



3D modelling the structure and hydrogeology of the Castlecomer Plateau

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1. Abstract

This joint project between Geological Survey Ireland (GSI) and University College Dublin aims to integrate a myriad of data sets captured across the plateau to model both the geology and hydrogeology of the study area. Combining surface geology mapped by GSI with stratigraphic information captured during exploratory drilling by local collieries and group water schemes for local abstraction, we hope to create a conceptual 3D model of the subsurface to greater inform our understanding of the complexities of groundwater flow and local aquifer properties.

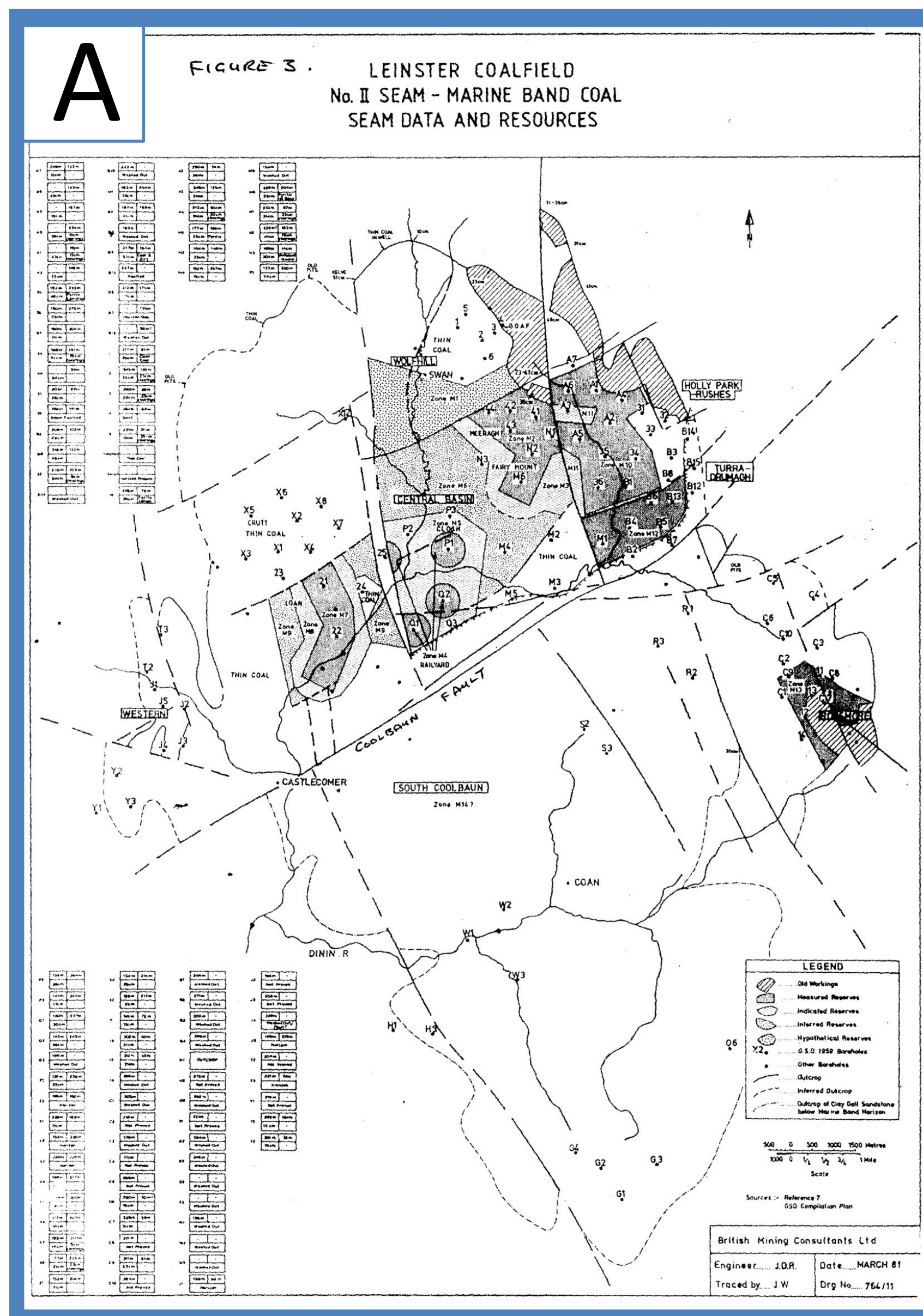


Figure A: Map of boreholes drilled by Castlecomer collieries showing old coal working areas.



Figure B: Sections of drill core from borehole GSI-85-3 held by Geological Survey Ireland taken from the Castlecomer plateau.

