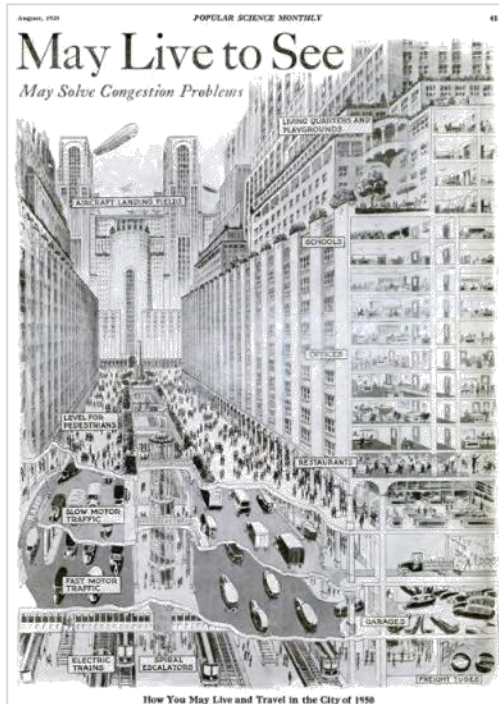


General-purpose 3D geological models in Italy: the new “dimension” of the Geological map of Italy at 1:50,000 scale

C. D'Ambrogi¹, P. Petricca¹, M.P. Congi¹, G. Castorina^{1,2}, E. Roccatello³, F. Clemente¹, L. Tomassetti¹

1. Servizio Geologico d'Italia – ISPRA
2. Monitoraggio e Tutela dell'Ambiente e Conservazione della Biodiversità - ISPRA
3. 3D GIS

Popular Science Monthly, 1925



looking at the range of current and future uses of the subsurface

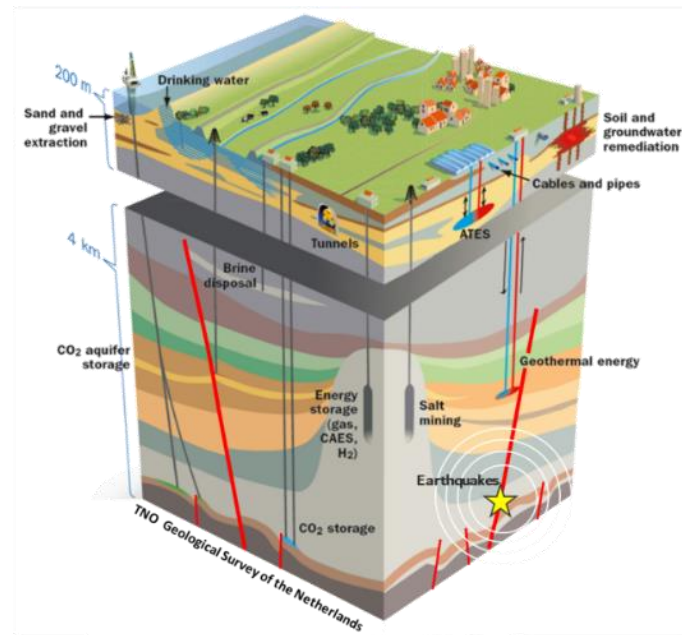
unchanged needs and emerging challenges

same demand for **up-to-date, high-quality, public** subsurface geoscientific knowledge, data and information

- integrate and reconcile data
- document geology in 3D
- reliable, open and interoperable data

**DIFFERENT
USERS**

Scientific knowledge
Decision makers support
Public awareness



Servizio Geologico d'Italia has long-established workflows for collection, management, integration and dissemination of geological data

1861

1st ed.
Geological Map 1M (1881)



2D

5th ed. Geological Map 1M (ISPRA, 2011)



