A 3D Geological Model of the Romagna and Ferrara Folds (Eastern Po Plain) for advanced deep geothermal exploration

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Figure 1: Location of the study area (blue rectangle).

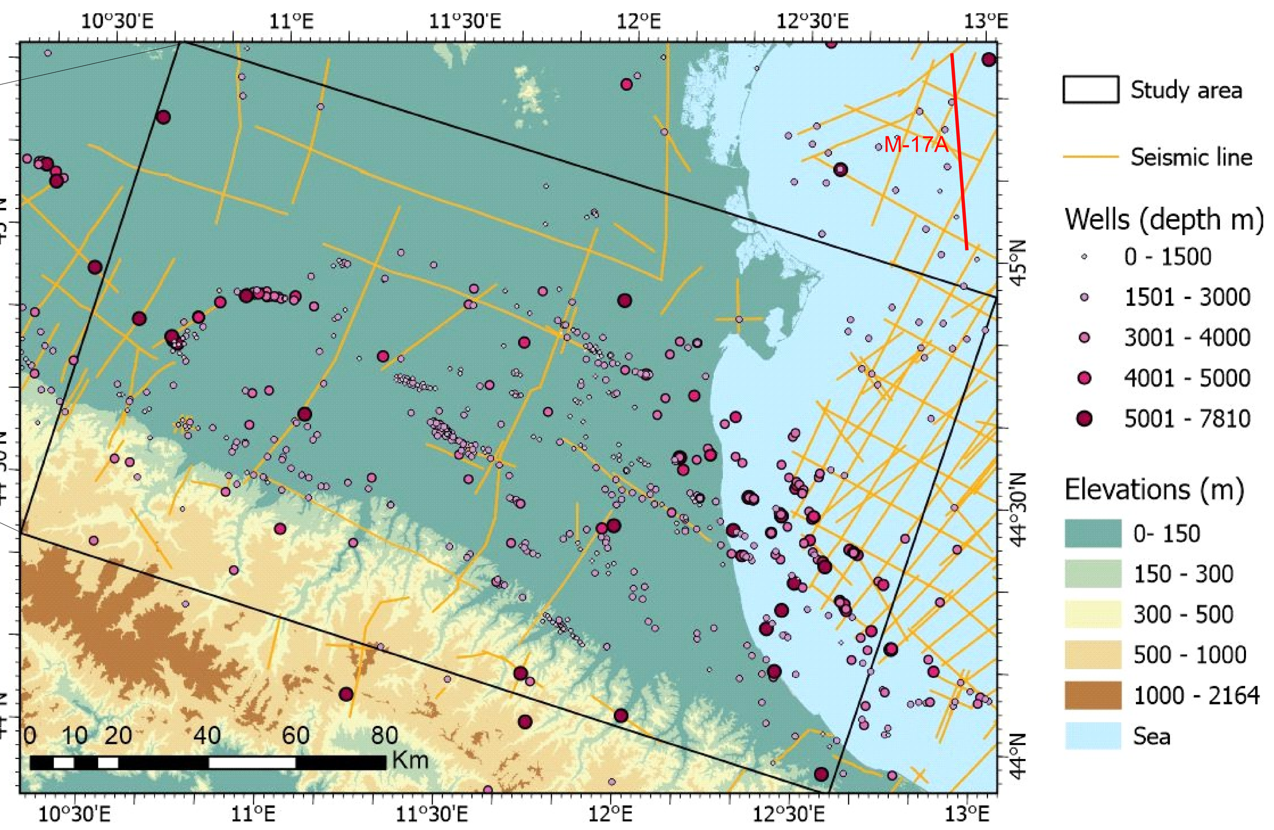


Figure 2: Location of the available subsurface information: well-logs data and 2D seismic reflection profiles, dispalyed over a DEM.

