3D GEOLOGICAL MODELLING FOR GROUNDWATER MANAGEMENT IN CARDONA

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INTRODUCTION

In the long history of the mining development of the Cardona's diapir, in Vall Salina (Cardona, Catalunya, NE Spain), there have been multiple episodes of groundwater inflow into the mine caused by the interception of karst conduits. Nowadays, the operation is done with a continuous drainage from the mine. In addition, the water surface of the tertiary aquifer is altered. Since 2011, the Institut Cartogràfic i Geològic de Catalunya (ICGC) has launched a project to improve the management of groundwater. In this context, a 3D geological model of the tertiary detrital units is being developed.

SITUATION AND GEOLOGICAL CONTEXT

The study area is located in the Meandre de la Coromina, in the NE of the Vall Salina, Cardona, where the valley merges with the old bed of Cardener River.

The predominant structure is the Pinòs-Cardona anticline constituted by Upper Eocene – Oligocene materials. The diapir structure displays a NE-SW elongation with a vergence to the South and a closing periclinal in the Meandre de la Coromina. Moreover, perpendicular faults on the direction of folding have been recognized. These ones do not just increase the NE termination of the diapir, but they would also be decisive for the karst development (Font, 1985).

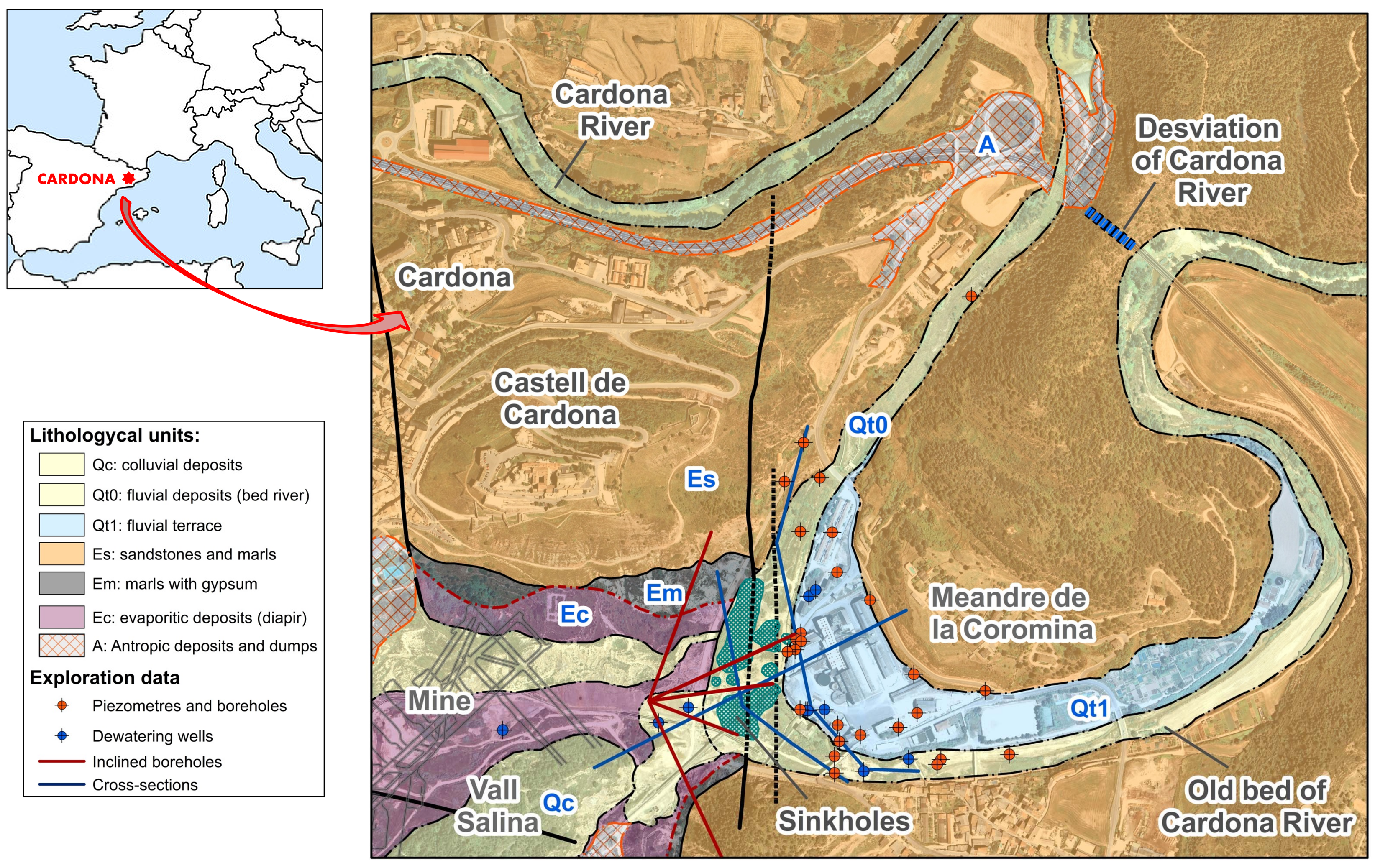

Figure 1: Situation and geological context of the study area.