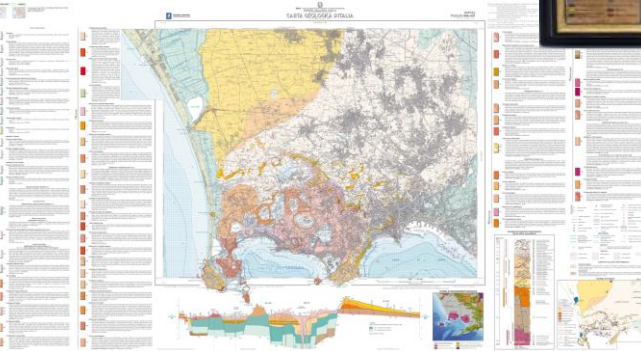
Geological Map of Italy 100k Sheet 273 Caltagirone (1885)



"Piano-rilievo" Mt. Etna (1877)



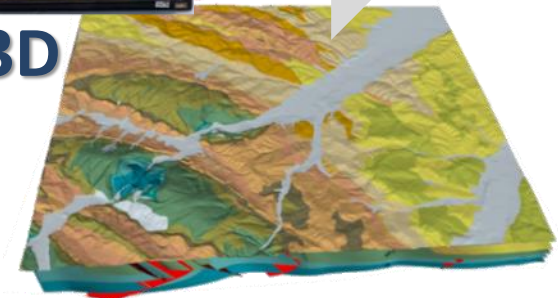
3D



Geological Map of Italy 50k Sheet 446-447 Napoli (2018)

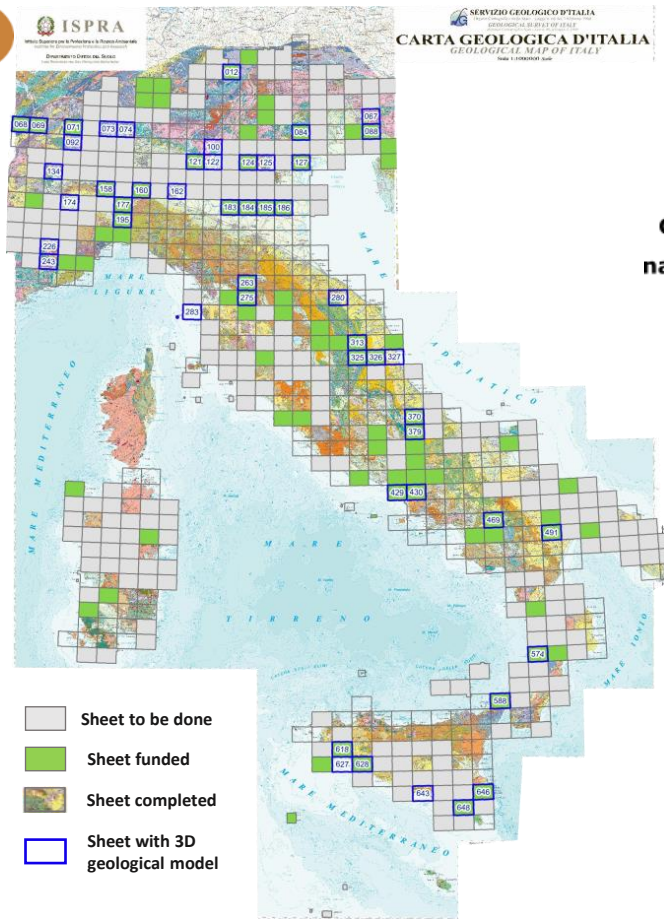
4D

future



Geological 3D model Sheet 280 Fossombrone (2004)

7TH EUROPEAN MEETING ON 3D GEOLOGICAL MODELLING
"New frontiers and challenges in geomodelling"
Warsaw 8-11 April 2025



PROGETTO CARG

National geological mapping programme 50k
and related DB 25k (from field survey 10k)

