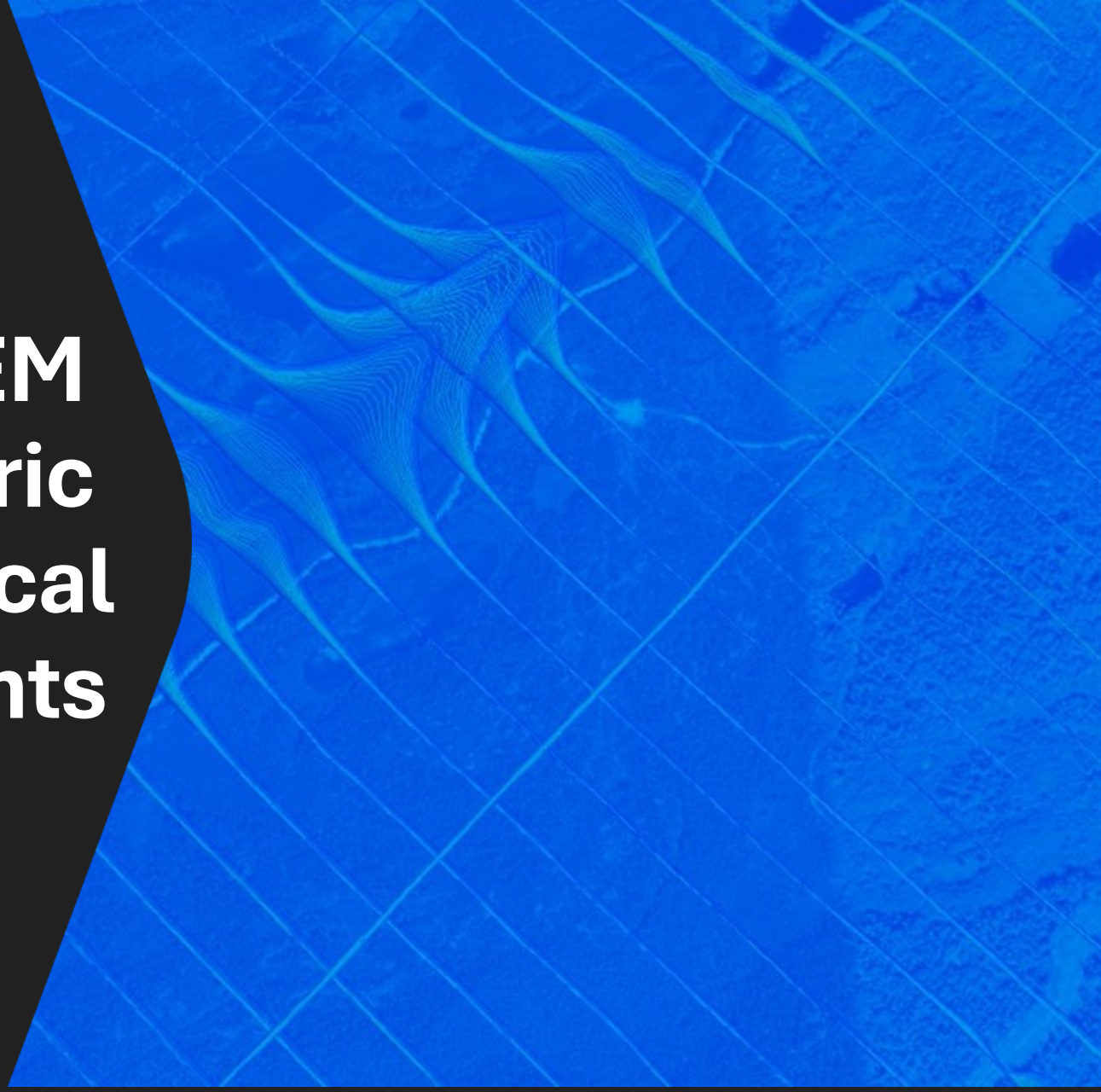
Leveraging Airborne TDEM and Magnetic/Radiometric Technologies for Geological and Environmental Insights



sanborn geophysics

Contents

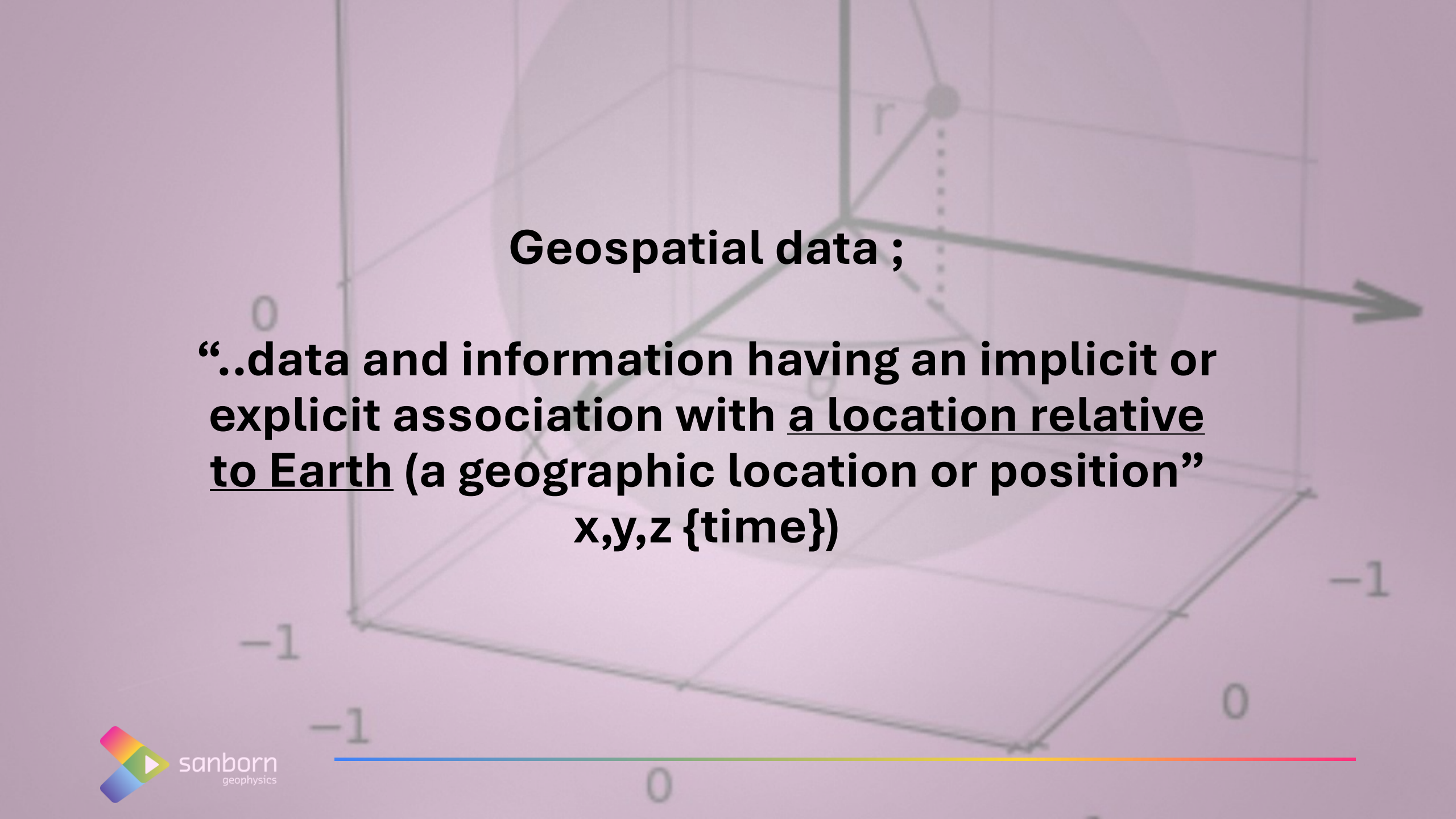
- Introduction
- Geospatial / Geophysical Datasets
- Combining Geophysical Datasets
- Summary
- Questions?

