3D GeoModelling: a collaborative platform for multidisciplinary interpretation

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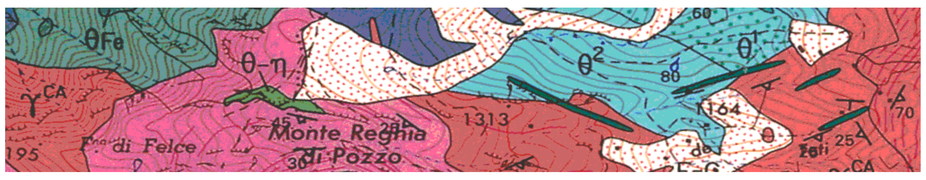

3D GeoModelling: a collaborative platform for multidisciplinary interpretation

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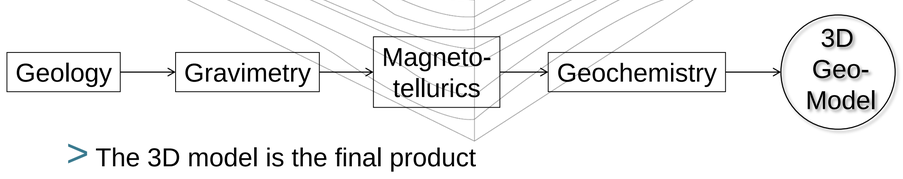
A better understanding of the structuration and evolution of the underground is crucial for many applications. Various disciplines are implemented to reach this goal. Among the most common ones are geology, geophysics, or geochemistry. Data are generally acquired in the field, such as geological observation, gravimetric survey, or fluid sampling. These data are interpreted to characterize the geometry, and the properties of the explored zone. They provide separate but complementary information to understand the area. However, combining geological, geophysical and geochemical interpretations is not an easy task [1].

In such a context, GeoModelling is often used to provide an integrative platform for interpretation [2] [3] [4]. Usually, the final model is completed through successive stages bringing new information at each step. This interdisciplinary workflow leads to a coherent conceptual model integrating as much as possible the outcomes of the disciplines deployed [5] [6]. Nevertheless, every step of this sequential workflow improves the previous one but without retroactive consequence on it. Moreover, a given step is ignorant of the next one. As a matter of consequence, the later a discipline appears in the workflow, the more important is its influence on the final model.

Producing a 3D model by associating complementary disciplines is an interesting perspective but giving these disciplines the opportunity to interact is even more powerful. Indeed, geological, geophysical, and geochemical interpretations have not to be disconnected. The interpretation coming from one discipline has to be enhanced by the others. To do so, the methodology needs to be object oriented instead of workflow oriented. In this collaborative approach, the central object is a 3D GeoModel that grows from the common interpretation implemented jointly by the specialists of various disciplines. In other words, they can compare, connect, discuss, adapt, and integrate their own approaches in a mutual environment via such a GeoModelling platform. At the end, the 3D GeoModel is not a conglomerate of distinct interpretations but a consensus agreed by the contributors [7].

In addition, the model can be enhanced - depending on new data or new interpretation - to provide an up-to-date knowledge of the investigated region. Such a 3D model can also be used to mesh the modelled geometry of the zone and to compute dynamic simulations.

Sequential modelling…



> The 3D model is the final product

> Quite independent

> "The one who is right is the last one who spoke"

VS.

… Model oriented modelling

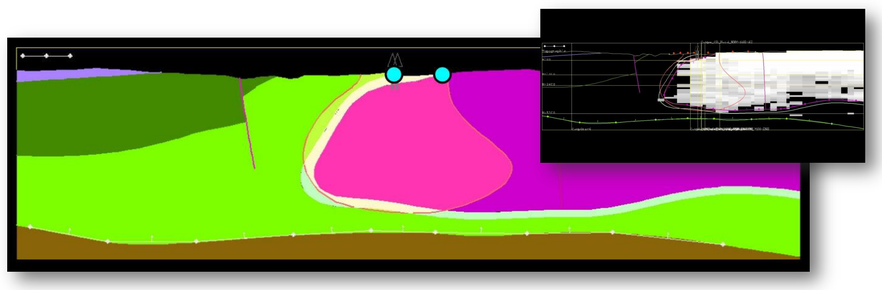
> Interactive

> Cross-interpretation

> The 3D model is the central product

Like a granite compared to a conglomerate

Granite and conglomerate are both made of various components. However the higher energy used to create granite makes it more coherent and robust than a conglomerate. This is the same for the interpretation provided by collaborative 3D GeoModelling compared to sequential modelling.