GEOLOGICAL SHEETS
national coverage **634**
completed **281**
funded **97**

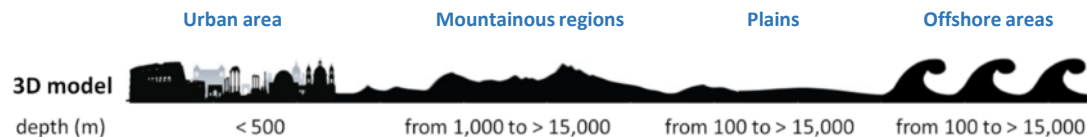
GEOLOGICAL SHEET with


submerged
areas


subsurface
sheet


geological
3D model

	submerged areas	subsurface sheet	geological 3D model
completed	67	25	7
funded	30	32	44



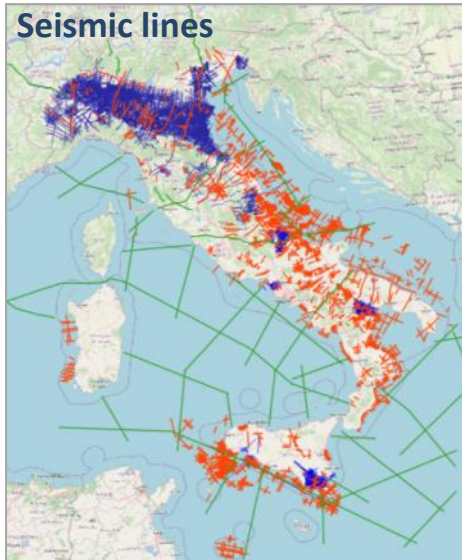
SUBSURFACE GEOLOGY IN THE CARG PROJECT

- Geological architecture
- Quaternary sediments
- Hydrostratigraphy
- Active and seismogenic faults
- Urban geology



Collaboration with private companies to access strategic subsurface data for the geological 3D models of the CARG Project

Seismic lines



● ENI confidentiality agreement

○ E&P wells public

E&P wells



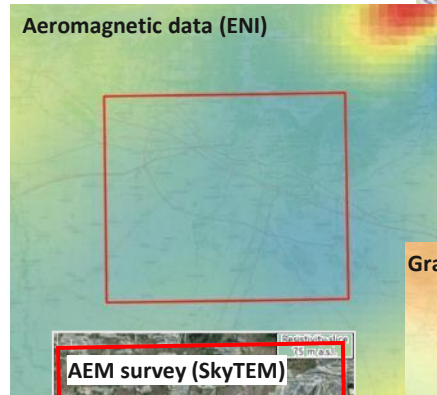
— ENI confidentiality agreement

— E&P seismic lines public

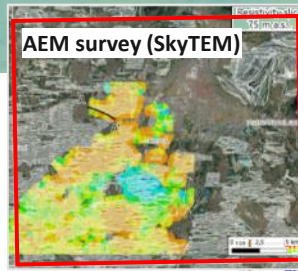
— Deep Crust Scientific Project (public)

Seismic lines, curve logs, T-D tables (ENI)

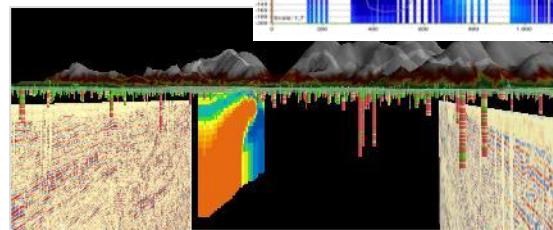
Aeromagnetic data (ENI)



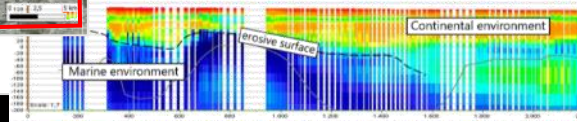
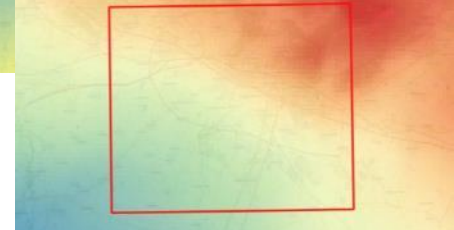
AEM survey (SkyTEM)



