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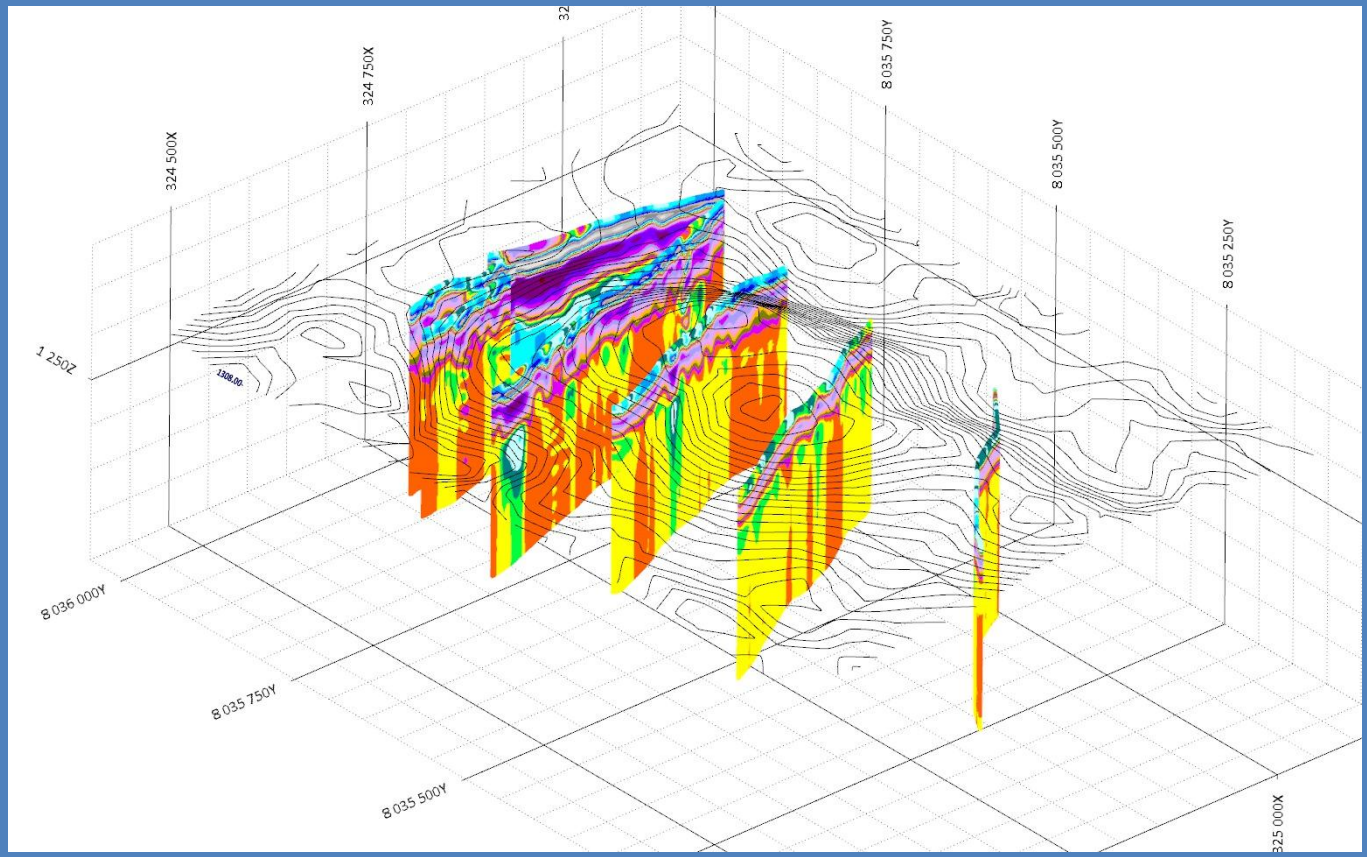
Subsurface insight

Ground Penetrating Radar (GPR) with 3D Modelling

- Non-invasive, high-resolution imaging of subsurface structures.
- 3D integration of multiple profiles for precise localization of hazards.
- Direct integration with CAD/BIM and mine planning software.
- Outcomes include higher safety, fewer surprises, faster decisions, and lower CAPEX/OPEX risk.