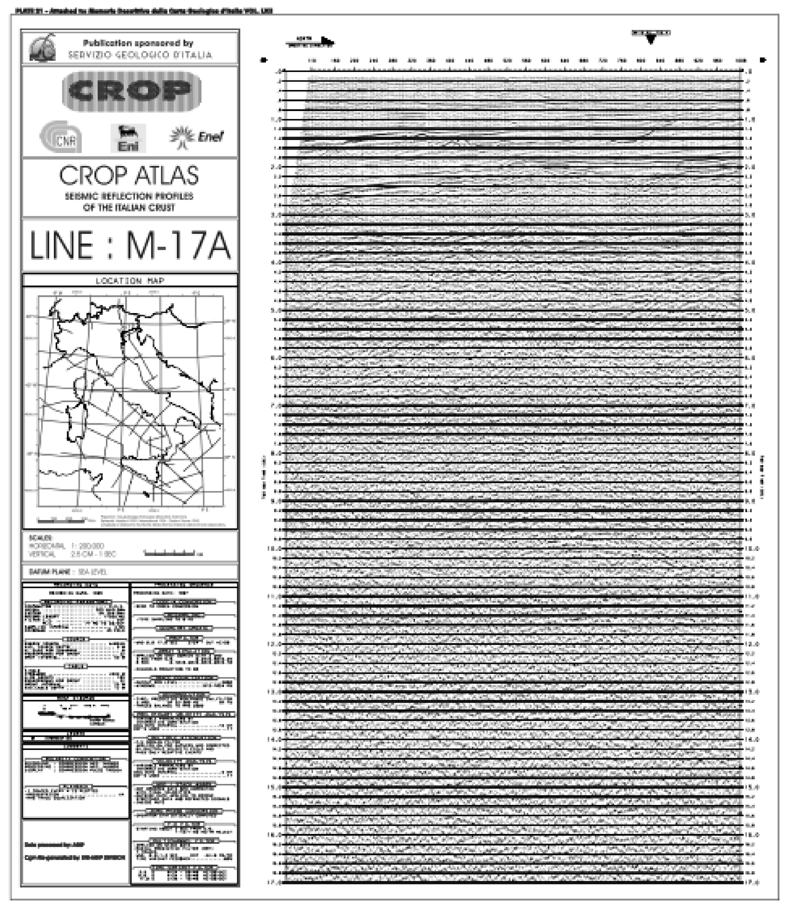


Figure 3: Raw seismic line M-17A and associated information taken from VIDEPI database.

Seismic lines workflow

Seismic lines are publicly available in PDF format. Two methods have been used to convert them to SEGY format. The first one, which is only suitable for some lines, is the open source code WIGGLE2SEGY (Sopher, 2018).The second method consists of converting PDF files to JPEG, manually straightening and cropping them, extracting header parameters and converting them using the free software Kogeo Seismic Toolkit 2.7 (www.kogeo.de).Coordinates are also digitised from base maps using QGIS and added to complete the SEGY file.