ATO Brescia - A2A



Gravimetric data - Bouguer anomalies (ENI)



Sheet 121
BRESCIA

FROM SURFACE TO HELL

Carta Geologica DOI: 10.15161/carg.it/211806

Info

Legge - Convenzione
L. 160/2019 - Convenzione tra ISPRA, Regione Emilia-Romagna e Università di Bologna

Coordinatori scientifici
A. Amorosi - Università di Bologna

Anno di pubblicazione online
2024

Anno di stampa
2024

Download

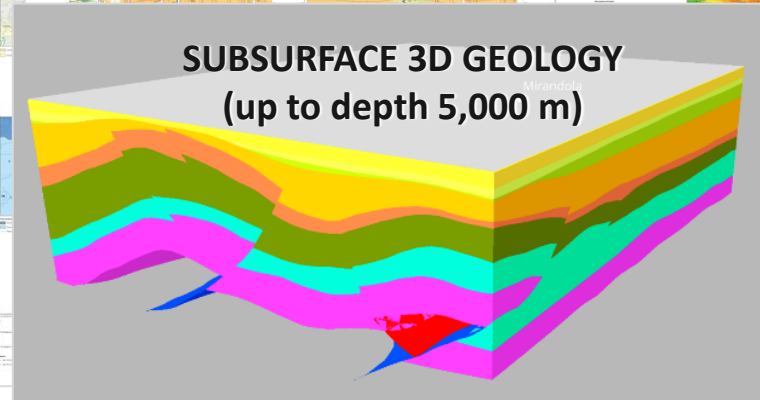
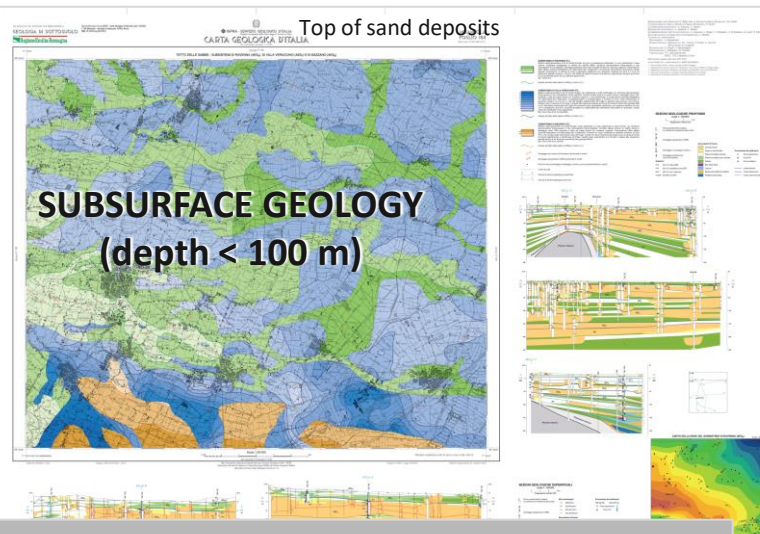
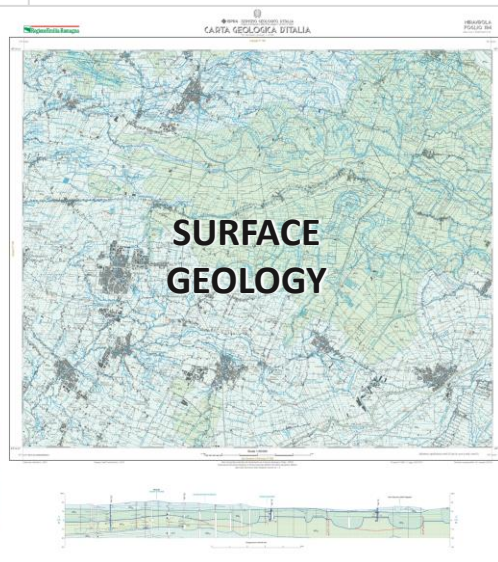
Note Illustrative