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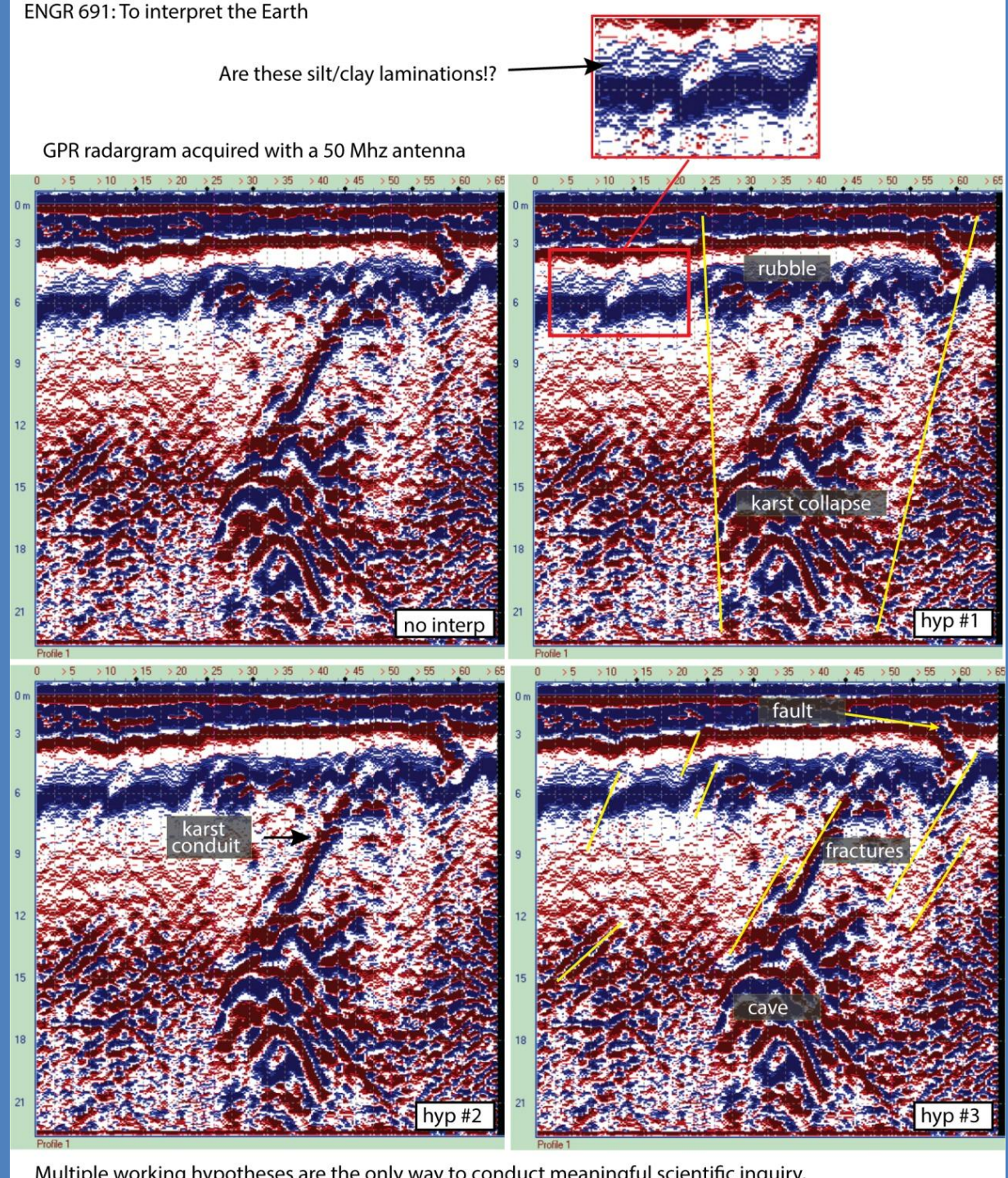
Subsurface insight

What is GPR?