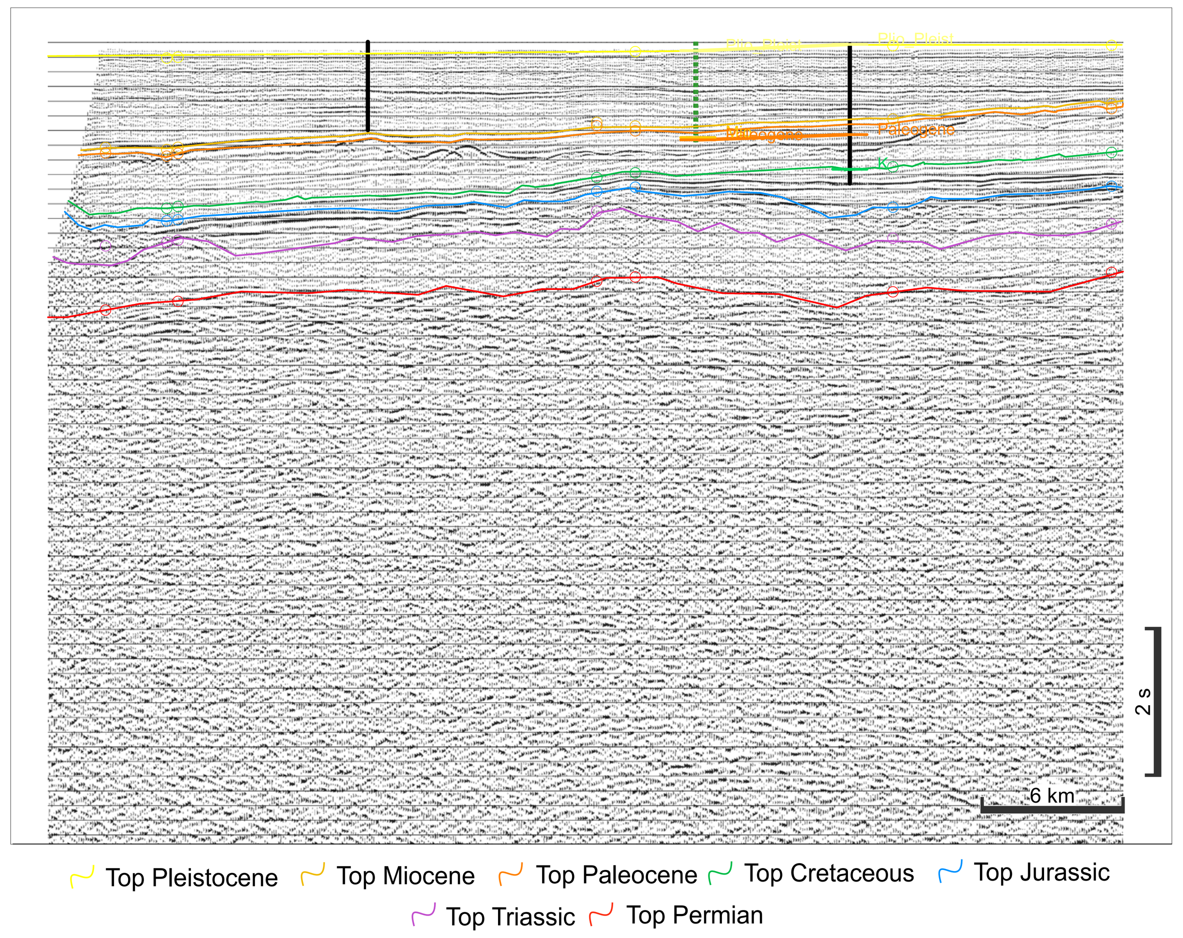


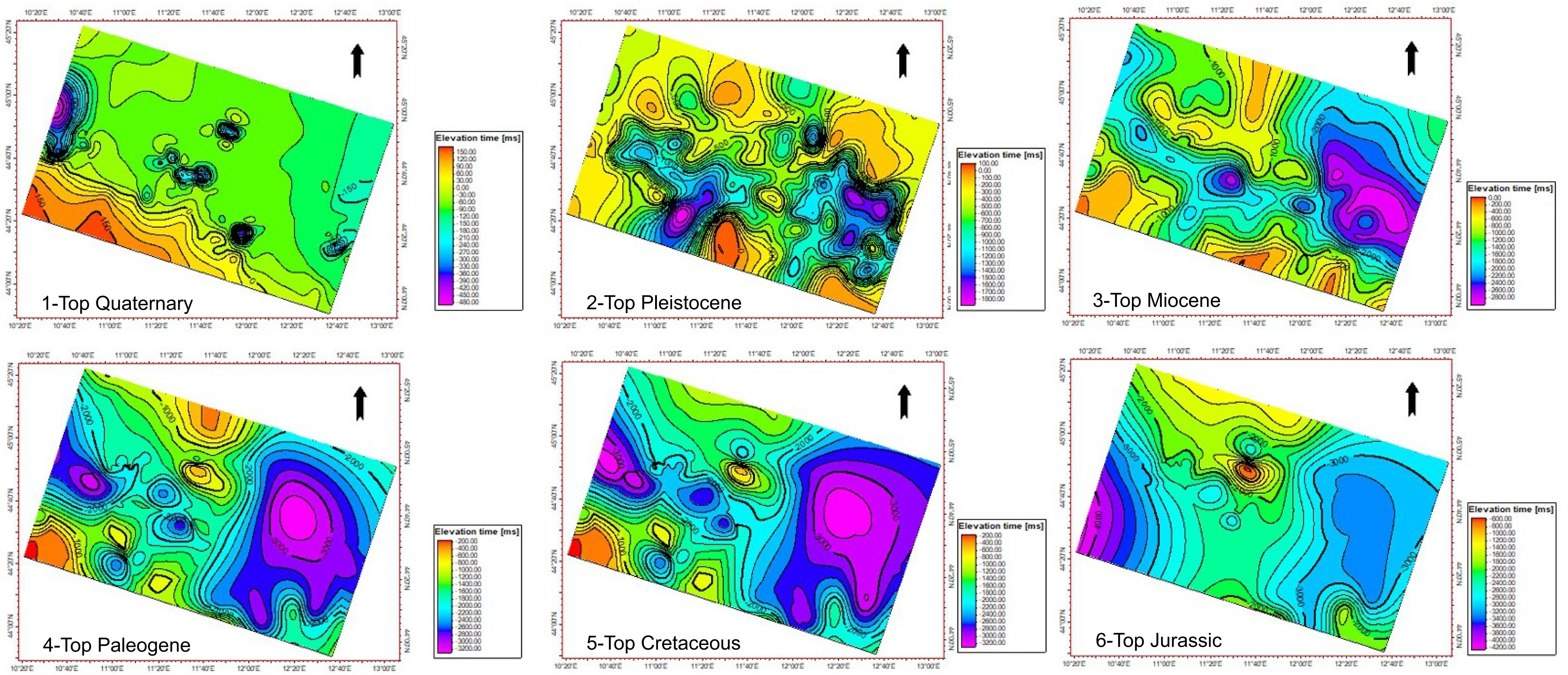
Figure 4: Seismic Line M-17A converted into SEGY format and interpreted.