Banca Dati
In corso di pubblicazione

Geologia di Sottosuolo

Modello Geologico 3D
Visualizza

Sheet 184 MIRANDOLA
Area $\approx 570 \text{ km}^2$



<https://progetto-carg.isprambiente.it>

HIGH VALUE DATASETS

are data associated with important benefits for society, the environment and the economy. They are considered reliable, homogeneous, in type and content.

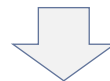


High-value datasets shall be

- available free of charge (CC BY 4.0 or other open or less restrictive licence)
- open, machine-readable and publicly documented format, recognized in the European Union or at international level
- provided via APIs and bulk download
- with INSPIRE metadata



to comply with the mandatory European rules for public sector organisations on data sharing and interoperability



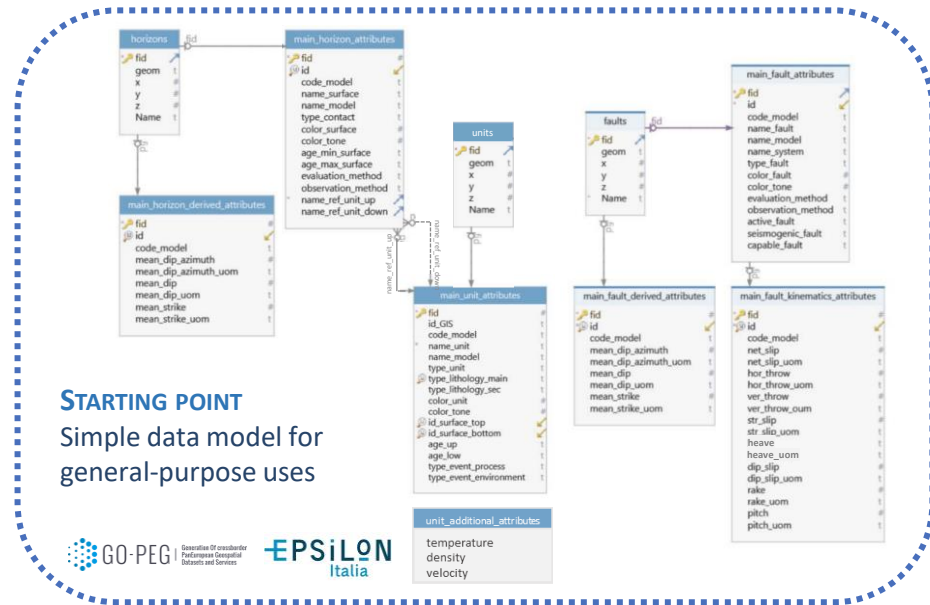
GEOLOGICAL 3D MODEL



- Adoption of an **INSPIRE Geology-based extended Data Model**



- Reuse and extension of **INSPIRE and GeoSciML vocabulary codelists**





OGC standard download services



Logged in as admin. Logout

Layer Preview

List of all layers configured in GeoServer and provides previews in various formats for each.

<< < 1 > >> Results 1 to 2 (out of 2 matches from 30 items)

Type	Title	Name	Common Formats	All Formats
M3D_PoBasin_faults	M3D:M3D_PoBasin_faults	OpenLayers GML KML	Select one	
M3D_PoBasin_horizons	M3D:M3D_PoBasin_horizons	OpenLayers GML KML	Select one	

<< < 1 > >> Results 1 to 2 (out of 2 matches from 30 items)

