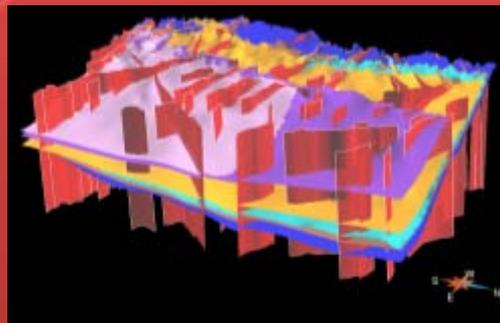
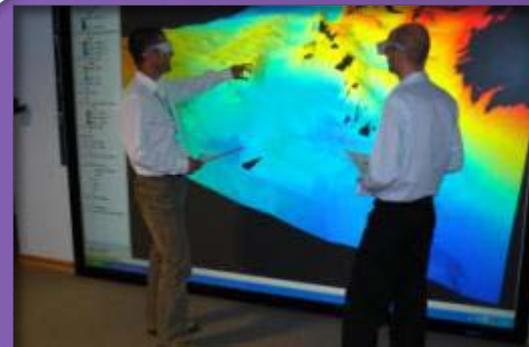
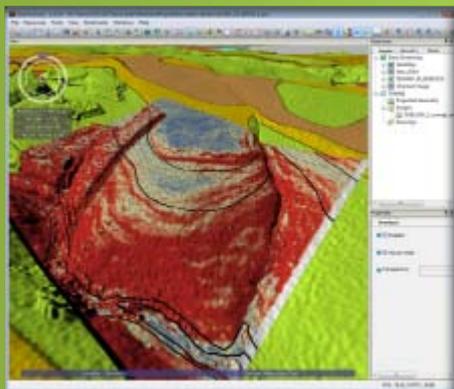


# 3-D VISUALISATION AT THE BRITISH GEOLOGICAL SURVEY



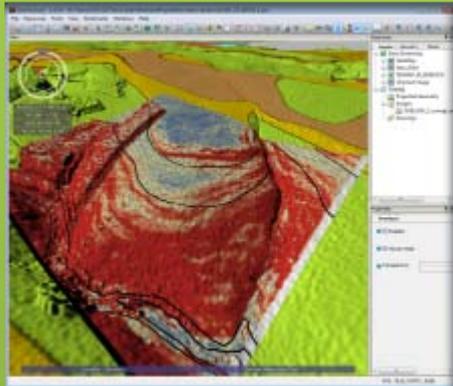
Mapping

Communication

Modelling

# 3-D VISUALISATION AT THE BRITISH GEOLOGICAL SURVEY

Mapping

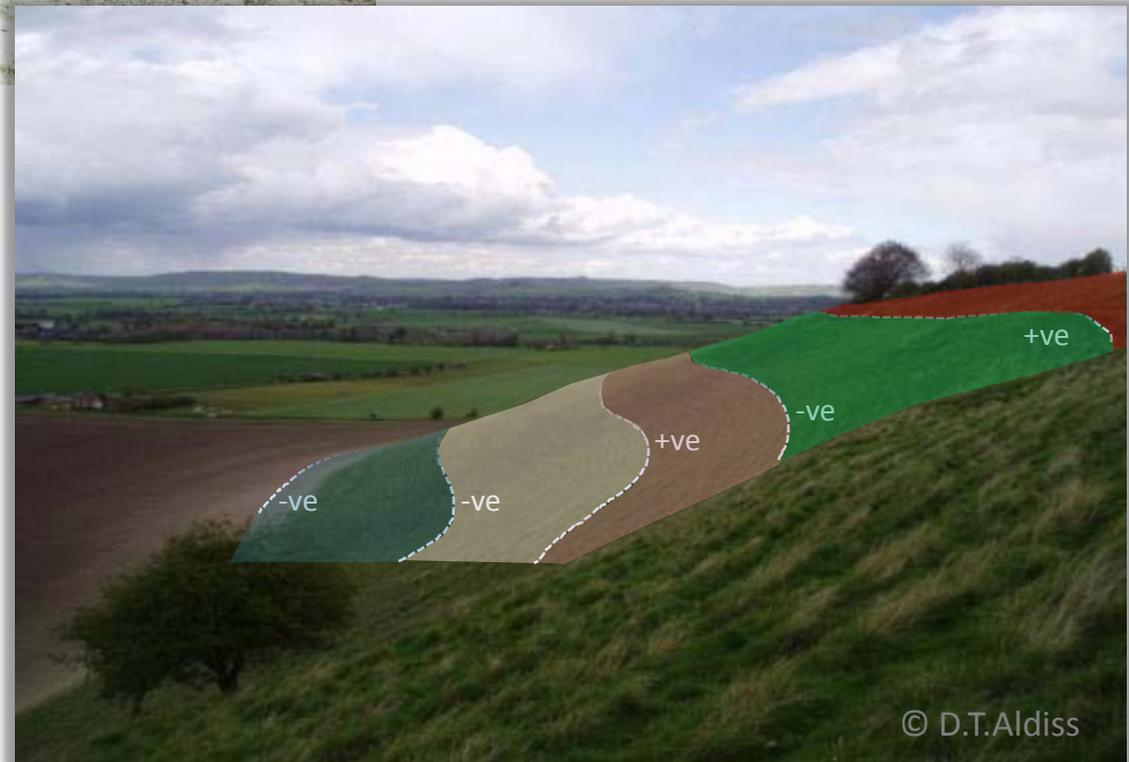


- Landscape literacy
- Conventional approaches
- The GeoVisionary solution
- Virtual Field Reconnaissance
- What are the benefits?

# Landscape Literacy

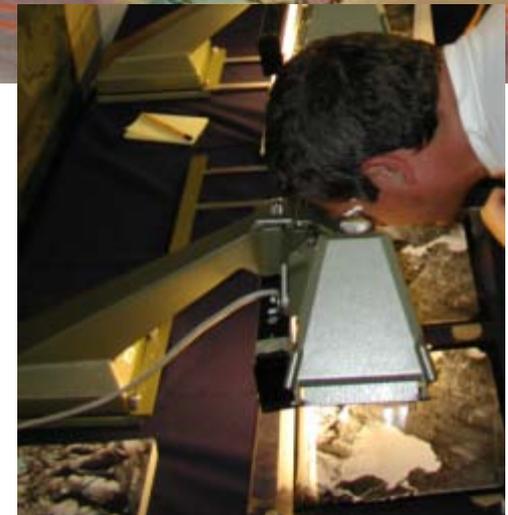
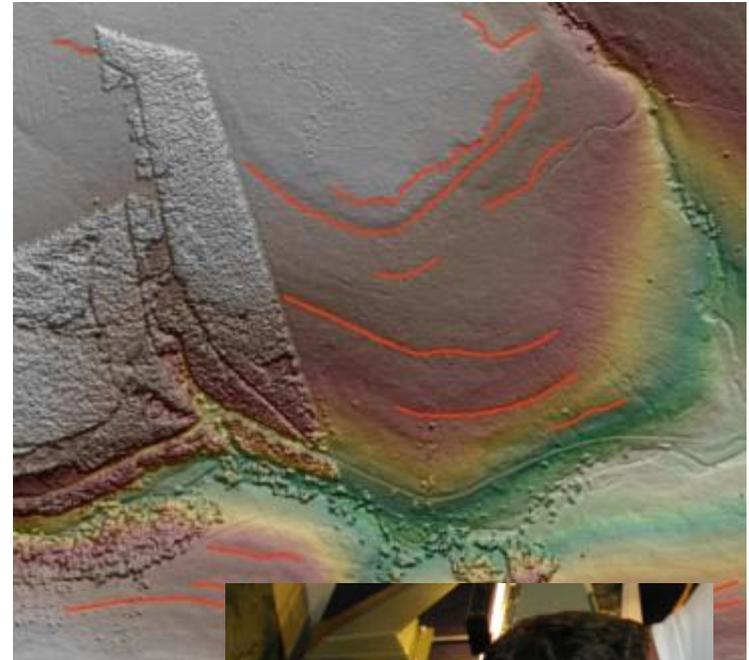


- Relating characteristic breaks of slope to underlying strata *or* landscape processes
- Inferring geological contacts and structures



# Conventional approaches

- **Complement field observation with remote sensing:**
  - photogrammetry
  - satellite image interpretation
  - GIS analysis of DEMs
- **Conventional techniques effective, but ‘restrictive’:**
  - fixed perspective (i.e. mostly vertical)
  - often complex tools / software
  - difficult to integrate subsurface data



# The GeoVisionary solution

A single application combining key functionality from common virtual globe, GIS and 3D modelling applications

