions. This means that either the inventory did not include all existing geomodels or these solutions are only used for specific, narrow applications. This needs to be verified. (Figure 4-22).

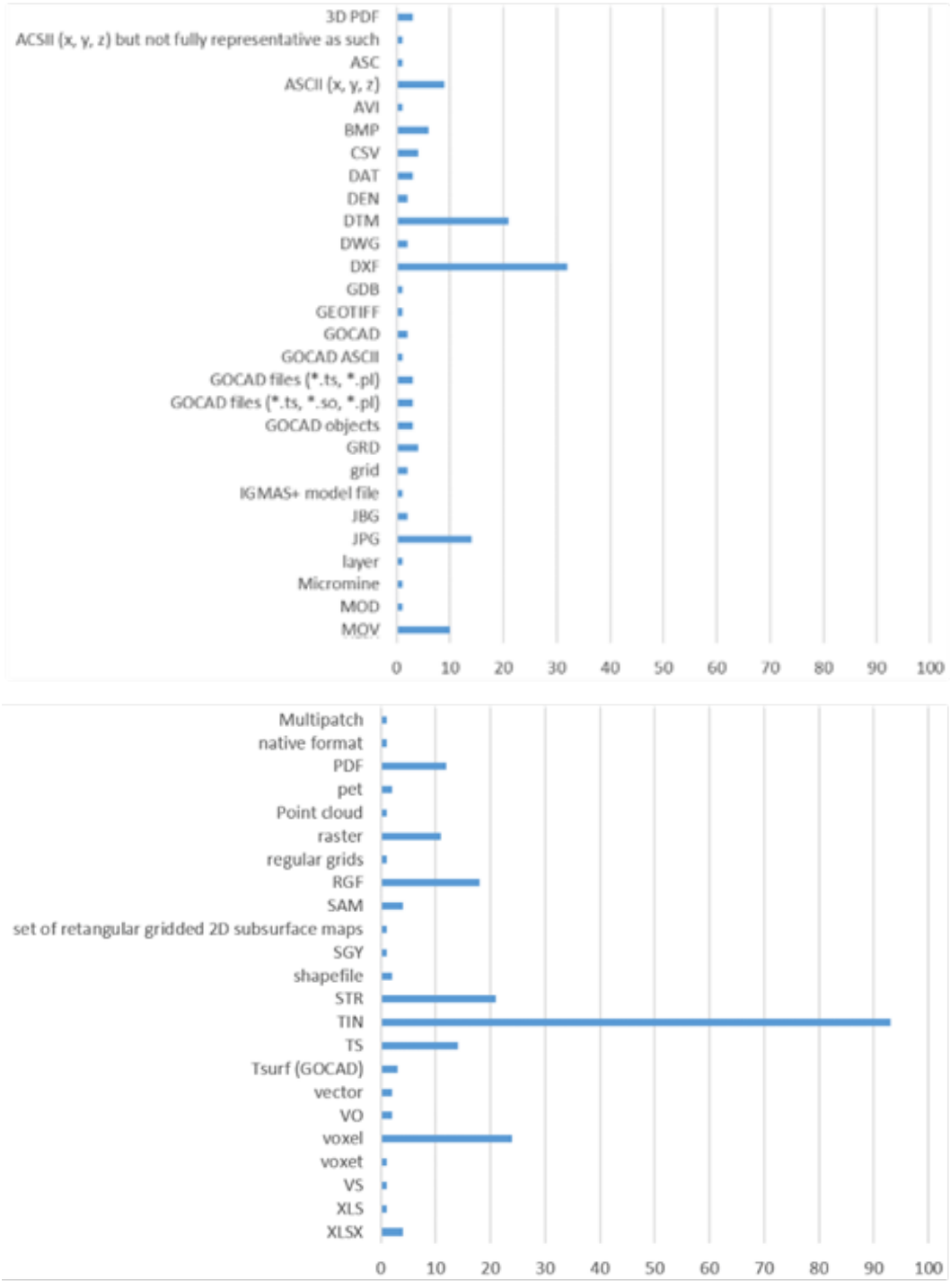

Figure 4-21: Format File of 3D Geomodels

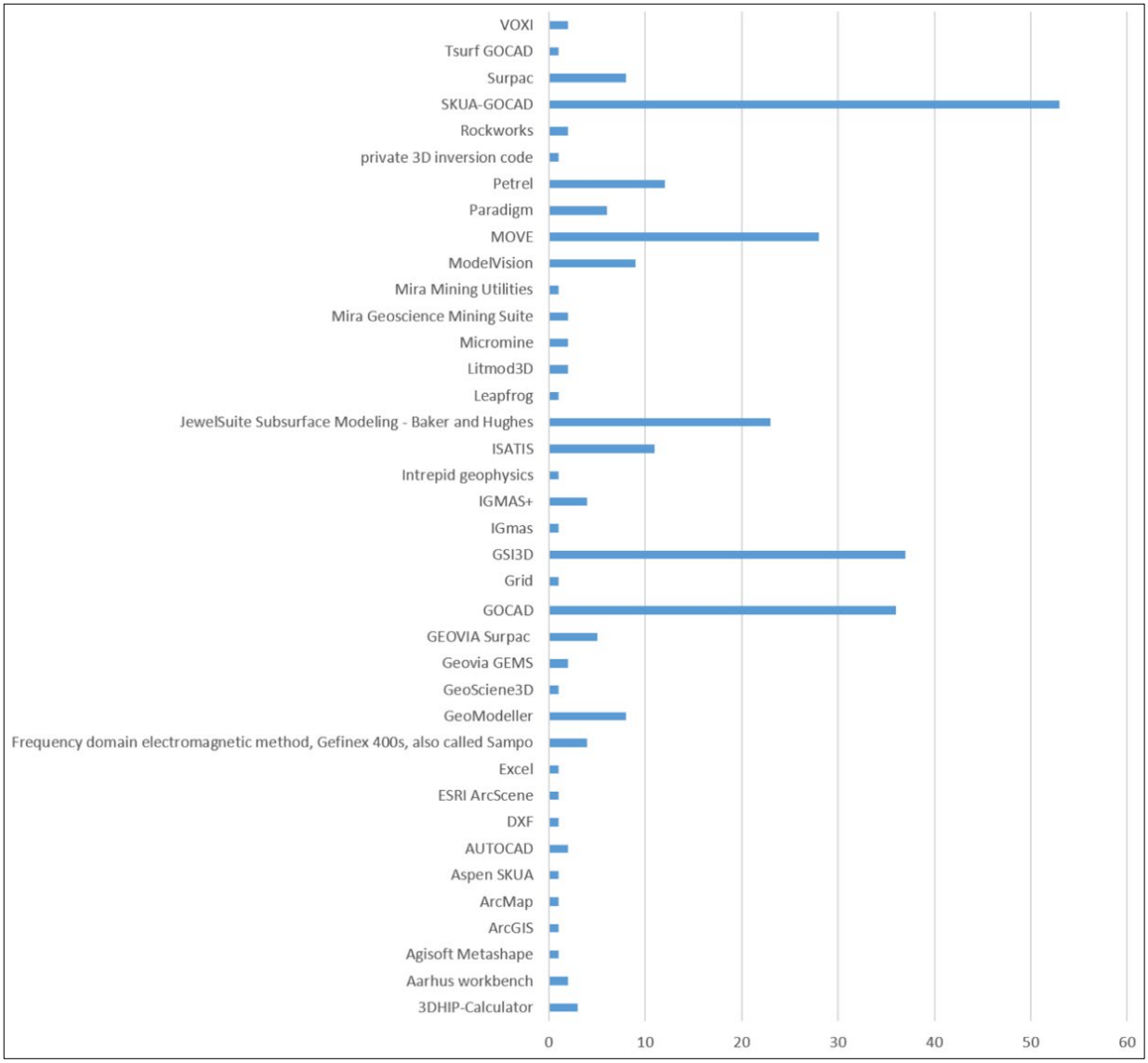

Figure 4-22: Software Used for Data Analysis, Transformation and Preparing 3D Geomodels

Most 3D geomodels are not accessible online (Figure 4-23). The reason for this situation should be discussed with the contacts in GSOs. It is uncertain whether this is a technical, formal or other issue. Another question in the inventory questionnaire asked whether the organisation was interested in publishing its 3D geomodels on the EGDI portal (Figure 4-24). Of all the 3D geomodels identified in the first stage of the Phase 2, only one has already been published on the EGDI portal. Almost 50% of the models (90 models) could potentially be published on the EGDI portal, but the remaining 50% will remain unavailable for various reasons. This aspect will be discussed.