Introduction

Presenter

Kevin Killin P.Geo.
Chief Geophysicist
Sanborn Geophysics ULC

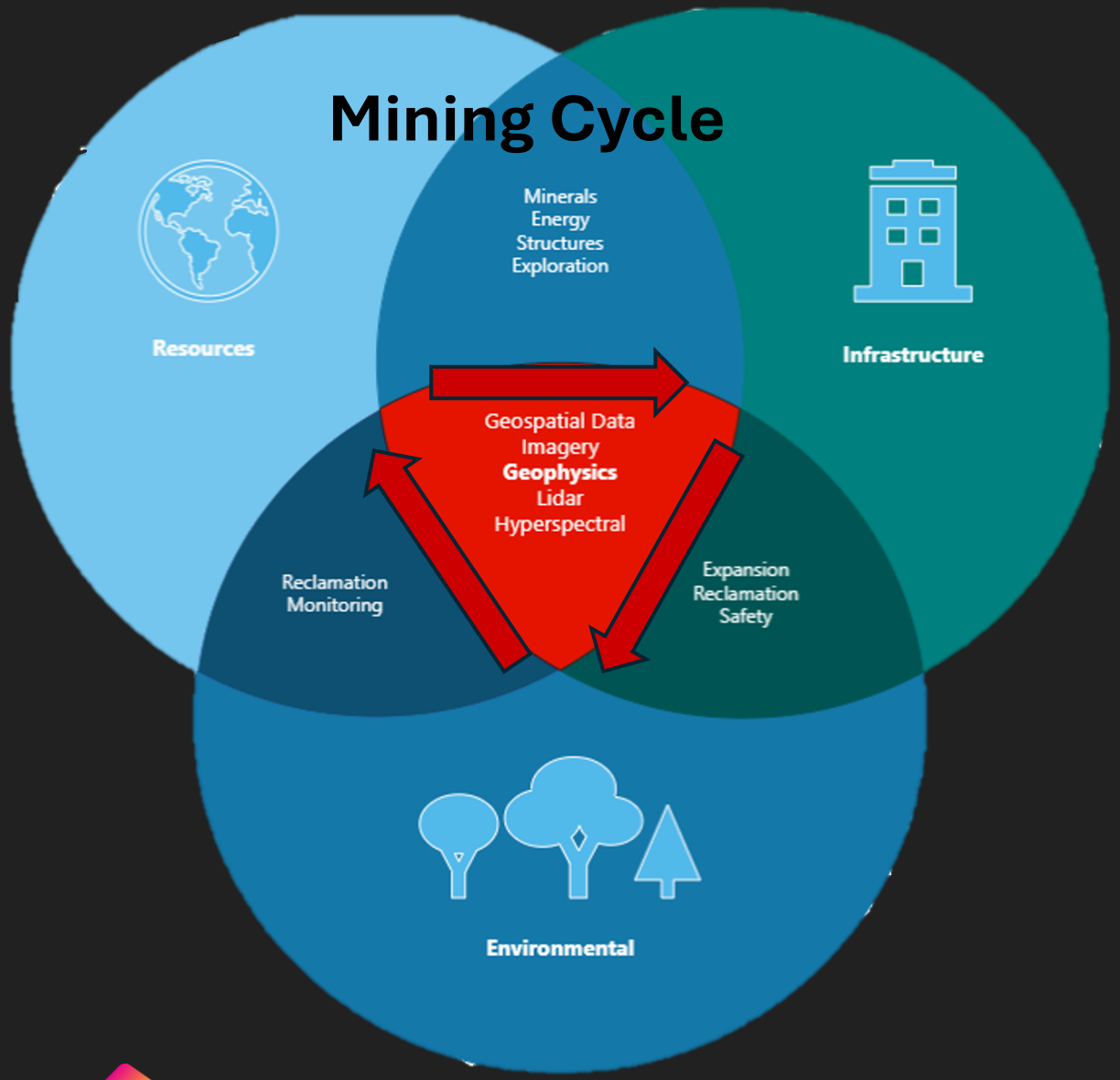
sanborn
geophysics



Geospatial data ;

“..data and information having an implicit or explicit association with a location relative to Earth (a geographic location or position” x,y,z {time})

sanborn
geophysics



Mining Cycle

Exploration and Discovery

Infrastructure and Expansion

Reclamation and Monitoring

Geophysics and Geospatial Data Layer Analysis are the Heart of the Mining Cycle

sanborn geophysics

Geophysical Data Layers

sanborn geophysics

Layers and Integration

- Maps (New/Old)
- GIS (Near Surface)
  - Environmental (ie Imagery, Lidar)
  - Vegetation (ie Lidar, Hyperspectral)
  - Infrastructure (ie Lidar)
- Geophysics (Near Surface/Subsurface)
  - Groundwater (TDEM)
  - Geology (TDEM /Radiometrics / Magnetics)

sanborn geophysics

sanborn
geophysics

FIXED WING PLATFORMS

- Magnetics + Derivative Products and Depth Modelling
- Radiometric + Derivative Products (Ternary)
- Gravity + Derivative Products