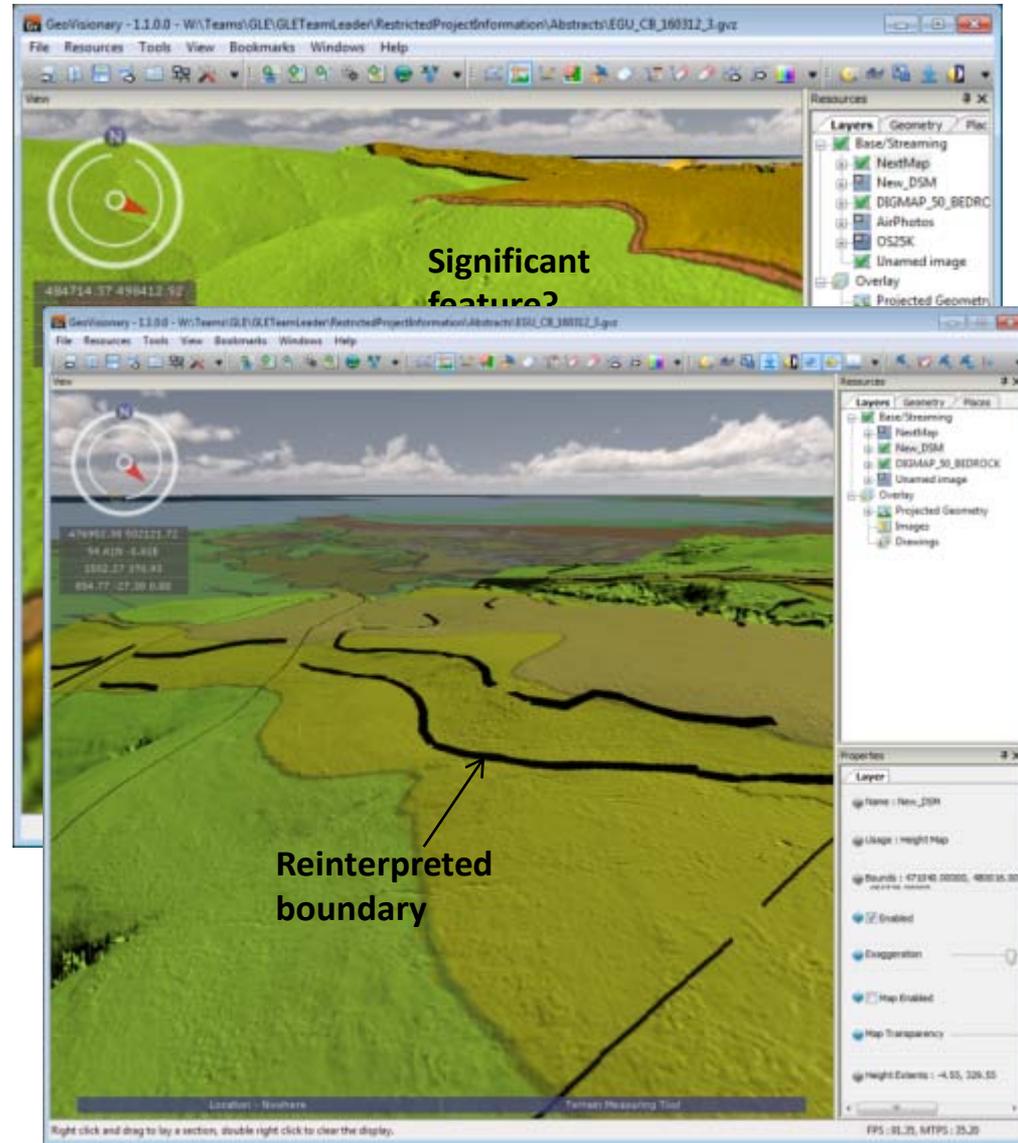


- **Intuitive GUI**
- Free-flight
- Rapid data streaming
- Powerful visualisation
- **Digitising**
- True-perspective
- Attribution-rich
- GIS compatible
- **Integrated subsurface data**
- Boreholes
- Cross-sections
- 3D models

<http://www.virtalis.com/geovisionary/>

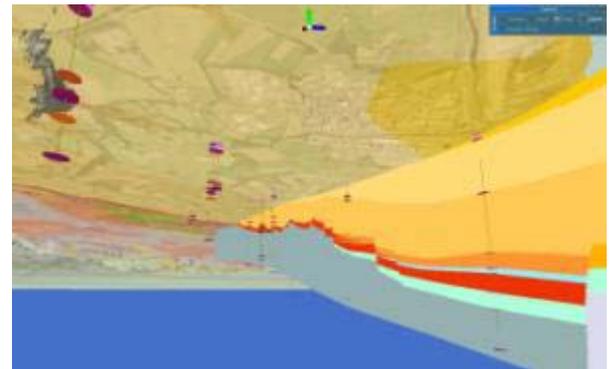
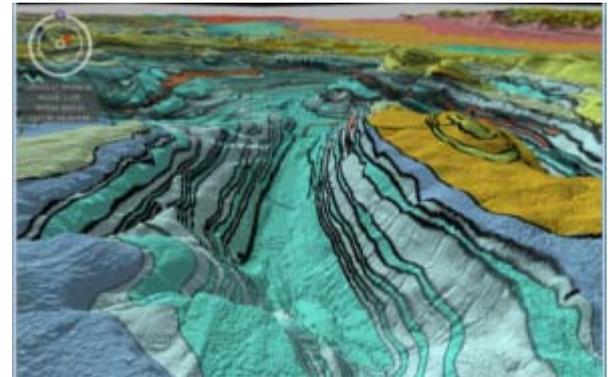
# Virtual Field Reconnaissance

- landscape familiarisation
- baseline data compilation
- assess existing mapping:
  - *accept?*
  - *reject and re-interpret virtually?*
  - *prioritise field targets?*
- promote consistency
- identify and resolve potential 'disagreements'



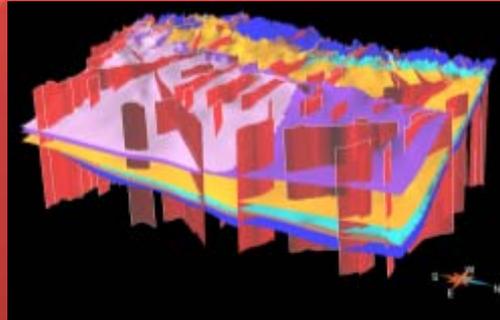
# What are the benefits?

- Logistical:
  - cost reduction (prioritising field observation)
  - risk reduction – staff and environment
- Contextual:
  - rich environment for interpretation
  - increased precision / accuracy
  - greater confidence
- Cultural:
  - ‘meeting of minds’
  - ‘killer app’ in the digital workflow
  - communication



# 3-D VISUALISATION AT THE BRITISH GEOLOGICAL SURVEY

- Baseline data validation
- Interactive surface creation
- Model interrogation and approval
- Scientific discovery