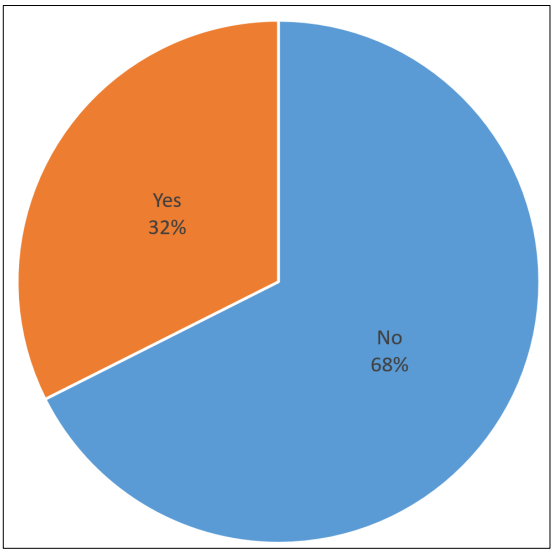

Figure 4-23: 3D Geomodel Online Access

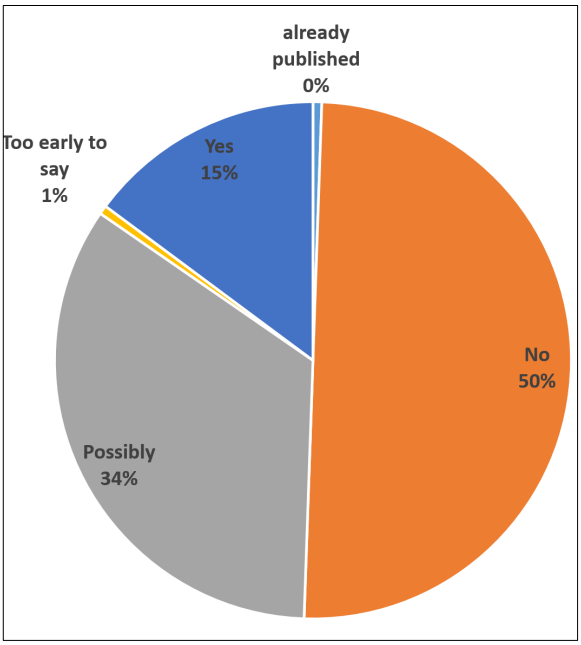

Figure 4-24: Interest of the Organisations in the Publication of their 3D Geomodels on the EGDI Portal

The first stage of the 3D geomodels inventory provided a lot of data, but also left many questions and uncertainties that need further clarification.

5. Inclusion of Inventory Data into EGDI Databases

All inventory data should primarily be integrated into the EGDI Metadata Catalogue. Additional domain-specific attributes, that need to be described in more detail for individual map products than the INSPIRE-compliant metadata profile allows, should be stored in a dedicated EGDI Inventory Database.

5.1. EGDI Metadata Catalogue

The EGDI Metadata Catalogue (https://metadata.europe-geology.eu/) is one of the central components of EGDI. It provides metadata describing data resources relevant to EGDI and tools for compilation of those metadata in a standardised format. In order to display a metadata record for which an on-line map service is available, the EGDI Metadata Catalogue is integrated into the EGDI portal (http://www.europe-geology.eu/metadata/).

5.1.1. EGDI Metadata Profile

Metadata attributes are defined in the EGDI Metadata Profile (Table 9), which itself is compliant with the requirements of the INSPIRE Directive, and EN ISO 19115:2003(E). For a metadata record to be validated, it must be completed in accordance with this profile for structured data. The document “EGDI Metadata Profile” defines the methodology for the unified metadata description of the results of projects within the European Geological Data Infrastructure (EGDI) with the extension to describe 3D geomodels. The document has been developed within EGDI initiative and extended within the previous GeoERA project and defines metadata elements, which are summarised in the table below. This table includes the minimum required metadata elements for the creation of metadata record.

The full version of the EGDI Metadata Profile document is currently available in the EGDI Metadata Catalogue (https://metadata.europe-geology.eu/layout/egdi/EGDI_metadata_profile-plus_3D_v-1-2.pdf).
In the EGDI Metadata Cataloguehttps://metadata.europe-geology.eu/ https://metadata.europe-geology.eu/ 92 records describing geological maps and 32 records of 3D geomodels were identified at the beginning of T6.1. These are mostly from previous projects such as OneGeology-Europe, GeoERA and others. They describe only small-scale maps and their metadata mostly lacks updates and a current metadata contact person. In many cases there is no appropriate keyword to help with searches. Existing records will need further processing.

Existing metadata catalogues containing sources of basic geological information should also be considered when collecting metadata. These metadata catalogues may be national or international.

Within the European Union, the INSPIRE Directive places a legal obligation on GSOs to provide metadata for certain thematic data, including geology. This means that most of GSEU project partner organisations have their own INSPIRE compliant metadata catalogues. The metadata then will be harvested into the EGDI Metadata Catalogue, or in the future GSOs catalogues could be included directly in the EGDI data search tools. Unfortunately, not all organisations comply with this.

5.1.2. Concept for Metadata Collection

The information collected through the inventory must be available in the form of metadata, which must be continuously updated and follow EGDI and FAIR guidelines and principles:

- All data must be supplemented by metadata (FAIR)
- Metadata provides valuable source of information even if data source is not available in EGDI (it can provide link to FAIR national data or services etc.)
- Only INSPIRE validated and EGDI compliant up-to-date metadata are accepted
- An English version of metadata is necessary

Metadata can be retrieved in different ways:

- Harvested from permanently updated national catalogues or catalogues of ongoing projects, as long as they meet the EGDI requirements - details in chapter 5.1.3
- Entered directly in EGDI Metadata Catalogue
- Stored and searched in national or project metadata catalogues (functionality to search directly in them is not yet completely available in EGDI)

Under current conditions, all inventory records must be populated with metadata that are stored in the EGDI Metadata Catalogue, either by harvesting from the national GSO catalogue or by manual insertion directly into the EGDI Metadata Catalogue. The preferred method is to store as much metadata as possible primarily in the GSO metadata catalogues and to harvest them regularly into the EGDI Metadata Catalogue to avoid duplication. However, this requires a lot of effort and cooperation, which was the reason why a Network of National Metadata Coordinators was established as part of the EGS SIEG activities.

Only fully validated and EGDI compliant up-to-date metadata is useful. Therefore, the main task of National Metadata Coordinators is quality control and continuous update of metadata. Regular campaigns and meetings are organised within the team, including metadata training and ongoing support.

5.1.3. Harvesting of Metadata Records from GSOs´ Metadata Catalogues to the EGDI Metadata Catalogue

The most recommended way of gathering metadata is harvesting from existing metadata catalogues, such as those maintained by GSOs, by other national organisations, or project metadata catalogues.

