The following was presented at DMT'12 (May 20-23, 2012).

The contents are provisional and will be superseded by a paper in the DMT'12 Proceedings.

See also earlier Proceedings (1997-2011)
http://ngmdb.usgs.gov/info/dmt/

3D GEOLOGIC MAPPING – STRUCTURAL STUDIES OF GEOTHERMAL SYSTEMS IN THE BASIN AND RANGE
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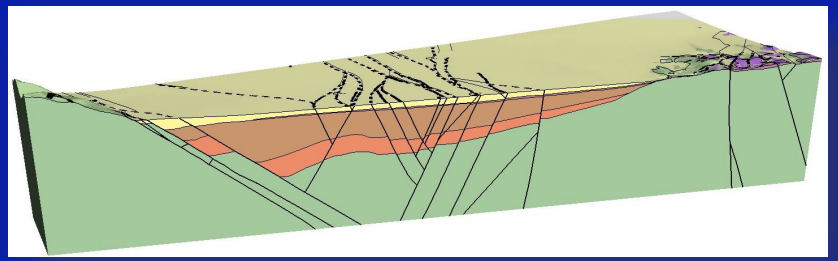
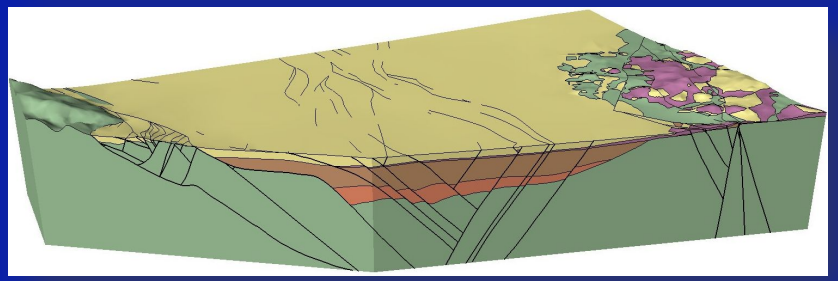
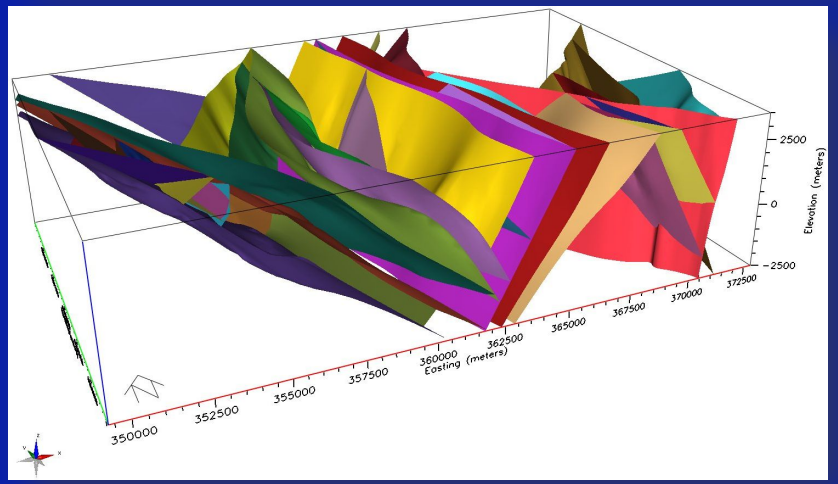
Drew Siler
Jim Faulds
Nevada Bureau of Mines and Geology

# 3D Geologic Mapping

- 3D geological mapping used by
  - Oil and Gas industry
  - Minerals industry
  - Groundwater resources/ contamination
  - Seismic hazard
- Only recently employed by the geothermal industry (5 yrs)
- "Mapping" vs "Modeling"

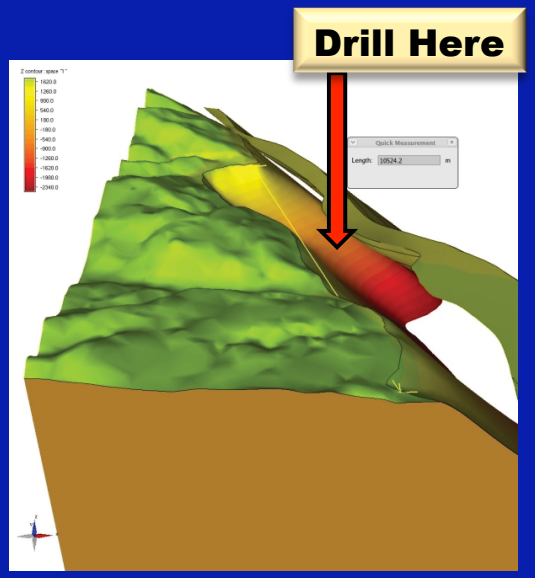


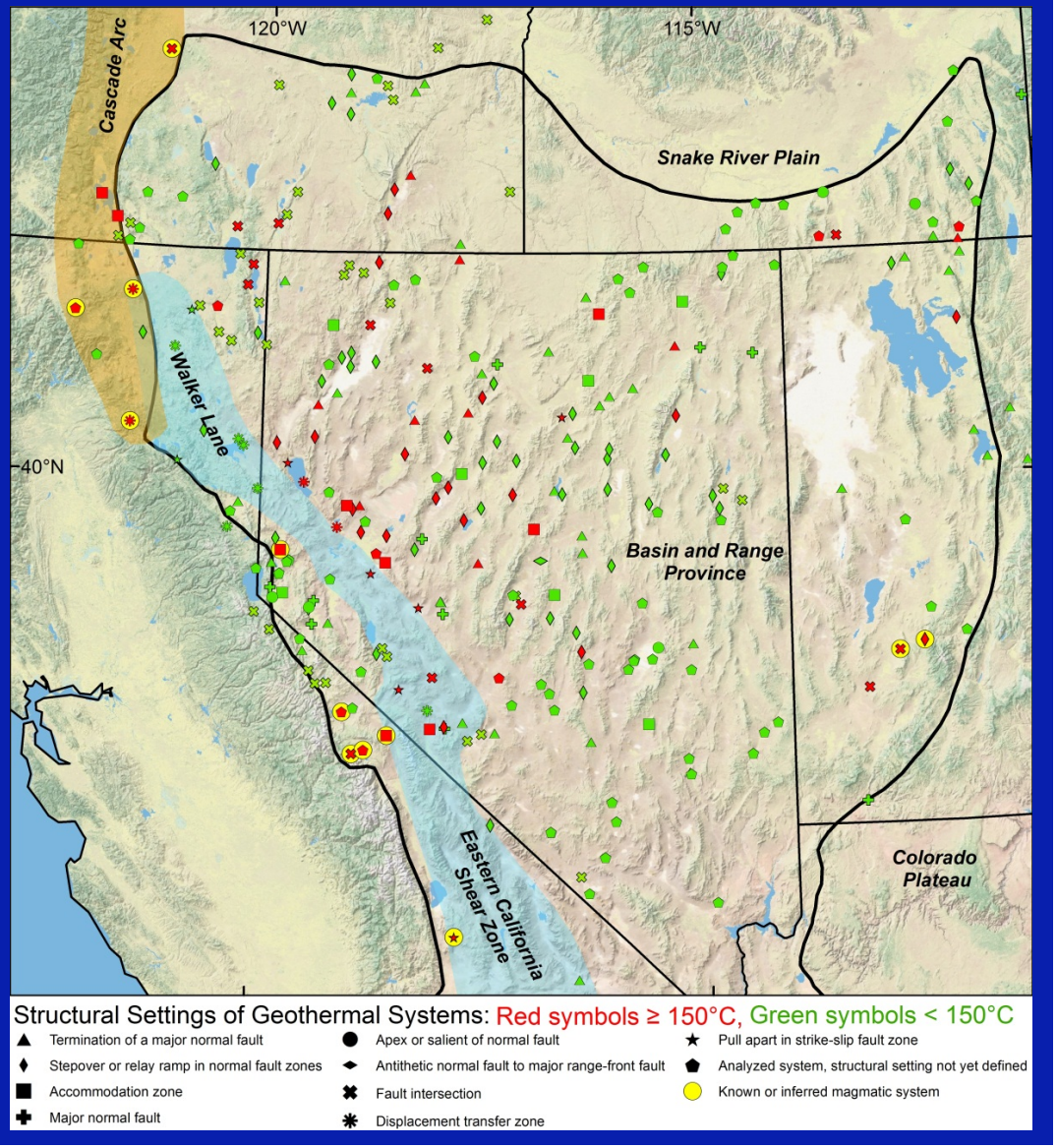




# Geothermal Systems in the Great Basin region

- Most systems are amagmatic
- Most systems are blind
- Fluid flow and producing reservoirs are largely controlled by faults

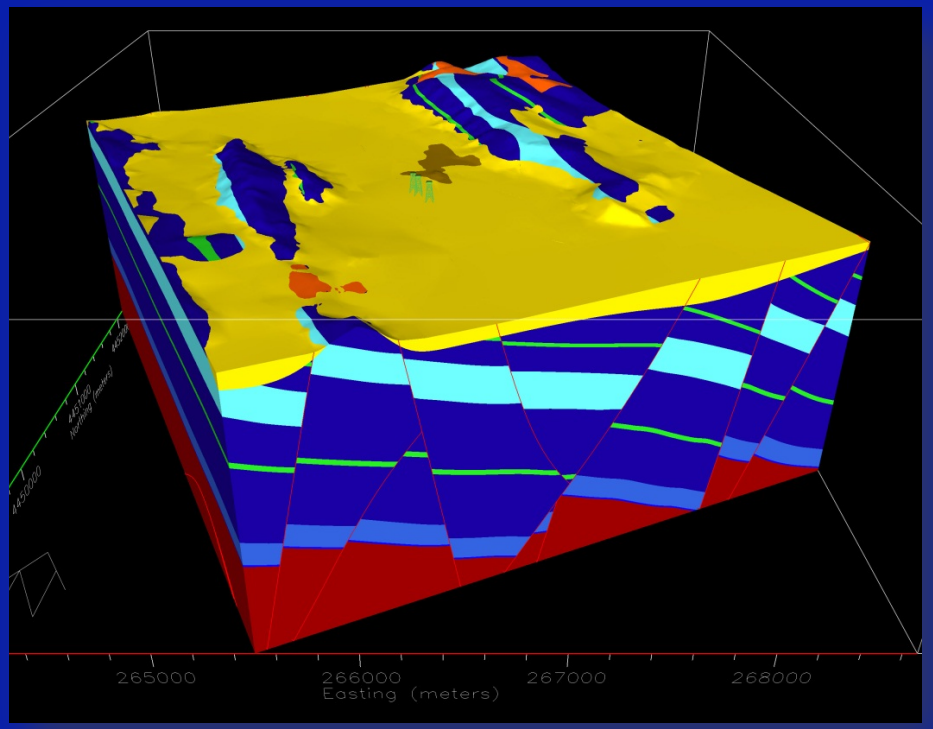


# Data Available for 3D Geologic Mapping

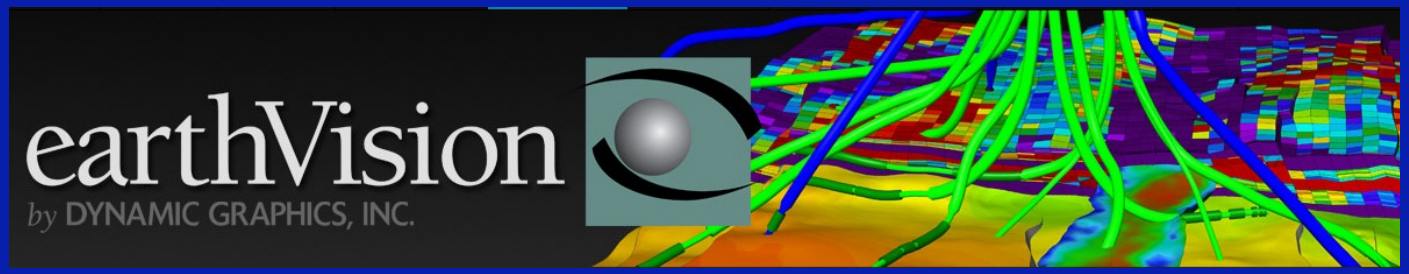
- 2D geologic map data
- Drill hole data
- 2D/3D seismic reflection data
- Gravity data
- Aeromagnetic data
- MT, CSAMT, ZTEM, etc.