METHODOLOGY

The processing of primary data provided geological constraints and preliminary surfaces. Then, the interpolation using DSI (Discrete smooth interpolation) has allowed us to fit the maximum constraints.

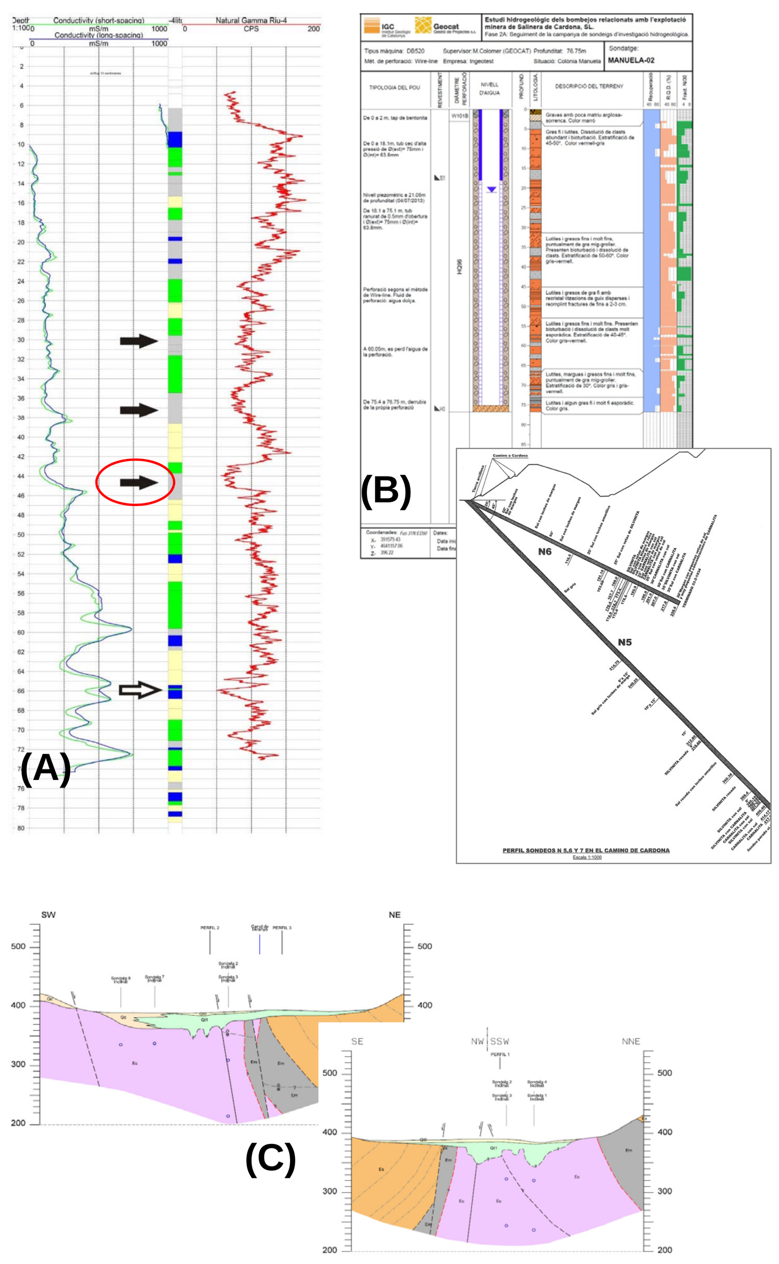

Figure 2: Primary data: **A)** Geophysical well logs (ICGC, 2014). Black arrows indicate sandstone levels with minimum values of natural gamma. The circled arrow indicates the level modelled as the Sandstone level (*Sd* surface); **B)** Drilling works (IGC-Geocat, 2012); **C)** Cross-sections (IGC-Geocat, 2012).