Harvesting from remote catalogues is set by the EGDI Metadata Catalogue administrator. The metadata contact has to provide information on the URL of the resource CSW service and the harvesting interval. It is possible to harvest only once and then update metadata manually, for example, if project is completed. Or a regular harvesting interval can be set (preferred option). Each harvesting session is documented by a harvesting report with a validation status that is sent to the relevant contact points. All harvested metadata record should be tagged with a keyword, “EGDI” is recommended, and that is set as filter for harvesting. This keyword should be inserted into the metadata record in the source metadata catalogue by metadata editor.

The advantage of harvesting metadata from GSO's catalogue is that metadata are maintained only once and close to the data source. The disadvantage is that it is not easy to convince GSOs to use specific tools such as the European Geoscience Registry, INSPIRE registry and other keywords thesauri and extended code lists.

Currently, out of 36 GSOs, 10 are already harvesting metadata into the EGDI Metadata Catalogue, 10 are in the process of preparing and testing harvesting, 8 have incompatibilities that cause problems, 4 do not have their own metadata catalogue and 3 are not responding.

5.2. EGDI Inventory Database

As described in previous chapters, some of the inventory data collected through the questionnaire can be directly integrated into the EGDI Metadata Catalogue, but this is not the case for all attributes. This is domain specific information that will help in targeted search requests but cannot be described in such detail in the INSPIRE compliant EGDI Metadata Profile. For this reason, it has been agreed in collaboration with WP7 to develop a second component of the inventory, a dedicated EGDI Inventory Database. This database will include a user interface and data management tools to be managed by the WP6 team. It is expected that this database will be populated and extended with additional attributes in Stage 2 by an application developed be WP7 team. The detailed requirements were submitted in June 2024 and the application is being developed and tested, and it is hoped that it will soon be demonstrated to partners and used in the planned next steps.

6. Conclusions

Task 6.1 of WP6 was dedicated during the first 26 months to the preparation and collection of basic information on geological maps and 3D geomodels available in partner organisations. These are a fundamental source of geological information and often serve as a necessary basis for all derived applied geoscience products and data. The main objective of this work was to improve the situation regarding the searchability and accessibility of existing data sources.

The first step was to analyse existing data, in particular those collected in the ”GMMEG map inventory activity” (see chapter 3.3). This provided a basic understanding of the existing geological maps. Based on this knowledge, the team defined the content and scope of the planned inventory. Appropriate procedures for storing the information collected in a way that would allow it to be used effectively were considered. At the same time, it was necessary to ensure that the information was managed and updated in a sustainable manner.

To facilitate the collection of basic information, interactive questionnaires were created in the MS Forms environment. These were used in the first two campaigns to collect basic information on existing geological maps and 3D geomodels. The information collected has been analysed and the statistics provide an overview of the situation. In this first phase, data were collected on 230 geological maps from 35 countries and 237 3D geomodels from 24 countries. The differences in the number of maps registered under the previous GMMEG activity and the current inventory was mainly due to the change in focus to only basic geological maps, not thematic or derived maps. A preference for the best possible product at a given scale was defined, with source and non-digital versions interlinked in the metadata and not listed as independent products. There were quite a few errors in the original survey data that required further communication with partners, explanations and manual corrections. With regard to 3D geomodels, issues such as the considerable number of formats and software tools in use, or the ability or willingness to share these models, either within EGDI or within the organisation's own environment, require further discussion and analysis as the work progresses.

After this experience, it was decided that for initial data collection, questionnaires were the best solution to quickly collect a basic set of information, but that a more sophisticated solution was needed for further processing. The team worked intensively with WP7 on the best way to store the collected information in EGDI. For the part of the information corresponding to the EGDI Metadata Profile, it was decided to store it in the EGDI Metadata Catalogue. Options for harvesting metadata from national metadata catalogues into the EGDI Metadata Catalogue were investigated to avoid duplication. For this purpose, the situation regarding metadata catalogues in the different partner organisations was studied. This method is not possible for organisations that either do not have a metadata catalogue compatible with the EGDI Metadata Catalogue or do not have one at all. The situation is specific to 3D geomodels, which are not covered by the obligations defined by INSPIRE, and therefore a large number of partners do not create metadata for them at all. The EGDI Metadata Profile includes EN ISO 19115:2003(E) - compliant attributes that enable the metadata description of 3D geomodels.

Task 6.1 also identified a number of metadata attributes that are essential for effective searching, but are not part of the EGDI Metadata Profile. This additional and subject-specific information will be stored in a dedicated EGDI Inventory Database. This database has been created and is now being tested by T6.1 team. A User Interface for maintaining, editing and adding new content is being developed in

cooperation with WP7. Once this tool is debugged and released, the T6.1 team will use it for data cleaning and subsequent data collection.

In the next period of work, the team will focus on data checks and corrections in collaboration with T6.1 partners. Follow-up campaigns will be organised to collect additional specific attributes describing the data sources already identified. At each step, emphasis is placed on establishing procedures and practices that will allow the results to be updated in the future. In collaboration with WP7, a major focus will be on the further development of the EGDI data search tool. This tool is essential to ensure effective searching, filtering and presentation of results to enable the use of the information collected. The possibility of searching directly in external metadata catalogues is being tested to eliminate the harvesting step can be in the future.

The activities described are ongoing and this first report describes the baseline situation, the process and methods for collecting and processing the information and the next steps planned for its effective use. The results of the activities in the following period should result in as complete an inventory of geological maps and 3D geomodels as possible, which will be an integral part of the EGDI. It is also important to develop an organisational framework in cooperation with GMMEG and GSEU Networking group (WP9 of GSEU) to ensure that these data are updated in the future. This will ensure long term access to much needed information on the data resources existing in a single GSOs. Results will be summarised in Deliverable D6.2 “Inventory of geological maps, map datasets, models, and services in the EGDI Metadata Catalogue v2” scheduled for M58.

There are many partners involved in this task, and, given the limited budget, their capacity has to be used very efficiently. However, the data collected during the campaigns are often incomplete and contain errors. Therefore, a time-consuming part of the work is dedicated to the bilateral communication in order to identify problems and find their solutions. Communication with the National Metadata Coordinators to set harvesting procedures is demanding. However, once this system is set up and running, it will ensure the long-term sustainability and continuous updating of the system. Very close cooperation with WP7 and EGDI Operational Group is essential in all stages of the work.

7. Annex I – Consortium Partners

	Partner Name	Acronym	Country
1	EuroGeoSurveys	EGS	Belgium
2	Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek	TNO	Netherlands
3	Sherbimi Gjeologjik Shqiptar	AGS	Albania
4	Vlaamse Gewest	VLO	Belgium
5	Bureau de Recherches Géologiques et Minières	BRGM	France
6	Ministry for Finance and Employment	MFE	Malta
7	Hrvatski Geološki Institut	HGI-CGS	Croatia
8	Institut Royal des Sciences Naturelles de Belgique	RBINS-GSB	Belgium
9	Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy	PGI-NRI	Poland
10	Institut Cartogràfic i Geològic de Catalunya	ICGC	Spain
11	Česká Geologická Služba	CGS	Czechia
12	Department of Environment, Climate and Communications - Geological Survey Ireland	GSI	Ireland
13	Agencia Estatal Consejo Superior de Investigaciones Cientificas	CSIC-IGME	Spain
14	Bundesanstalt für Geowissenschaften und Rohstoffe	BGR	Germany
15	Geološki zavod Slovenije	GeoZS	Slovenia
16	Federalni Zavod za Geologiju Sarajevo	FZZG	Bosnia and Herzegovina
17	Istituto Superiore per la Protezione e la Ricerca Ambientale	ISPRA	Italy
18	Regione Umbria	-	Italy
19	State Research and Development Enterprise State Information Geological Fund of Ukraine	GIU	Ukraine
20	Institute of Geological Sciences National Academy of Sciences of Ukraine	IGS	Ukraine
21	M.P. Semenenko Institute of Geochemistry, Mineralogy and Ore Formation of NAS of Ukraine	IGMOF	Ukraine
22	Ukrainian Association of Geologists	UAG	Ukraine