- Electromagnetic method
  - Uses high-frequency radio waves
  - Detects contrasts at layer interfaces
- Typical targets
  - Karst voids & sinkholes
  - Fracture/cavity zones
  - Abandoned workings
  - Utilities & foundations
  - Water-bearing layers
- Non-destructive: no drilling or excavation required



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Subsurface insight

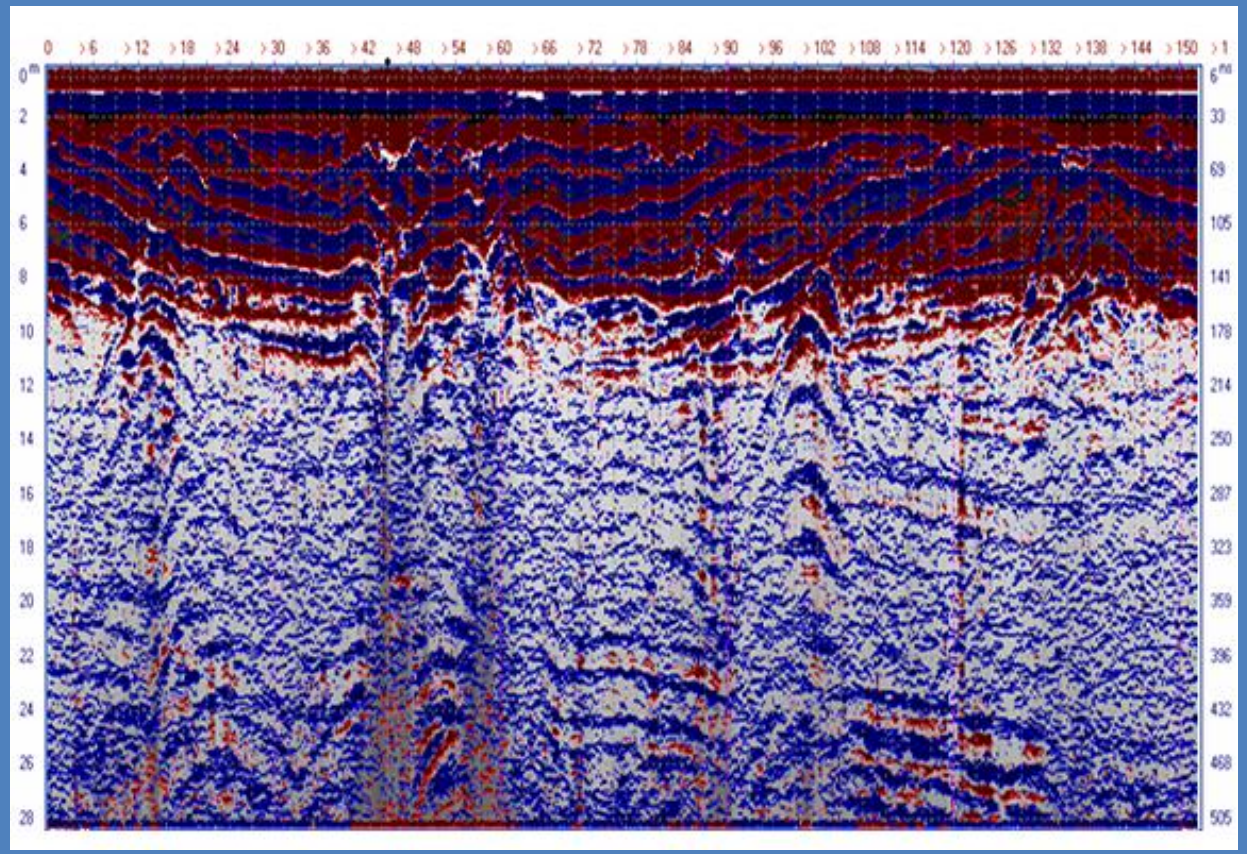
Why 3D Instead of Only 2D Profiles?