- Select one
- KML (network link)
 - KML (plain)
 - OpenLayers
 - OpenLayers 2
 - OpenLayers 3
 - PDF
 - PNG
 - PNG 8bit
 - SVG
 - TiF
 - TiF 8-bits
 - UTFGird
 - WFS
 - CSV
 - GML2
 - GML3.1
 - GML3.2
 - GeoJSON
 - GeoPackage
 - KML



mha_mua_down

fid 3

code_model PB3D

name_unit PoBas_Pal_Mio

name_model 3DMod_PoBasin

type_unit geologic unit

type_lithology_main MARL

type_lithology_sec ARENITE

id_surface_top NULL

id_surface_bottom NULL

age_up MESSINIANO

age_low EOCENE

type_event_process sedimentary process

type_event_environment marine setting

inspireId_localId PoBas_Pal_Mio

inspireId_namespace http://sgi.isprambiente.it/geologicunits

inspireId_versionId NULL

URI_type_unit http://inspire.ec.europa.eu/codelist/GeologicUnitTypeValue/geologicUnit

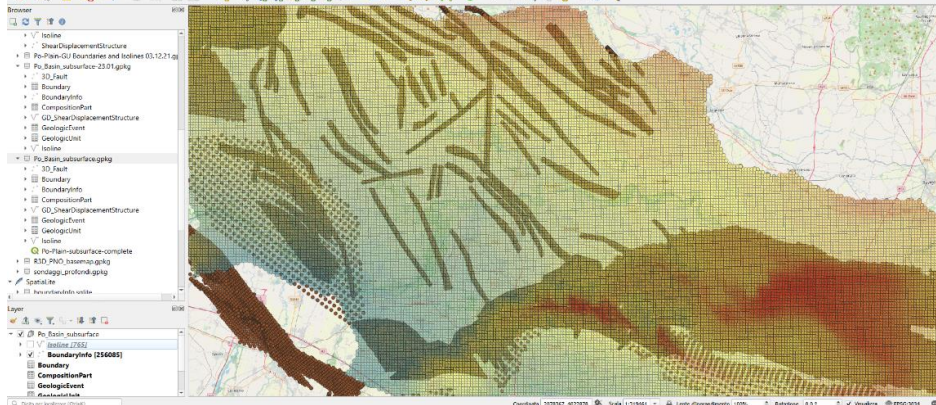
URI_type_lithology_main https://progetto-carg.isprambiente.it/glossario/voci.html?voce=Marne

URI_type_lithology_sec http://inspire.ec.europa.eu/codelist/LithologyValue/arenite

URI_type_event_process http://inspire.ec.europa.eu/codelist/EventProcessValue/sedimentaryProcess

URI_type_event_environment http://inspire.ec.europa.eu/codelist/EventEnvironmentValue/marineSetting

Progetto: Modifica Visualizza Layer: Impostazioni: Plugins: Virtuale: Baster: Database: Web: Mesh: Processing: Guida



Automated consistency check

The screenshot shows the GitHub repository page for 'BaterHub / check-GeoT3D-model'. The repository is public and has 1 branch and 0 tags. The main branch is selected. The repository description states: 'A set of routines for verifying the consistency, formatting, and content of file packages to ensure compliance with the requirements of 3D geological models for uploading and visualization on the GeoT3D web viewer of ISPRA - Servizio Geologico d'Italia - CARG project'. The repository contains several files, including 'cartella_files', 'LICENSE', 'README.md', 'chk_3D.ipynb', 'code_domain.csv', 'csv_validator.py', 'file_utils.py', 'json_validator.py', 'requirements.txt', and 'ts_validator.py'. The repository is licensed under GPL-3.0 license. The repository is also available as a Jupyter Notebook.

From 3D geological model production to publication

The screenshot shows the Jupyter Notebook interface for the 'chk_3D.ipynb' file. The notebook is titled 'chk_3D.ipynb' and is saved in GitHub. The notebook contains a section titled 'Validazione ID nei file CSV' which displays the results of a validation process. The results show that 3/6 files are valid, 3/6 files have errors, and 0/6 files are not found. The notebook also includes a section titled '4.7 esistenza codici tabelle domini' which shows the code for validating the domain codes in the CSV files.