- *Geologist's interpretations*

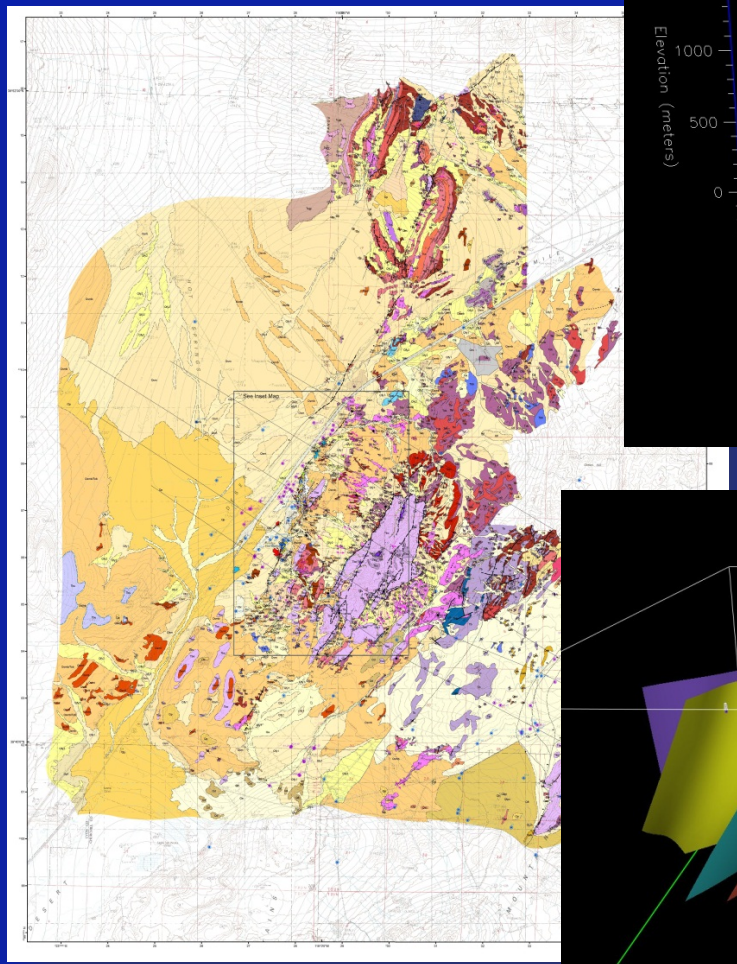


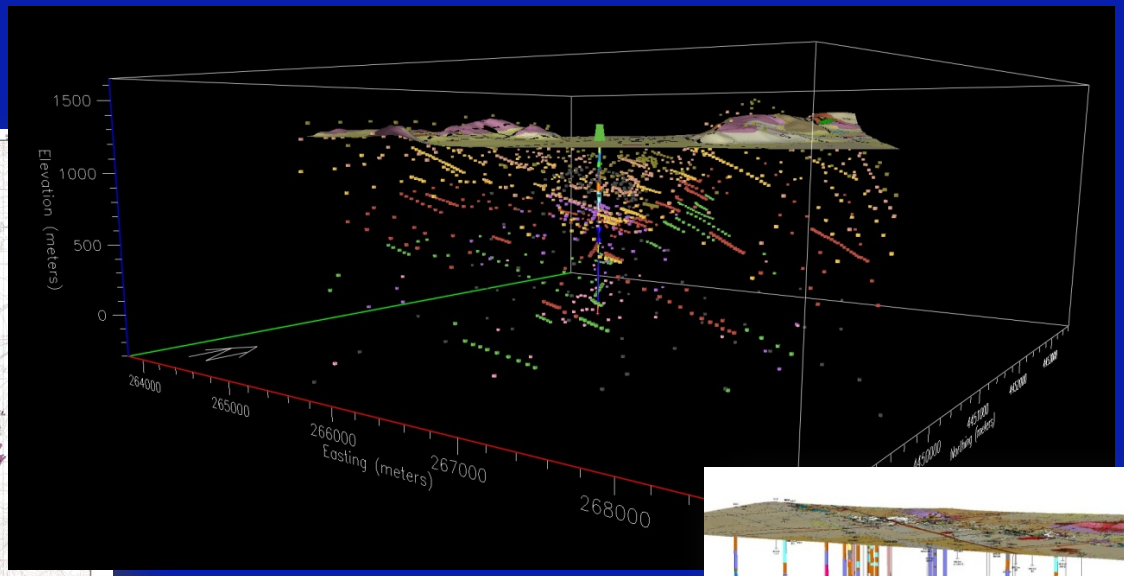
# Workflow

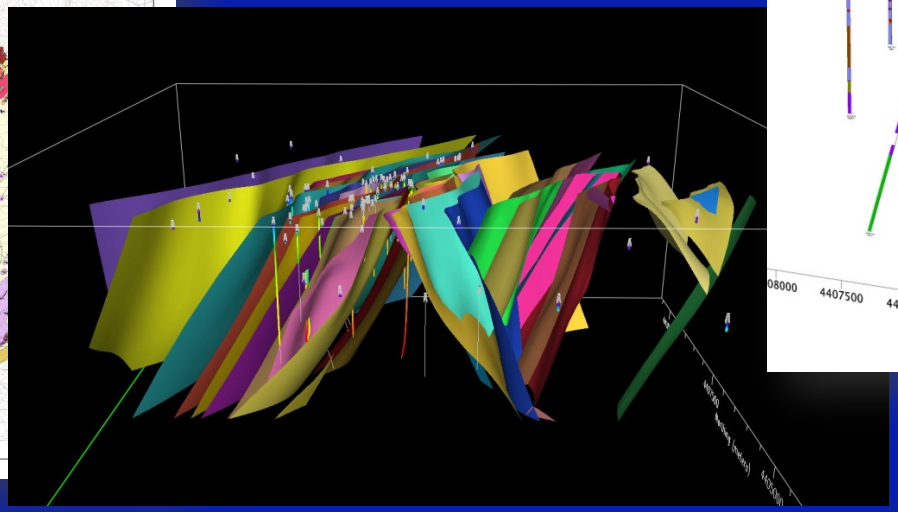
1. 2D Surface Map Data
2. 2D Geologic Cross Sections
   - Map data + Drill hole data + Geophysics
3. Build 3D model, ***faults first, then contacts***
   - Include data intermediate to cross-sections
   - Rebuild 3D model
   - Add intermediate control points as necessary
   - Rebuild 3D model
   - Add/modify control points as necessary
   - Rebuild 3D model…