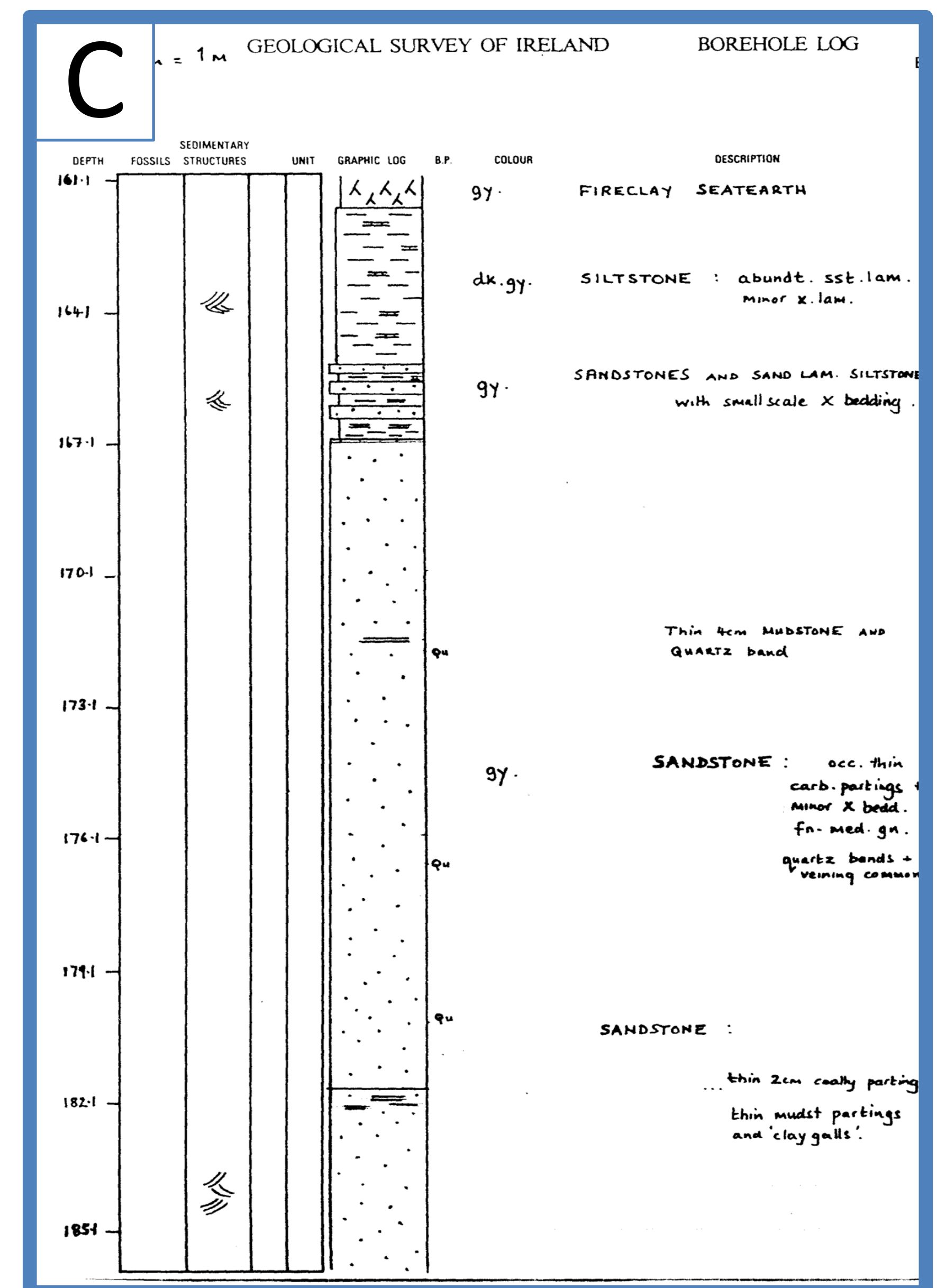


Figure C: A sample of the log of GSI-85-3 (Higgs & O'Connor 2005).

2. Data & Methods

This was the first known attempt to enter many of the paper logs captured across the region during exploratory drilling by local collieries into a digital 3D geological model.

Logs were analysed for units that could provide good stratigraphic control on modelled units such as the many named coal beds, fossil horizons and easily identified lithologies such as the Clay Gall and Swan Sandstones. Coordinates for these wells were then obtained from georeferenced workings maps (Fig.A) in ARCGIS.

Core from the plateau (Fig.B) held by GSI was examined in combination with existing logs (Fig. C) to aid future analysis of the lithologies for input into the model.

The stratigraphic information captured in these logs was then entered into Leapfrog and given surface constraints by feeding the model mapped surface geology information captured by GSI.

Pumping test information generated by drilling for group water schemes across Castlecomer were then added to the project for later analysis.