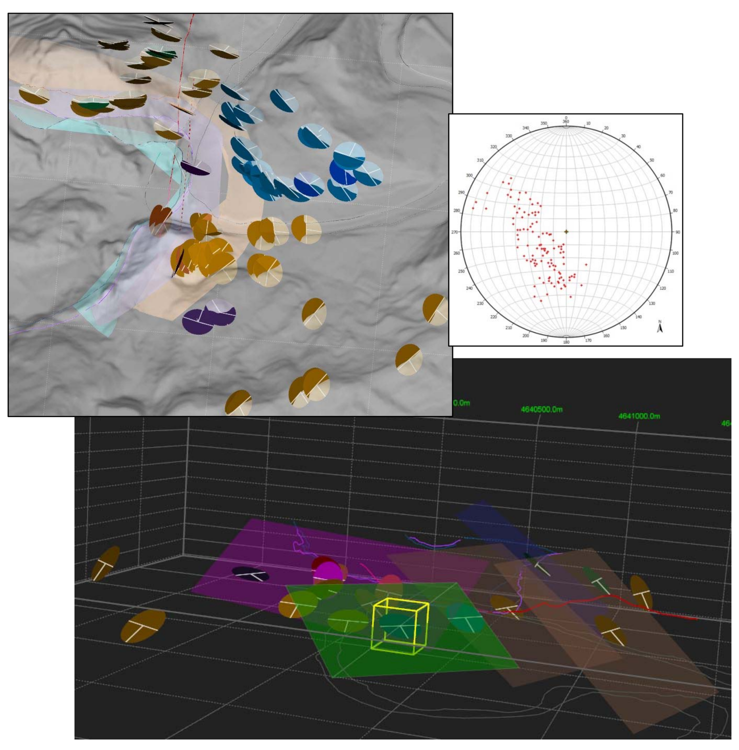

Figure 3: Defining dip domains and obtaining preliminary surfaces.

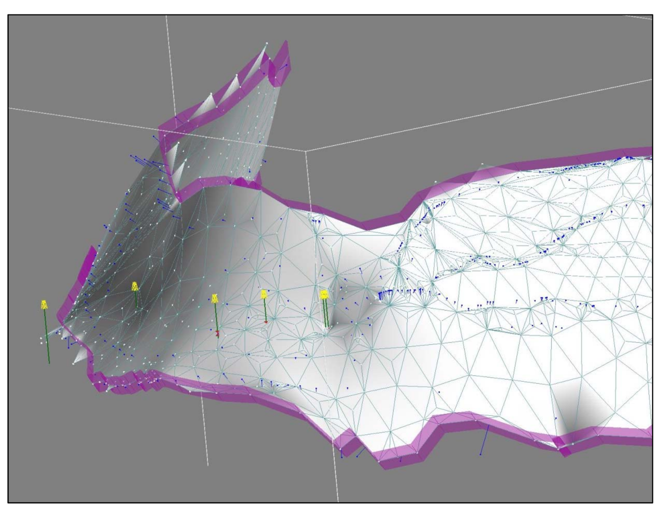

Figure 4: Interpolation (DSI) considering geological constraints (control points, borders,…) to generate the *Sd* surface.

RESULTS

In the current phase of this project, a preliminary model has been built using GOCAD and MOVE software. Five main surfaces have been created: base of quaternary deposits (*Qt*); sandstone level (*Sd*); top of marls with gypsum (*Em*); top of diapir (*Es*); and fault surface (*F*).