Data Access and reuse through 3D viewer

<https://geo-it3d.isprambiente.it/>

3DMod_PoBasin

Geological 3D model of the Po Basin. The model includes the geometries of four boundary horizons (top or unconformity) of sedimentary lithologically homogeneous successions (represented by their volumes) Triassic - Pleistocene in age, and the geometries of 179 faults. Maximum depth of the model: 13,375 meters.

Code
PB3D

Name
3DMod_PoBasin

Author
C. D'Ambrogio et al.

License
CC-BY-4.0

DOI
<http://doi.org/10.15161/oar.it/76873>

Source
ISPRA - Servizio Geologico d'Italia

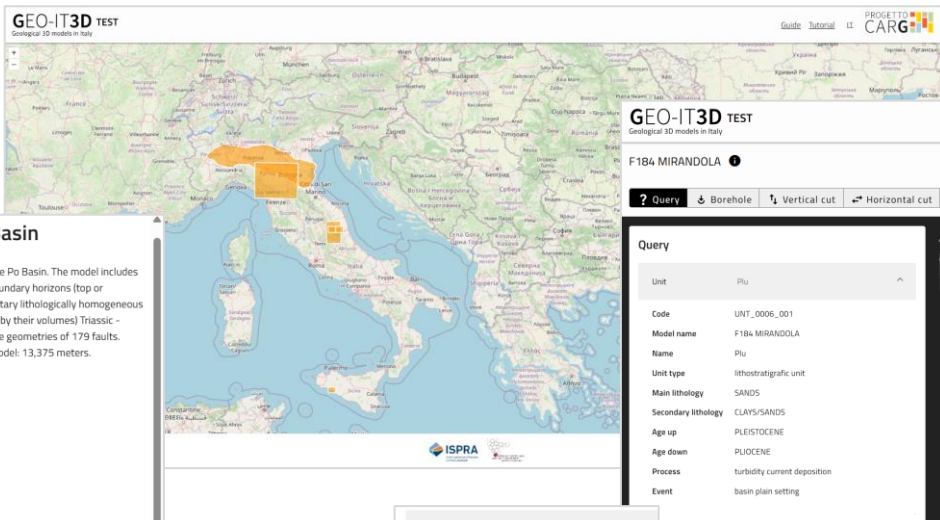
Project
GO-PEG (<https://www.go-peg.eu/>); GeoMol (<https://www.geomol.eu/>) and GeoERA HotLine (<https://geoera.eu/>)

Creation date
10/30/2018, 01:00 PM

Publication date
06/01/2023, 02:00 PM

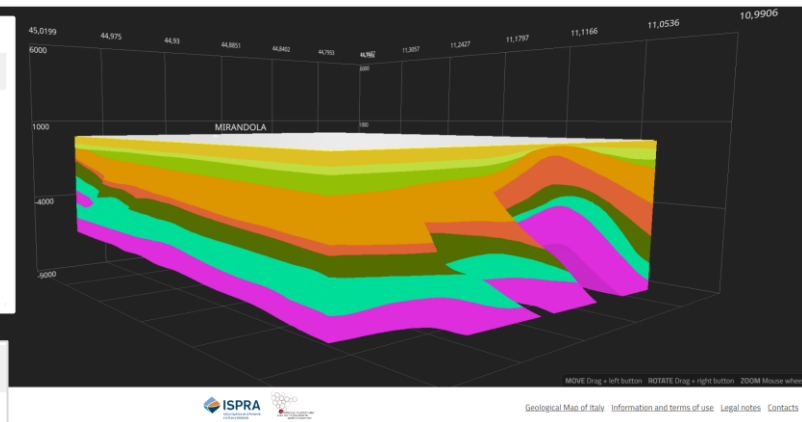
Metadata URL
[Open metadata URL](#)

[Access 3D geological model](#)