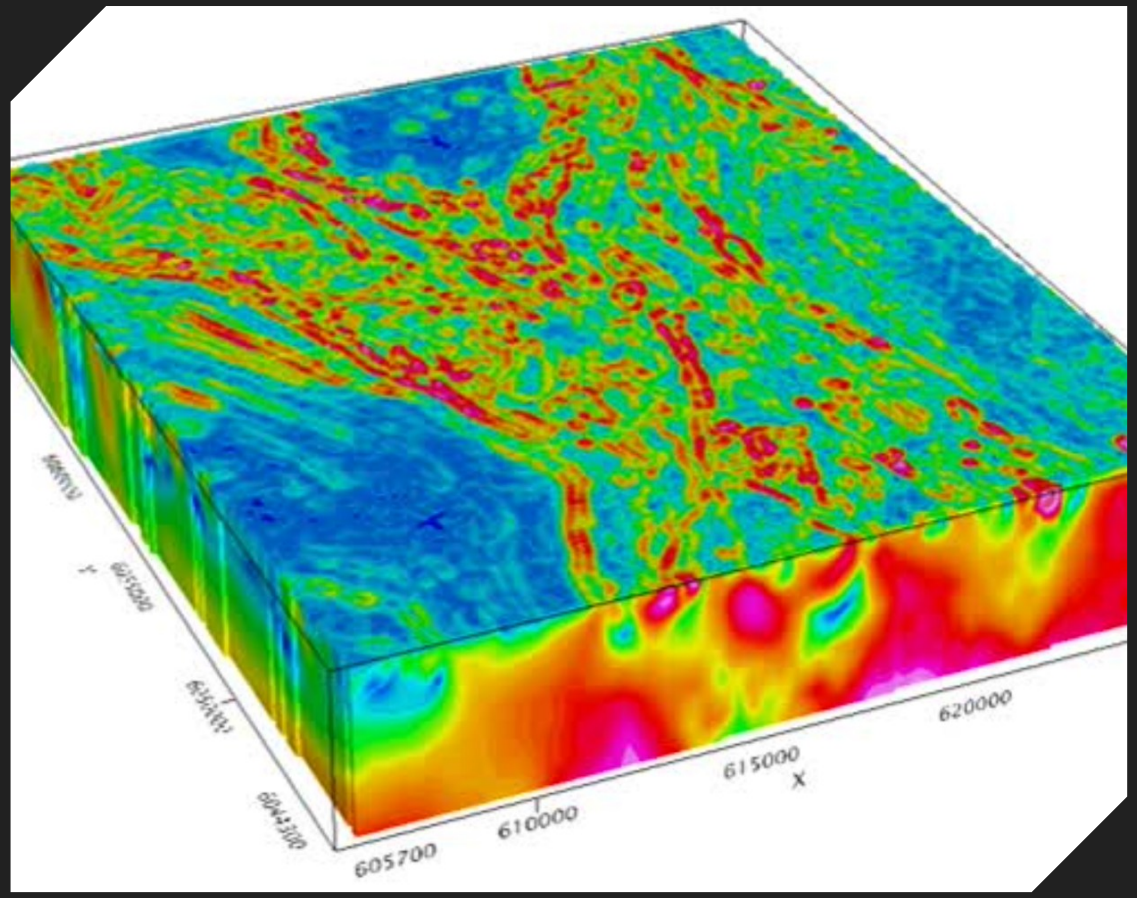
sanborn
geophysics

Fixed Wing Advantages

- Fast Mobilization
- Cost Effective
- High Rates of Acquisition
- Larger Areas

sanborn geophysics

Understanding Magnetic Data Layers

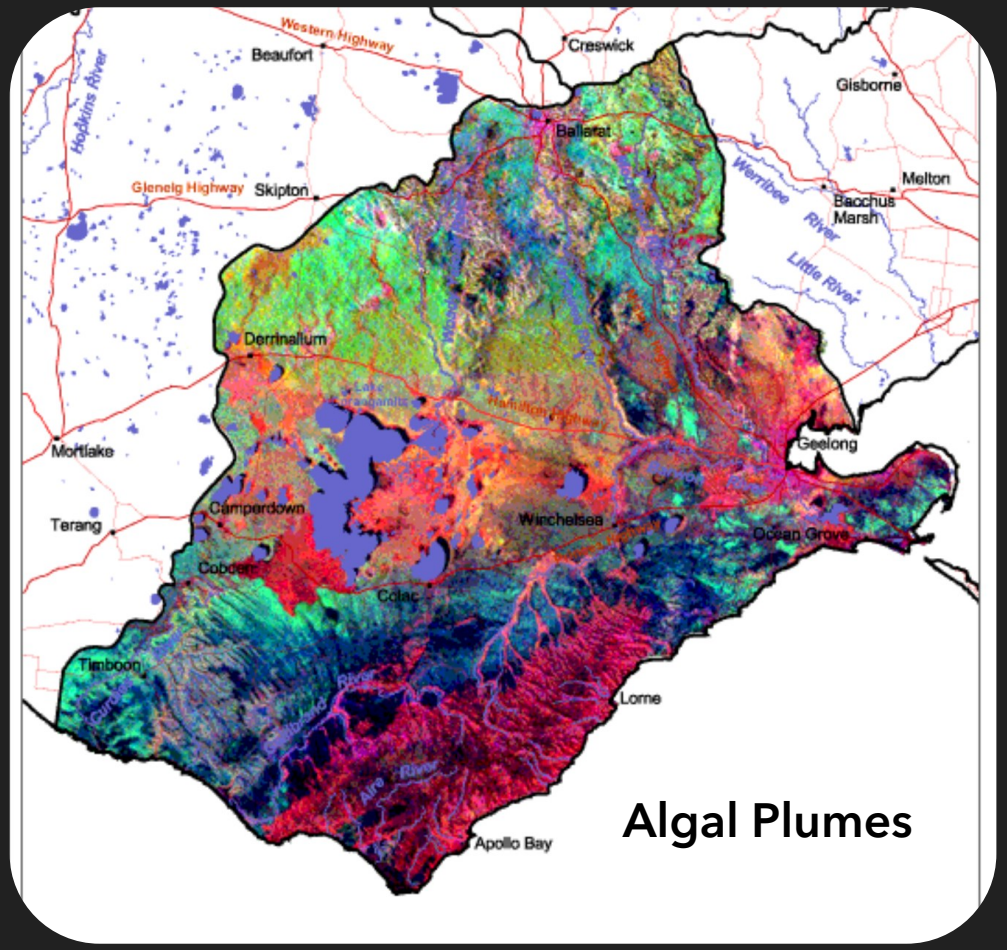


- Near Surface Information
  - Wells/Pipelines
  - Infrastructure
- Geological Mapping, Surface
  - Rock types, intrusions, alteration
  - Lineaments (Faults/Contacts)
- Deep Structure (Mining)
  - Geological Formations
  - Ore Bodies
  - Large Intrusions/Impacts
  - Kilometers deep

sanborn geophysics

Radiometric Data Layer Uses

- Isotope Mapping
  - Geology
  - Soil Compositions
  - Agriculture/Fertilizer
- Local Contamination/Monitoring
  - Site Cleanups
  - Site Baseline Determination
- Nuclear Cleanup / Monitoring
  - Chernobyl (Plume of Cs to UK)
  - Fukushima (Ground Contamination)
  - Three Mile Island

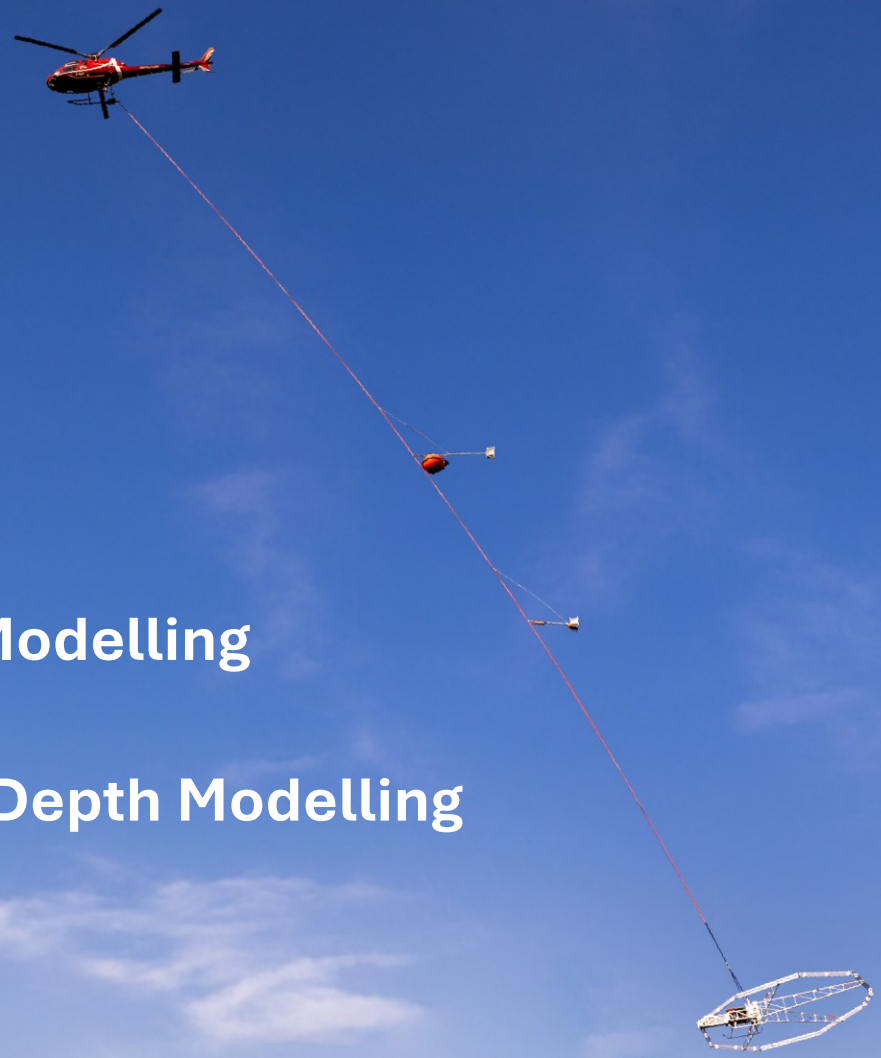


sanborn geophysics

sanborn
geophysics

HELICOPTER PLATFORMS

- Magnetics + Derivative Products and Depth Modelling
- Radiometrics + Derivative Products (Ternary)
- Electromagnetics + Derivative Products and Depth Modelling