UNIT	Lithology
1-QUATERNARY	Alluvial deposits
2-PLIO-PLEISTOCENE	Sandstones and shales
3-MIOCENE	Sandstones, Sandy Marls, Marls, Evaporites
4-PALEOGENE	Limestones, Marls
5-CRETACEOUS	Marls, Limestones
6-JURASSIC	Limestones
7-TRIASSIC	Dolostones
8-PERMIAN	Sandstones
9-IGNEOUS/METAM. BASEMENT	Igneous and metamorphic rocks

Figure 5: Simplified stratigraphic column, used to implement the preliminary geological model, displayed in Figure 6.

3D Modelling - Age Limits Maps (TWT) - Preliminary results

Age limits maps show the location of the top of each of the main units in ms TWT today. These maps have been obtained by interpolating well tops (converted to TWT for seismic-well tie) and interpreted seismic horizons. The results are preliminary and will later be converted into depth to obtain a consistent geological model of the study area. The uncertainties increase with the age of the units, due to the decrease of the control points with depth (well tops).



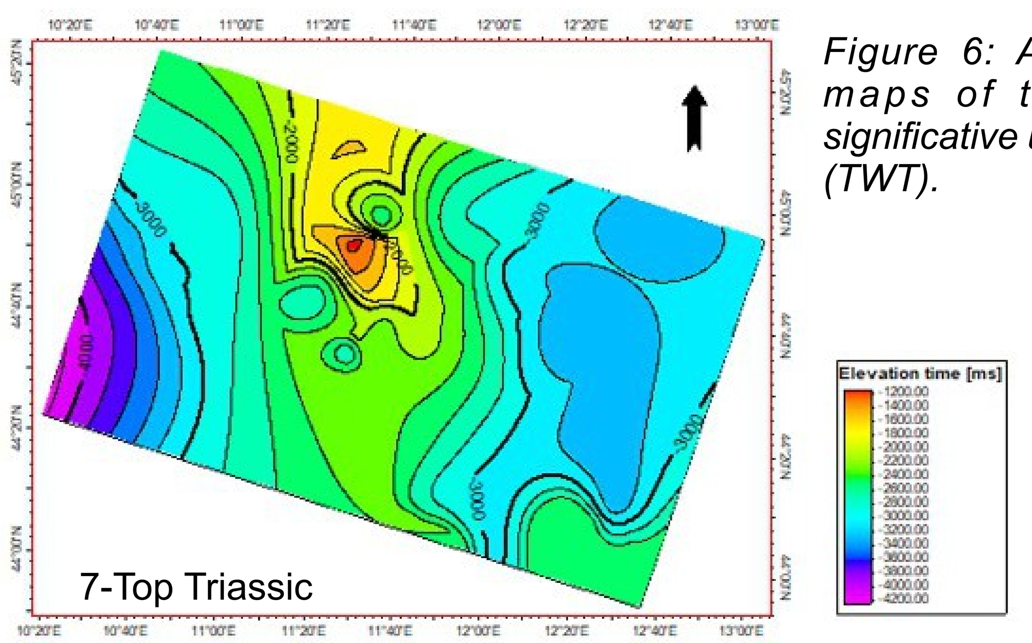


Figure 6: Age limits maps of the most significative units in ms (TWT).