> Gravimetry survey and 3D inversion process

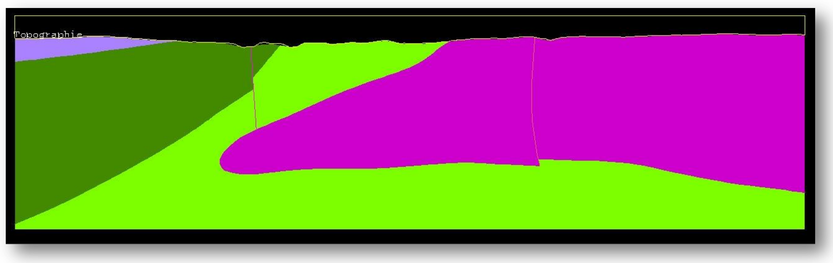
GeoModelling

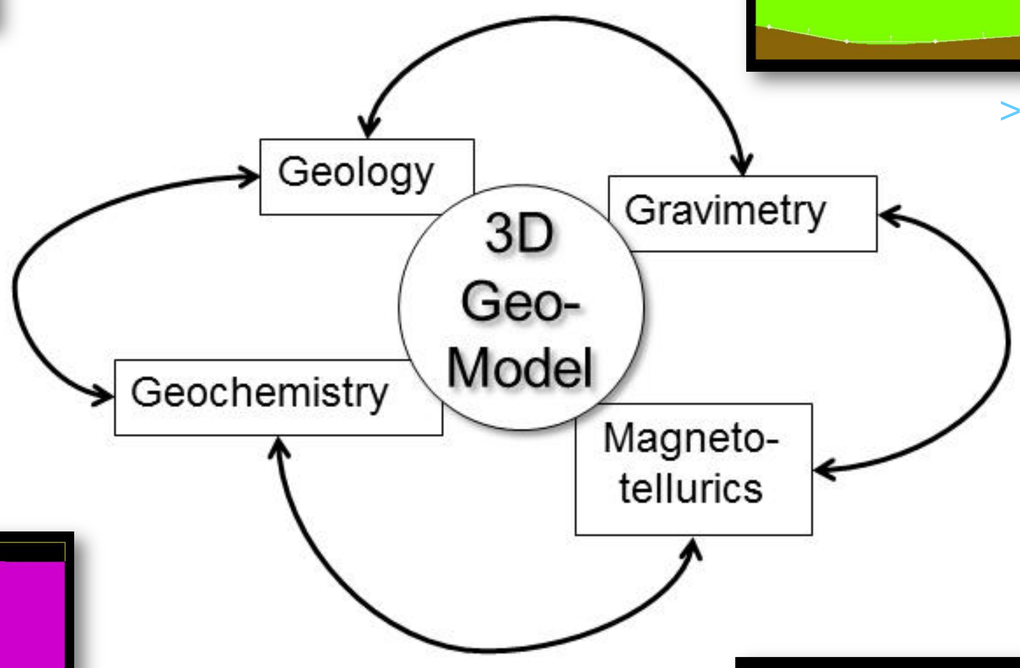
> Representation of the solid Earth using surface and underground data in a computer aided process

> Integration and combination of data acquired in the field to model 3-dimensional structures

> Coherent geological interpretation

> Bibliography





Benefits

> The geological interpretation benefits from the input of multiple scientific fields

> The disciplines collaborate for a cooperative and cohesive interpretation

> Such a shared interpretation will be easier to produce if the experts have a common platform to help them to work together

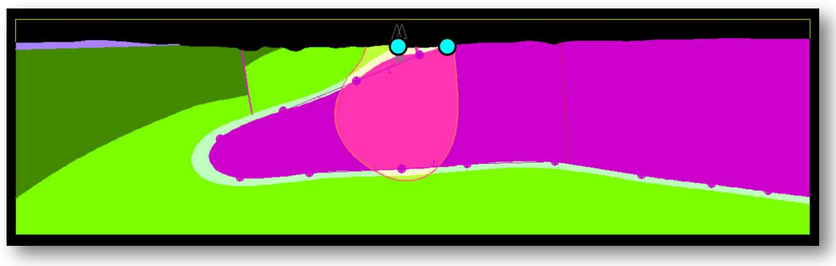
Needs

> Gather disciplines around a common platform

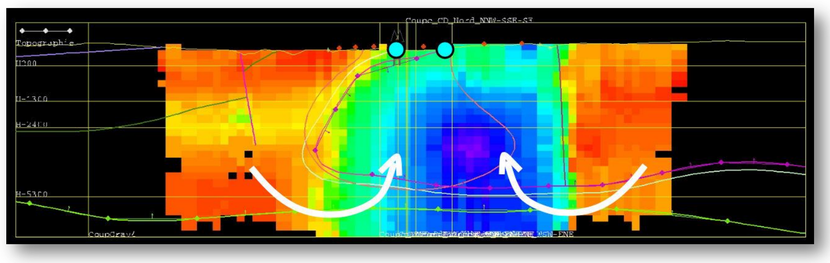
> Specialists work and interact together