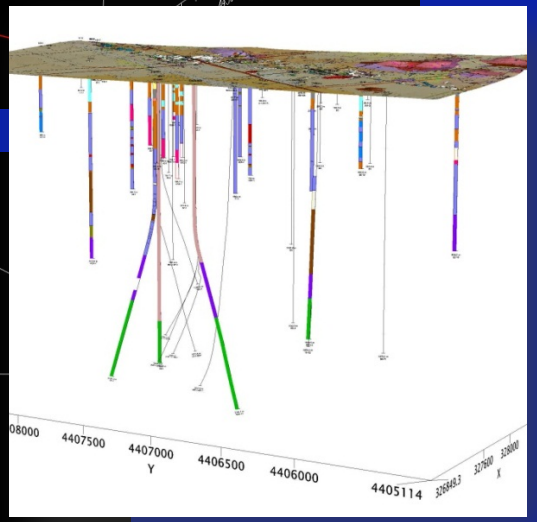


# Why 2D Cross-Sections?

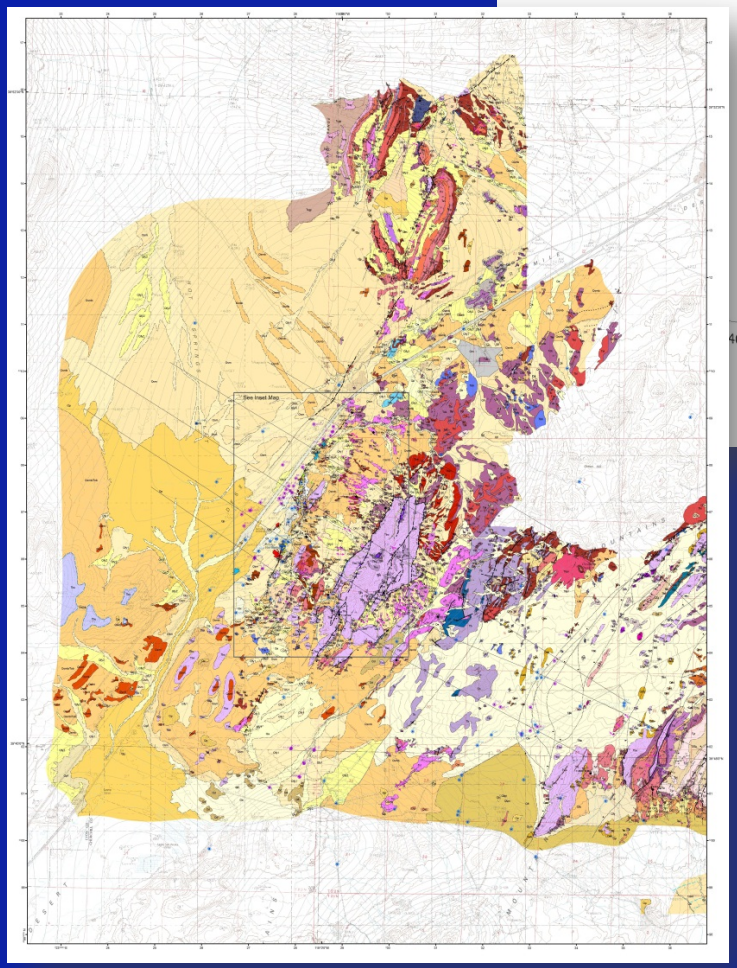


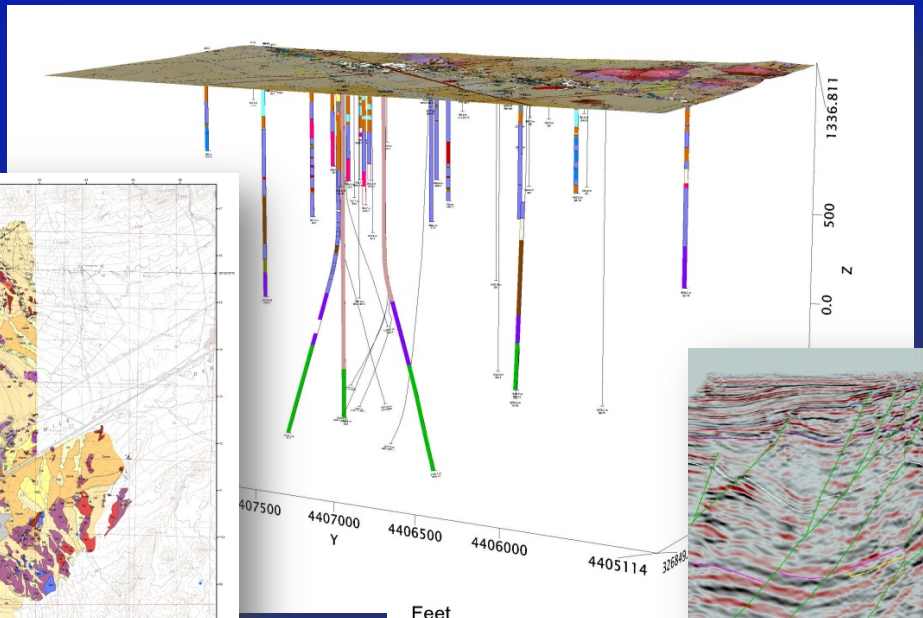


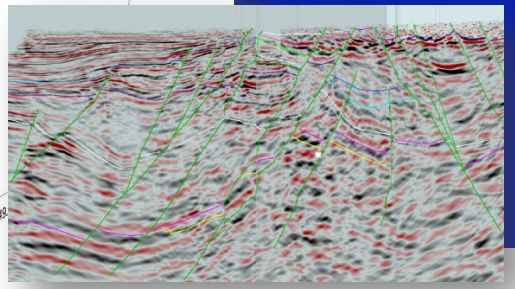



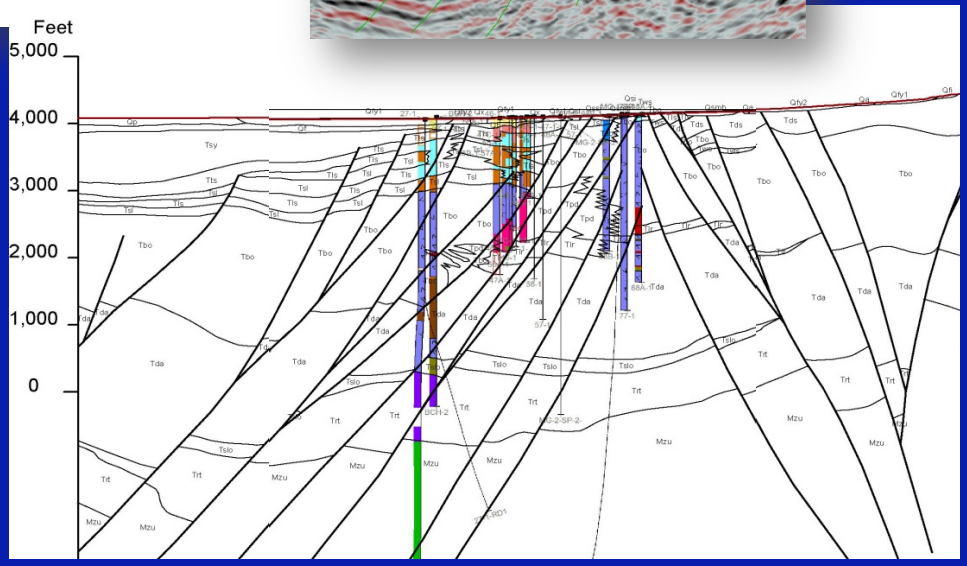


# 2D sections with 3D drill-hole data







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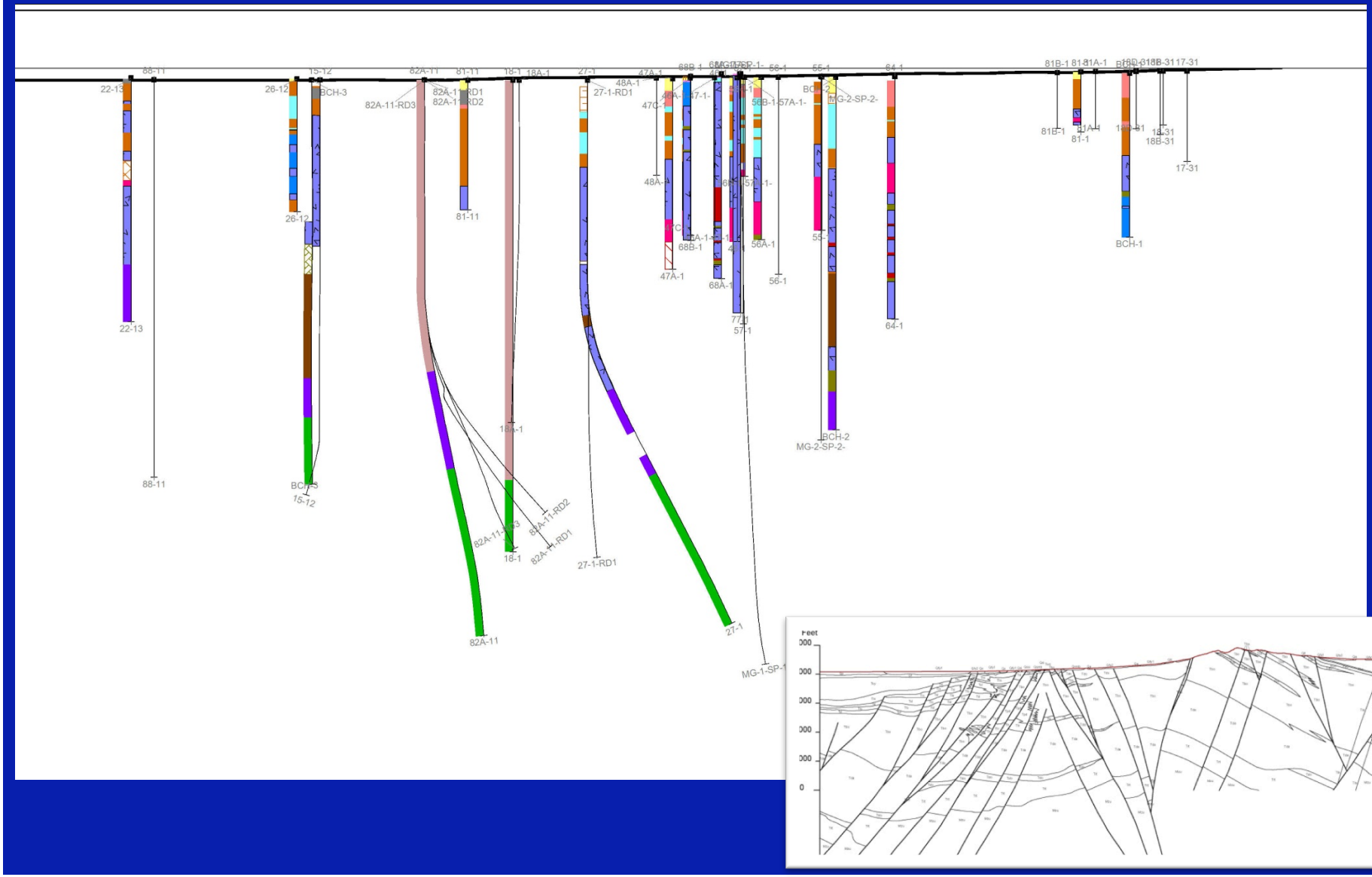
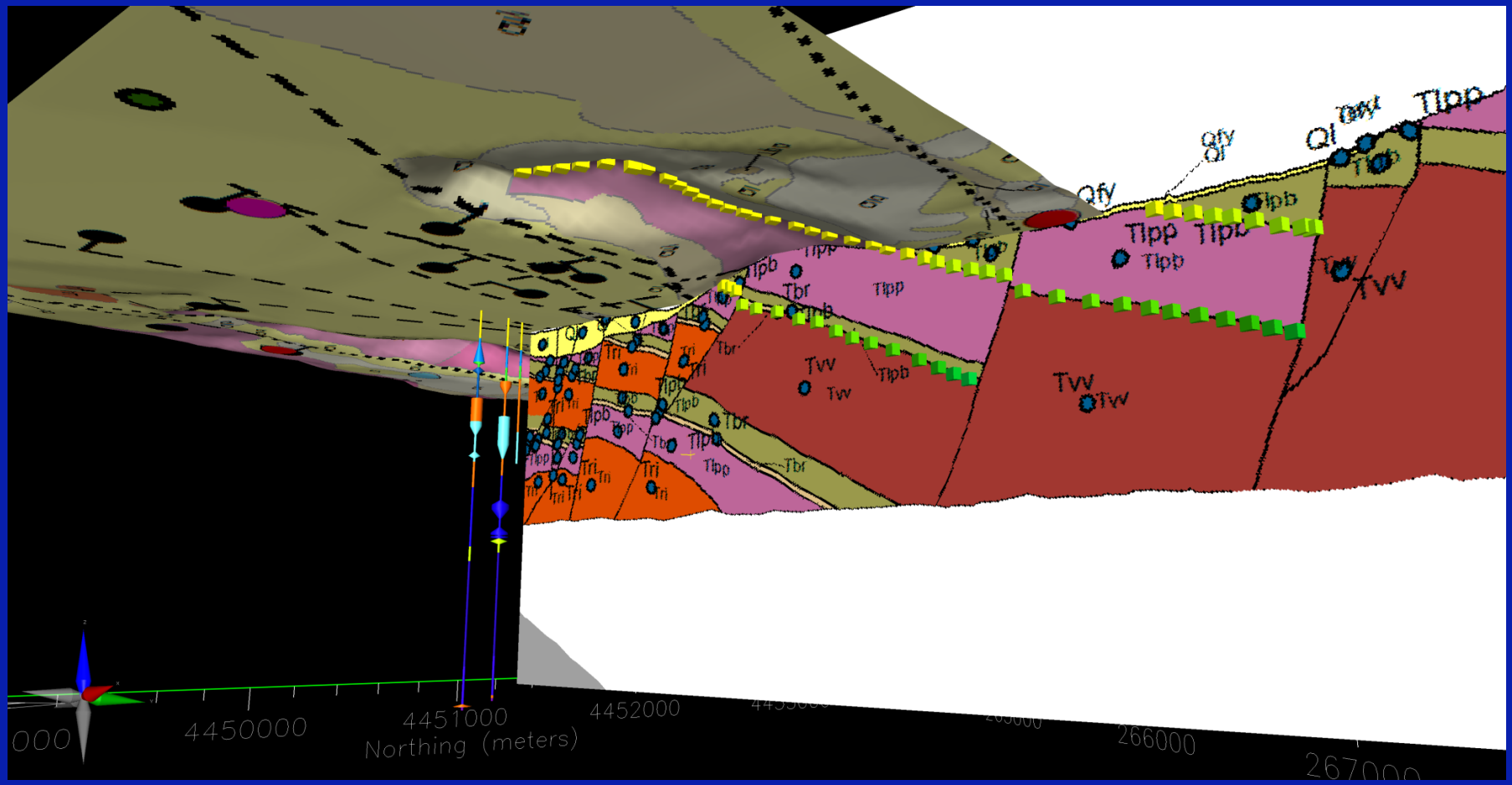
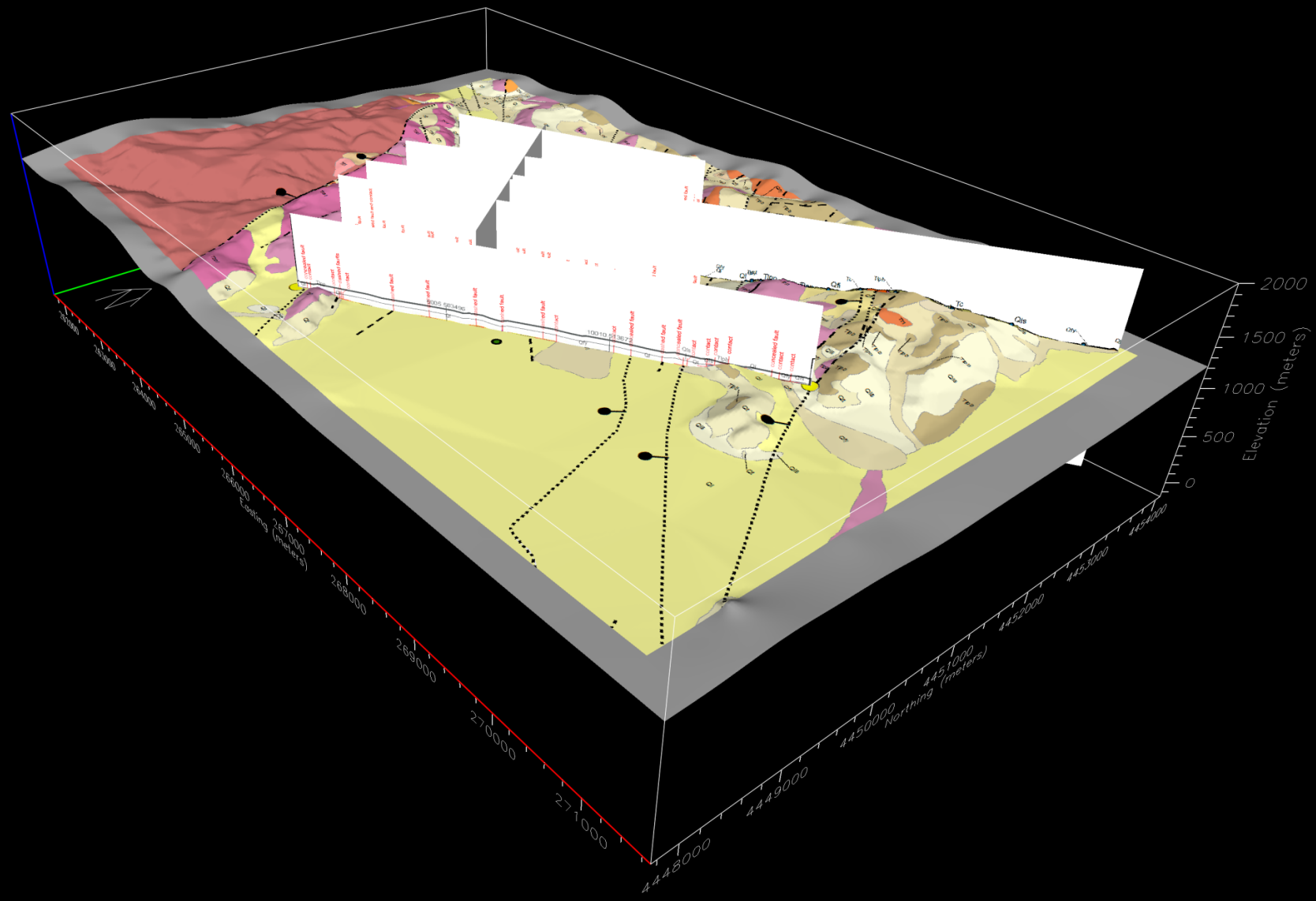