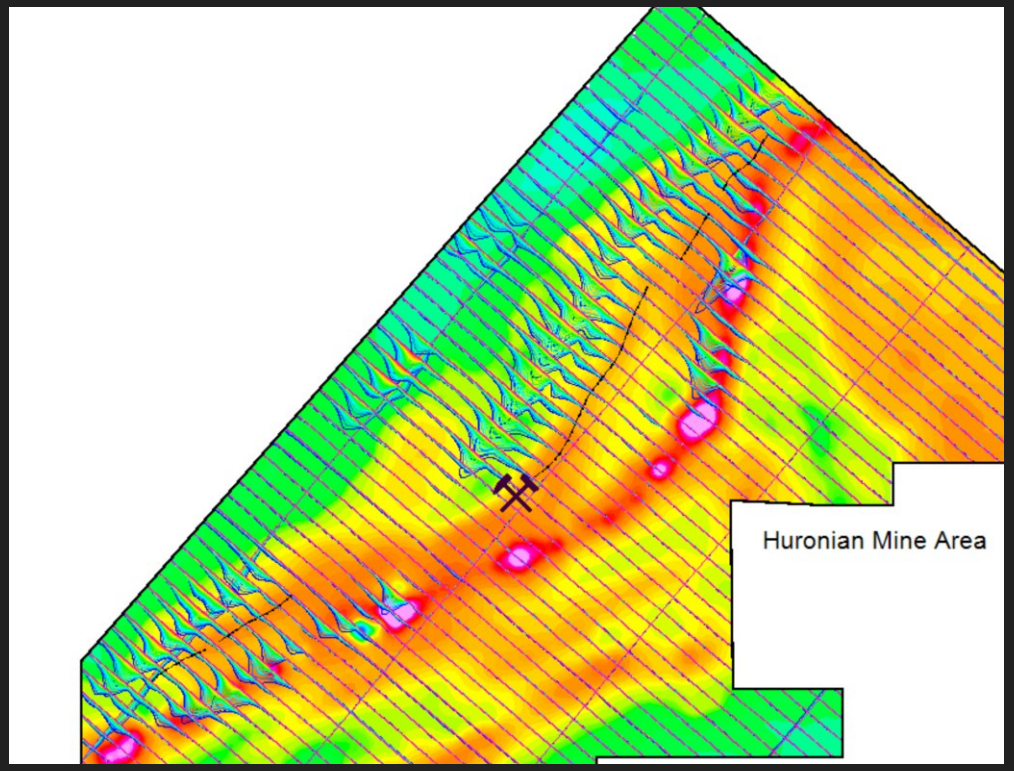
Helicopter Advantages

- Denser sampling in the flight direction
- Closer to the ground
- Better in rugged terrain
- Contour terrain better than Fixed Wing
- Collection of TDEM

