Summary of gravity inversion process
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Y2

YILGARN CONSTRAINED GRAVITY INVERSION

DEVELOPMENT OF MODEL INPUTS AND PROCESS

1. **Validation of seismic interpretation with gravity and magnetic data along line NY1.**

   a. Identification of key PF elements – principally greenstones and granites
   b. Test expected petrophysical values and ranges
   c. Determine average thickness and orientation (dips etc) of key elements and revise interpretation where necessary

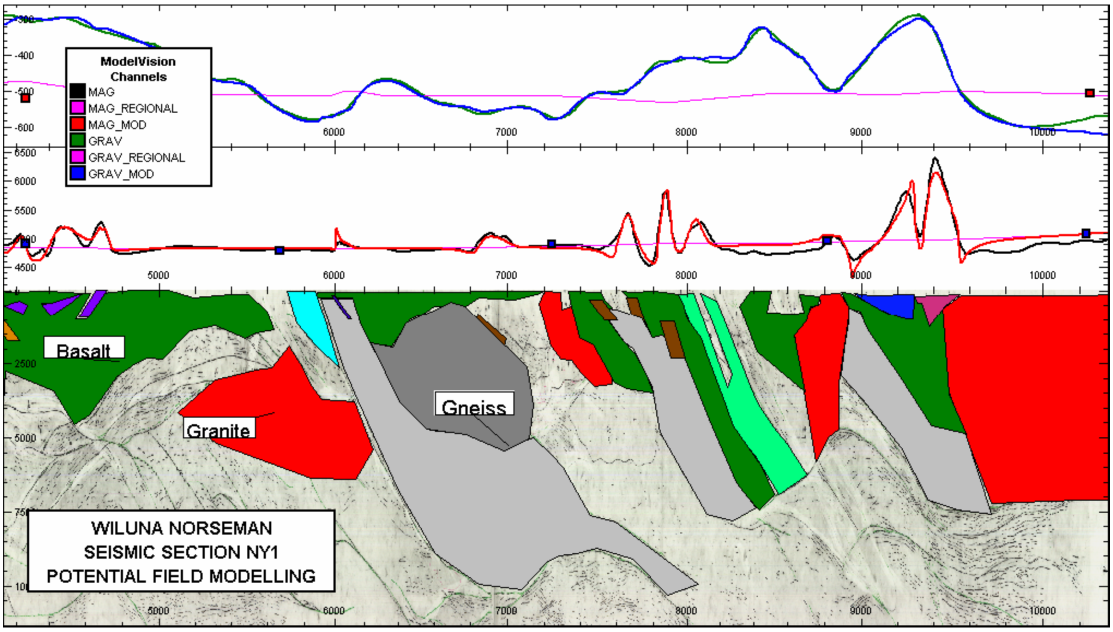

Figure 1 – Sub section of seismic line NY1 showing key PF elements as mapped from the interpreted seismic section.

2. **Ascertain regional and local volumes of interest**

   a. Local volume – defines terrain with some assumed commonality of density (or mag values), such that intra-unit variation is small compared to variation between units that are being mapped.
   b. Regional volume – removes background sources to the sides and below 'sources' of interest.

c. Established gravity as the less ambiguous tool with ‘highs’ correlating more or less with mapped basalts and greenstones, and lows predominantly as granite