23	Geologian Tutkimuskeskus	GTK	Finland
24	Geological Survey of Serbia	GZS	Serbia
25	Ministry of Agriculture, Rural Development and Environment of Cyprus	GSD	Cyprus
26	Norges Geologiske Undersøkelse	NGU	Norway
27	Latvijas Vides, ģeoloģijas un meteoroloģijas centrs SIA	LVGMC	Latvia
28	Sveriges Geologiska Undersökning	SGU	Sweden
29	Geological Survey of Denmark and Greenland	GEUS	Denmark
30	Institutul Geologic al României	IGR	Romania
31	Szabályozott Tevékenységek Felügyeleti Hatósága	SZTFH	Hungary
32	Bundesamt für Landestopografie	SWISSTOPO	Switzerland
33	Elliniki Archi Geologikon kai Metalleftikon Erevnon	HSGME	Greece
34	Laboratório Nacional de Energia e Geología I.P.	LNEG	Portugal
35	Lietuvos Geologijos Tarnyba prie Aplinkos Ministerijos	LGT	Lithuania
36	GeoSphere Austria	GSA	Austria
37	Service Géologique de Luxembourg	SGL	Luxembourg
38	Eesti Geoloogiateenistus	EGT	Estonia
39	Štátny Geologický ústav Dionýza Štúra	SGUDS	Slovakia
40	Íslenskar Orkurannsóknir	ISOR	Iceland
41	Instituto Português do Mar e da Atmosfera	IPMA	Portugal
42	Jarðfeingi	Jardfeingi	Faroe Islands
43	Regierungspräsidium Freiburg	LGRB	Germany
44	Geologischer Dienst Nordrhein-Westfalen	GD NRW	Germany
45	Landesamt für Geologie und Bergwesen Sachsen-Anhalt	LfU	Germany
46	Vlaamse Milieumaatschappij	VMM	Belgium
47	Norwegian Offshore Directorate	SODIR	Norway
48	United Kingdom Research and Innovation - British Geological Survey	UKRI-BGS	UK

8. Annex II – EGDI Metadata Profile: Summary of Metadata Elements

EGDI profile nr.	INSPIRE profile nr.	MD element title	Mandatory minimum	Obligation/condition according to described data source		
			All metadata sources	"2D" dataset	3D model	Service, application
1	1.1	Resource title	[1]	[1]	[1]	[1]
2	1.2	Resource abstract	[1]	[1]	[1]	[1]
3	1.3	Resource type	[1]	[1]	[1]	[1]
4	1.4	Resource locator		[0..*]	[0..*]	[0..*]
5	1.5	Unique resource identifier		[1..*]	[1..*]	[1..*]
6.1	1.6	Coupled resource		not applicable	not applicable	[0..*]
6.2		Coupling type		not applicable	not applicable	[1]
7	1.7	Resource language		[1..*]	[1..*]	not applicable
8	2.1	Topic category		[1..*]	[1..*]	not applicable
9	2.2	Service type		not applicable	not applicable	[1]
10.1	3.1	Keyword		[1..*]	[1..*]	[1..*]
10.2	3.2	Originating controlled vocabulary		[1..*]	[1..*]	[1..*]
11.1	4.1	Geographic location		[1..*]	[1..*]	[1..*]
11.2		Geographic identifier		[0..*]	[0..*]	[0..*]
12		Presentation form		[0..*]	[1..*]	not applicable
13		Edition		[0..*]	[0..*]	not applicable
14.1	5	Reference date		[1..*]	[1..*]	[1..*]
14.2	5.1	Resource temporal extent		[0..*]	[0..*]	[0..*]
15	6.1	Lineage		[1]	[1]	not applicable
16	6.2	Spatial resolution - Scale/Distance		[0..*]	[0..*]	not applicable
17.1	7.1	Conformity – Specification		[1..*]	[1..*]	[1..*]
17.2	7.2	Conformity – Degree		[1]	[1]	[1]
18.1	8.1	Conditions applying to access and use		[1..*]	[1..*]	[1..*]
18.2	8.2	Limitations on public access		[1..*]	[1..*]	[1..*]

19	9.1	Responsible party	[1]	[1..*]	[1..*]	[1..*]
20	12	Data quality scope		[1]	[1]	not applicable
21	IOD-1*	Coordinate reference system		[1..*]	[1..*]	[0..*]
22		Vertical reference systém		[1]	[1]	[0..*]
23.1		Vertical extent – max. model depth		not applicable	[1]	not applicable
23.2		Vertical extent – min. model depth		not applicable	[1]	not applicable
23.3		Vertical extent reference system		not applicable	[1]	not applicable
24	IOD-3*	Distribution format		[1..*]	[1..*]	not applicable
25	IOD-6*	Spatial representation type		[1..*]	[1..*]	not applicable
26		Maintenance and update frequency		[0..1]	[0..1]	not applicable
27		Purpose		[0..1]	[0..1]	not applicable
28.1	10.1	Metadata point of contact	[1]	[1..*]	[1..*]	[1..*]
28.2	10.2	Metadata date		[1]	[1]	[1]
28.3	10.3	Metadata language		[1..*]	[1..*]	[1..*]
29	2.2.1	File identifier		[1]	[1]	[1]
30		Parent identifier		[0..1]	[0..1]	[0..1]
31		Sources		[0..*]	[0..*]	[0..*]

Explanations:
*Metadata elements marked with the “IOD” prefix are metadata elements for interoperability as defined in INSPIRE data specifications

[1] metadata element has only one occurrence in the resulting record
[1..*] metadata element has at least one occurrence in the resulting record
[0..1] the presence of the metadata element in the resulting record is conditional, but the metadata element can only appear once
[0..*] the presence of the metadata element in the result file is conditional, but the metadata element may appear once or more
https://metadata.europe-geology.eu/layout/egdi/EGDI_metadata_profile-plus_3D_v-1-2.pdf

9. Annex III – List of Attributes

Table 1: List of Attributes Associated with the General Identification Information Section