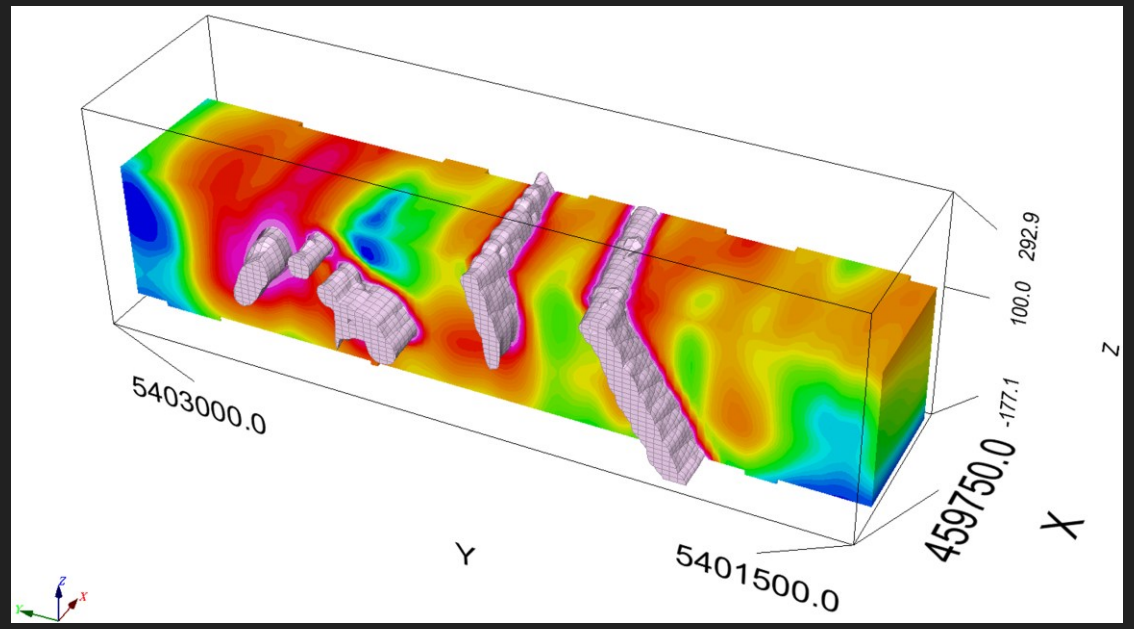
sanborn geophysics

Example TDEM Layers

TDEM Profiles and Magnetic Layers



TDEM 3D Inversion



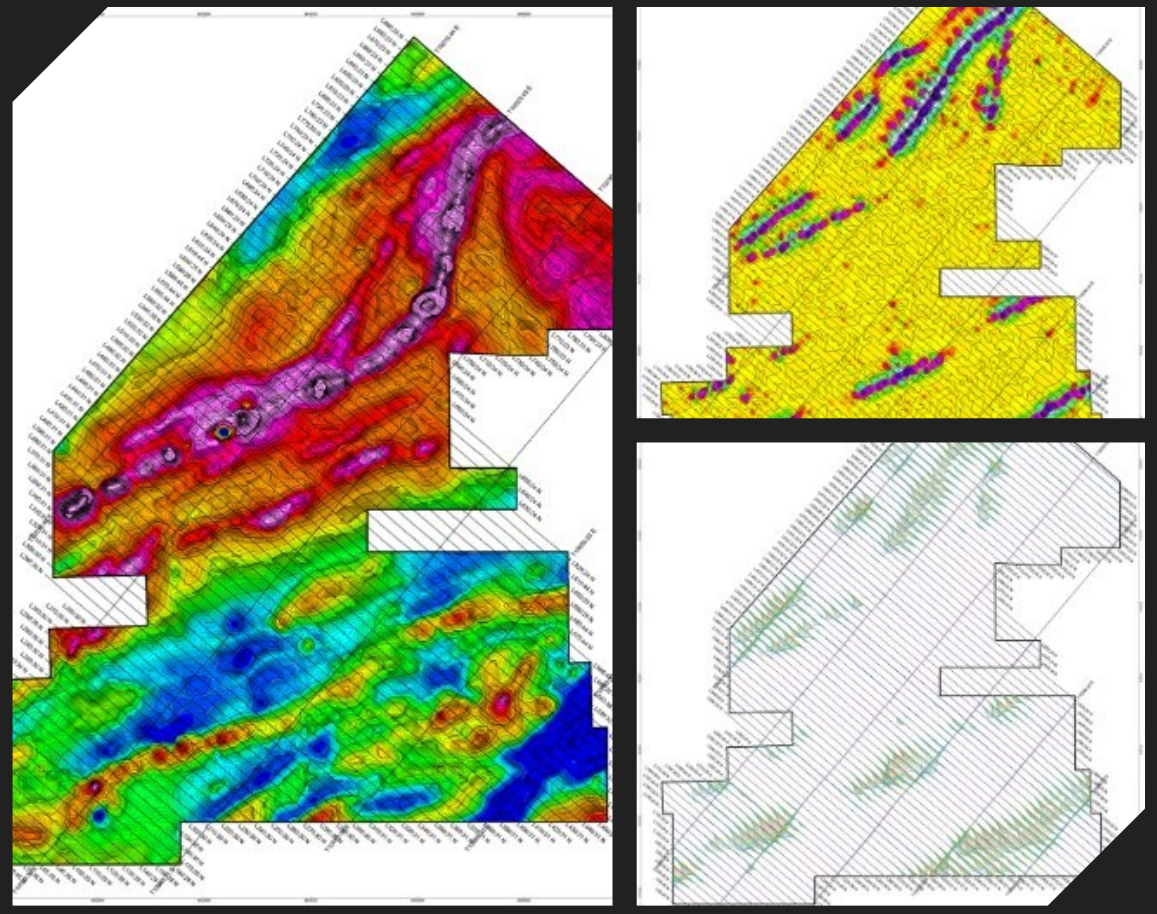
sanborn geophysics

Combining Data Layers and Different Perspectives

sanborn geophysics

MULTIPARAMETER GEOPHYSICAL SURVEY FOR MINING

- **Magnetic Intensity**
- **Mid-Time Time Domain EM Channels**
- **TDEM Profile Data**



Huronian Property

sanborn geophysics

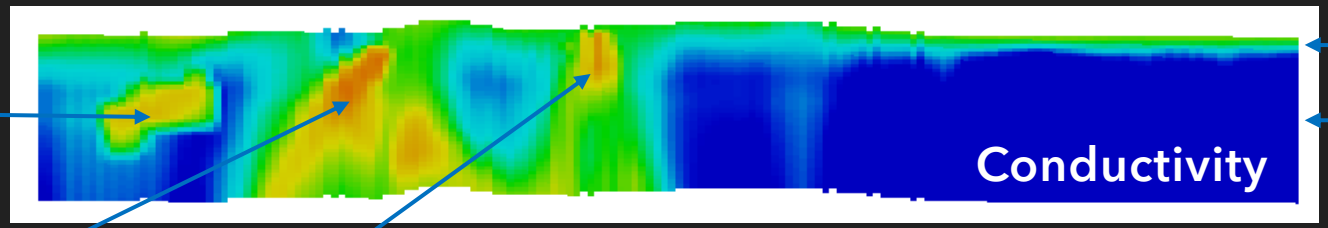
KESSELRUN

SUBSURFACE VERTICAL SECTION MODEL ANALYSIS

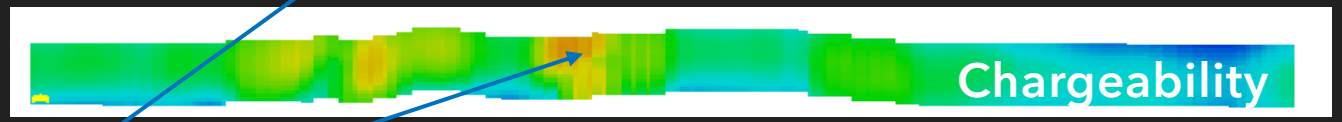
Unknown Deep Conductor

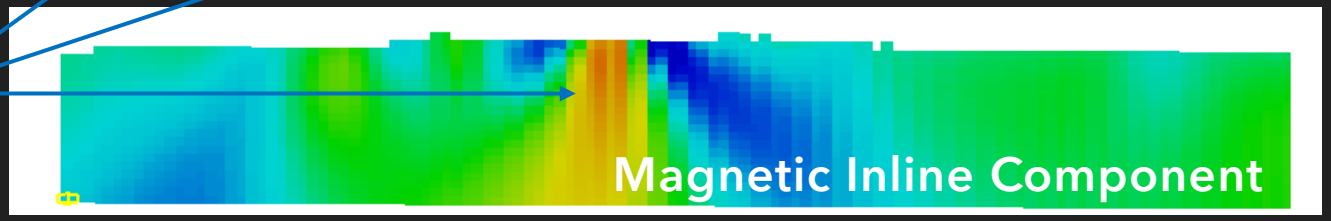
Known Graphitic Conductor

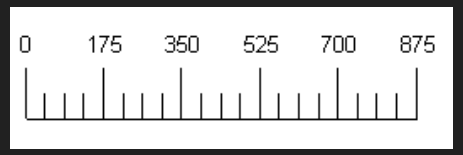
Mineralization
Chargeable
Magnetic
Conductive



