



Surface and subsurface geological data in Italy: state of the art of the harmonization process.

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Abstract

The Geological Survey of Italy - ISPRA serves as the authoritative entity responsible for the comprehensive collection and management of geological data at a national scale. Before the realization of the new 1:50k scale map series, the evolution of the nationwide surface geological mapping in Italy spans from 1877 to 1976, resulting in the production of 277 geological sheets 1:100k scale. This prolonged timeline mirrors the significant advancements in both geological knowledge and cartographic technologies, evident in the diverse terminology used to describe rock formations.

Conversely, information garnered from deep boreholes for oil or geothermal exploration in continental or marine environments falls under the purview of the National mining office for hydrocarbons and georesources (UNMIG-MASE). Following the expiration of industrial licenses, ISPRA has undertaken the task of collating, analysing, and digitizing this information, incorporating it into a dedicated database.

Our aim is to integrate surface (100k scale Geological map) and subsurface (deep boreholes) geological information using a standardized data model, aligning with European and international geological management systems such as OneGeology, EGDI, and EPOS.

The entire dataset from the 100k scale mapping underwent a process of semantic and partial geometric harmonization conforming with the INSPIRE and GeoSciML data models.

The INSPIRE Data Specification and the Implementing Rules are also applied through the support of UML data models developed by INSPIRE's thematic working groups. These models are available in the INSPIRE Geoportal and in the specific GIT-LAB repository.

With these tools, the Geological Survey of Italy started additional harmonization process by applying it to the dataset derived from deep boreholes. The result is an organized dataset that adheres to the GeoSciML data model.

The deep boreholes dataset includes stratigraphic, lithological, structural, and chronostratigraphic data extrapolated from about 1,100 deep wells logs, realized both onshore and offshore.

Given the complexity of the dataset, the simplest standard chosen for this purpose was GeoSciML - Lite, designed for simple map-based applications. This standard is a simplify model aligned with INSPIRE, by complying the interoperability requirements.

Deep well data are provided in Geography Markup Language (GML) format for INSPIRE validation purposes. Other OGC standard formats (e.g. gpkg) have been prepared to simplify the download and the reuse.

The result of our efforts is thematic mapping sharing using OGC standard, semantically harmonized with respect to lithostratigraphic units, chronostratigraphy, lithology, depositional

environment, texture, and layering.

The analysis of deep boreholes facilitates the correlation of stratigraphic and structural features, enabling correlation between geological horizons and the reconstruction of geologically significant surfaces.

The integration between geological map and boreholes datasets is particularly valuable for conducting stratigraphic and structural studies, assessing subsurface resources, and contributing to CO2 capture studies.

The next phases of our work plan involve geometric harmonization of geological map polygons and the integration of the deep boreholes database with newly acquired log registrations. These steps will further enhance the completeness and accuracy of our geological information integration efforts.

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Keyword

Italy, geological map, borehole, data harmonisation, INSPIRE