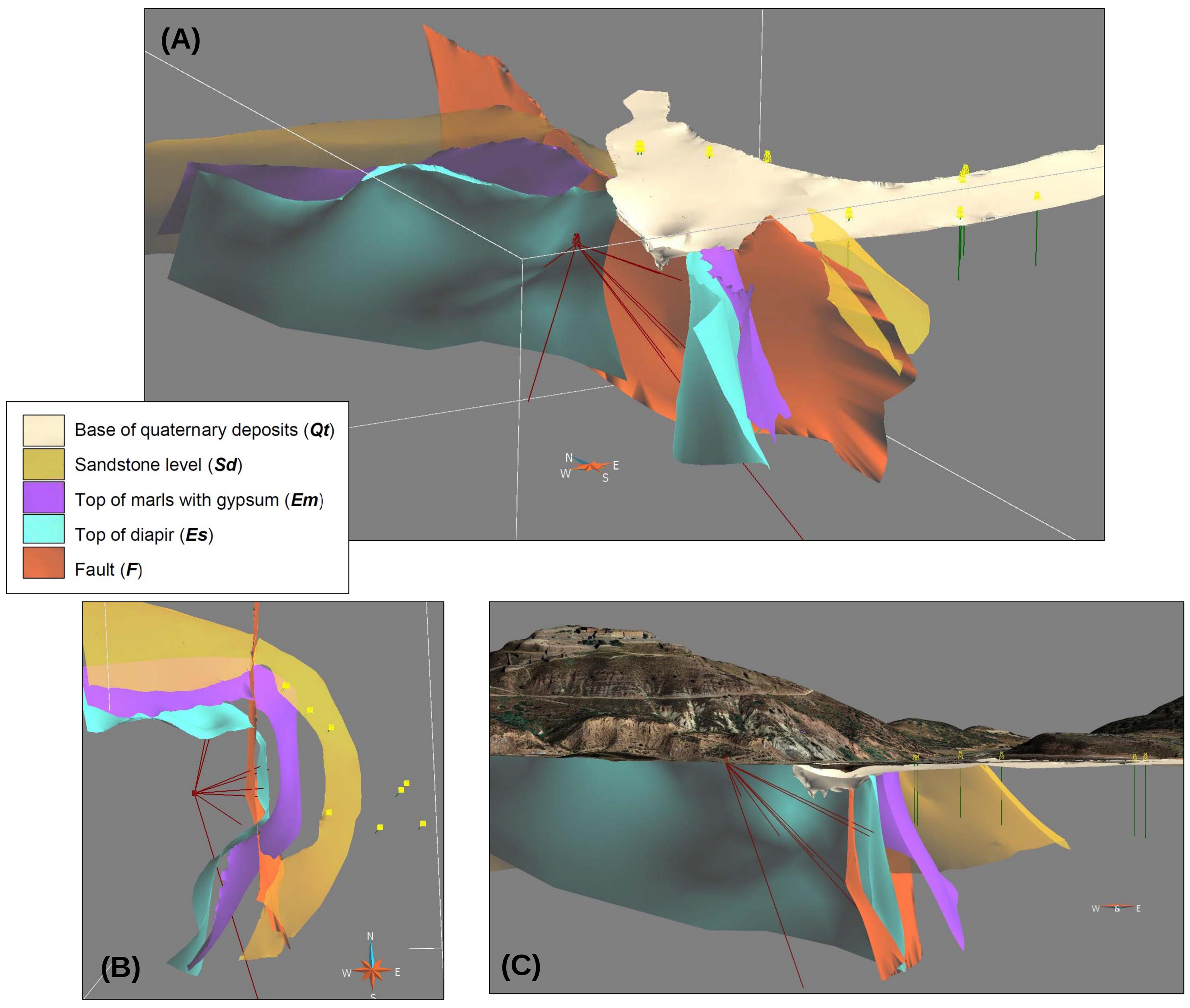

Figure 5: Isometric view **(A)**, aerial view **(B)** and view from the South **(C)** of the 3D model.

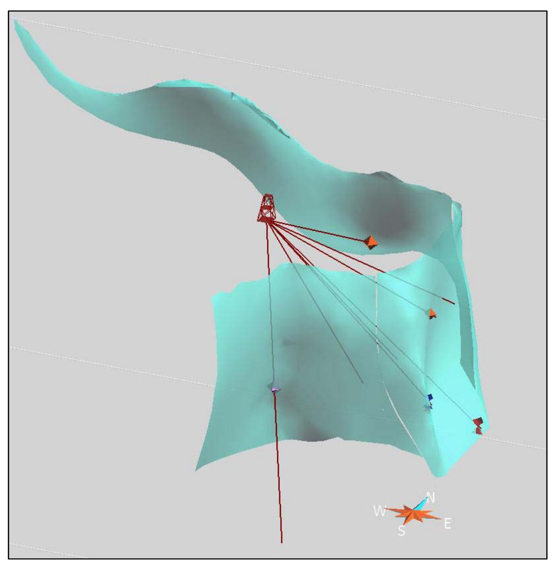

Figure 6: In spite of the difficulty of modelling the diapir surface, inclined boreholes have allowed us to delimit the NE boundary of the diapir .

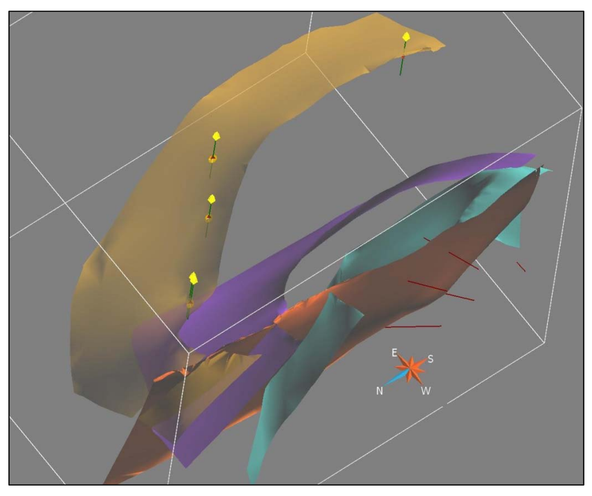

Figure 7: Detail of the ***Sd*** surface (sandstone level), considered a preferential way for the groundwater flux.

CONCLUSIONS

The 3D model improves the understanding of the geological structure, confirming the initial interpretations and reducing the inaccurate points detected.

Next steps should be:

- Densification with new data is needed (e.g., gravimetric and geophysics studies, new point data…), in order to reduce the uncertainties and to obtain more geological constraints.
- Transformation of this deterministic model to a tetrahedral mesh (solid object) to be used in a groundwater flow model.

REFERENCES

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