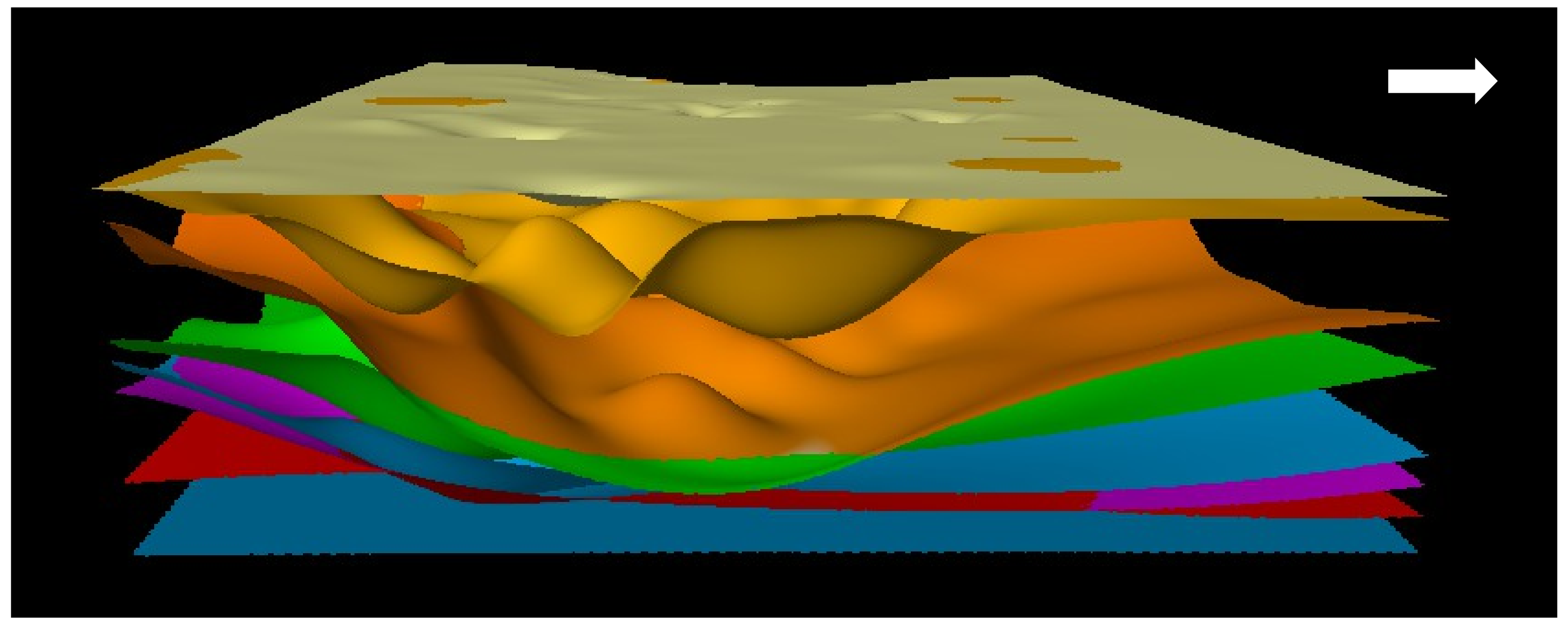


Figure 7: 3D view of the interpreted units. Vertical exageration 10x.

Data sources

This study was carried out using publicly available data (open source) and 10 seismic reflection profiles, provided by ENI.From the VIDEPI database (www.videpi.com) we downloaded 190 2D seismic profiles in PDF format located in our study area. Well reports are available from VIDEPI and CNR database (www.geothopica.igg.cnr.it) with a total of >800 well logs analysed in this study. Further well-log data, were obtained from Livani et al. (2023).

Outlook

We plan to add more geological constraints that can improve the interpretation of the seismic reflection lines and thus increase the resolution of meaningful units, especially the deepest ones. Later, the results will be converted from TWT to the depth domain and compared with other geological models of the study area. Our 3D model will be the input for testing the consistency of different geophysical datasets (Basant et al., 2025) and become part of a crustal model public available for multiple applications, such as geothermal resource evaluation.

Acknowledgements

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References

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