Group	ATTRIBUTE_NAME	ATTRIBUTE DESCRIPTION / COMMENTS	EGDI Metadata Profile item	Metadata ISO 19115 (MD)
General Identification Information	**country**	Country name (ISO 3166) /Search for the country name in the link: https://www.iso.org/obp/ui/#search	19 Responsible party – country (role: custodian)	identificationInfo / MD_DataIdentification / pointOfContact / CI_ResponsibleParty / contactInfo / CI_Contact / address / CI_Address /country
	ISOcountryCode	Country code (ISO 3166 Alpha-2 code) / Searching by country name, find the Alpha-2 country code in https://www.iso.org/obp/ui/#search	Not available - could be implemented	ISO 3166 CountryCode
	ownership	Owner of the geological map / Geological Survey, Organisation that owns this resource	19 Responsible party – organisation (role: owner)	identificationInfo / MD_DataIdentification / pointOfContact / CI_ResponsibleParty /organisationName
	GSOname	Custodian of map data: fill this as URL to Registry https://data.geoscience.earth/ncl/organization / On this website it is possible to search for GSOs by their full name or acronym. If the GSO is missing in the registry, do not use URL, just put the name of GSO. It will be very useful information about missing values	19 Responsible party – organisation (Role: custodian)	identificationInfo / MD_DataIdentification / pointOfContact / CI_ResponsibleParty /organisationName
	GSOacronym	Acronym by which the organisation that custodian the map data is known	Not available - could be implemented	
	custodianName	Name of person responsible for resource Personal name of custodian contact person of geological map	19 Responsible party – Person (Role: custodian)	identificationInfo / MD_DataIdentification / pointOfContact / CI_ResponsibleParty /individualName
	electronicMailAddress	E-mail addres of custodian contact person of geological map	19 Responsible party – Email (role: custodian)	identificationInfo / MD_DataIdentification / pointOfContact / CI_ResponsibleParty / contactInfo / CI_Contact / address / CI_Address /electronicMailAddress
	scaleDenominator	Scale denominator is the second part of a scale	17 Spatial resolution-Scale	identificationInfo / MD_DataIdentification / spatialResolution / MD_Resolution / equivalentScale / MD_RepresentativeFraction / denominator
	mapPublishingType	Describes the types of formats in which the map is published: vector, image, printed map, manuscript, other	12 Presentation form	identificationInfo / MD_DataIdentification / citation / CI_Citation / presentationForm
	longName	Descriptive name of the dataset to be catalogued	1 Resource title	identificationInfo / MD_DataIdentification / citation / CI_Citation /title
	longNameEN	Descriptive English name of the dataset to be catalogued	1 Resource title (EN)	identificationInfo / MD_DataIdentification / citation / CI_Citation /title
	dataType	Type of data choosen from the list: data set /map/other data type	3 Resource type	identificationInfo / MD_DataIdentification / resourceFormat / MD_Format /
	yearPublication	The date on which the map data was created The year of creation should be filled in	14.1 Reference date (publication)	identificationInfo / MD_DataIdentification / citation / CI_Citation / date / CI_Date
	yearActualisation	The date on which the map data was updated The year of actualisation should be filled in	14.1 Reference date (revision)	identificationInfo / MD_DataIdentification / citation / CI_Citation / date / CI_Date

Table 2: List of Attributes Associated with the Metadata Information Section

Group	Attribute_Name	Attribute Description / Comments	EGDI Metadata Profile item	Metadata ISO 19115 (MD)
Metadata Information	**metadataExistence**	Indicates whether map metadata exists in any catalogue Expected values: yes, no	Not available as item	
	fileIdentifier	UUID file identifier of metadata (in national meteadata catalogue) / If 'yes' in the above parameter, file identifier of the metadata file	29 File identifier	fileIdentifier
	URLmetadataGSO	The URL address of the metadata in GSO metadata catalogue	4 Resource locator - URL	distributionInfo / MD_Distribution / transferOptions / MD_DigitalTransferOptions / onLine / CI_OnlineResource / linkage
	URLmetadataEGDI	The URL address of the metadata in EDGI metadata catalogue (MicKA) link to basic metadata view, for example https://egdi.geology.cz/record/basic/ESPIGMEMAGNA502016052420373-1	4 Resource locator - URL	distributionInfo / MD_Distribution / transferOptions / MD_DigitalTransferOptions / onLine / CI_OnlineResource / linkage
	URLmetadataOther	The URL address of the metadata in other catalogues that are different from the GSO Metadata Catalogue or the EGDI Metadata Catalogue, for example the INSPIRE Metadata Catalogue.	4 Resource locator - URL	distributionInfo / MD_Distribution / transferOptions / MD_DigitalTransferOptions / onLine / CI_OnlineResource / linkage
	URLmetadataImage	The URL of the metadata for the image of the geological map	4 Resource locator - URL	distributionInfo / MD_Distribution / transferOptions / MD_DigitalTransferOptions / onLine / CI_OnlineResource / linkage
	metadataContact	The name of the person who is the contact person for the metadata. This value is not mandatory in the metadata profile, but it is required for the GSEU project	28.1 Metadata point of contact - Person*	contact / CI_ResponsibleParty /individualName
	metadataElectronicMailAddress	E-mail address of the contact person This attribute is mandatory	28.1 Metadata point of contact - Email	contact / CI_ResponsibleParty / contactInfo / CI_Contact / address / CI_Address / electronicMailAddress

Table 3: List of Attributes Associated with the Manuscript Data Information Section

Group	ATTRIBUTE_NAME	ATTRIBUTE DESCRIPTION / COMMENTS	EGDI Metadata Profile item	Metadata ISO 19115 (MD)
Manuscript Data Information	**manuscriptAccess**	Accessibility of manuscript of map / Manuscript means a source data of geological map, "hand drawn map". Information about accessibility of manuscript. Excepted values: yes, no, ongoing	Not available as item	dataQualityInfo / DQ_DataQuality / lineage / LI_Lineage / source / LI_Source / sourceCitation / CI_Citation
	URLmanuscriptAcces	Link URL to access to manuscript data If the manuscript is accessible online a URL is mandatory	31 Source - Source Citation - href	dataQualityInfo / DQ_DataQuality / lineage / LI_Lineage / source / LI_Source / sourceCitation / CI_Citation / href

Table 4: List of attributes associated with the Data Access and Source section

Group	ATTRIBUTE_NAME	ATTRIBUTE DESCRIPTION / COMMENTS	EGDI Metadata Profile item	Metadata ISO 19115 (MD)
Data Access and Source	**printedMapAccess**	Accessibility of printed version of map / Firstly choose the one of the listed values (yes|no|partly|ongoing|not planed). If the answer is positive (yes|partly|ongoing) please add information about format	31 Source - Source Citation	dataQualityInfo / DQ_DataQuality / lineage / LI_Lineage / source / LI_Source / sourceCitation / CI_Citation
	referencesPrintedMap	Citation and ISSN/ISBN (if available) e.g. Marks L., Grabowski J., Stępień U. (eds.), 2022 – Geological Map of Poland 1:500 000. A – Surface Geology. Polish Geological Institute – NRI, Warsaw. ISBN 978-83-67567-27-5	31 Source - Source Citation	dataQualityInfo / DQ_DataQuality / lineage / LI_Lineage / source / LI_Source / sourceCitation / CI_Citation
	scannedMapAccess	Accessibility of raster (image) map / Raster map it refers to map that is a scan of printed map. The raster map that are created from vector data should be described in "vector section". Choose the one of the listed values: yes|no|partly|ongoing|not planed	31 Source - Source Citation	dataQualityInfo / DQ_DataQuality / lineage / LI_Lineage / source / LI_Source / sourceCitation / CI_Citation
	scannedMapFormat	Short comment to raster version of map example: file format (jpg, tiff, png)	24 Distribution format	distributionInfo / MD_Distribution / distributionFormat / MD_Format
	georeferencedScannedMapAccess	Accessibility of georeferenced raster map Choose the one of the listed values: yes|no|partly|ongoing|not planed	31 Source - Source Citation	dataQualityInfo / DQ_DataQuality / lineage / LI_Lineage / source / LI_Source / sourceCitation / CI_Citation
	vectorMapAccess	Accessibility of vector (GIS) map / Choose the one of the listed values: yes|no|partly|ongoing|not planed	31 Source - Source Citation	dataQualityInfo / DQ_DataQuality / lineage / LI_Lineage / source / LI_Source / sourceCitation / CI_Citation

Table 5: List of Attributes Associated with the General Identification Information Section