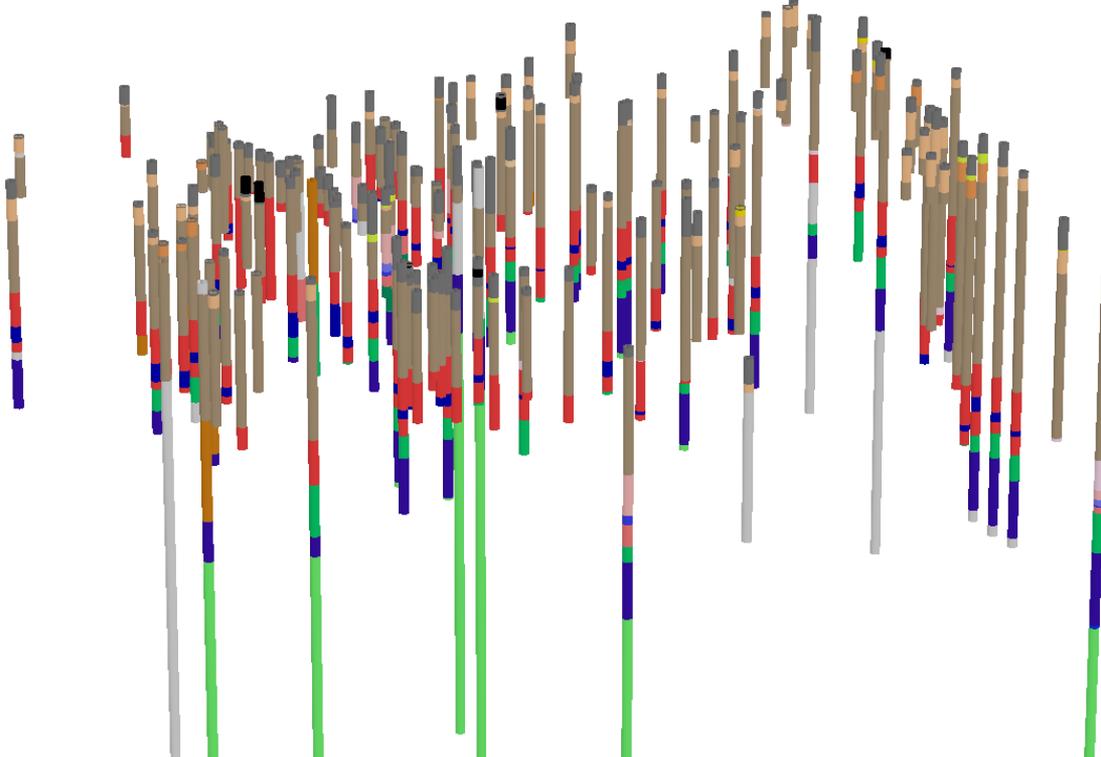
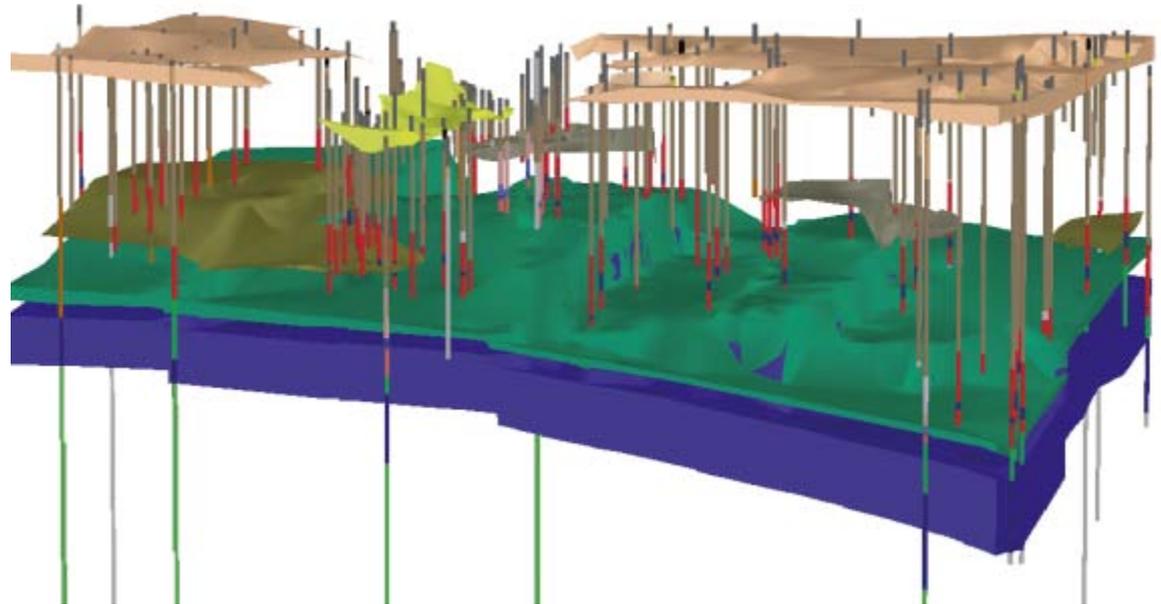
Modelling

# Baseline data validation

- Contextual assessment of diverse data
- Supports improved data trend and anomaly detection

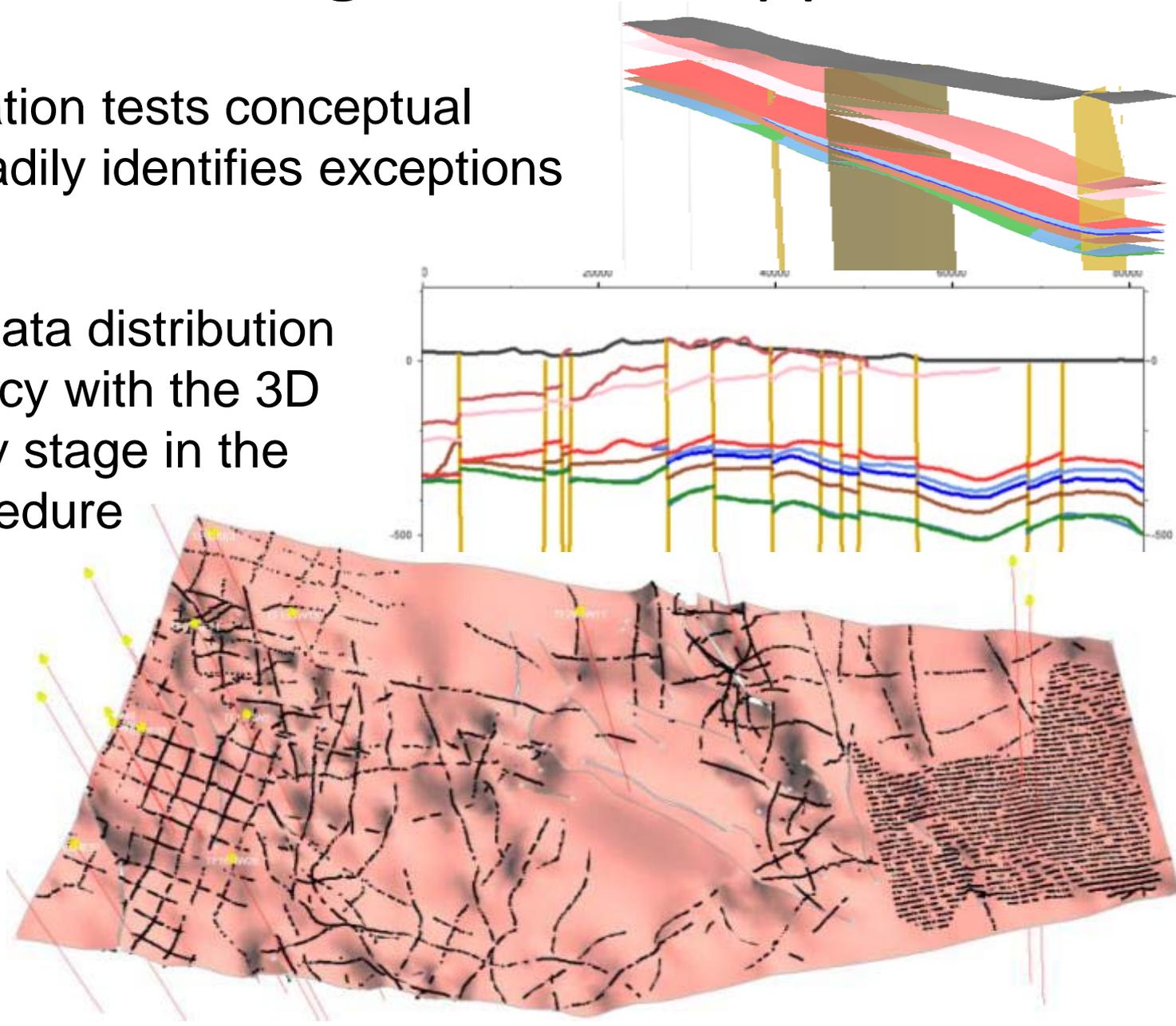
# Interactive surface creation

- Rapid 'prototyping' of conceptual model
- Real-time verification of evolving model

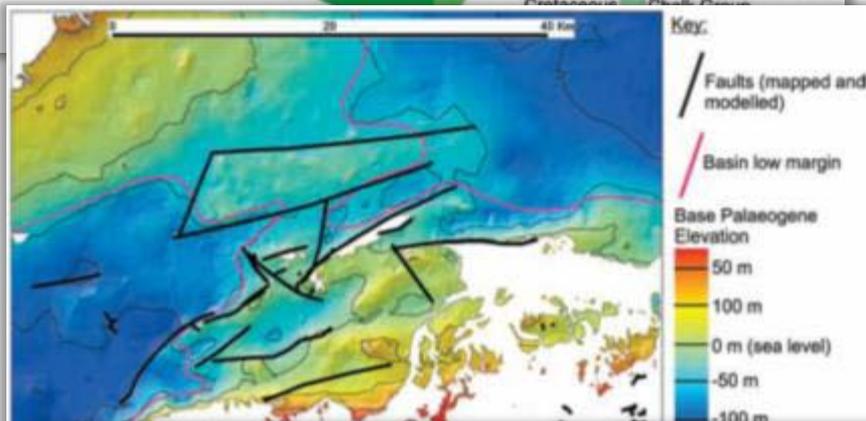
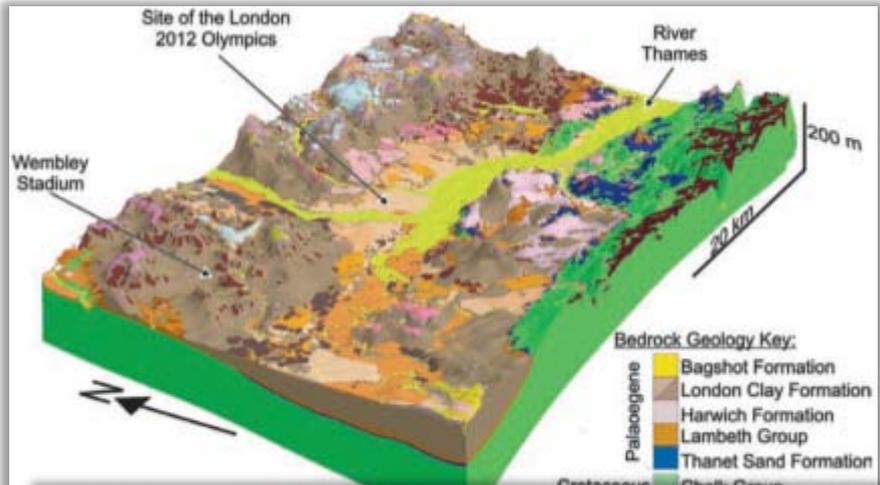