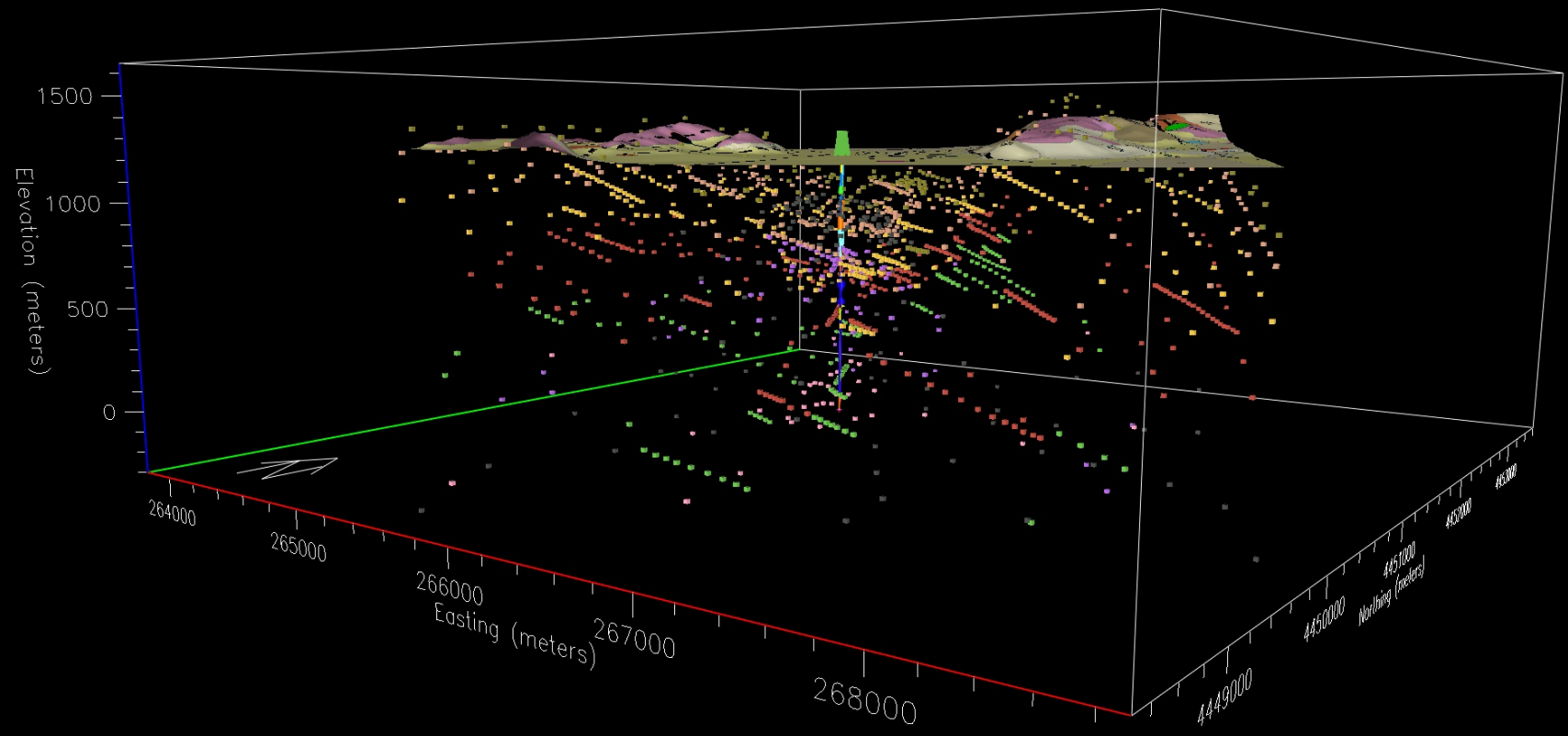
# Importing and/or digitizing in EV



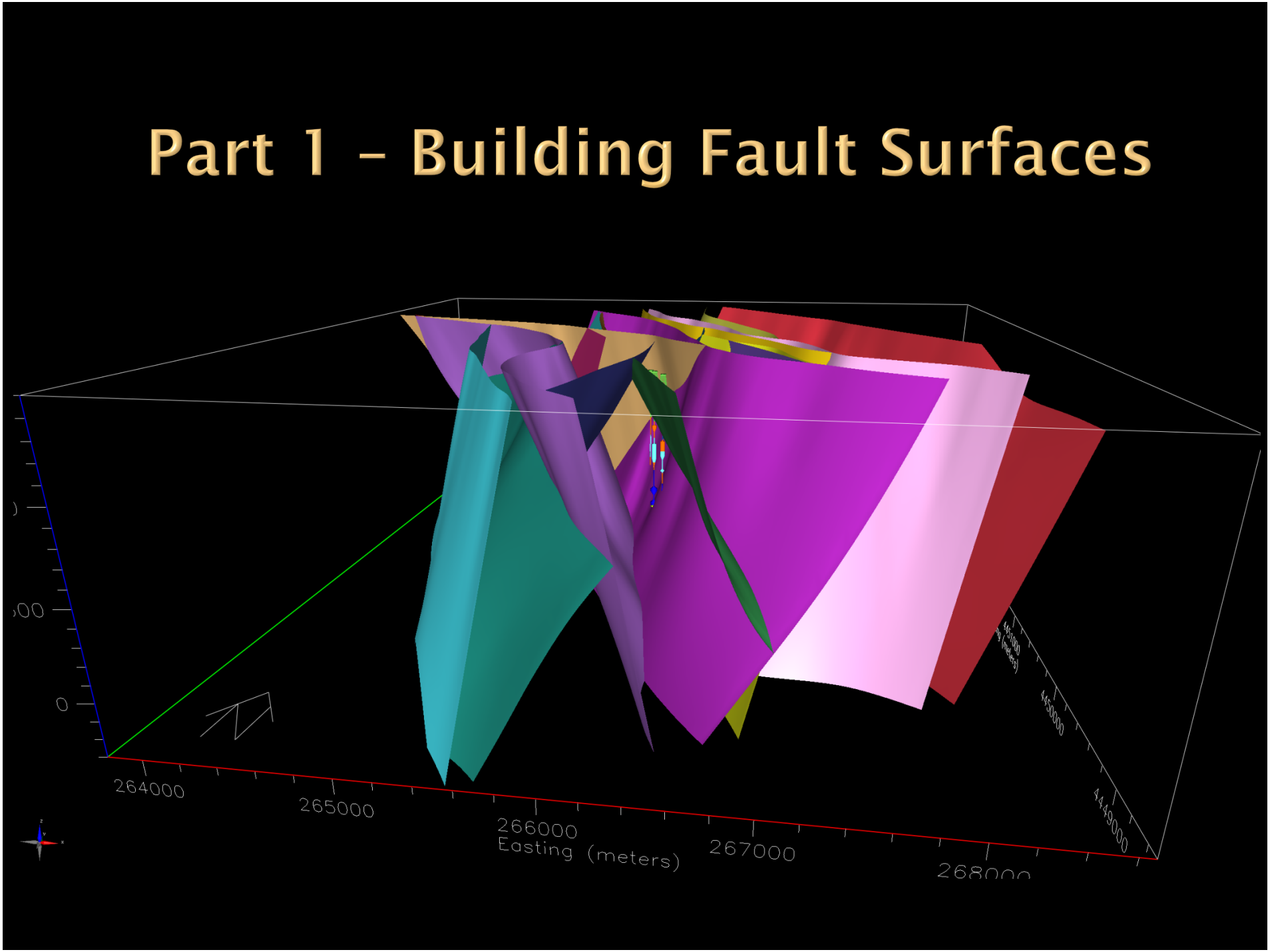
# Multiple cross-sections



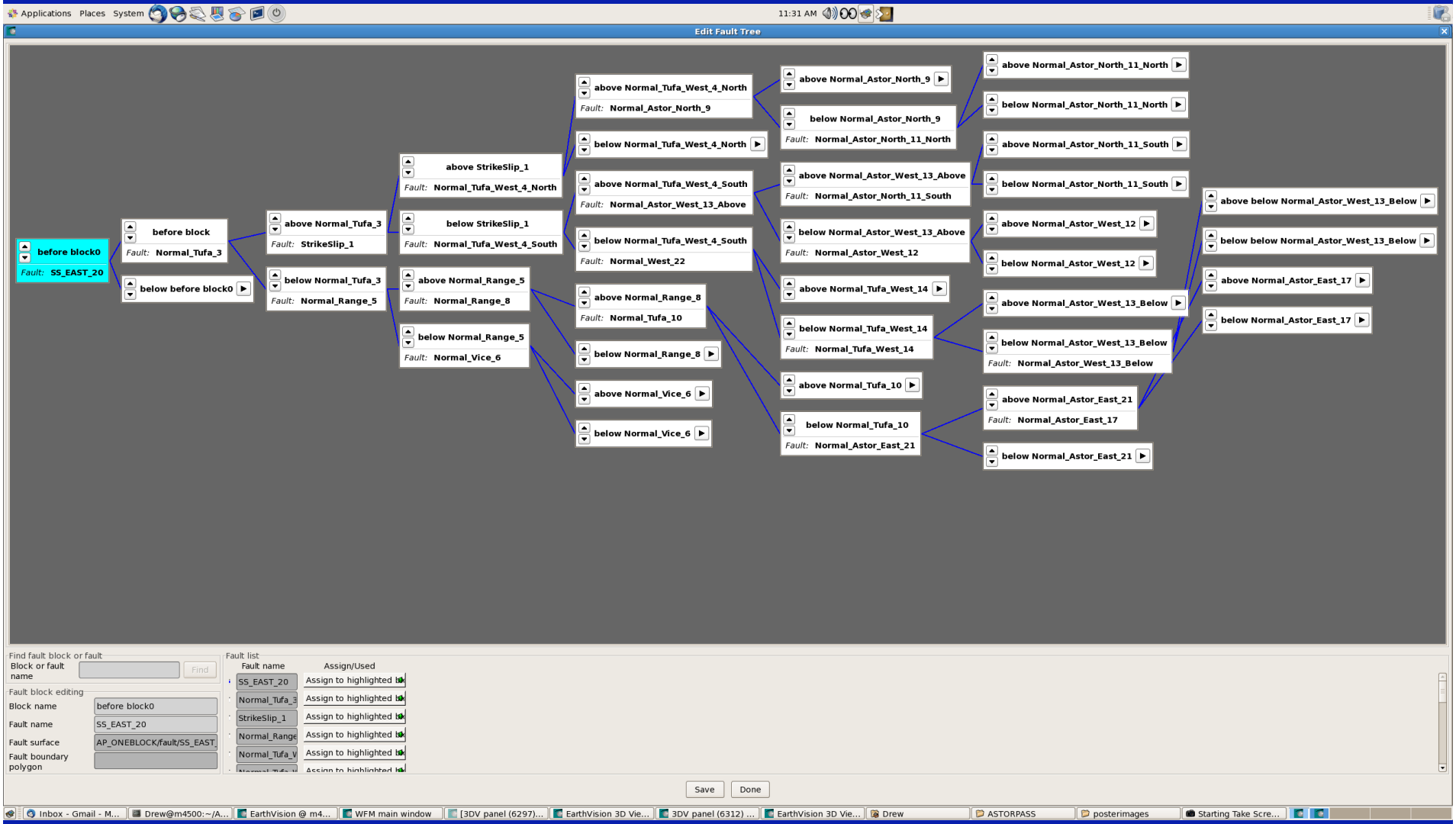
# Input data completely imported/digitized and attributed