Group	Attribute_Name	Attribute_Descriptions / Comments	EGDI Metadata Profile item	Metadata ISO 19115 (MD)
General Identification Information	**country**	Country name (ISO 3166) /Search for the country name in the link: https://www.iso.org/obp/ui/#search	19 Responsible party – country (role: custodian)	identificationInfo / MD_DataIdentification / pointOfContact / CI_ResponsibleParty / contactInfo / CI_Contact / address / CI_Address /country
	ISOcountryCode	Country code (ISO 3166 Alpha-2 code) / Searching by country name, find the Alpha-2 country code in	Not available - could be implemented	ISO 3166 CountryCode
	ownership	The name of the owner of the 3D geomodel that is described Geological Survey, Organisation that owns this resource	19 Responsible party – organisation (role: owner)	identificationInfo / MD_DataIdentification / pointOfContact / CI_ResponsibleParty /organisationName
	GSOname	Custodian of 3D Model: fill this as URL to Registry https://data.geoscience.earth/ncl/organization On this website it is possible to search for GSOs by their full name or acronym. If the GSO is missing in the registry, do not use URL, just put the name of GSO	19 Responsible party – organisation (Role: custodian)	identificationInfo / MD_DataIdentification / pointOfContact / CI_ResponsibleParty /organisationName
	custodianName	Name of person responsible for resource Personal name of custodian contact person of data	19 Responsible party – Person (Role: custodian)	identificationInfo / MD_DataIdentification / pointOfContact / CI_ResponsibleParty /individualName
	electronicMailAddress	email addres of custodian contact person of 3D Model	19 Responsible party – Email (role: custodian)	identificationInfo / MD_DataIdentification / pointOfContact / CI_ResponsibleParty / contactInfo / CI_Contact / address / CI_Address /electronicMailAddress
	title	Official name of the described 3D geomodel. Descriptive name of the dataset (3D Model) to be catalogued. The name by which the resource is known	1 Resource title	identificationInfo / MD_DataIdentification / citation / CI_Citation /title
	titleEN	Official name of described the 3D geomodel in English Descriptive English name of the dataset to be catalogued	1 Resource title (EN)	identificationInfo / MD_DataIdentification / citation / CI_Citation /title
	abstractEN	short description, abstract of 3D model (in English only) Short descriptive summary of the content of the	2 Resource abstract	identificationInfo / MD_DataIdentification / abstract
	yearCreation	Write a year of creaction of the 3D geomodel The year of creation or publication should be filled, optionally also other types of reference dates can be added (publication date/date of the last revision)	14.1 Reference date (creation)	identificationInfo / MD_DataIdentification / citation / CI_Citation / date / CI_Date
	yearPublication	Please, write a year of making of the 3D geomodel public. The year of creation or publication should be filled, optionally also other types of reference dates can be added (publication date/date of the last revision)	14.1 Reference date (publication)	identificationInfo / MD_DataIdentification / citation / CI_Citation / date / CI_Date
	spacialExtent	Bounding box describing the spatial extent of data using coordinates in WGS84 (EPSG: 4326) in decimal degrees separated with comma. Order: West, East, South, North EGDI proposes Defined by the western and eastern longitude and southern and northern latitude in decimal degrees (2 digits precision) in the WGS-84 coordinate system EPSG:4326 (WGS-84) not 4258 (ETRS-89)!!!!	11.1 Geographic location	identificationInfo / MD_DataIdentification / extent / EX_Extent / geographicElement / EX_GeographicBoundingBox
	originalDataCoordinationSystem	describe the original data coordination system. If possible with an EPSG code	21 Coordinate Reference System	referenceSystemInfo / MD_ReferenceSystem / referenceSystemIdentifier / RS_Identifier
	verticalExtent	Describe the reference system use to describe vertical extent. As EPSG code or in a descriptive way Description of the vertical reference system used in the dataset (EPSG code and URL) Mandatory por 3D models in EGDI profile	22 Vertical reference system	referenceSystemInfo / MD_ReferenceSystem / referenceSystemIdentifier / RS_Identifier

	min3DGeomodelVertical Extent	MINimum vertical extent (value of the bottom of the model, the deepest point of the model) in given reference system	23 Vertical extent - min	identificationInfo / MD_DataIdentification / extent / EX_Extent / verticalElement / EX_VerticalExtent /minimumValue
	max3DGeomodelVertical Extent	MAXimum vertical extent (value of the top of the model, the highest point of the model) in given reference system	23 Vertical extent - max	identificationInfo / MD_DataIdentification / extent / EX_Extent / verticalElement / EX_VerticalExtent /maximumValue
	scope	Scope of the described 3D geomodel Expected values: local, national, Europe,cross-border	10.1 Keyword - spatial scope	identificationInfo / MD_DataIdentification / descriptiveKeywords / MD_Keywords /
	dataType	Type of data choosen from the list = 3D model	12 Presentation form - "Model digital"	identificationInfo / MD_DataIdentification / citation / CI_Citation / presentationForm

Table 6: List of Attributes Associated with the Metadata Information Section

Group	Attribute_Name	Attribute_Descriptions / Comments	EGDI Metadata Profile item	Metadata ISO 19115 (MD)
Metadata Information	**metadataExistence**	Does the 3D Model have metadata ? Expected values: yes, no	Not available as item	
	metadataOnlineAccess	Does the 3D Model metadata accessible on line ? Expected values: yes, no	Not available as item	
	URLmetadataGSO	The URL address of the metadata in a metadata catalogue Example http://catalogo.igme.es/geonetwork/srv/spa/catalog.search#/search?any=ESPIGMEMAGNA502016052420373-	4 Resource locator - URL	distributionInfo / MD_Distribution / transferOptions / MD_DigitalTransferOptions / onLine / CI_OnlineResource / linkage
	otherMetadataForm	Only if metadata does not exist in a catalogue, but metadata does exist, please provide a format of the existing metadata	Not available as item	
	URLotherMetadata	The URL address of the metadata in the specified format	4 Resource locator - URL	distributionInfo / MD_Distribution / transferOptions / MD_DigitalTransferOptions / onLine / CI_OnlineResource / linkage
	fileIdentifier	UUID file identifier of metadata (in a meteadata catalogue)	29 File identifier	fileIdentifier
	URLmetadataEGDI	The URL address of the metadata in EDGI. If the record doe not exist, please inform leaving the message: not available For example: link to basic metadata view https://egdi.geology.cz/record/basic/ESPIGMEMAGNA502016052420373-1	4 Resource locator - URL	distributionInfo / MD_Distribution / transferOptions / MD_DigitalTransferOptions / onLine / CI_OnlineResource / linkage
	metadataLanguage	Language of the metadata (ISO 3166 Alpha-2 code https://www.iso.org/obp/ui/#search) separated by single vertical bar "pipe" if more than one languag. Example: pl|en	28.3 Metadata language	language /LanguageCode
	nameMetadataContact	The name of the person who is the contact person for the metadata.	28.1 Metadata point of contact - Person	contact / CI_ResponsibleParty /individualName
	metadataOrganisationName	Name of the organisation that is responding for metadata	28.1 Metadata point of contact - OrganisationName	contact / CI_ResponsibleParty /individualName /organisationName
	URLregistryOrganizsationName	Name of organization who is the response for metadata: fill this as URL to Registry https://data.geoscience.earth/ncl/organization On this website it is possible to search for GSOs by their	28.1 Metadata point of contact - OrganisationName	contact / CI_ResponsibleParty /individualName /organisationName
	metadataElectronicMailAddress	E-mail address of the contact person This attribute is mandatory	28.1 Metadata point of contact - Email	/ MD_Metadata / contact / CI_ResponsibleParty / contactInfo / CI_Contact / address / CI_Address / electronicMailAddress

Table 7: List of Attributes Associated with the General Data Information Section

Group	Attribute_Name	Attribute_Descriptions / Comments	EGDI Metadata Profile item	Metadata ISO 19115 (MD)
General Data Information	**dataLanguage**	Language of data (ISO 3166 Alpha-2 code https://www.iso.org/obp/ui/#search) separated by single vertical bar "pipe" if more than one language	7. Resource language	identificationInfo / MD_DataIdentification / language / LanguageCode
	thematic	Information about thematic choose the value from list	Not available as item	
	application	Information about application choose the value from list	Not available as item	