# Model interrogation and approval

- 3D visualisation tests conceptual model and readily identifies exceptions
- Assessing data distribution and consistency with the 3D model is a key stage in the approval procedure



# Visualisation for science

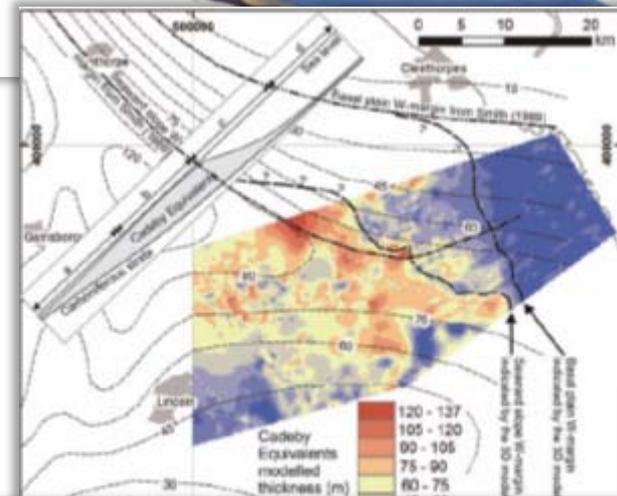
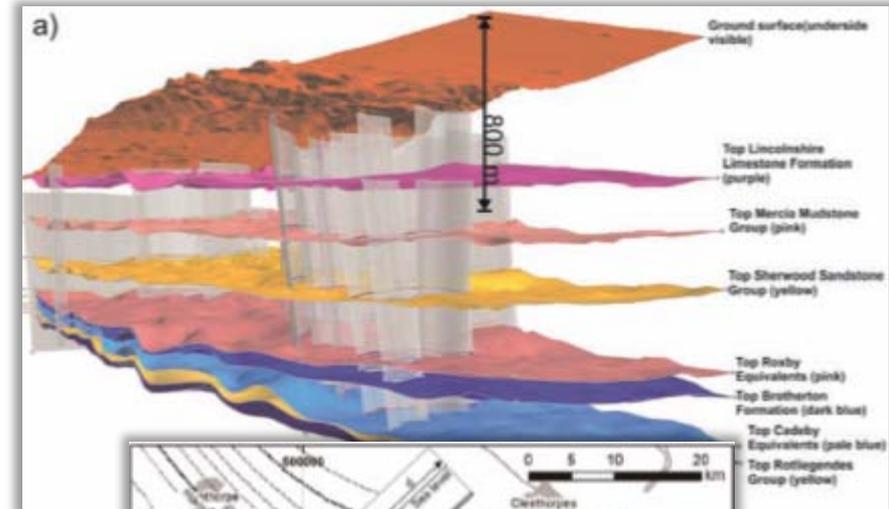


Z. dt. Ges. Geowiss., 161/2, p. 205–218, 17 figs., 1 tab.  
Stuttgart, June 2010

Article

Geological 3D modelling: scientific discovery and enhanced understanding of the subsurface, with examples from the UK

Jonathan R. Ford, Stephen J. Mathers, Katherine R. Royse, Donald T. Aldiss & David J.R. Morgan\*



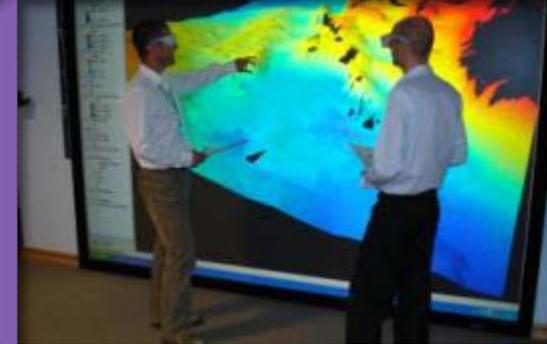
PROCEEDINGS OF THE YORKSHIRE GEOLOGICAL SOCIETY, VOL. XX, PART 1, PP. 1-23, 2012

New insights from 3D geological models at analogue CO<sub>2</sub> storage sites in Lincolnshire and eastern Scotland, UK

ALISON MONAGHAN<sup>1\*</sup>, JONATHAN FORD<sup>2</sup>, ANTONI MILCOWSKI<sup>2</sup>, DAVID McENROY<sup>1</sup>, TIMOTHY PHARACH<sup>2</sup>, JEREMY RUSHTON<sup>2</sup>, MIKE BROWNE<sup>1</sup>, ANTHONY COOPER<sup>2</sup>, ANDREW HULBERT<sup>2</sup> & BRUCE NAPIER<sup>2</sup>

# 3-D VISUALISATION AT THE BRITISH GEOLOGICAL SURVEY

- Geology and landscape
- Augmented Reality
- 3D collections
- Geology and infrastructure
- 3D model interrogation
- 3D model dissemination



Communication



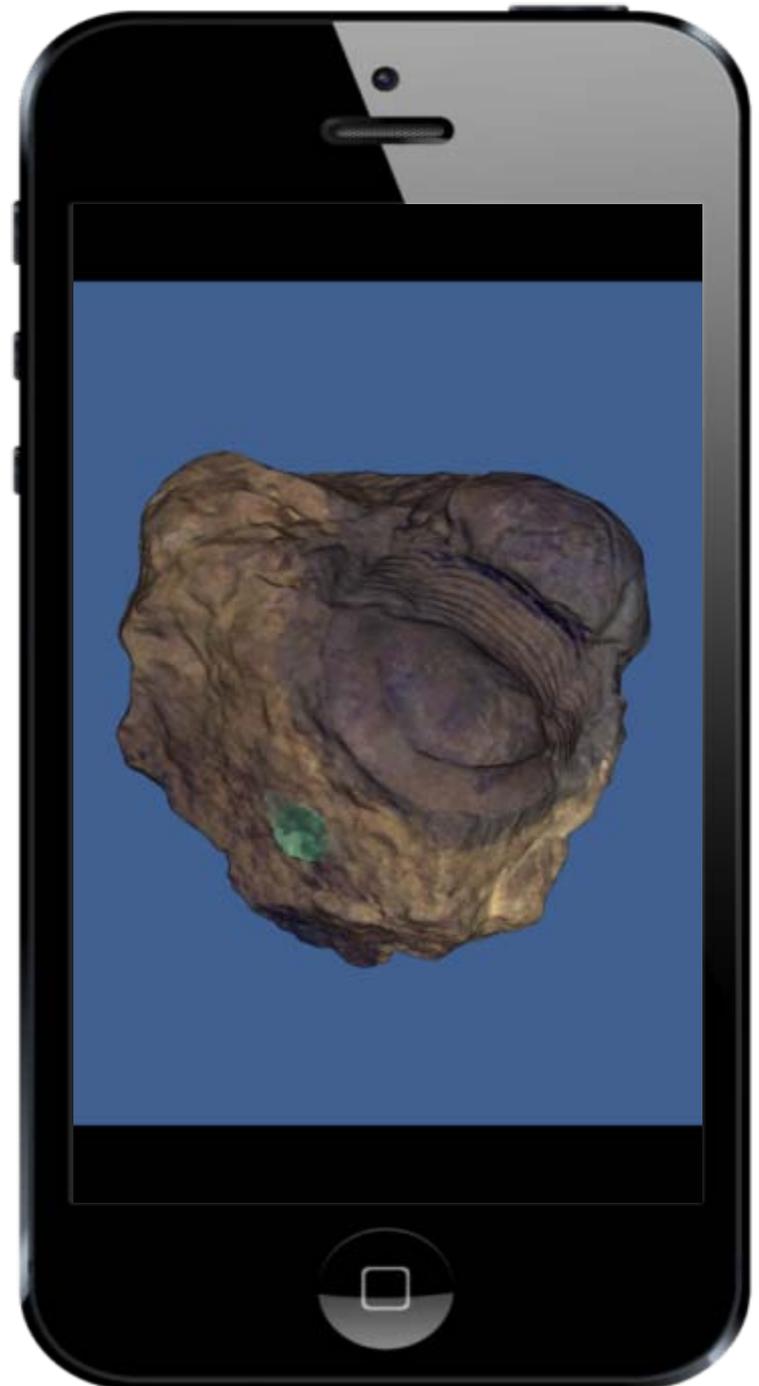
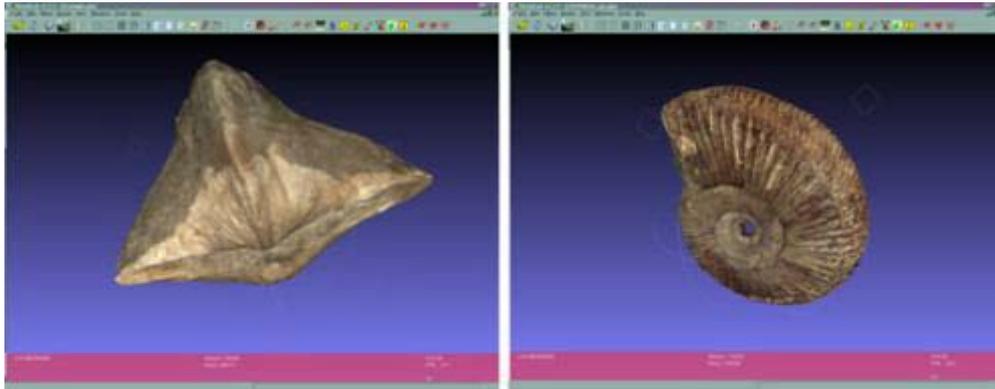
- Free Smartphone app for Android download from [Google Play](#)
- Combining DEM data, digital geology and landscape to 'paint' the geological map on the ground