> A versatile platform able to integrate various data

> An interactive interpretation allowing on-the-fly changes



> Fieldwork



> MT survey and geothermal interpretation

Conclusion

> Start from the beginning of the exploration
- Bibliography…… Exploration borehole

> A shared interpretation taking into account multidisciplinary data

> Not a workflow with disconnected inputs but an integration platform for cross-interpretations

> Steps forward
- Up to date interpretation using new data or concepts
- Towards simulation

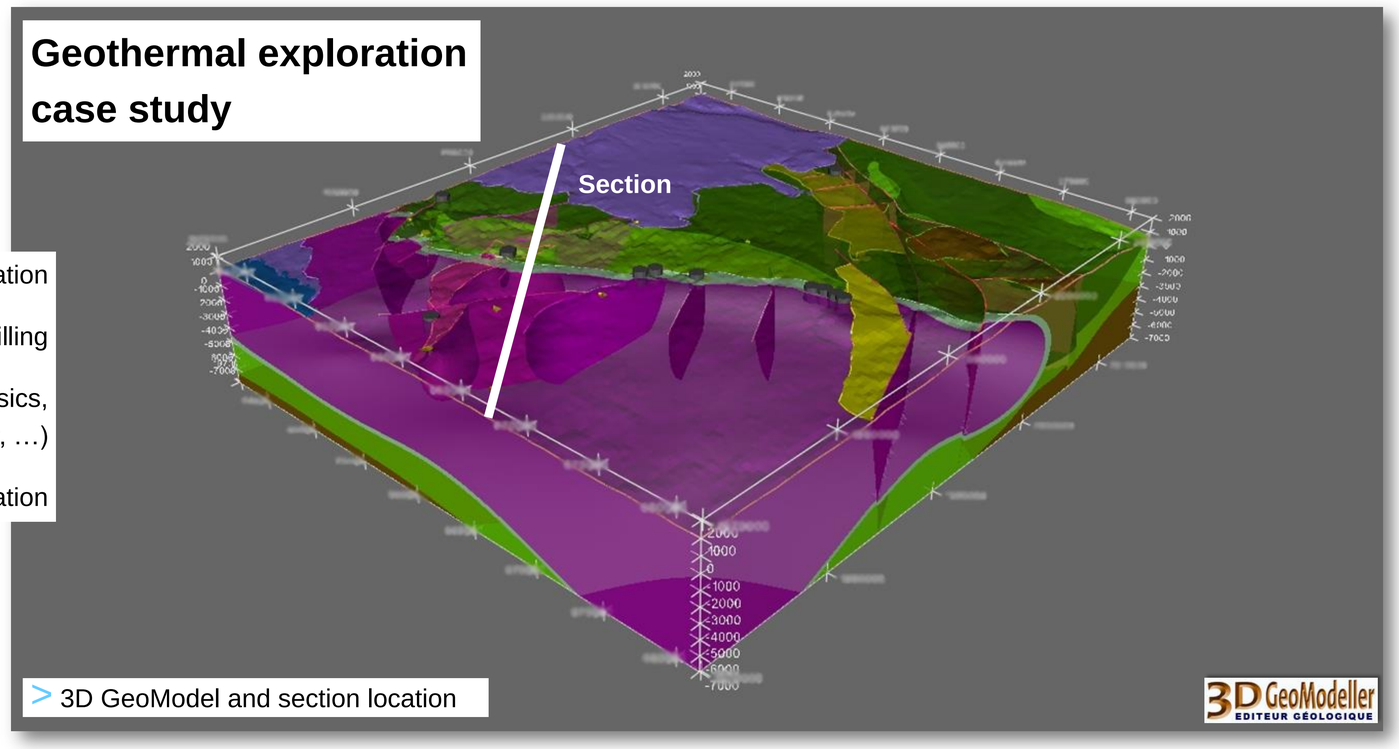
> Locate favourable target for exploitation

> Reduce the geological risk before drilling

> Various disciplines (Geology, Geophysics, Geochemistry, …)

> Separate but additional information

Geothermal exploration case study



> 3D GeoModel and section location

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