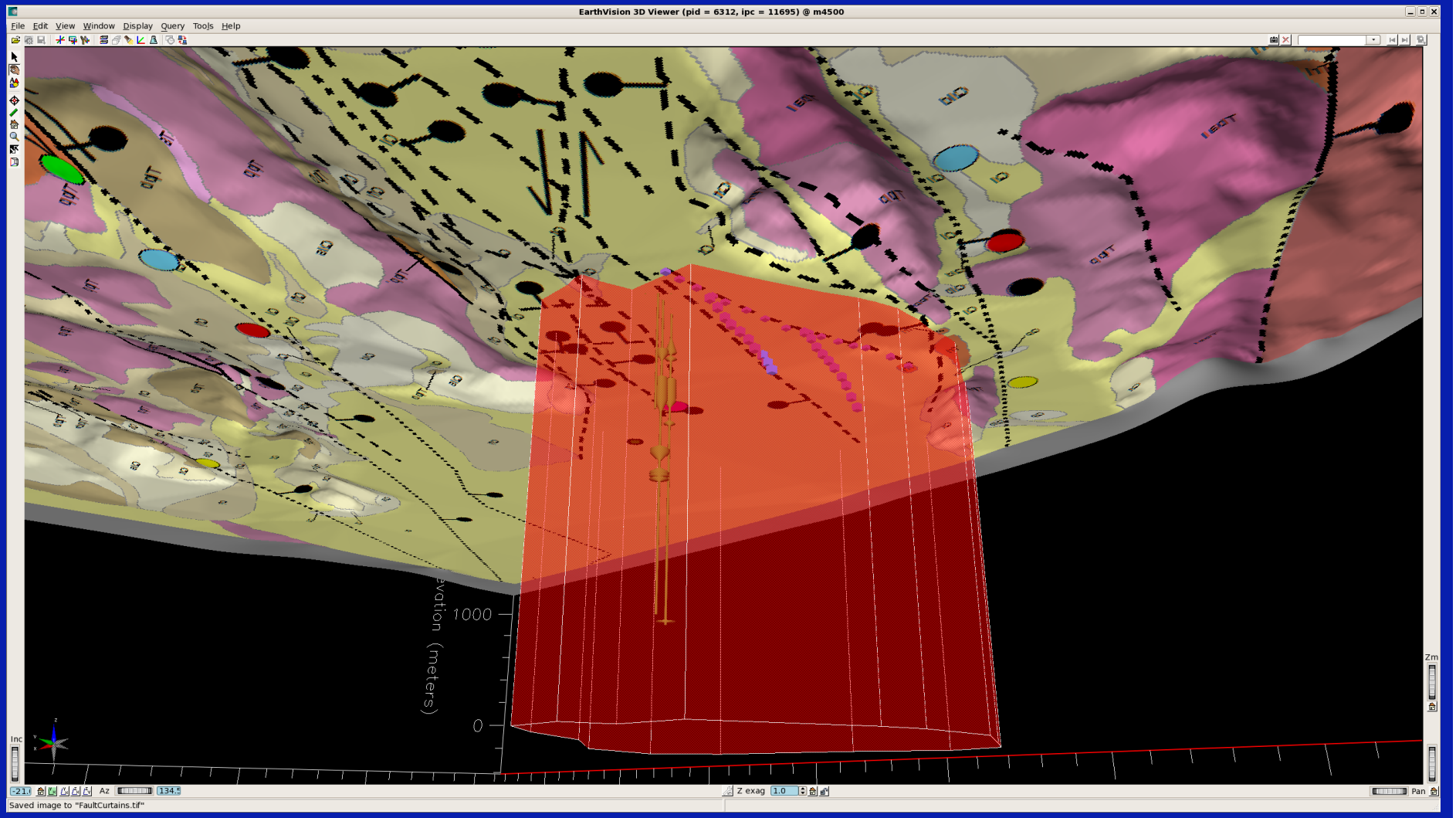
# Part 1 – Building Fault Surfaces



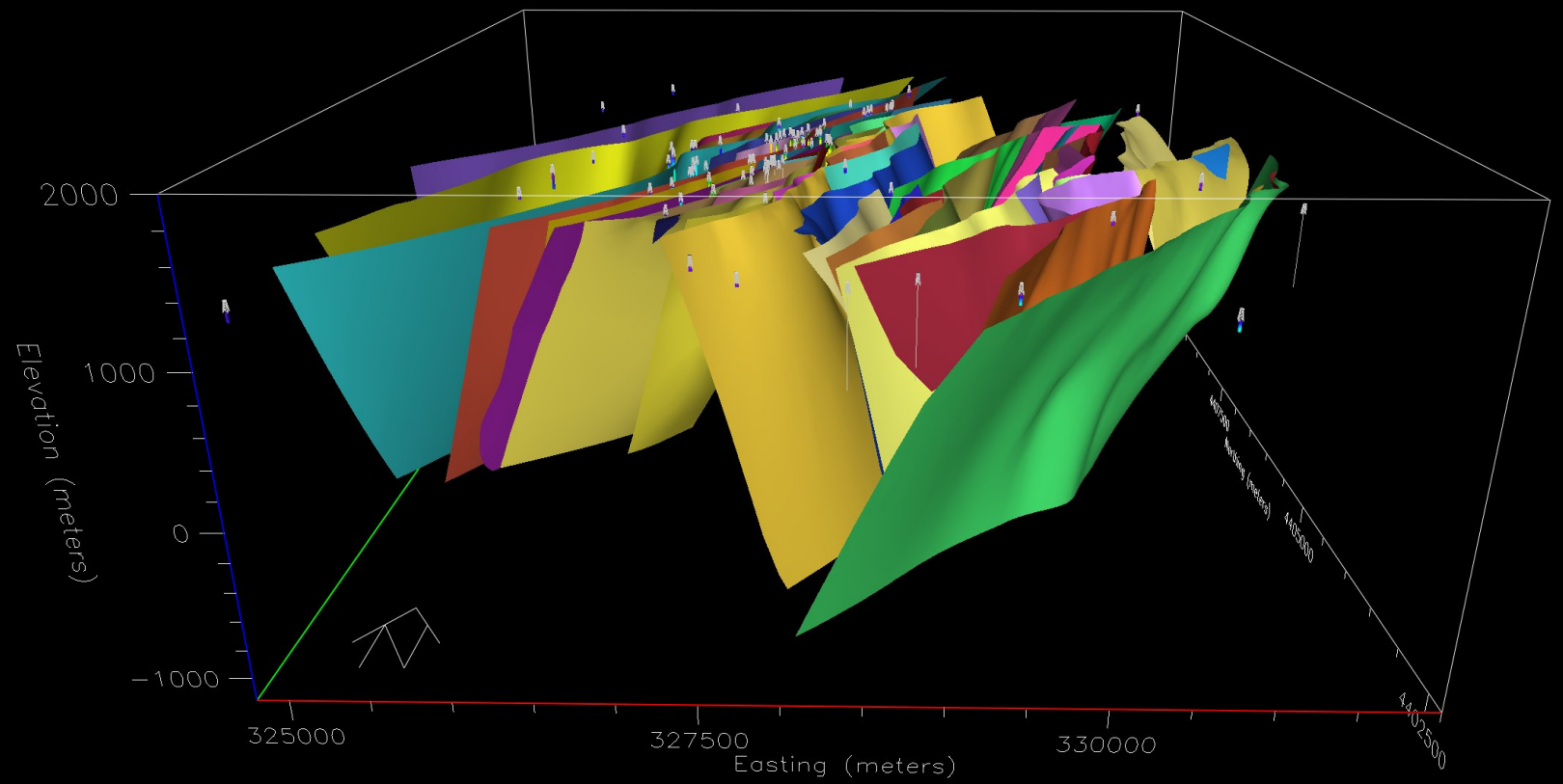
# Fault Hierarchy



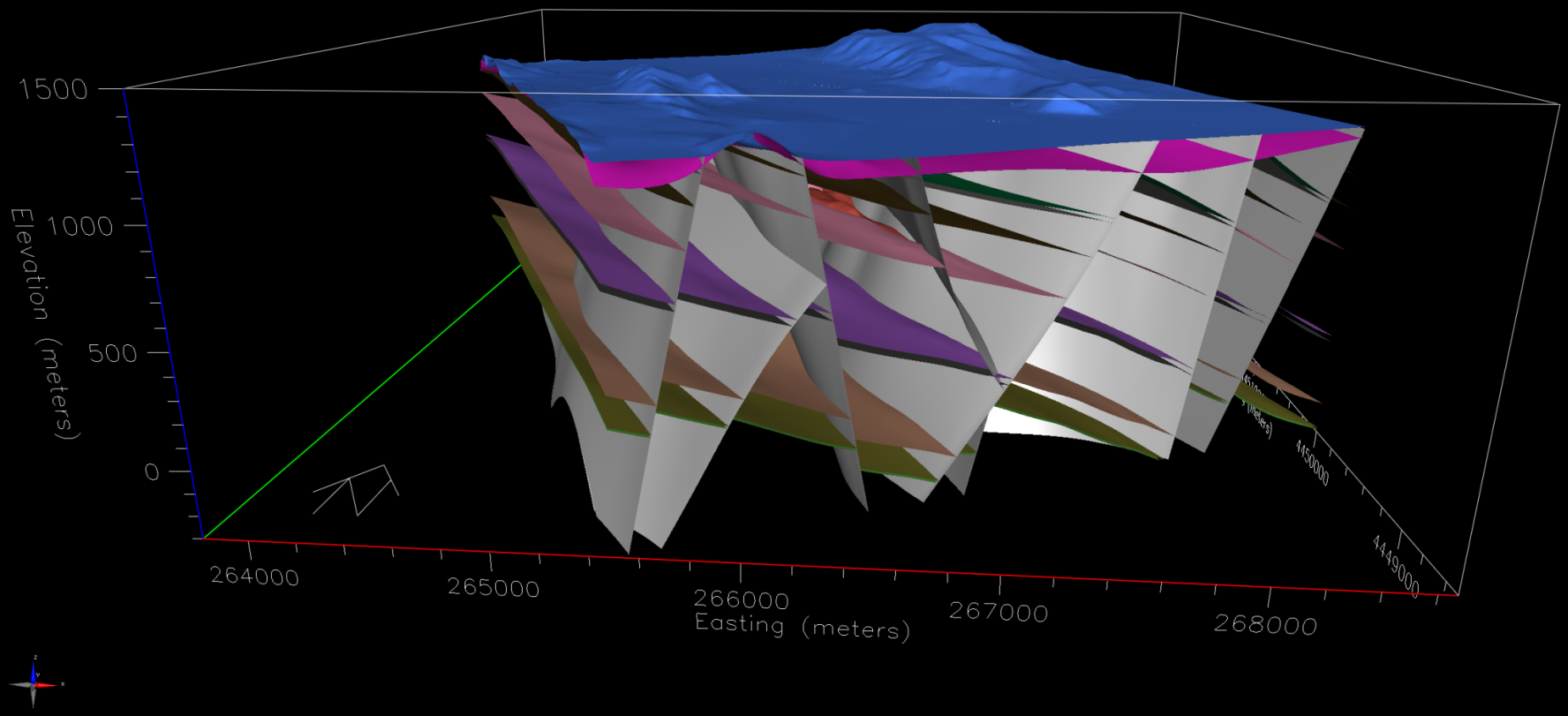
# Fault Curtains



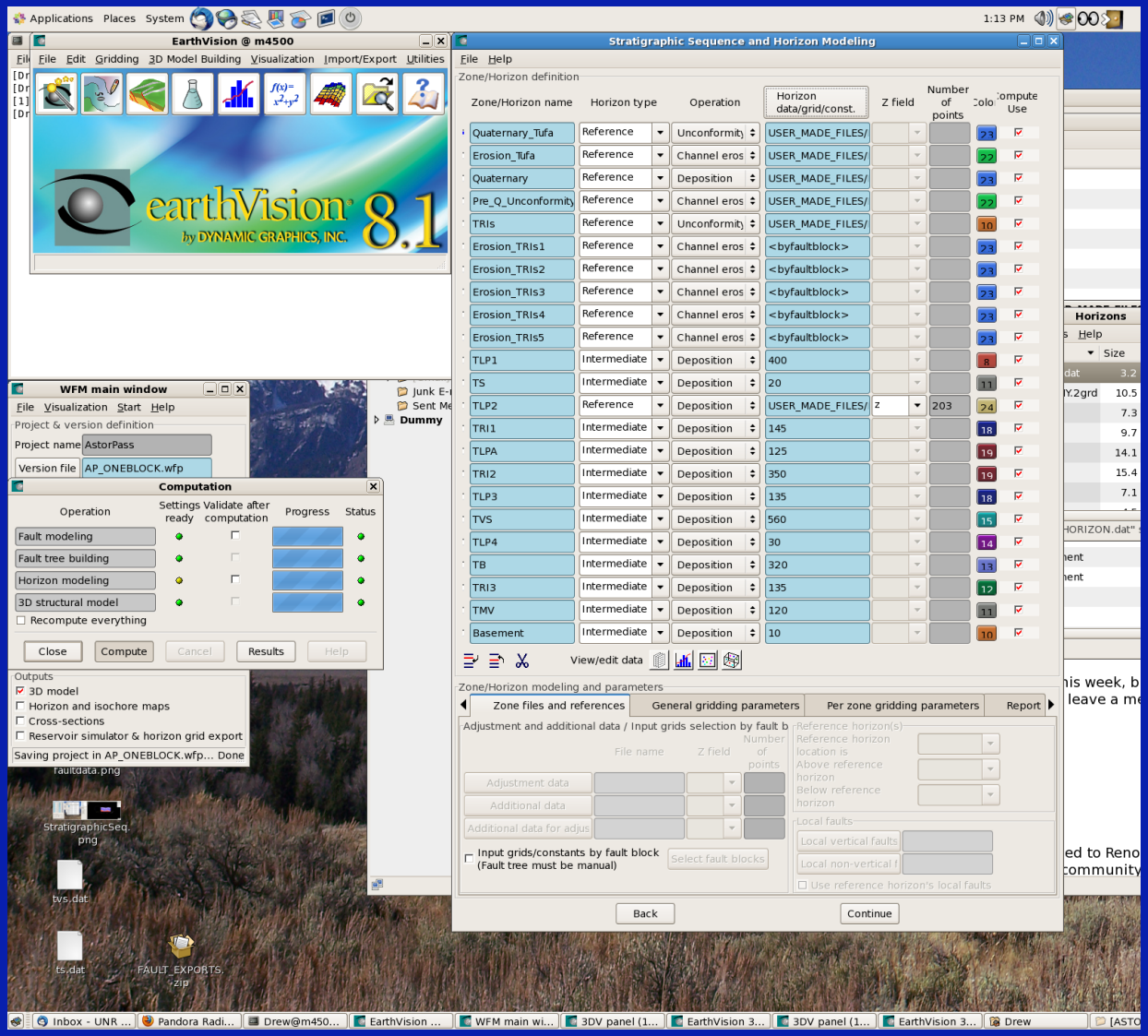
# Completed Fault Surfaces

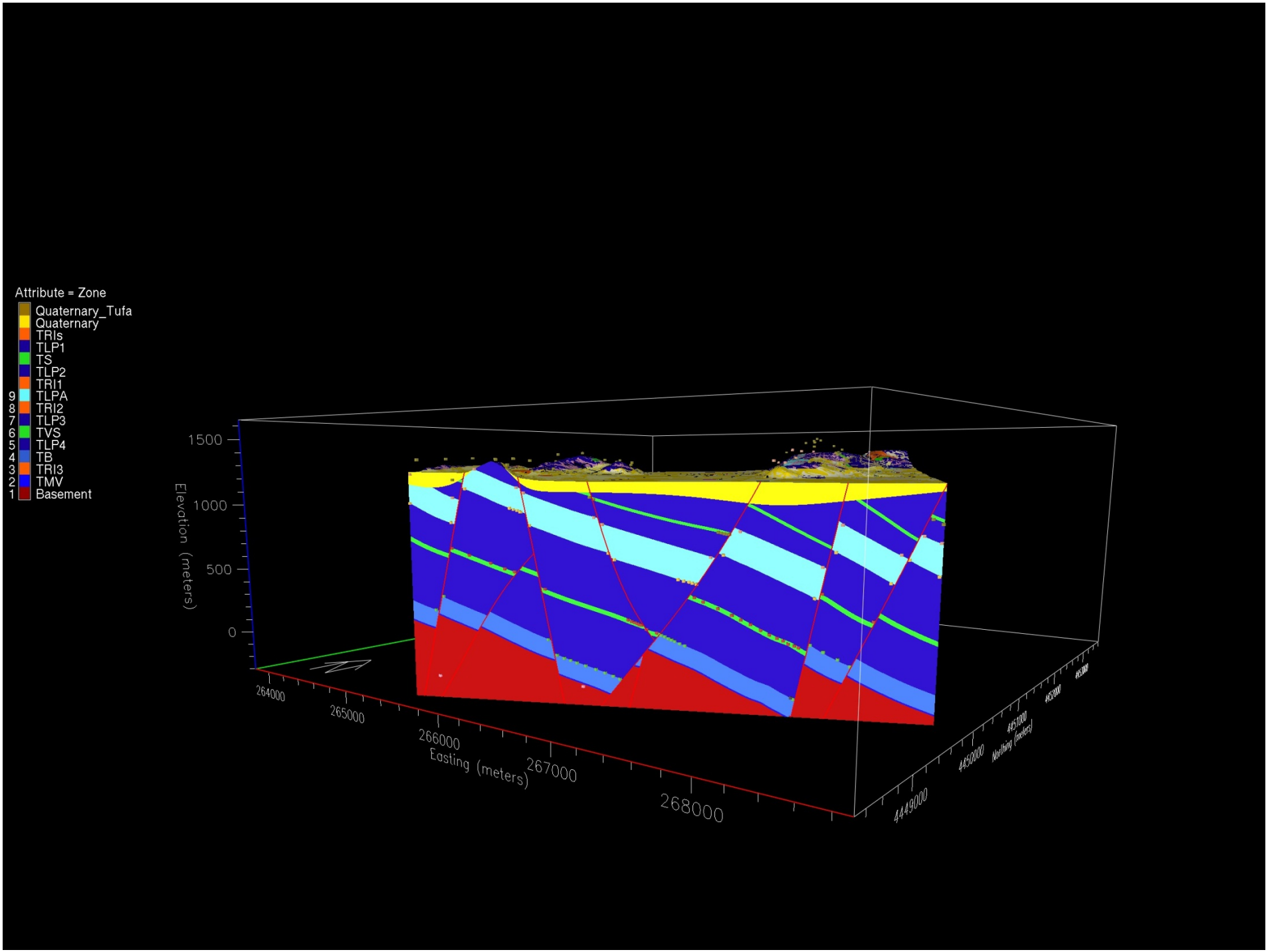


# Stratigraphic Contacts



# Stratigraphic Sequence and Horizon Modeling