# GB/3D type fossils online

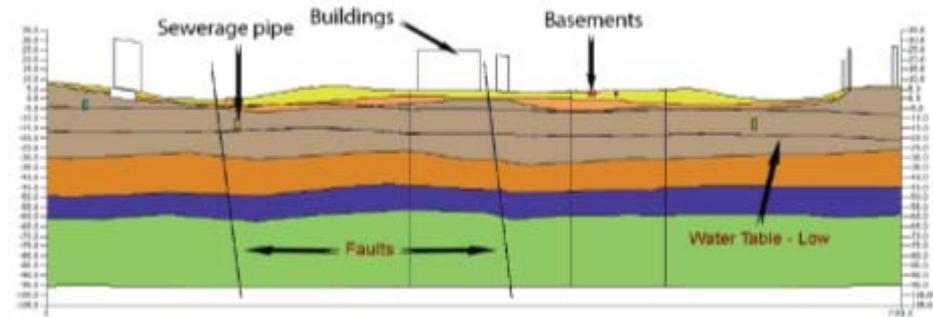
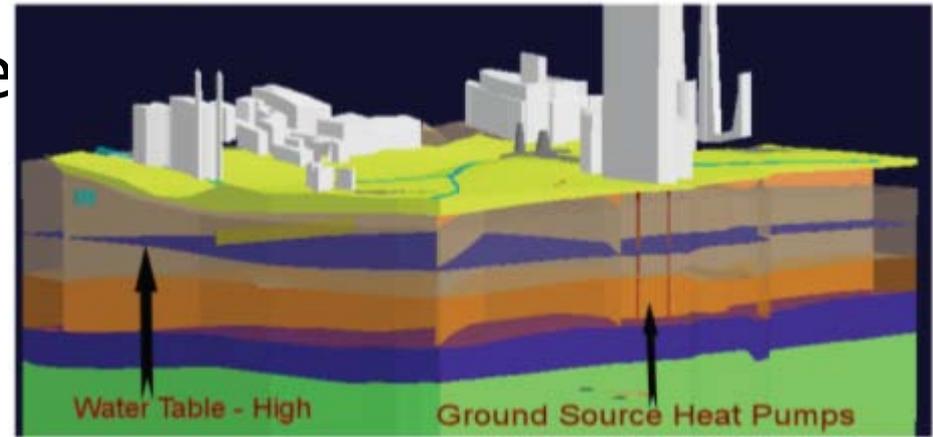
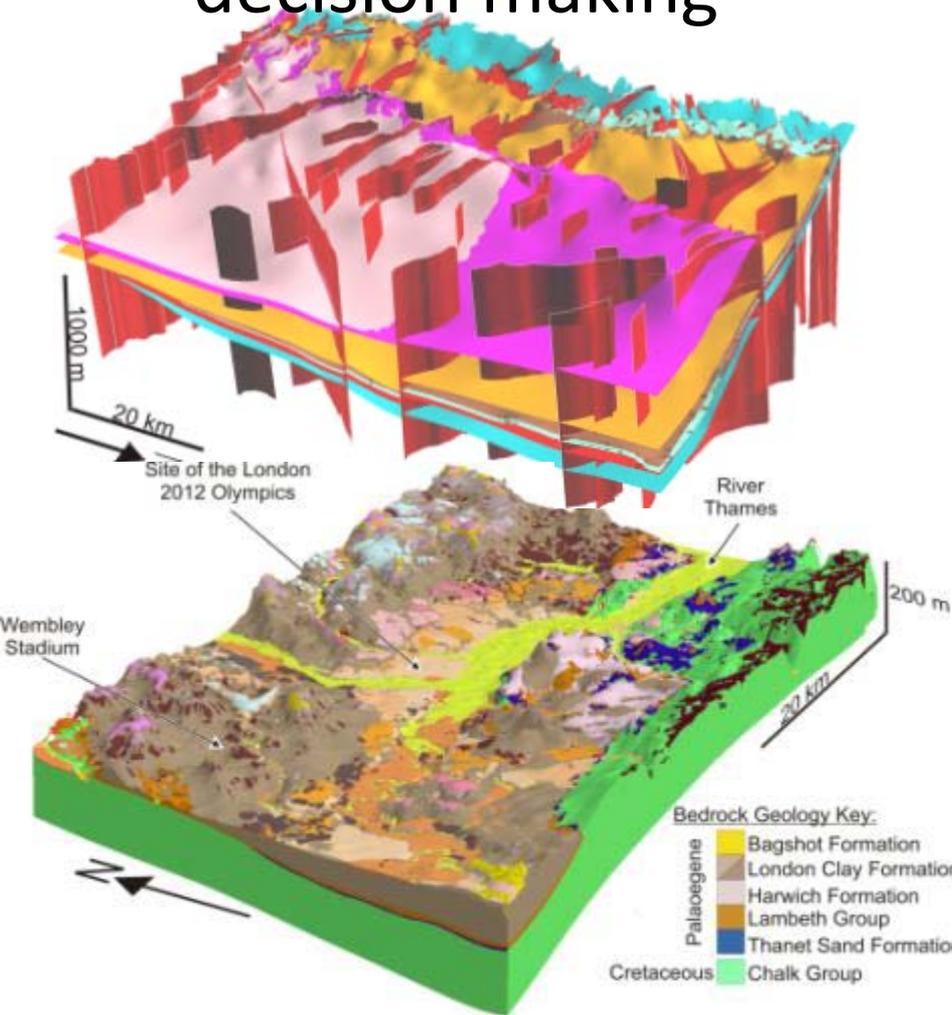
- A collaborative database of British type specimens
- Web-enabled images and digital models

[www.3d-fossils.ac.uk](http://www.3d-fossils.ac.uk)



# Geology and infrastructure

- 3D geology to support decision making



- Export to CAD or GIS for integration with infrastructure models
- Extensible and dynamic – updated as new data becomes available

# 3D model interrogation - via the web

Firefox

Geology of Britain viewer | British Geolo... | +

mapapps.bgs.ac.uk/geologyofbritain/home.html?mode=groundhog

British Geological Survey  
NATURAL ENVIRONMENT RESEARCH COUNCIL

Geology of Britain viewer

Surface Geology 3D Models Borehole Scans Earthquake Timeline

Go to Location

**Groundhog 3D geological models**

1) Choose Model:  
York

2) Drill virtual boreholes, or create virtual sections.