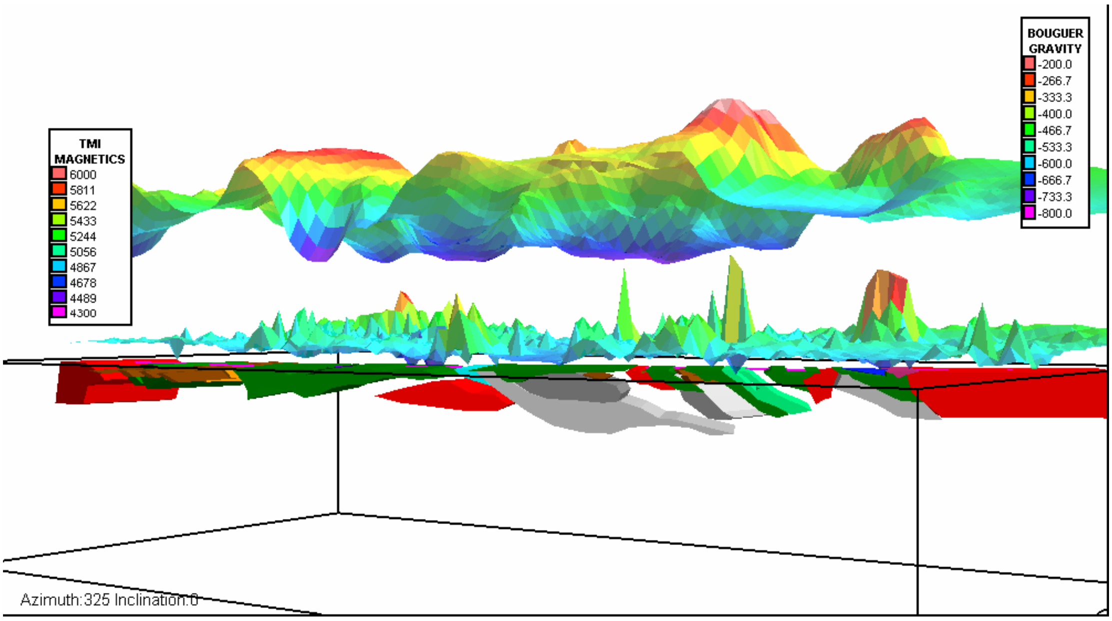

Figure 2. Isometric projection of interpreted and PF modelled seismic section NY1, with viewing angle of 325 azimuth and 0 inclination. Superimposed images show observed TMI and Bouguer gravity coverage over the area surrounding the section. Whilst the BG is relatively simple, the magnetics data contains numerous inter and intra greenstone sources

3. Extend two dimension modelling to three dimensions with inversion

a. Smooth model – drives iteration to convergence by pushing solution towards model with smoothest boundary conditions
b. Use density range as defined by forward modelling and petrophysics (if available)
c. 500000 cells represents about the limit of ‘practical’ interactive inversion (~ 4-5 hours depending on tolerances used). In this case local grid involved 150 *2km cell-widths east, 300*2km cell-widths north and 15*1km cell-widths vertically, making a total of 675000 cells. At a tolerance of 0.05mgals, convergence took about 6 hours each run
d. The result of the above inversion is to fit excess mass into just a few unconstrained zones, with mass generally increasing with depth (>10km)

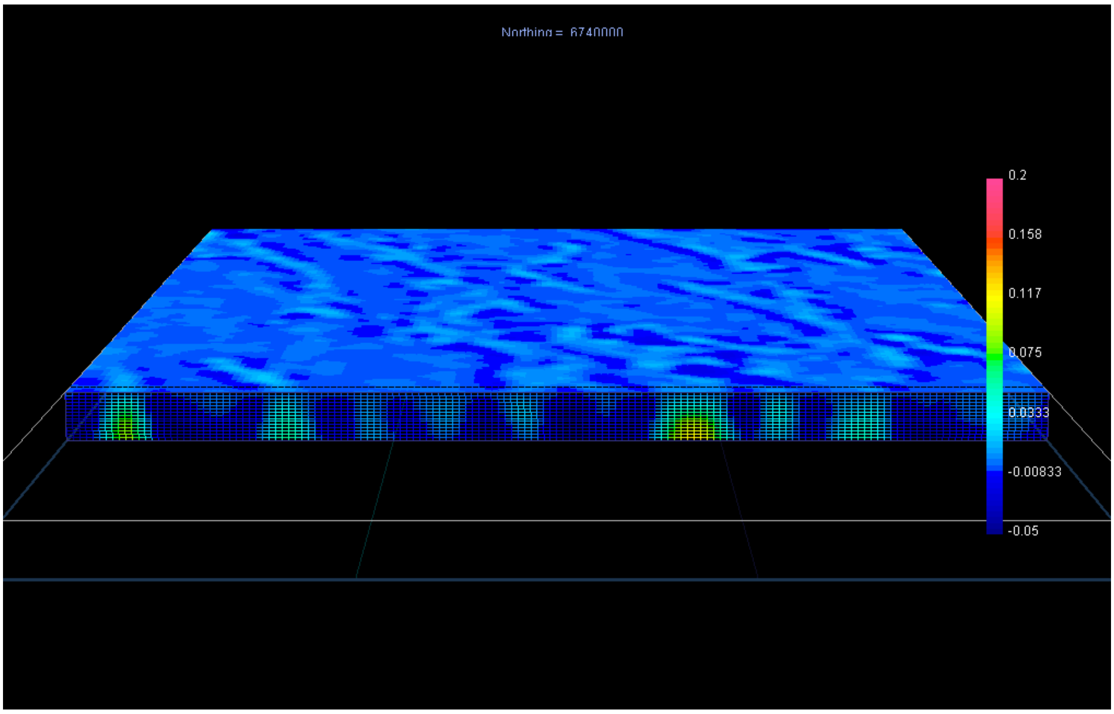

Figure 3. Resulting model from spatially-unconstrained inversion using the local volume outlined above. Density range covers greenstones to 2.9g/cc (+0.2g/cc on base) down to granitic rocks of 2.6g/cc (-0.1g/cc)