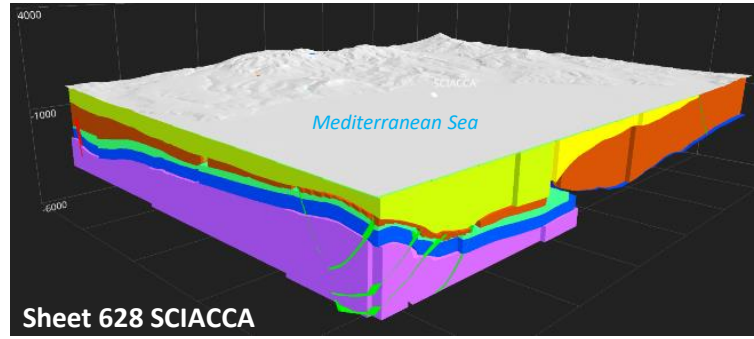
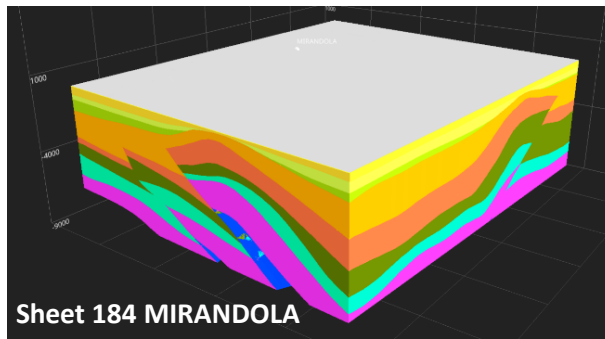
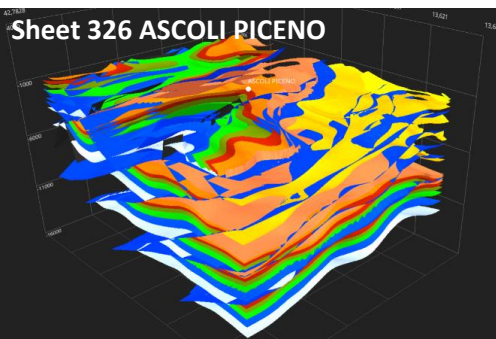


Fault		Poggio Rusco_2
Code	FLT_0002_001	
Model name	F184 MIRANDOLA	
Fault name	Poggio Rusco_2	
System name	Poggio Rusco	
Fault type	thrust fault	
Evaluation method	compilation	
Observation method	2D seismic survey	
Active fault	true	
Seismogenic fault	N/D	

Horizon		b_Plu
Code	SRF_0006_001	
Nome modello	F184 MIRANDOLA	
Surface name	b_Plu	
Contact type	unconformable contact	
Surface age (min)	PLIOCENE	
Surface age (max)	PLEISTOCENE	
Evaluation method	compilation	
Observation method	2D seismic survey	

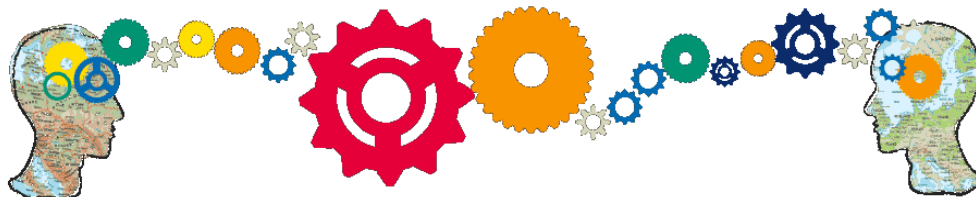


- Access, discover and reuse
- Work in progress: testing phase
- Available for hosting geological 3D models from other Italian institutions



This increased effort in the production of 3D general-purpose geological models aims to provide a solid foundation for applications such as urban geology, hydrostratigraphy, seismogenic faults, contaminated sites, and natural resources

**SERVIZIO
GEOLOGICO
D'ITALIA**



USERS