Drill Borehole

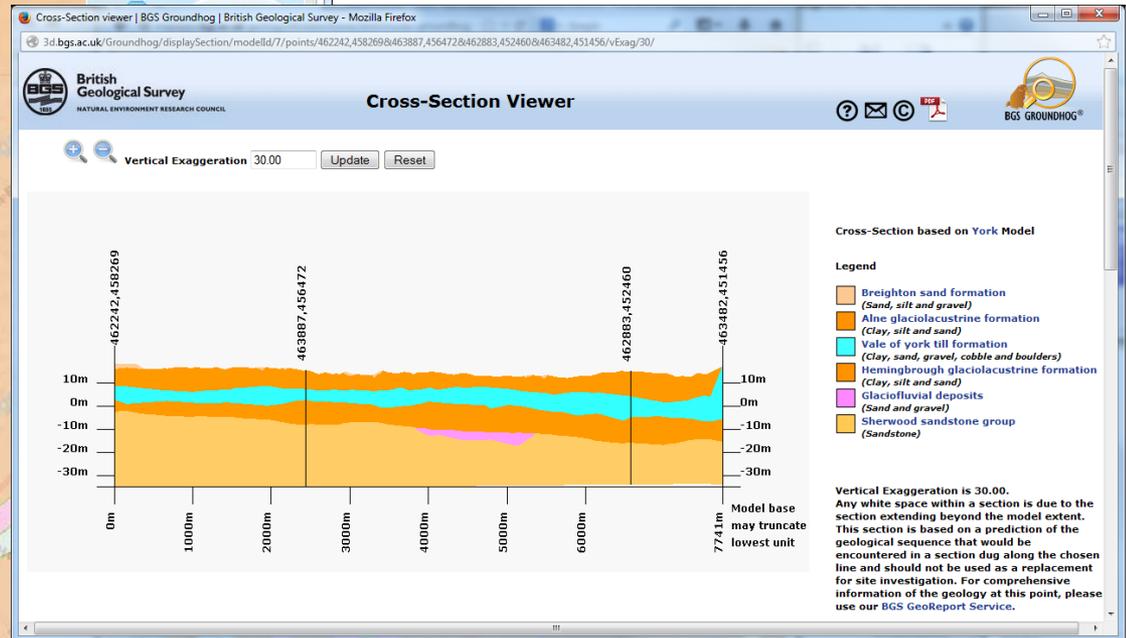
Draw Cross-section

Horizontal Section

More on 3D geology

0 1 2km

POWERED BY esri



<http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html>

# 3D model interrogation - via the web

Geology of Britain viewer | British Geolo...  
mapapps.bgs.ac.uk/geologyofbritain/home.html?mode=groundhog

British Geological Survey  
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Geology of Britain viewer

Surface Geology | 3D Models | Borehole Scans | Earthquake Timeline

Groundhog 3D geological models

1) Choose Model:  
York

2) Drill virtual boreholes, or create virtual sections.

Drill Borehole  
Draw Cross-section  
Horizontal Section

More on 3D geology

Horizontal Section

Create Horizontal Section

Enter elevation (in metres) relative to sea level:

OR

depth (in metres) below ground level:

Enter number of pixels. This is the number of pixels across the resulting image and not the cell size:

Generate section

Horizontal Section Viewer | BGS Groundhog | British Geological Survey - Mozilla Firefox  
3d.bgs.ac.uk/Groundhog/displayHorizontalSlice/modelId/7/sampleSize/75/hSliceZRetToDTM/20/

British Geological Survey  
NATURAL ENVIRONMENT RESEARCH COUNCIL

Horizontal Section Viewer

Elevation (in metres) relative to sea level   
or  
Depth (in metres) below ground level   
No. of pixels across the image  Update

Horizontal Section based on York Model

Legend

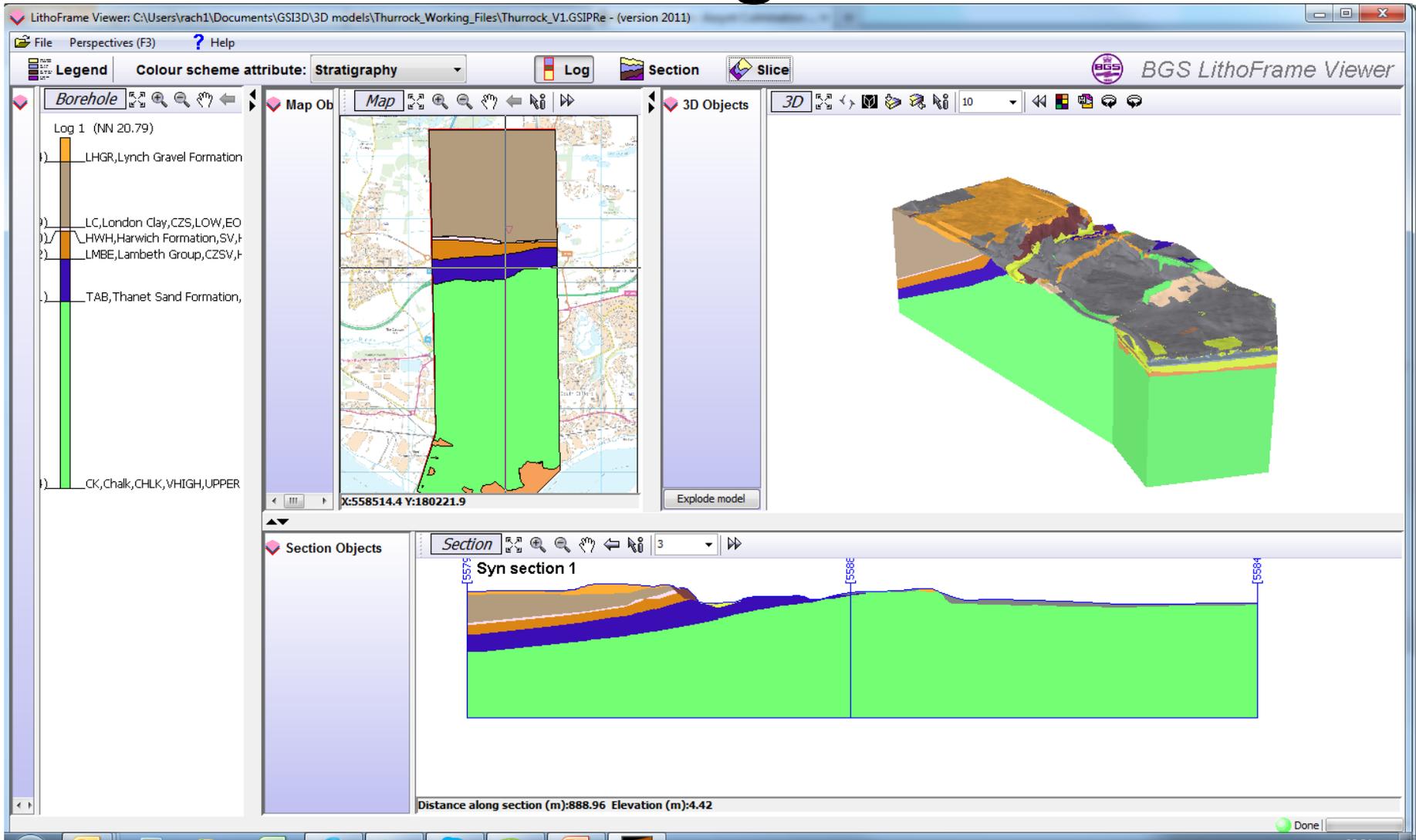
- Vale of york till formation (Clay, sand, gravel, cobble and boulders)
- Hemingbrough glaciolacustrine formation (Clay, silt and sand)
- Glaciofluvial deposits (Sand and gravel)
- Sherwood sandstone group (Sandstone)

Horizontal section depth at 20m below ground level.

This horizontal section is based on a prediction of the geological sequence that would be encountered at a surface excavated at the selected elevation and should not be used as a replacement for site investigation. For comprehensive information of the geology at this point, please use our BGS GeoReport Service.