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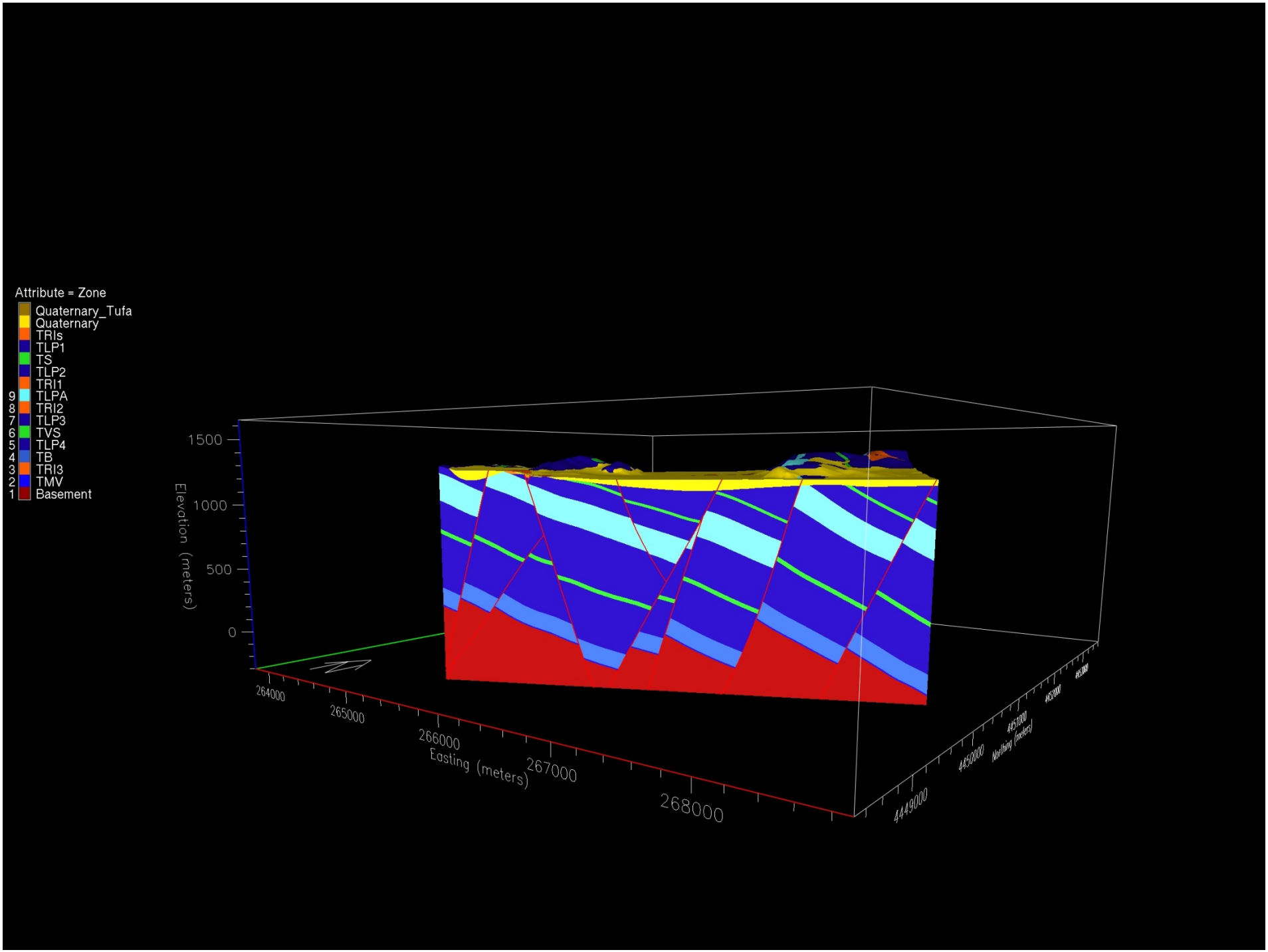
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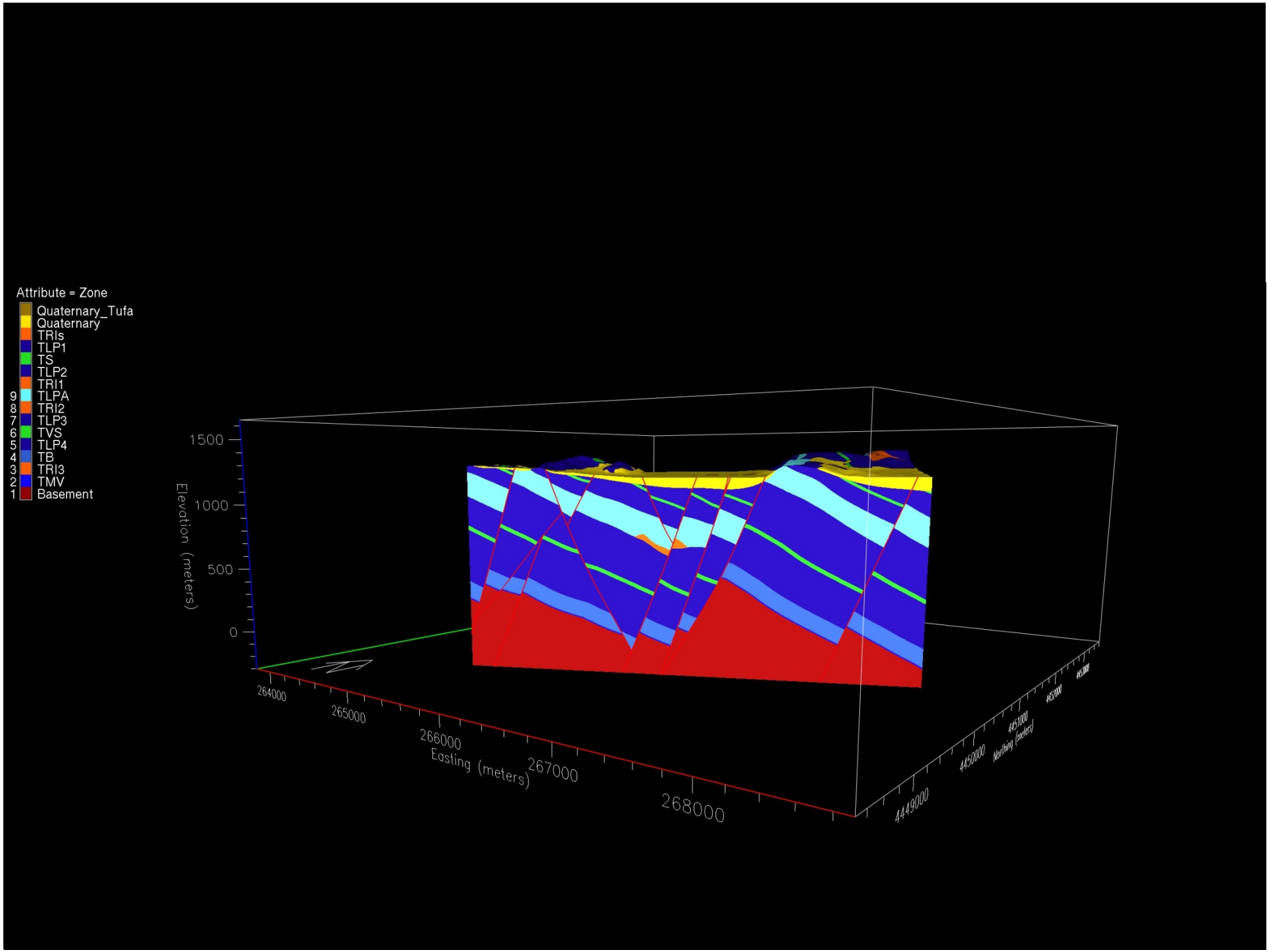
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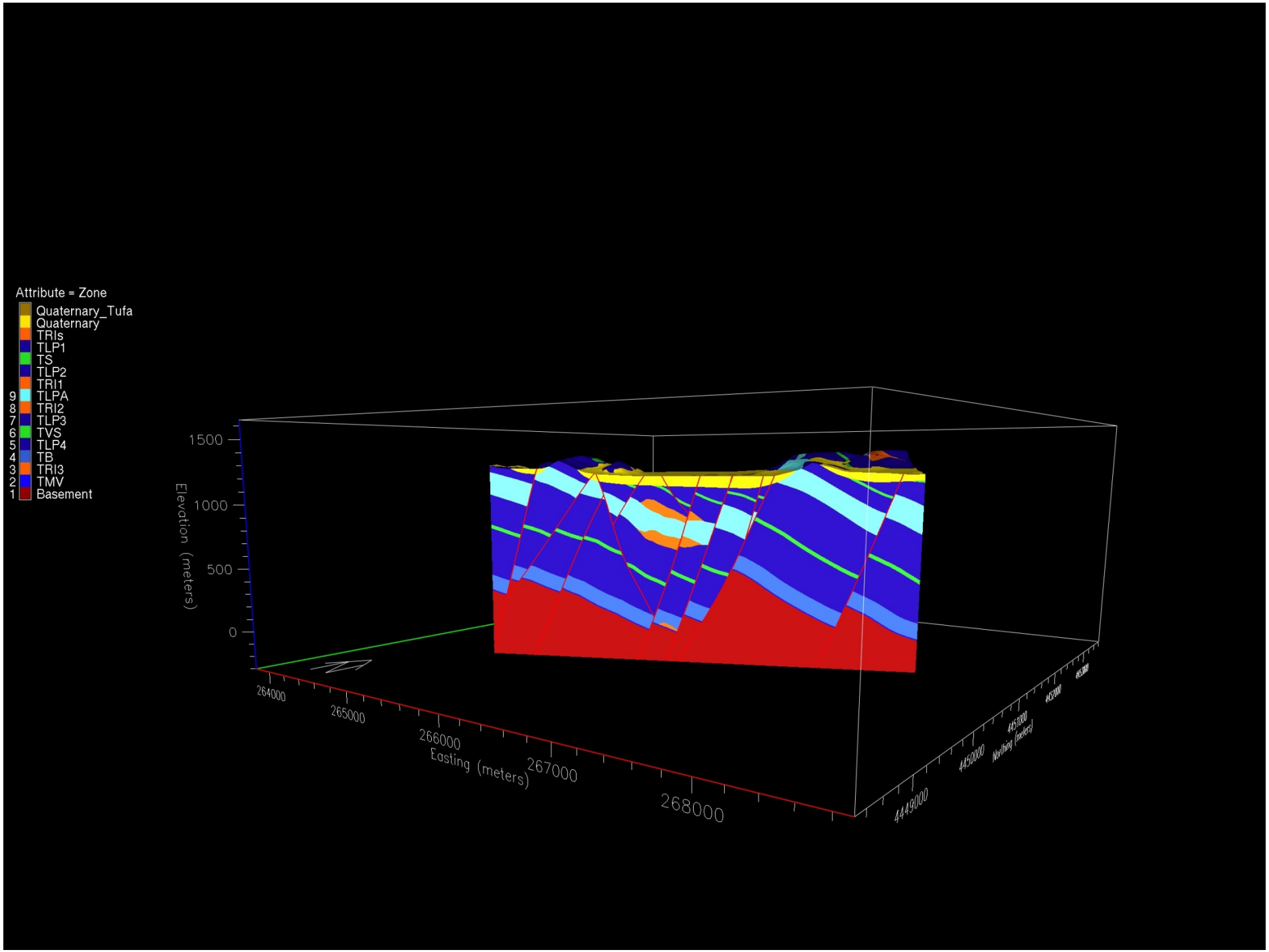
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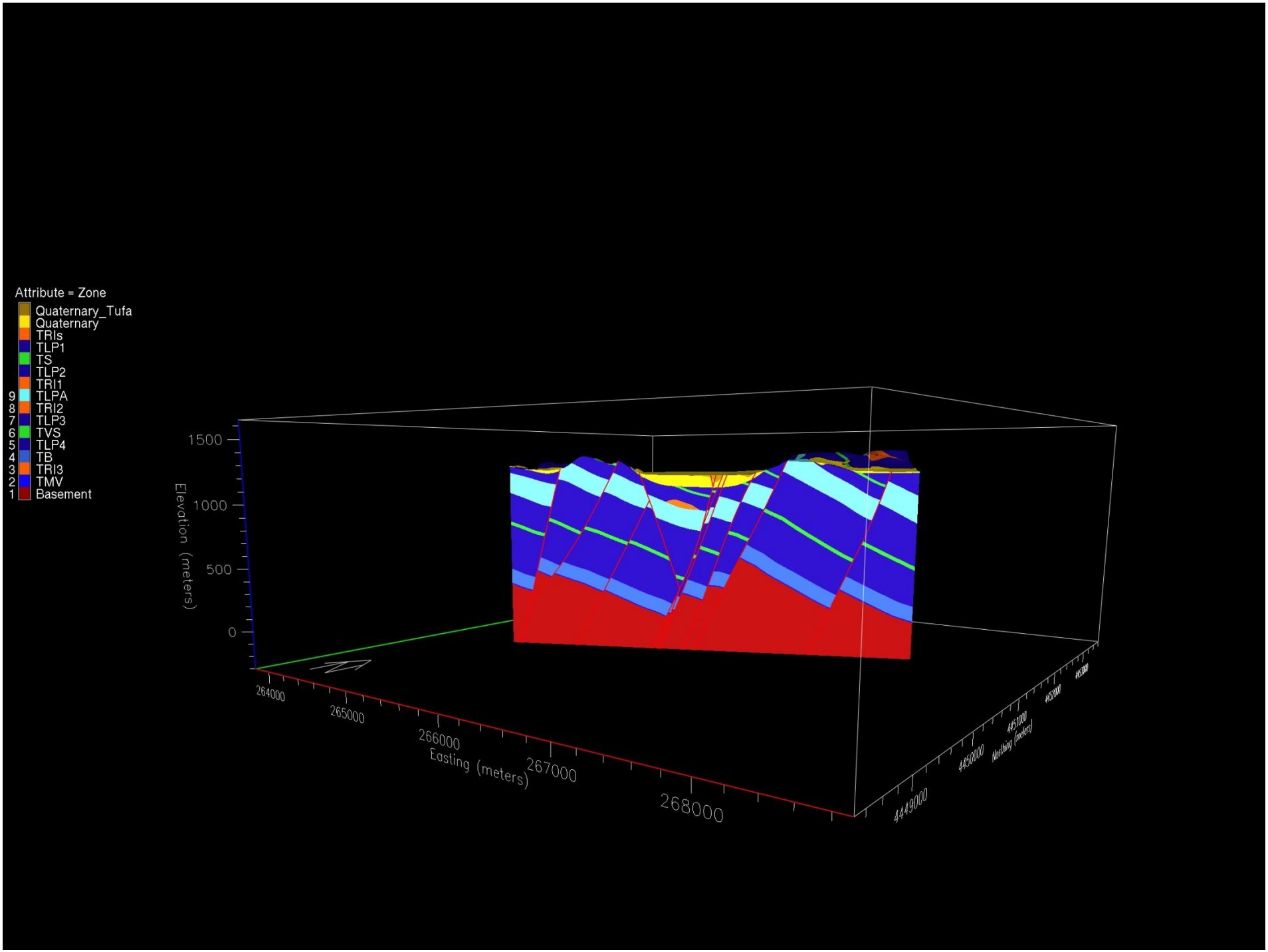
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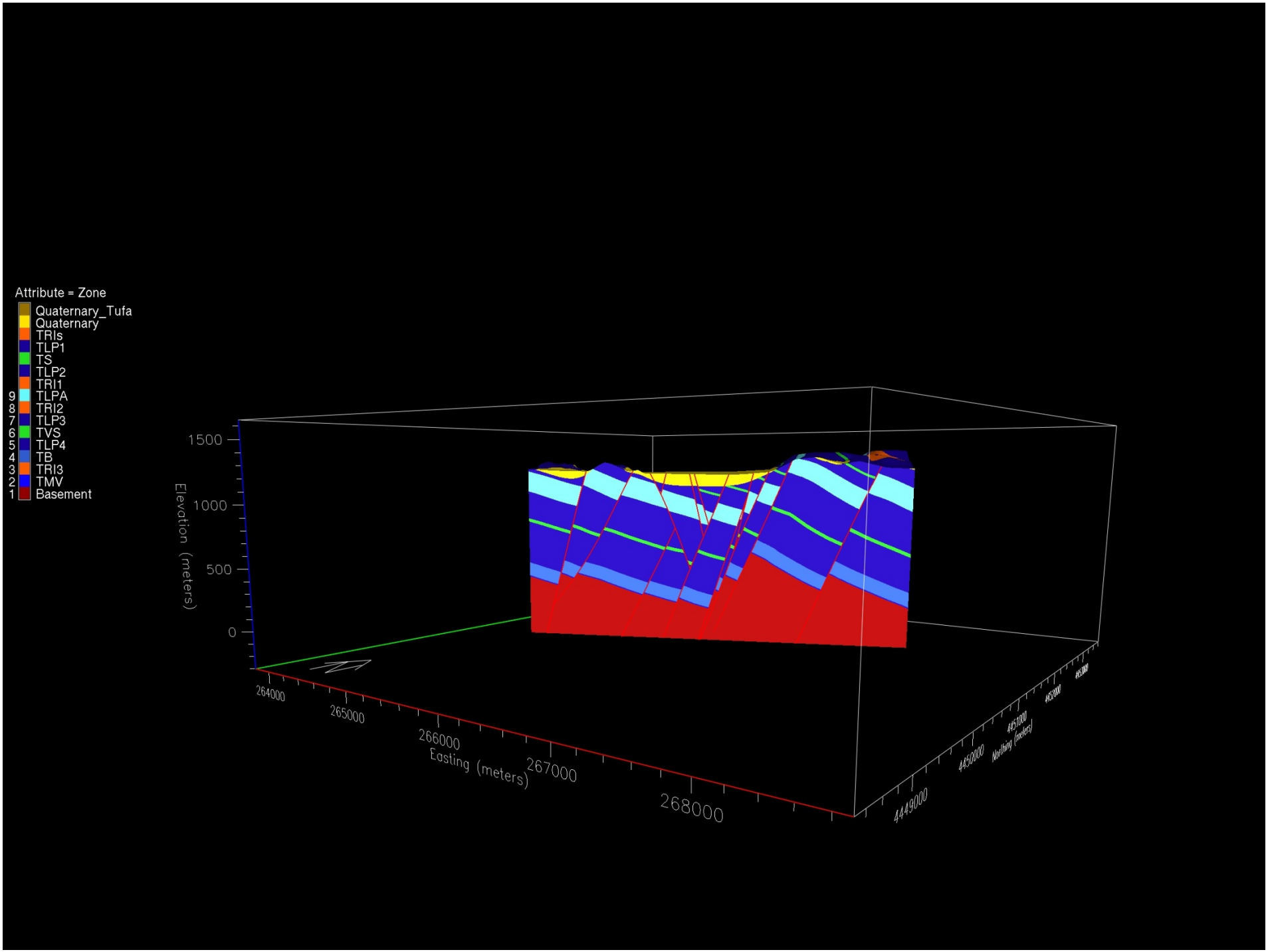