Table 8: List of Attributes Associated with the Data Access, Source and Software Section

Group	Attribute_Name	Attribute_Descriptions / Comments	EGDI Metadata Profile item	Metadata ISO 19115 (MD)
Data Access, Source and SW	**3DmodelAccess**	Is the 3D model accessible or published? Choose the one of the listed values: yes|no|partly|ongoing|not planed	Not available as item	
	URL3DmodelAccess	URL of the 3D geomodel, if available. Recommendation: URL of a descriptive web page and/or link to an online visualisation of the model	4 Resource locator - URL	distributionInfo / MD_Distribution / transferOptions / MD_DigitalTransferOptions / onLine / CI_OnlineResource / linkage
	URI3Dmodel	Value uniquely identifying an object within a namespace	4 Resource locator - URL	distributionInfo / MD_Distribution / transferOptions / MD_DigitalTransferOptions / onLine / CI_OnlineResource / linkage
	softwareName	Name of software (commercial, open source or free tools) used to create the 3D geomodel described. Please select at least one option from the list or add the	Not available as item	
	softwareVersion	Version of software used to create the described 3D geomodel	Not available as item	
	formatFile	Format of the 3D geomodel described File format	24 Distribution format	distributionInfo / MD_Distribution / distributionFormat / MD_Format / name
	DOI	DOI or Persistent identifier of 3D geomodel data	4 Resource locator - URL	distributionInfo / MD_Distribution / transferOptions / MD_DigitalTransferOptions / onLine / CI_OnlineResource / linkage
	3DmodelAccessEGDI	Is the 3D model accessible in EGDI platform? Choose the one of the listed values: yes|no|partly|ongoing|not planed	Not available as item	
	interestPublicationEGDI	Describe the organisation's interest in publishing the model on the EGDI platform	Not available as item	
	EGDIpublicationContactPersonEmail	If you are interested in publishing 3D model on EGDI platform, please, leave a contact person email	Not available as item	

10. Annex IV - Metadata Inventory: Phase 1 Stage 1

The main aim of this first phase of this inventory is to identify existing geological maps and map datasets *by collecting a first set of basic metadata.*

In order to better characterise the identified maps and map datasets, additional information on the same maps and datasets will be collected in the second phase of the inventory.

The metadata of webservices and 3D geomodels will be collected in a separate campaign.

For the purposes of Task 6.1, we understand „geological" to mean surface geology (lithology, lithostratigraphy, (litho)tectonic, age and structural information), including bedrock, Quaternary and structural maps or datasets. Maps and datasets that are limited to information on subcrop, geomorphological features and anthropogenic deposits are excluded.

For pragmatic reasons, we decided to focus on the most recently published maps and datasets in particular scales. This means that legacy maps are excluded from this effort.

„Published" refers to printed paper maps, vector data in webservices (WMS, WFS, and similar), and formal data publications with DOIs.

Unpublished map information (e.g. hand-drawn manuscript maps, unpublished vector data, unpublished image formats) is only collected if this information does not exist in any published format.

GENERAL I ENTIFYING INFORMATION

1. longN me *

*Descriptive name of **map/map dataset** or **series of map/map datasets** to be catalogued in national language*
The name/ title by which the resource is known.
***IMPORTANT:** In the case of series of map/map dataset we only collect the information about the series, not about each individual map sheet. Any additional information and comments can be written in the last section of the questionnaire.*

2. longNameEN *

*The English translation of descriptive name of the **map/map dataset** or **series of map/map datasets.***
The English name/ title translation used by the owner and custodian

3. countryNameCustodian *

Country name: Select more than 1 country in the case it is an international map/map dataset

- [ ] Montenegro
- [ ] SIovenia
- [ ] Denmark

...All Countries were listed here.

4. dataType *

*Is this a **single map/map dataset** or a **series of maps/map datasets**?*

- ◯ **single map** *or* **single map dataset**
- ◯ **series of maps** *or* **series of map datasets**

5. yearPublicationSingleMap *

*Period of publishing **series of map** or **series of map dataset***

6. yearPublicationMapSeries *

*Date of publishing **single map** or **single map dataset***

7. scaleDenominantor *

*Scale denominator of **single map** or **single map dataset***

- ◯ 1 000 000
- ◯ 500 000
- ◯ 250 000
- ◯ 200 000
- ◯ 100 000
- ◯ 50 000
- ◯ 25 000
- ◯ Inne

8. mapPublishingType *

*What is the type of **map/map dataset** or **series of map/map dataset**? Selection of more than one type is possible*

- [ ] Vector dataset (published dataset)
- [ ] Image format (published as an image data, raster data)
- [ ] Printed map (published paper version)
- [ ] "Manuscript" (all types of unpublished source data of basic geological maps and datasets like vector datatsets, image formats, paper manuscripts)
- [ ] Inne

9. ownership *

*Owner of **map/map dataset** or **series of map/map dataset.** Geological Survey, Ministry or other Organisation that owns this resource*

10. GSOacronym *

Data custodian name. Name of Geological Survey or data holding organisation

- [ ] AGS
- [ ] BGR
- [ ] BRGM
- [ ] CGS
- [ ] EGS

...All partners were listed here.

11. individualName

Custodian contact person name

12. electronicMailAddress *

Email address of the custodian contact person

VECTOR DATA INFORMATION

*Main information about published vector **map dataset** or **series of map datasets.***

13. vectorMapAccess *

Does the map data exist as a vector dataset?

- ◯ Yes
- ◯ No

14. metadataExistenceGSO *

Does the data have metadata in the GSO's metadata catalogue?

- ◯ Yes
- ◯ No

15. URLmetadataGSO *

URL address of metadata record in the GSO's metadata catalogue

16. metadataContactGSO *

Name of GSO's metadata contact person

17. metadataElectronicMailAddressGSO *

Email address of GSO's metadata contact person

18. metadataExistenceOther *

Does metadata record exist in any other (non-national) metadata catalogue?

- ◯ Yes
- ◯ No

19. nameNonNationalCatalogue *

The name of the non-national metadata catalogue?

- ☐ EGDI (MICKA)
- ☐ OneGeology
- ☐ Inne

20. URLmetadataOther *

URL address of metadata record in non-national metadata catalogue

21. metadataContactOther *

Name of metadata contact person of non-national metadata catalogue. Name of the GSO contact person responsible for metadata in the non-national metadata catalogue.

22. metadataElectronicMailAddressOther *

Email address of metadata contact person of non-national metadata catalogue. Email address of the GSO contact person responsible for metadata in the non-national metadata catalogue.

PRINTED AND OTHER NON-VECTOR MAP DATA INFORMATION

*General information about **published printed map or map series** and **other published non-vector map data***

23. printedMapAccess *

Does map data exist as a printed version?

- ◯ yes
- ◯ ongoing
- ◯ partly
- ◯ no, but it is published as an image format
- ◯ no
- ◯ not planned

24. referencesPrintedMap

References of printed map
***IMPORTANT:** only in case of single map*
Please add a citation and ISSN/ISBN (if available) e.g. Marks L., Grabowski J., Stępień U. (eds.), 2022 – Geological Map of Poland 1:500 000. A – Surface Geology. Polish Geological Institute – NRI, Warsaw. ISBN 978-83-67567-27-5

25. scannedMapAccess *

Does the map data exist as an image format?

- ◯ yes, as an image generated from vector dataset
- ◯ yes, as a scan of paper map
- ◯ ongoing
- ◯ partly
- ◯ no

26. georeferencedScannedMapAccess *

Is the image map data georeferenced?