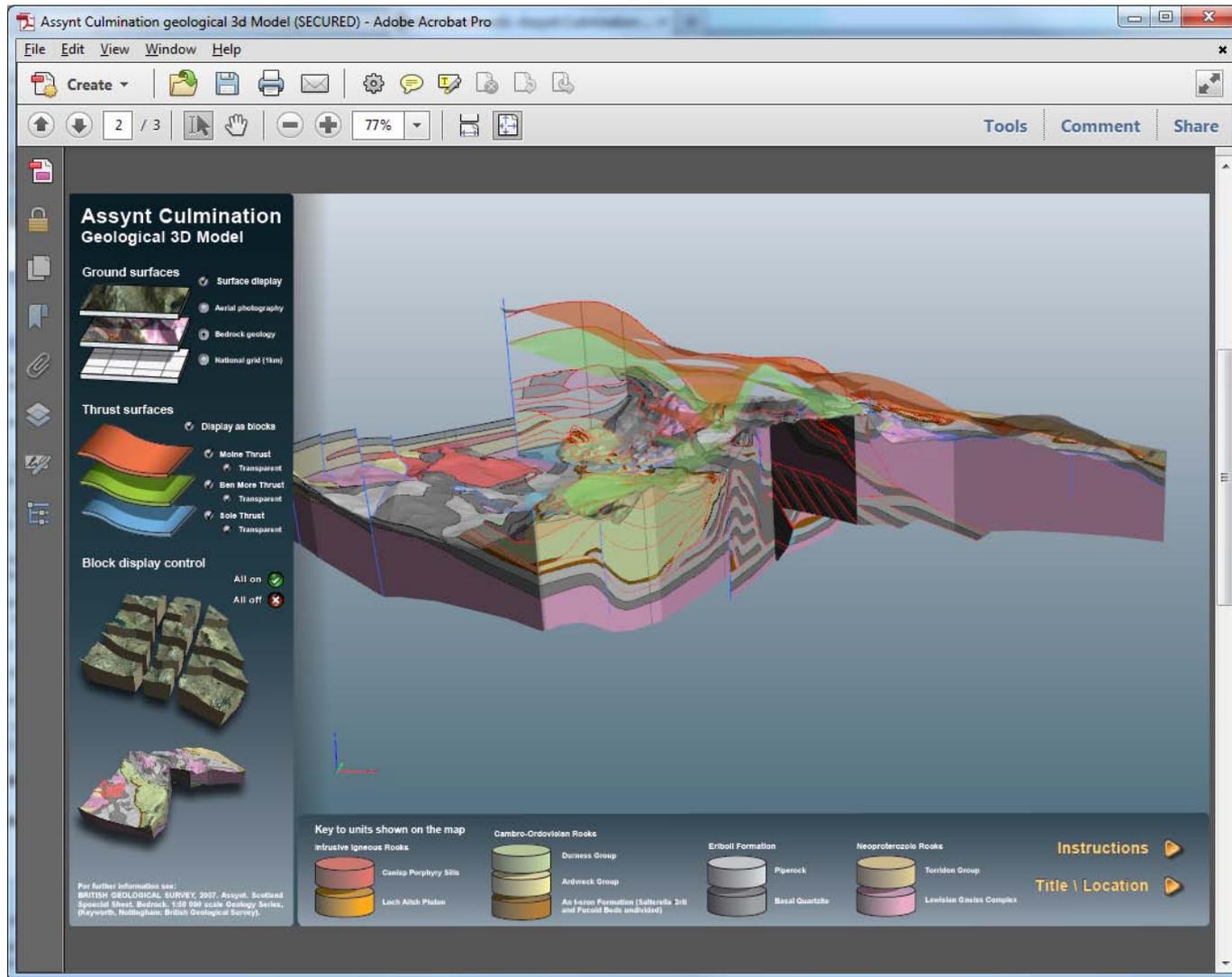
BGS GROUNDHOG® © NERC 2013. All rights reserved. BGS GROUNDHOG® is a trademark registered in the United Kingdom in the name of the Natural Environment Research Council. NEXTMAP Britain elevation data from Intermap Technologies. Any attempt to decompile or reverse engineer any part of this data is prohibited.

# 3D model interrogation - viewer



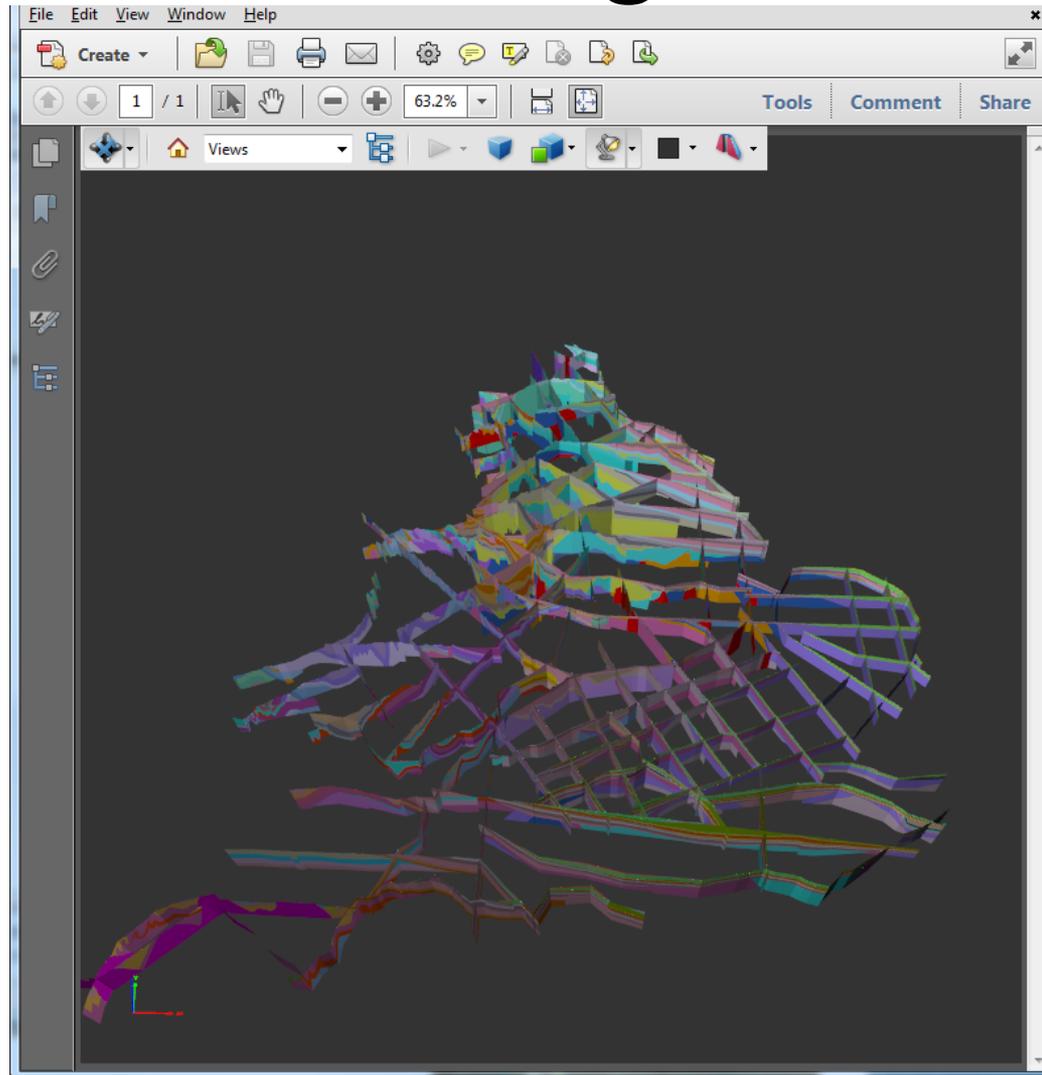
<http://www.bgs.ac.uk/services/3Dgeology/lithoframeSamples.html>

# 3D model interrogation - 3D PDF



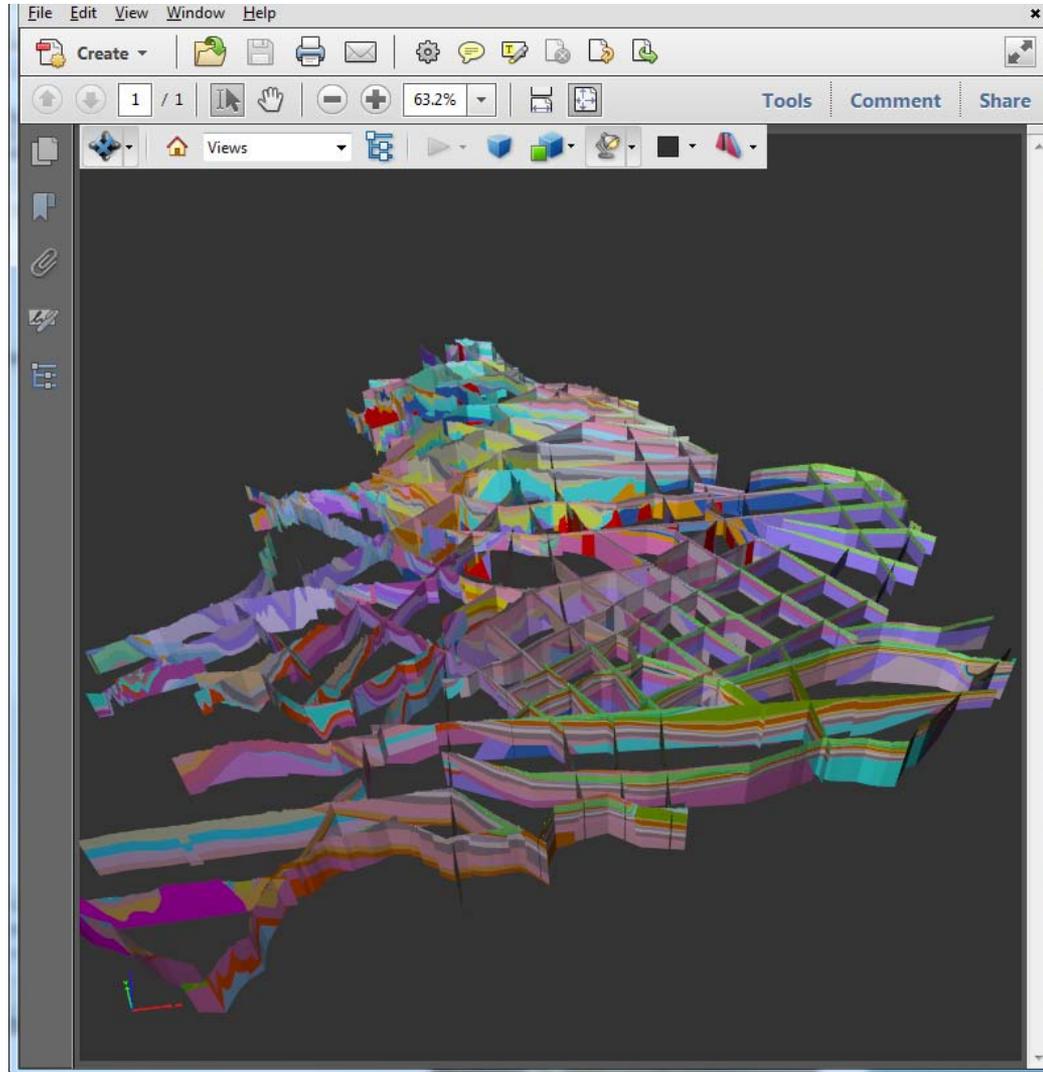
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# 3D model interrogation - 3D PDF