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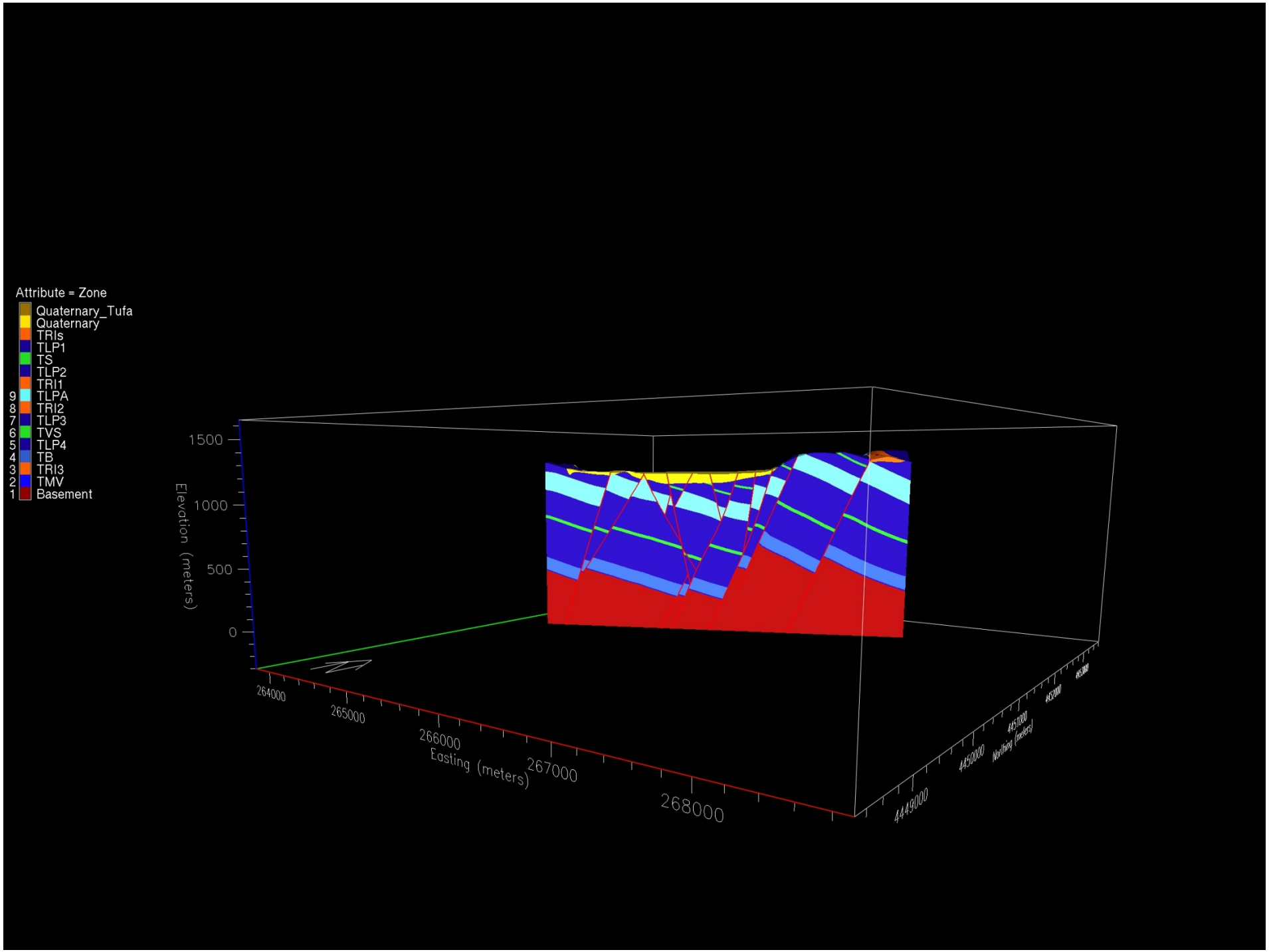
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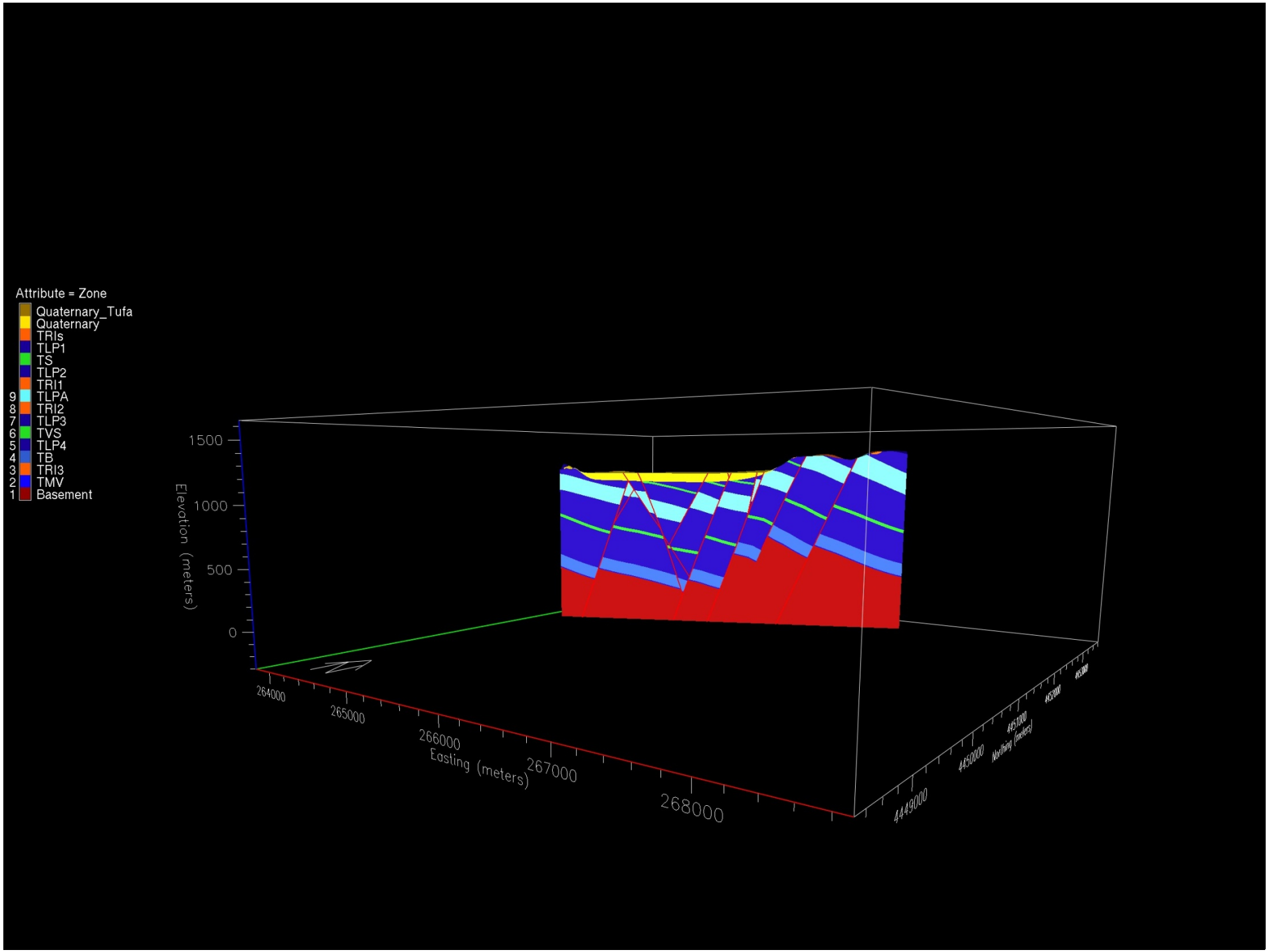
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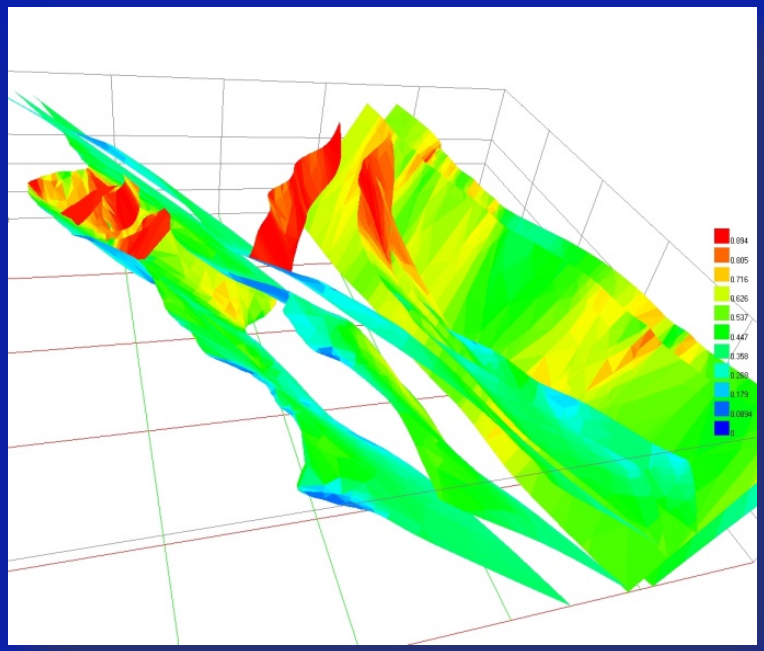
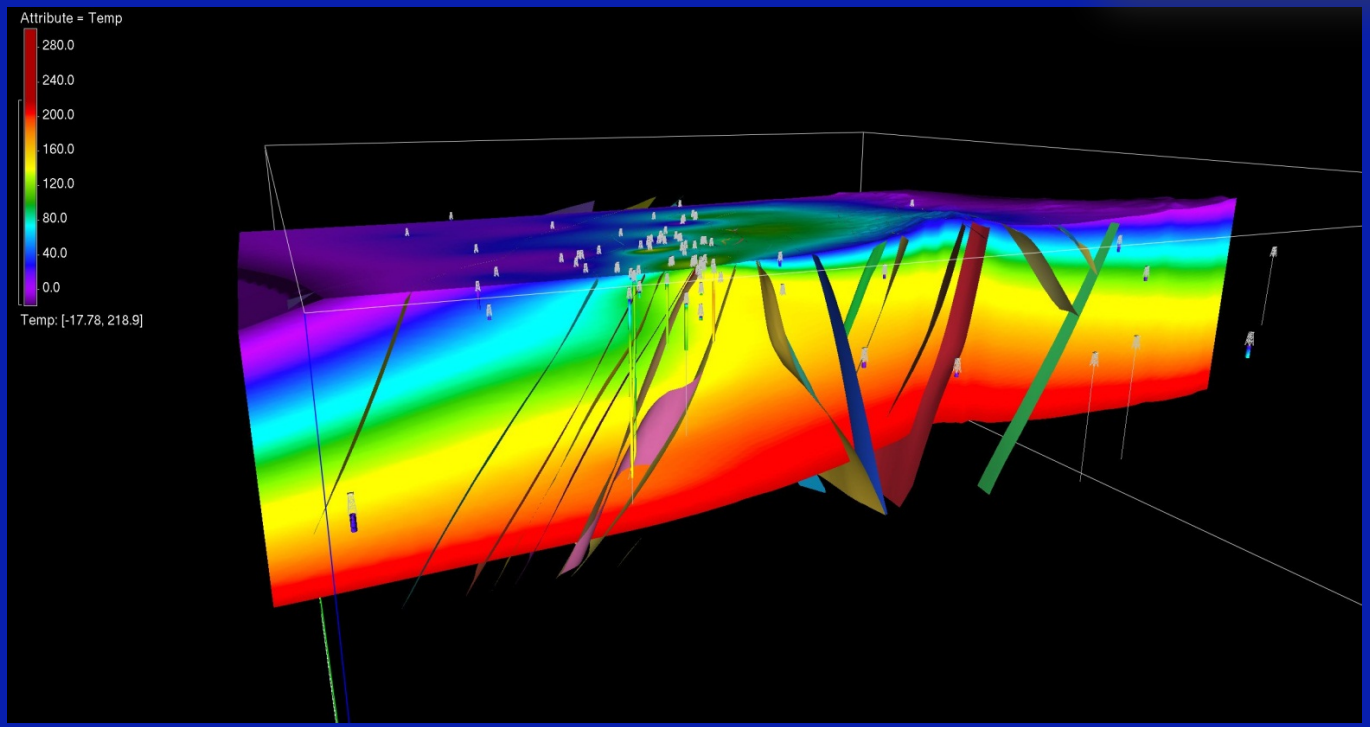
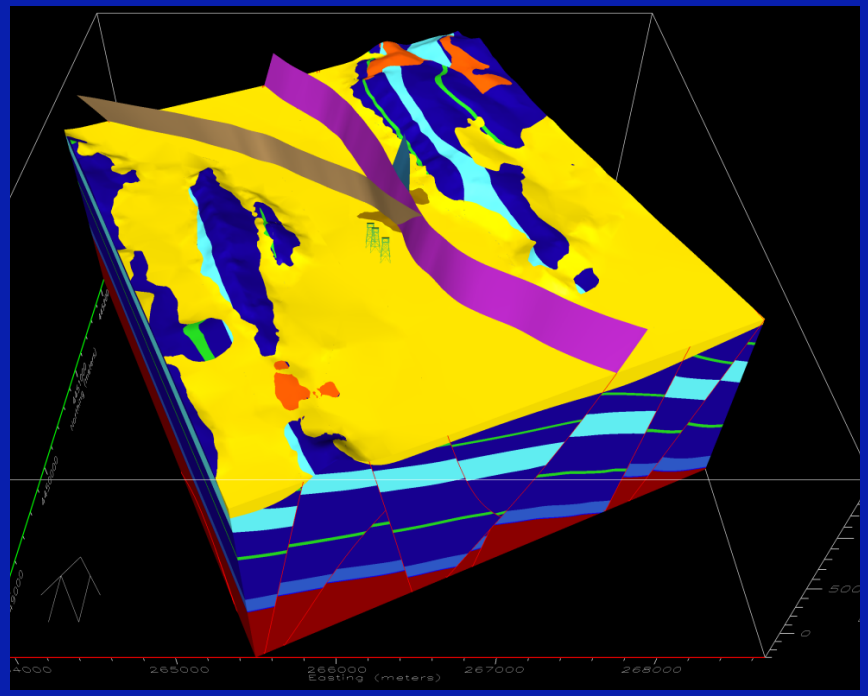
# Model Uses