Overburden
Resistive Host







Distance (m)
No Vertical Exaggeration

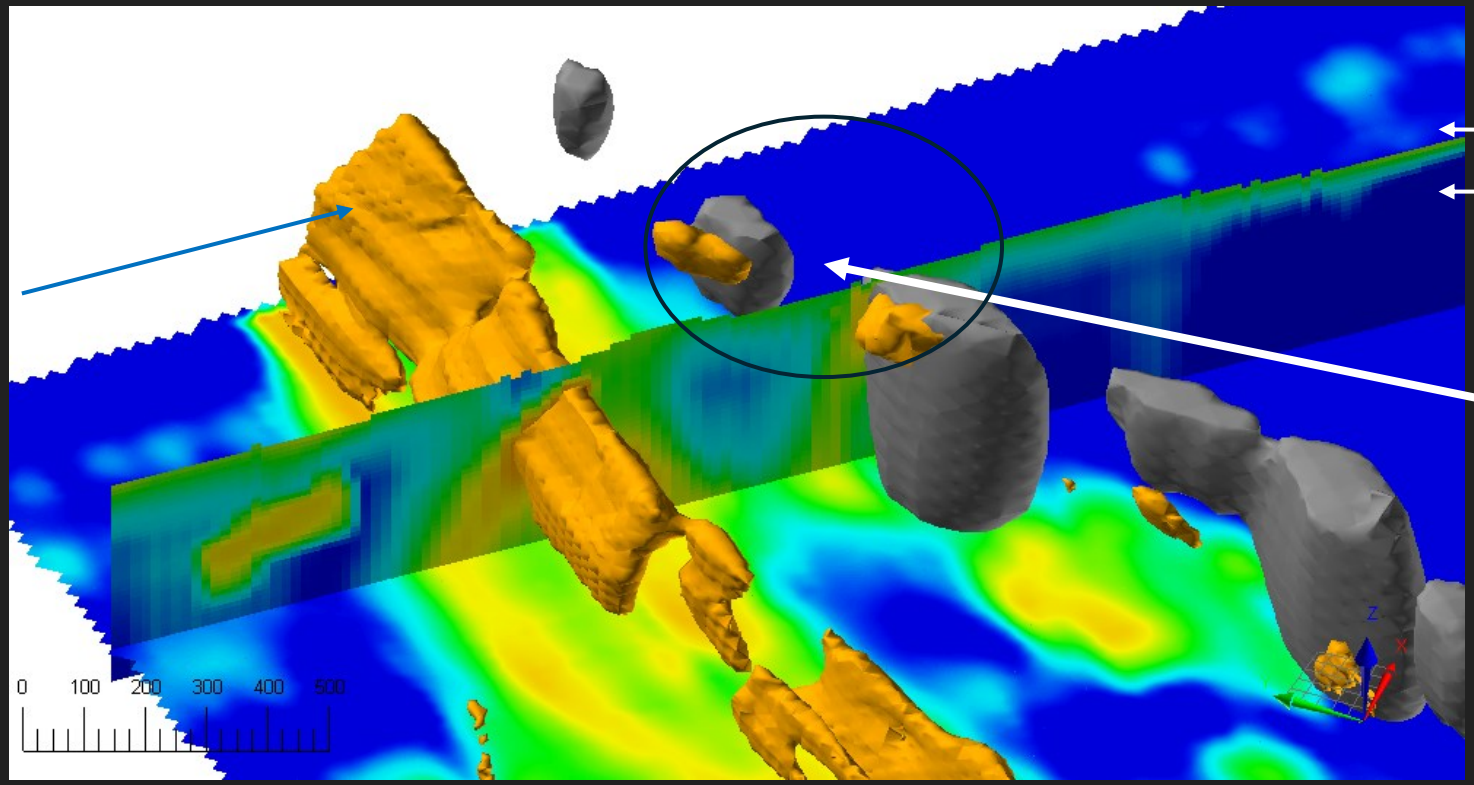
Huronian Property

TECHNOIMAGING®

KESSELRUN

sanborn geophysics

3D PERSPECTIVE VIEW OF MODELLED DATA



Distance (m)
No Vertical Exaggeration

Known Graphitic Conductor

Overburden

Resistive Host

Favorable Targets located with Isobody intersections

Huronian Property

sanborn geophysics

TECHNOIMAGING®

KESSELRUN

REGIONAL EXPLORATION (SUCH AS THE ONGOING EARTH MRI PROJECT)

- Sparse Legacy Geology Map
- Georeferenced Manually

- Large Modern Geophysical Survey
- Magnetics and Radiometrics

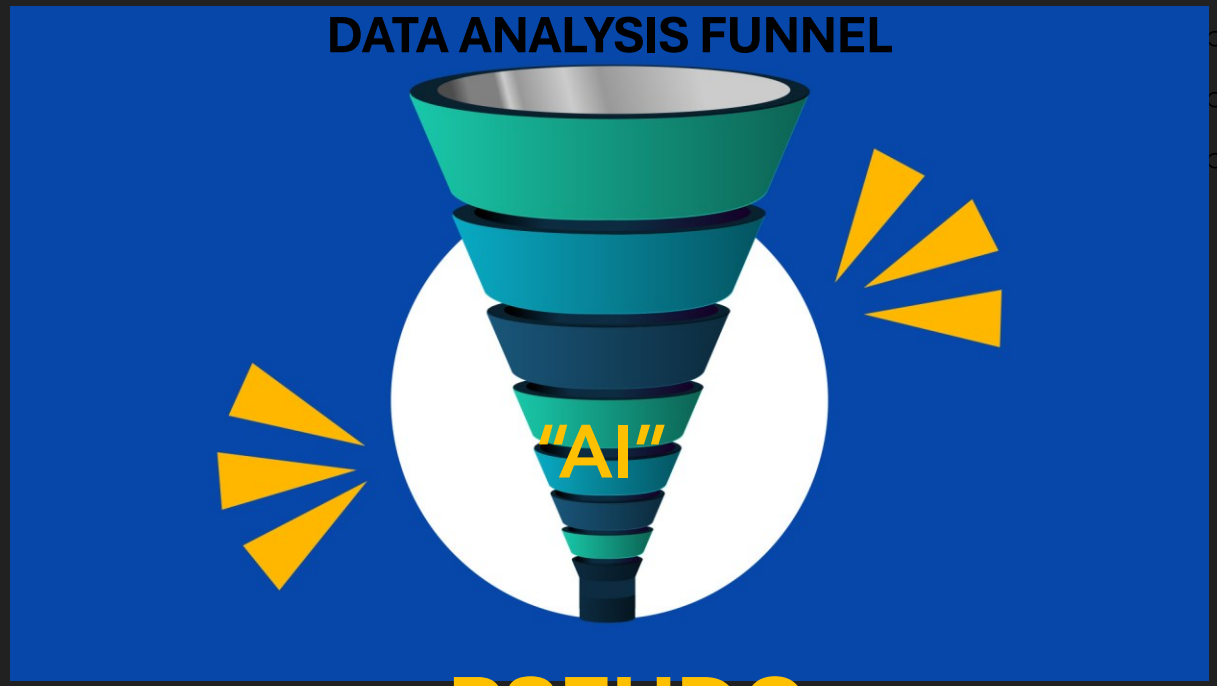
sanborn geophysics

METHODOLOGY

- Limited , legacy Geology maps
- Legacy topographic maps
- Modern GIS satellite base maps

- Radiometric Data
  - K, U, Th, Processed

- Total Magnetic Intensity
- Pole Reduced Magnetic Intensity
- Derivative Products (ie)
  - All gradients
  - Tilt derivative
  - Analytic Signal