4. Add geological constraints to inversion from surface mapping

a. Digitise gross features from surface geology
b. Grid

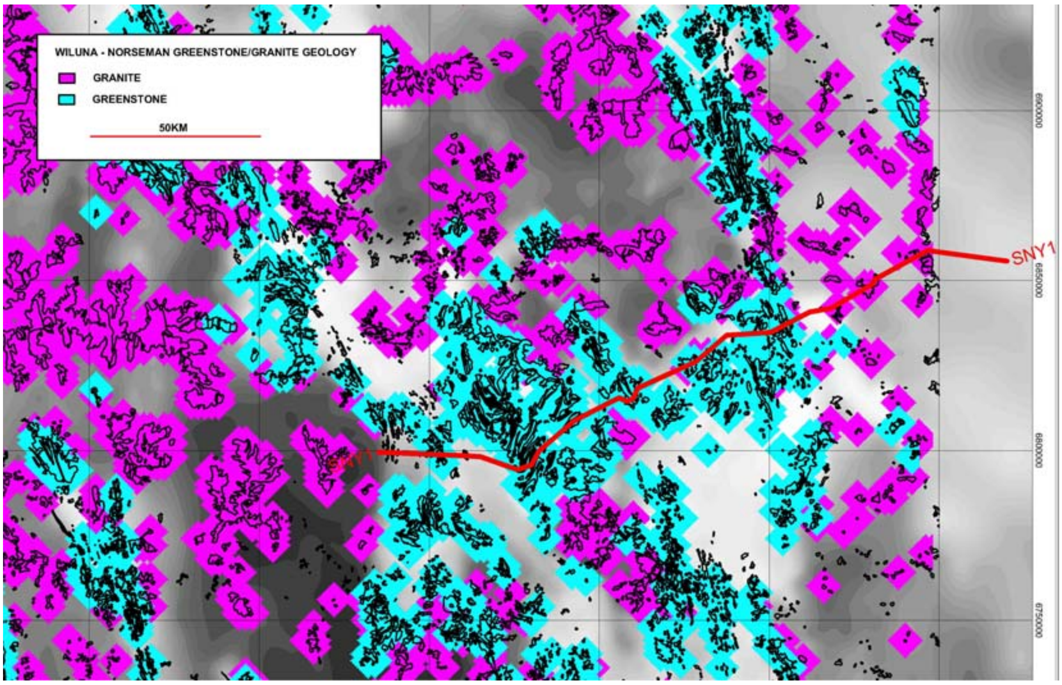

Figure 4. Sub-set of local volume geology showing gridded greenstone and granite, based on outcrop geology.

5. Resample geology to local volume mesh and spatially constrain inversion

a. From seismic, constrain depth of outcropping greenstone to a maximum of about 4km
b. Cells outside of outcropping granite or greenstone unconstrained below top cell sheet
c. When excess mass of greater than 4km thick block of greenstone required, set inversion to preferentially build mass laterally.
d. Methodology refined over several iterations to optimise constraints-versus-depth function