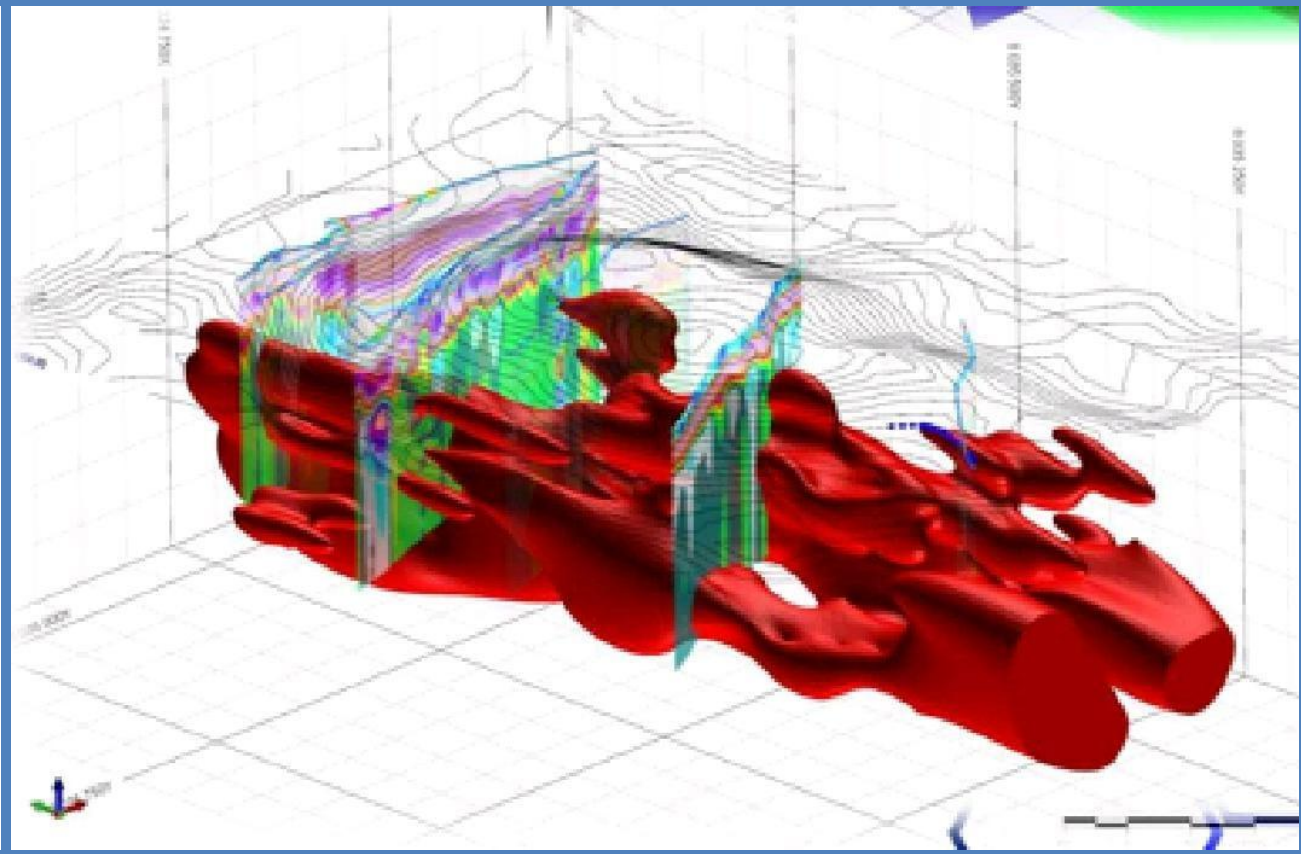
2D Profiles :

- only slice-level
- ambiguous interpretation

3D Visualisation :

- full spatial reconstruction of anomalies
- clear geometry & location of hazards
- direct export to CAD, GIS & mine planning software





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Subsurface insight

Value for Industry

- Safety
  - Early detection of voids/weak zones
  - Supports ground control decisions
- Cost & Time
  - Rapid coverage of large areas
  - Reduces redundant drilling
- High Resolution
  - Centimetre-scale for near-surface features
- Versatility
  - Open pits, underground, tunnels, civil & hydrogeology

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Subsurface insight

Value for Industry

- 1) Planning
  - Define objectives, line spacing, antenna frequency
- 2) Acquisition
  - Survey with GNSS control; QA/QC on site
- 3) Processing
  - Dewow, background removal, migration, 3D cube build
- 4) Interpretation
  - Pick reflectors/voids; classify risk zones
- 5) Delivery
  - 3D model (DXF/OBJ), GIS layers, report & recommendations

End-to-End Workflow

- 1) Planning
  - Define objectives, line spacing, antenna frequency
- 2) Acquisition
  - Survey with GNSS control; QA/QC on site
- 3) Processing
  - Dewow, background removal, migration, 3D cube build
- 4) Interpretation
  - Pick reflectors/voids; classify risk zones
- 5) Delivery
  - 3D model (DXF/OBJ), GIS layers, report & recommendations

Case Example

SUBSURFACE VOID DETECTION AND 3D MODELLING OF HISTORICAL UNDERGROUND MINE BENEATH AN IRON ORE OPEN-PIT MINE

Using advanced geophysical techniques and 3D modeling, we created a detailed subsurface model that reveals underground features, highlights potential instability, maps old stope voids, and identifies backfilled zones, while also uncovering previously unknown voids and collapsed areas that may threaten pit operations.