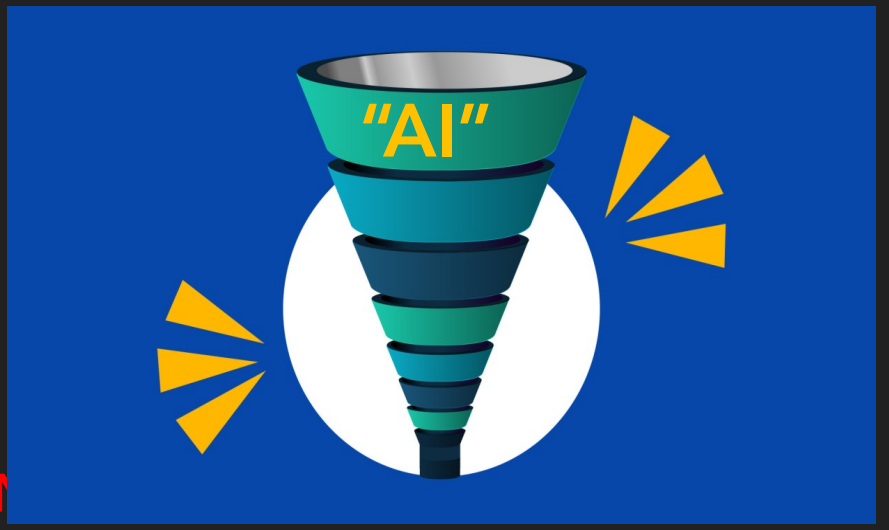
PSEUDO GEOLOGY MAP

sanborn geophysics

Is it good to put ALL the information into the computation……

NOT NECESSARILY ALL AT ONCE

1) PRE-PROCESS YOUR DATA
2) REMOVE OBVIOUS OUTLIERS
3) START SLOWLY
4) DON'T WEIGHT YOUR PROJECT TO RELY ON ON

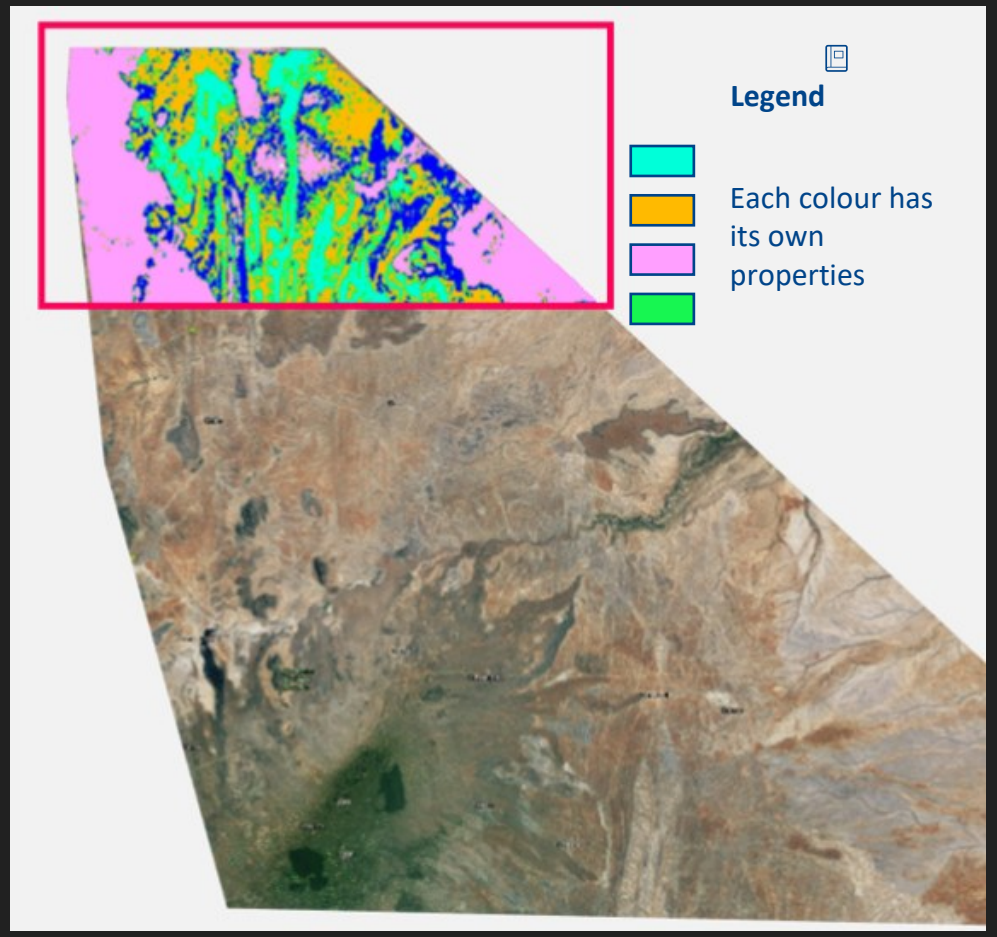


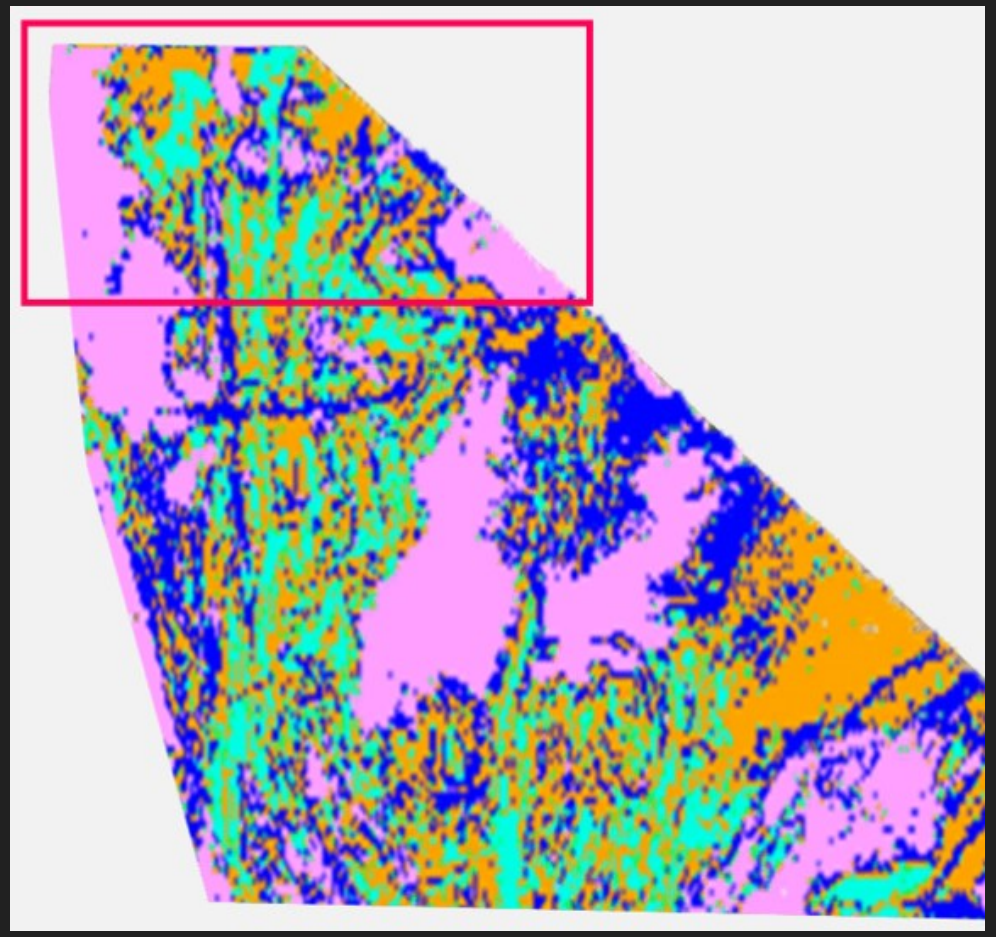
Example: Creating Pseudo-Geology Map

- Preprocess : Ensure your input geology is georeferenced as carefully as possible
- Preprocess : Remove any local large outlier anomalies from your data
- Try fitting geology and magnetic data first
- Use most appropriate geophysical products and don't overweight them , ie don't use CVG, MAG, and TILT as they are all based on the Total Magnetic Intensity