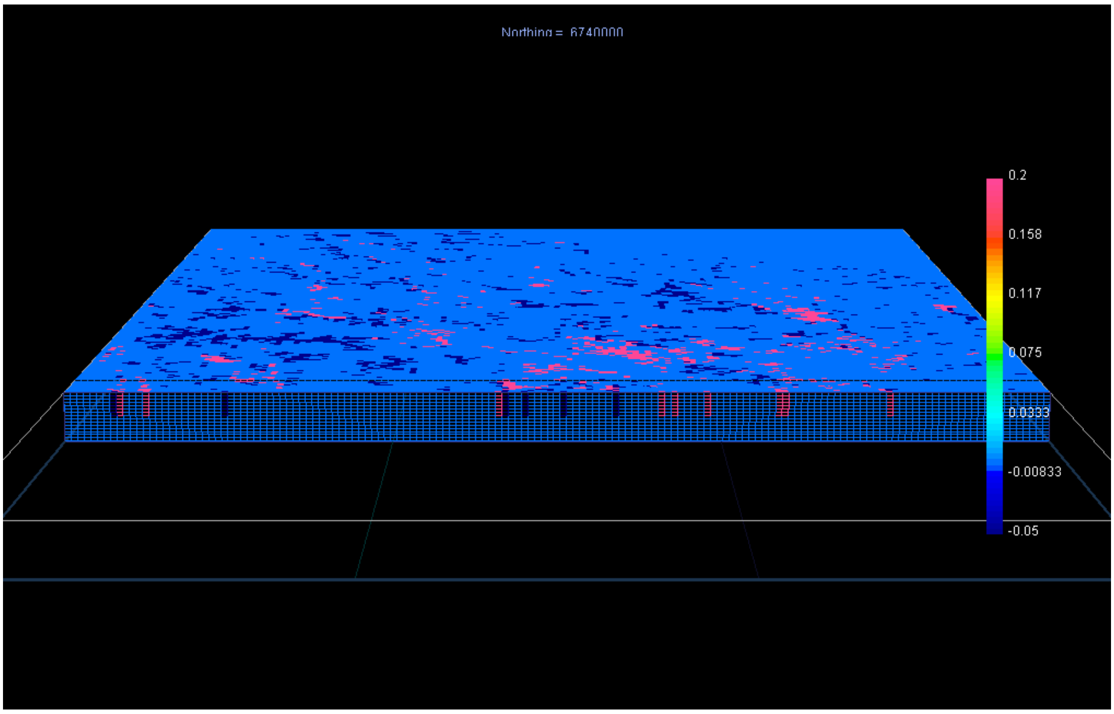

Figure 5. Starting model for spatially-constrained inversion using the local volume outlined above. Density range covers greenstones to 2.9g/cc (+0.2g/cc on base) down to granitic rocks of 2.6g/cc (-0.1g/cc)

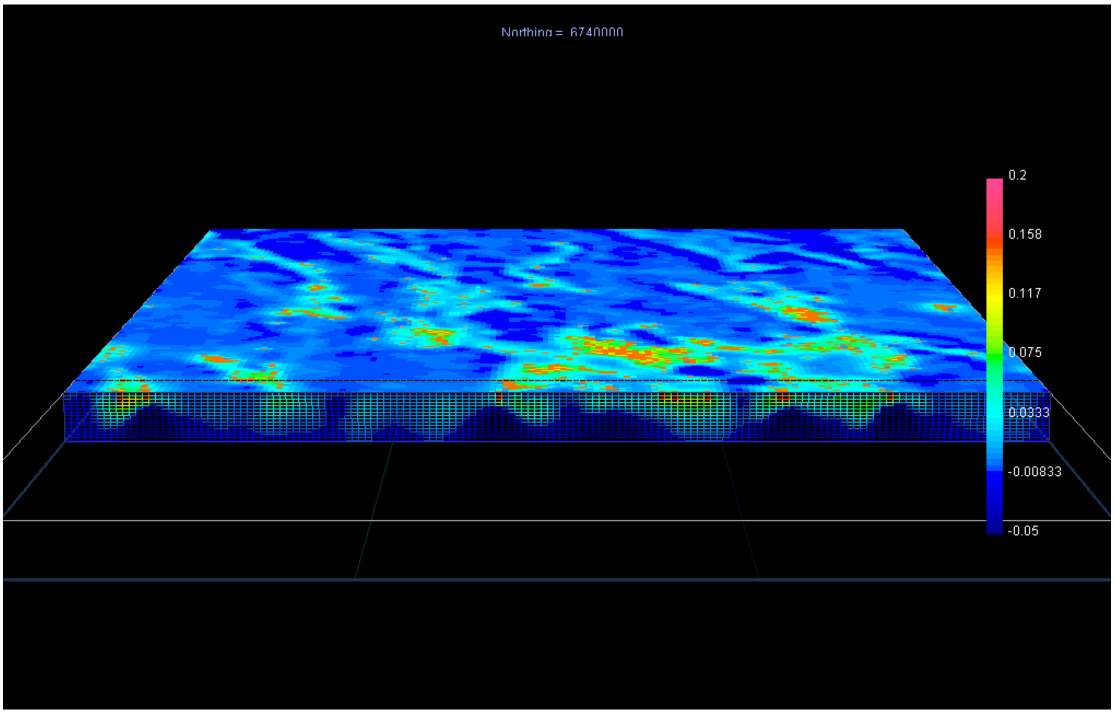

Figure 6. Resulting model for spatially-constrained inversion using the starting model of Figure 5 and a local volume as outlined above. Density range covers greenstones to 2.9g/cc (+0.2g/cc on base) down to granitic rocks of 2.6g/cc (-0.1g/cc)

6. Calibrate results against well-controlled points and conceptual models

a. Having refined inversion to match dips and gross magnitude of features, set density thresholds to match model-depths extents against seismic boundaries and other depth-control data

**************************** See GOCAD Files **************************************

7. Where to from here?

a. Reduce scale of inversion even further over specific areas of interest and with smaller cell sizes for greater detail.
b. Employ gravity inversion results as starting model to magnetic inversion in less complicated areas. Disparities/anomalies may be instructive in identifying areas with alteration.
c. Acquire and develop detailed petrophysical database to better constrain inversion and refine features. Any density/mag vectors derived by the process may also help in the understanding and mapping of weathering, terrane boundaries and regional metamorphism.