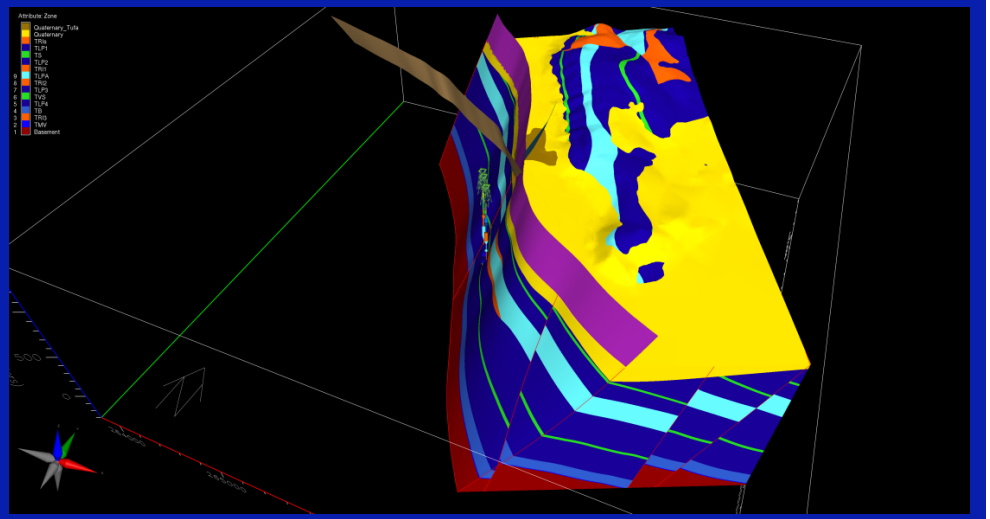
- Slip and Dilatation tendency analyses of faults
- Thermal data, alteration, etc,
- Well planning and reservoir modeling

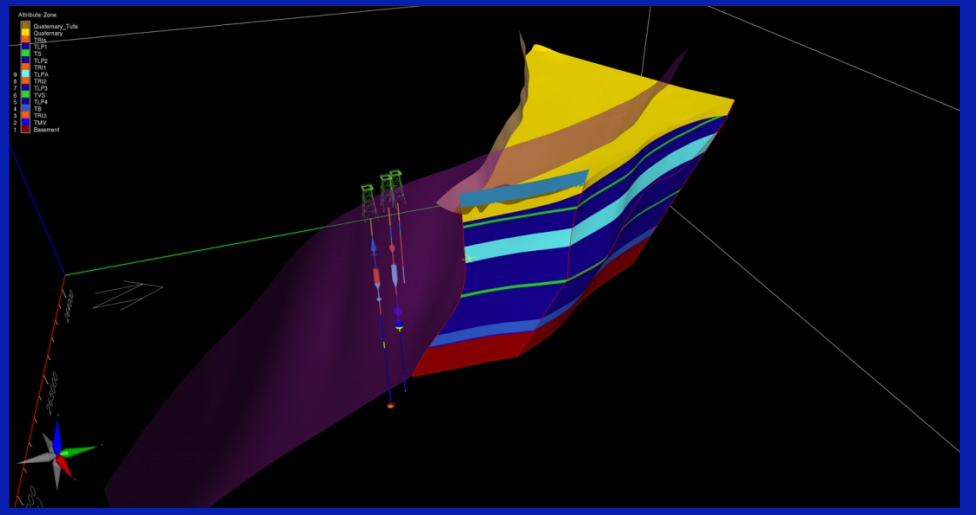




# Reconciling missed targets and planning for ones



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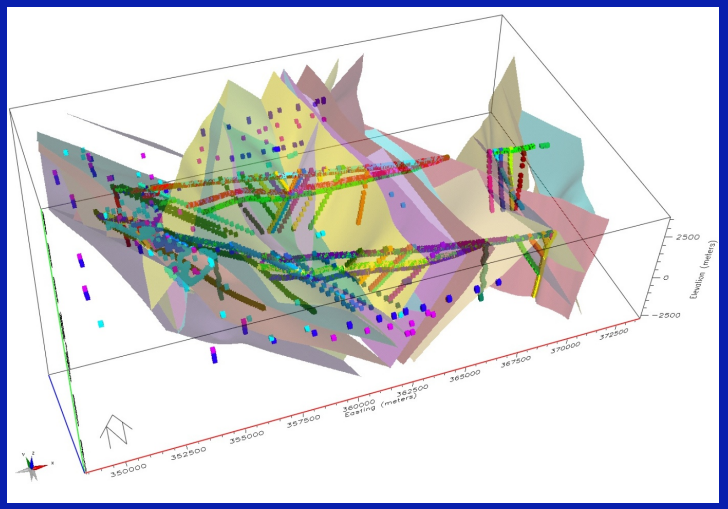
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  - Different levels of accuracy
- Rendered surfaces and volumes
  - Accuracy dependent upon source of point data
  - Also on distribution and concentration of point data