sanborn geophysics

REGIONAL EXPLORATION PSEUDO-GEOLOGY PRODUCT

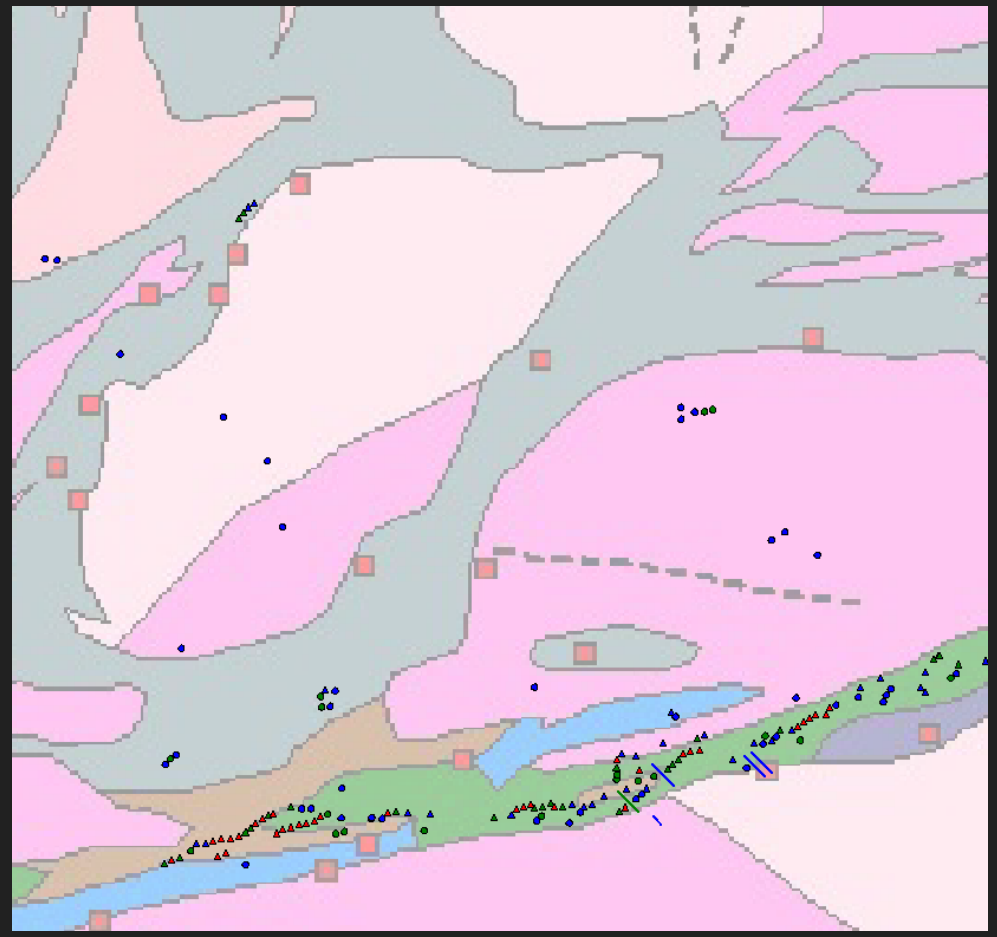


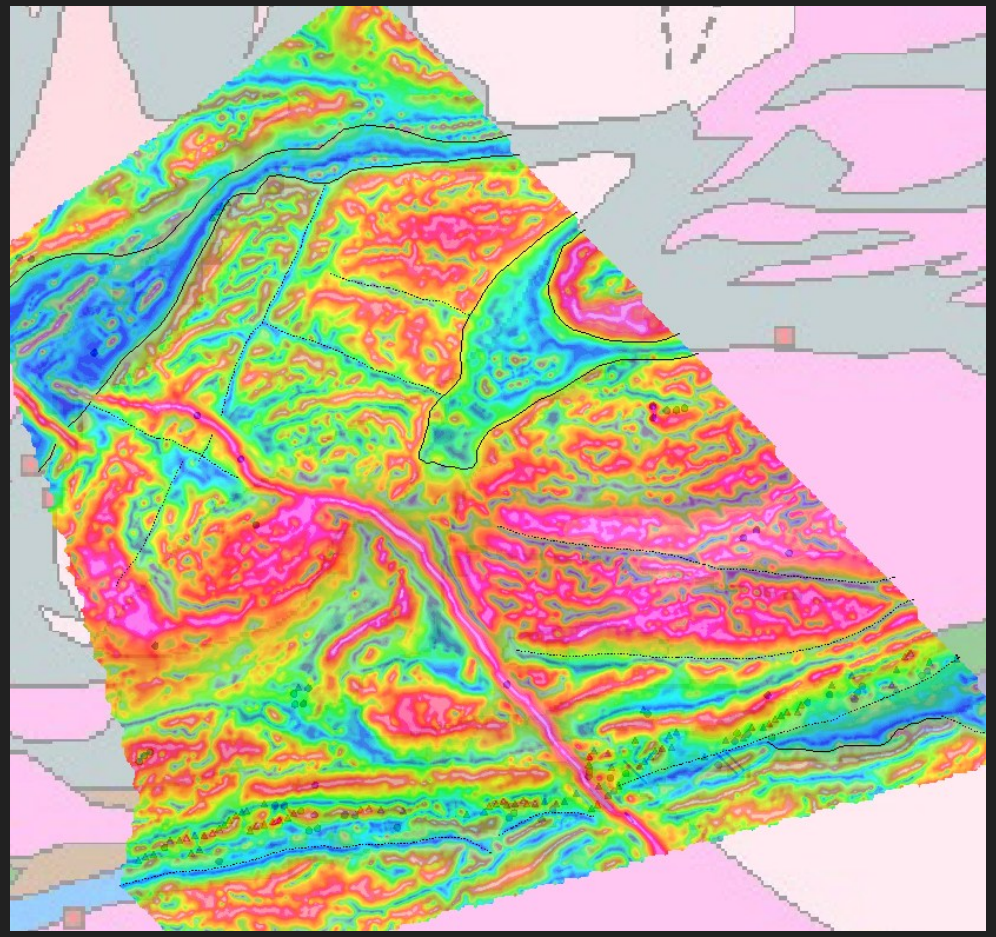


SCALABLE TO MORE DETAIL PROJECTS AS WELL

sanborn geophysics

DETAIL EXPLORATION GEOLOGICAL ENHANCEMENT





SCALABLE TO REGIONAL PROJECTS AS WELL (30 SQ KILOMETERS)

sanborn geophysics

SUMMARY

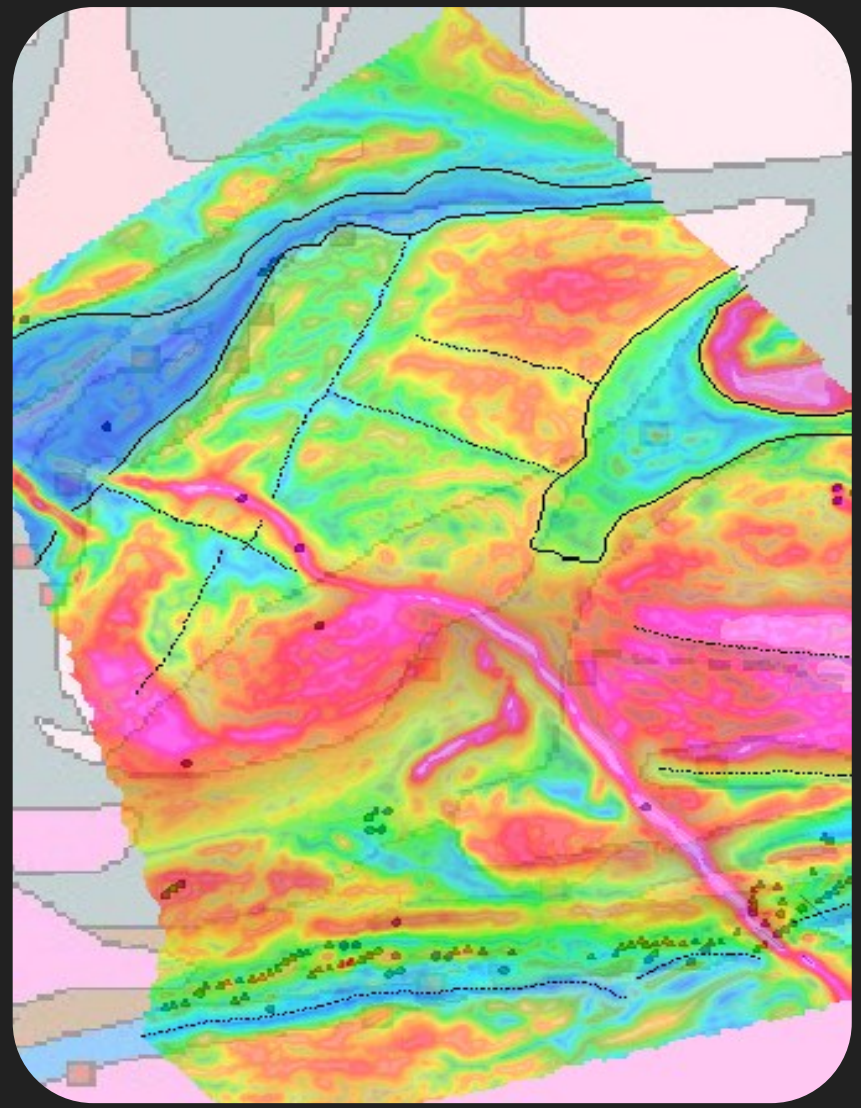
- Leveraging Geophysical data along with other Geospatial datasets is a strong tool that can help achieve many survey goals.

- Sanborn can help you achieve these goals with its capability to provide many layers of geospatial and geophysical data.

sanborn
geophysics

Thank you

Questions?



sanborn geophysics