- ◯ yes
- ◯ no

27. scannedMapFormat *

What is the format of map data? You can choose more than one option

- [ ] TIFF
- [ ] JPG
- [ ] PNG
- [ ] PDF
- [ ] paper
- [ ] Inne

28. metadataExistenceImage *

Does the image (non-vector) map data have metadata in the GSO's metadata catalogue?

- ◯ Yes
- ◯ No

29. URLmetadataImage *

URL address of metadata of the image (non-vector) map data in GSO's metadata catalogue

30. metadataContactImage *

Name of respective GSO's metadata contact person

31. metadataElectronicMailAddressImage *

Email address of respective GSO's metadata contact point

MANUSCRIPT DATA INFORMATION

General information about unpublished source data of geological map data (e.g. hand-drawn manuscript maps, unpublished vector data, unpublished image formats). Information about accessibility of manuscript.

32. manuscriptAccess *

Is a manuscript available?

- ◯ yes
- ◯ no

33. manuscriptAccessOnline *

Is a manuscript availables manuscript accessible online?

- ◯ Yes
- ◯ No

34. URLmanuscriptAcces

Link to manuscript, online access to manuscript

FINAL REMARKS

35. anyOtherComments

Any other comments and questions?

36. questionaireContactEmail *

Please include your email address for contact in case of doubt.

11. Annex V - Metadata Inventory: Phase 2 Stage 1

*The main aim of the second phase of this inventory is to identify existing **3D geological models** by collecting a first set of basic metadata.*

In order to better characterise the identified 3D models, additional information on the same models will be collected in the second stage of the inventory.

*The term "geological models" refers to models that describe the subsurface based on units defined primarily by lithology, lithostratigraphy, age or lithotectonic affiliation. At this stage, we do not have specific requirements as to which models should be described in this questionnaire. **Priority is obviously given to geological models covering large areas,** but local or applied models can also provide very interesting insights.*

Please, choose from the list name of your country.

- ☐ Austria
- ☐ Belgium
- ☐ Bosnia and Hercegovina

...All Countries were listed here.

2. GSOName *

Please, choose your Organisation from the list.

- ◯ AGS
- ◯ BGR
- ◯ BGS

...All Partners were listed here.

3. 3DGeomodelExistence *

Do the 3D geomodels exist in your Organisation?

- ◯ Yes
- ◯ No

GENERAL INFORMATION

We need a general information about existing 3D geomodels in your GSO. This will help us to create an inventory of existing 3D geological models in Europe and to better understand the aims and objectives of the projects.

4. title *

Official name of the described 3D geomodel

5. titleEN *

Official name of described the 3D geomodel in English

6. ownerName

The name of the owner of the 3D geomodel that is described

7. custodianName *

Please, choose your Organisation from the list.

- ◯ AGS
- ◯ BGR
- ◯ BGS

...All Partners were listed here.

8. custodianContactPersonName *

Name of person responsible for resource

9. custodianContactPersonEmail *

Email address of custodian contact person

10. descriptionEN *

Short abstract/description of 3D model (in English only)

11. yearCreation *

*Please, write a **year** of creaction of the 3D geomodel*

12. yearPublication

*Please, write a **year** of making of the 3D geomodel public*

13. geographicExtent *

***IMPORTANT:** Spatial extent is described as a bounding box using coordinates in WGS84 (EPSG: 4326) in decimal degrees separated with comma. Order: West, East, South, North*
Example:
11.6200, 19.1900, 48.0100, 51.5600

14. originalDataCoordinationSystem *

Please describe the original data coordination system. If possible with an EPSG code

15. verticalExtentReferenceSystem *

Please, describe the reference system you use to describe vertical extent. As EPSG code or in a descriptive way

16. min3DGeomodelVerticalExtent *

Add a MINimum vertical extent (value of the bottom of the model, the deepest point of the model) in given reference system

17. max3DGeomodelVerticalExtent *

Add a MAXimum vertical extent (value of the top of the model, the highest point of the model) in given reference system

18. scope *

Scope of the described 3D geomodel

- [ ] local
- [ ] regional
- [ ] national
- [ ] European
- [ ] cross-border
- [ ] Inne

19. dataLanguage *

Please choose at least one language. If your language is missing, please add it.

- [ ] Czech
- [ ] Dutch
- [ ] English
- [ ] French
- [ ] German
- [ ] Italian
- [ ] Polish
- [ ] Portuguese
- [ ] Slovak
- [ ] Slovinian
- [ ] Spanish
- [ ] Inne

20. application *

What geoscience applications is described 3D geomodel used for?

- [ ] Mineral resources
- [ ] Hydrogeology
- [ ] Geotechnics
- [ ] Geothermal energy
- [ ] Urban geology
- [ ] GeoEnergy
- [ ] Geological storage
- [ ] Inne

21. thematic *

What type is described 3D geomodel of?

- [ ] Structural
- [ ] Sedimentological/Facies
- [ ] Petrophysical
- [ ] Inne

METADATA

This part of the questionnaire contains questions about existing metadata. Completing this part can help and shorten an inventory process.
https://www.europe-geology.eu/data-and-services/metadata/

22. metadataExistence *

Does the metadata exist?

- ◯ Yes
- ◯ No

23. metadataOnlineAccess *

Is the metadata accessible online?

- ◯ Yes
- ◯ No

24. metadataExistenceGSOMetadataCatalogue *

Is the metadata record exist in a GSO's or national metadata catalogue?

- ◯ Yes
- ◯ No

25. metadataURL *

URL of metadata in GSO's or national metadata catalogue

26. otherMetadataForm

Does the metadata file exist in any structured form?

- ◯ Yes
- ◯ No

27. otherMetadataLink

Link to metadata not published in metadata catalogue

28. EGDIMetadataURL *

URL of metadata in EGDI metadata catalogue. If the record doesn't exist please inform leaving the message: not available

29. GSOMetadataContactPersonName *

Please, add name of person who is responsible for metadata in your organization

30. GSOMetadataEmailAddress *

Please, add an email addres of metedeta contact person in your organization

31. metadataOrganizationName *

Please, add metadata organization name

DATA INFORMATION

32. formatFile *

Format of the described 3D geomodel

- [ ] voxel
- [ ] tin
- [ ] dxf
- [ ] Inne

33. softwareName *

Name of software (comercial, open source or free tools) used to create the described 3D geomodel. Please choose at least one or add name of software not listed below.

- [ ] Petrel
- [ ] SKUA-GOCAD
- [ ] Geo Modeller
- [ ] MOVE
- [ ] Leapfrog
- [ ] Isatis
- [ ] Surpac
- [ ] GDM-Multilayer
- [ ] GemPy
- [ ] Loop3D
- [ ] VisualKarsys
- [ ] PZero
- [ ] GOCAD
- [ ] GSI3D
- [ ] Inne

34. softwareVersion

Version of software used to create the described 3D geomodel

35. 3DGeomodelOnlineAccess *

Is the 3D model accessible online?

- ◯ Yes
- ◯ No

36. URL3DGeomodelAccess *

URL of 3D geomodel access

37. URI

Unique Resource Identifier of 3D geomodel data

38. DOI

DOI of 3D geomodel data

39. 3DGeomodelOnEGDI *

Is your organization interested in publishing the model via EGDI platform?

- ◯ Yes
- ◯ No
- ◯ Possibly
- ◯ Inne

40. EDGIPublicationContactPersonEmail *

If you are interested in publishing 3D model on EGDI platform, please, leave a contact person email

41. questionnaireContactPerson *

Contact email to person filling in the questionnaire

42. Q&C

Any questions or comments?