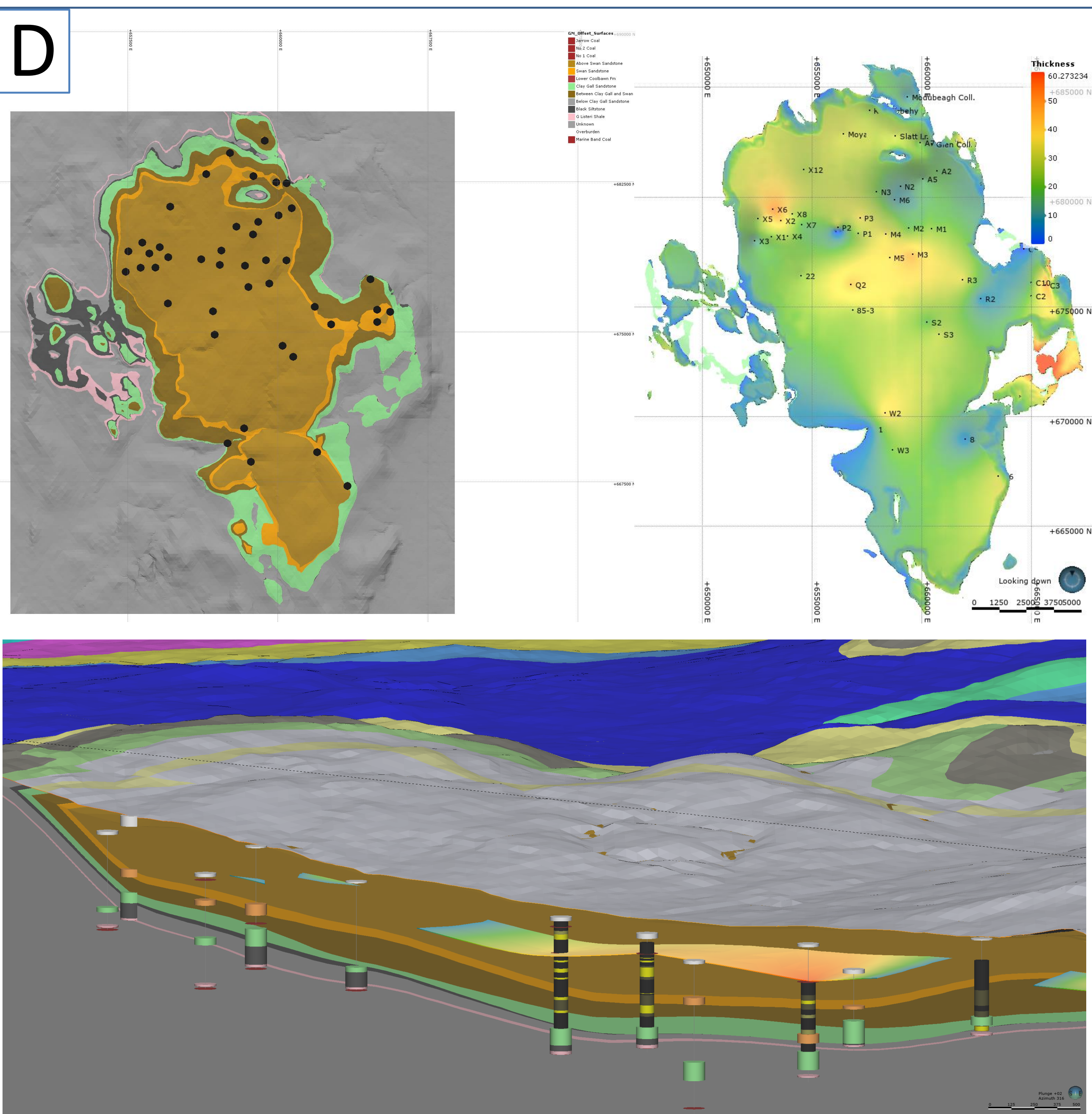


Figure D: Overview model of the Castlecomer plateau with thickness map of Clay Gall Sandstone Aquifer.

3. Results

By digitising many of the boreholes captured across the Castlecomer Plateau and the stratigraphic information therein, and combining it with the mapped geology captured by Geological Survey Ireland, we have been able to create a constrained 3D model of the local subsurface.

This has been a great help in visualising the confined Swan and Clay Gall Sandstone aquifers that are hosted in the succession. Characteristics such as aquifer thicknesses and relationships with the many faults can be observed with greater clarity in three dimensions and will serve as a starting point for further work on the plateau.

4. Further Work

Future work will comprise:

- Examination of group water scheme pump testing rates and their relationship to the structural geology of the plateau;
- Refinement of surface geology constraints with outcrop information from mapping;
- Addition and refinement of borehole log interpretation in the model;
- Addition of medium to small scale faults across the modelled area.

Further Reading:

- Higgs & O'Connor (2005). Stratigraphy and Palynology of the Westphalian Strata of the Leinster Coalfield, Ireland. Irish Journal of Earth Sciences.
- Daly et al. (1980). Fault control of groundwater flow and hydrochemistry in the aquifer system of the Castlecomer Plateau, Ireland/Quarterly Journal of Engineering Geology and Hydrogeology.