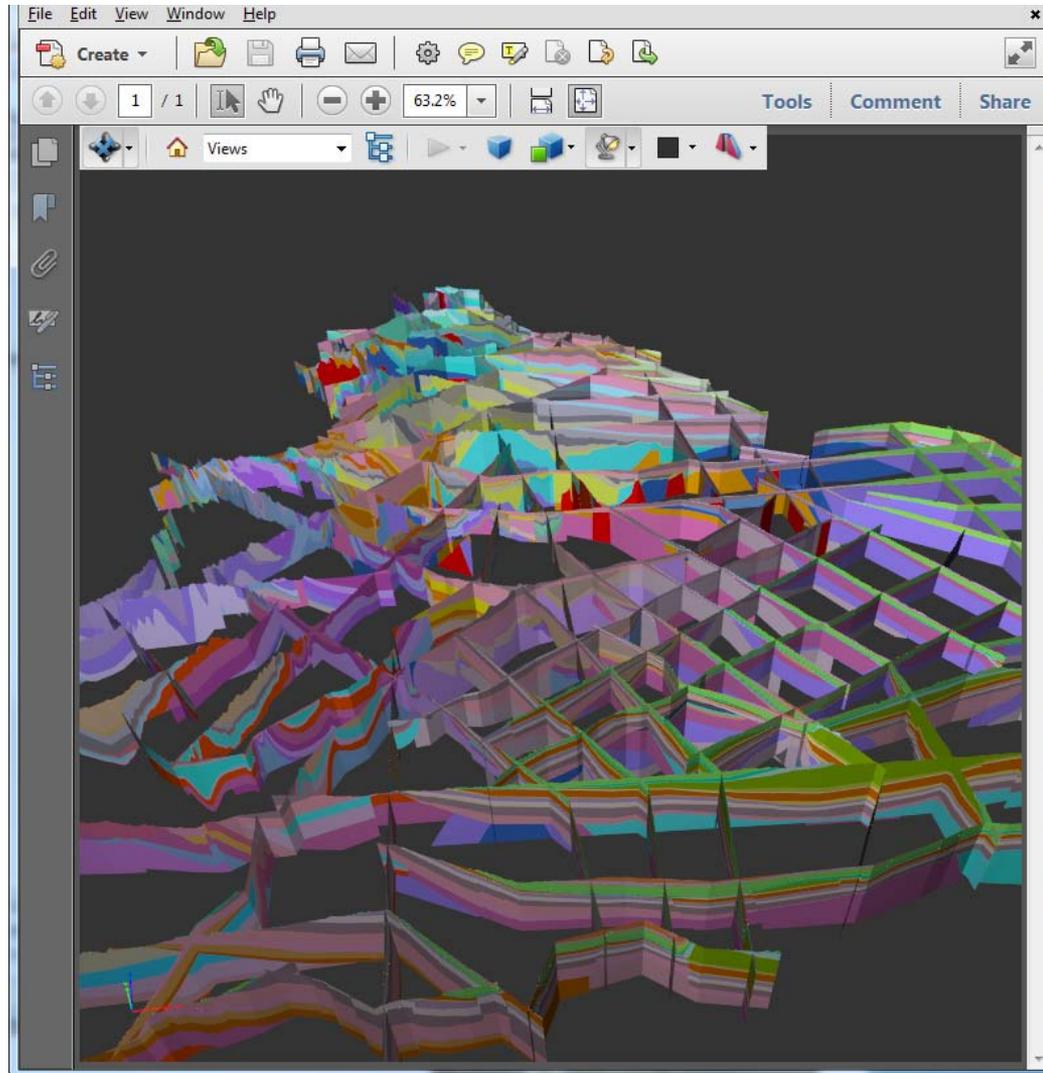


<http://www.bgs.ac.uk/research/ukgeology/nationalGeologicalModel/GB3D.html>

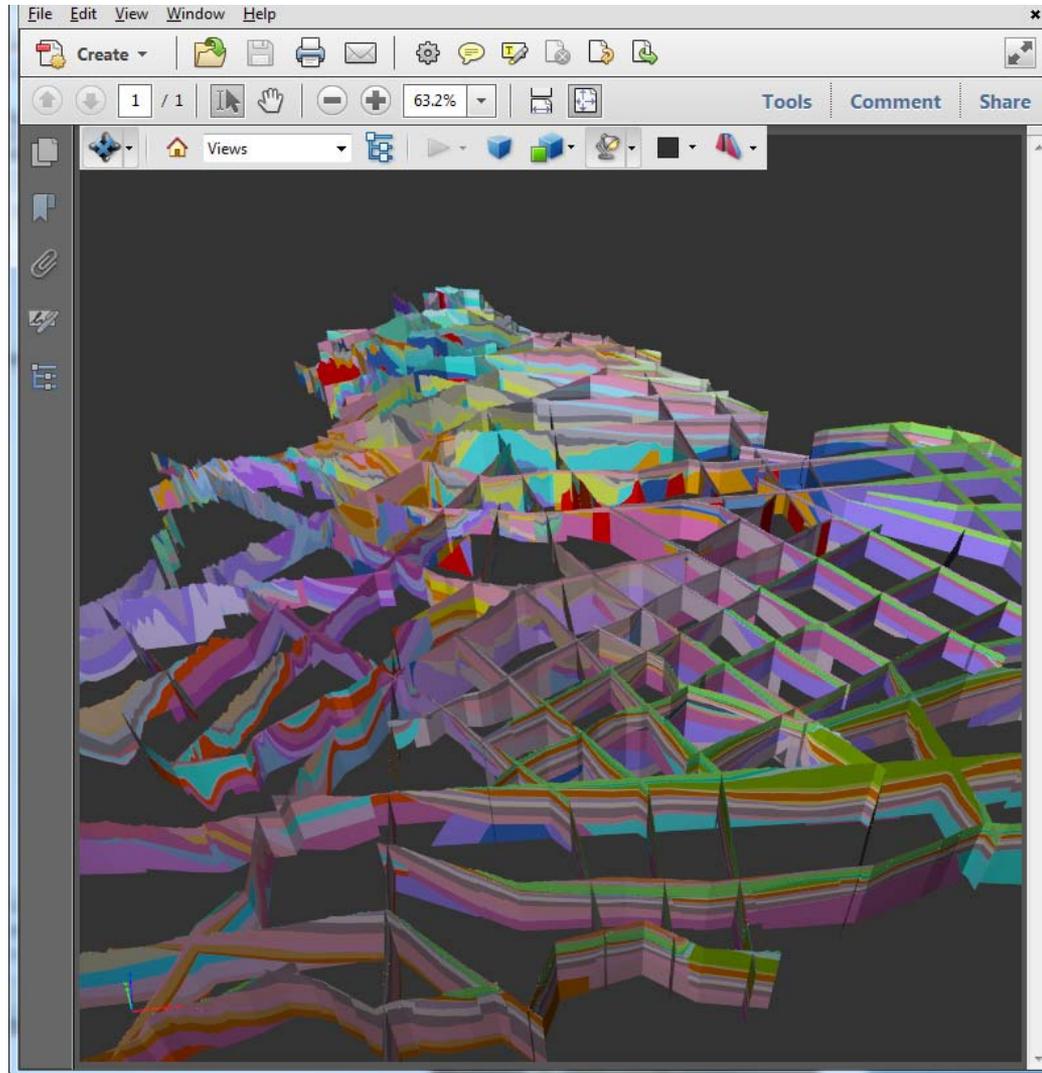
# 3D model interrogation - 3D PDF



# 3D model interrogation - 3D PDF



# 3D model interrogation - 3D PDF



# 3D model interrogation - 3D PDF

