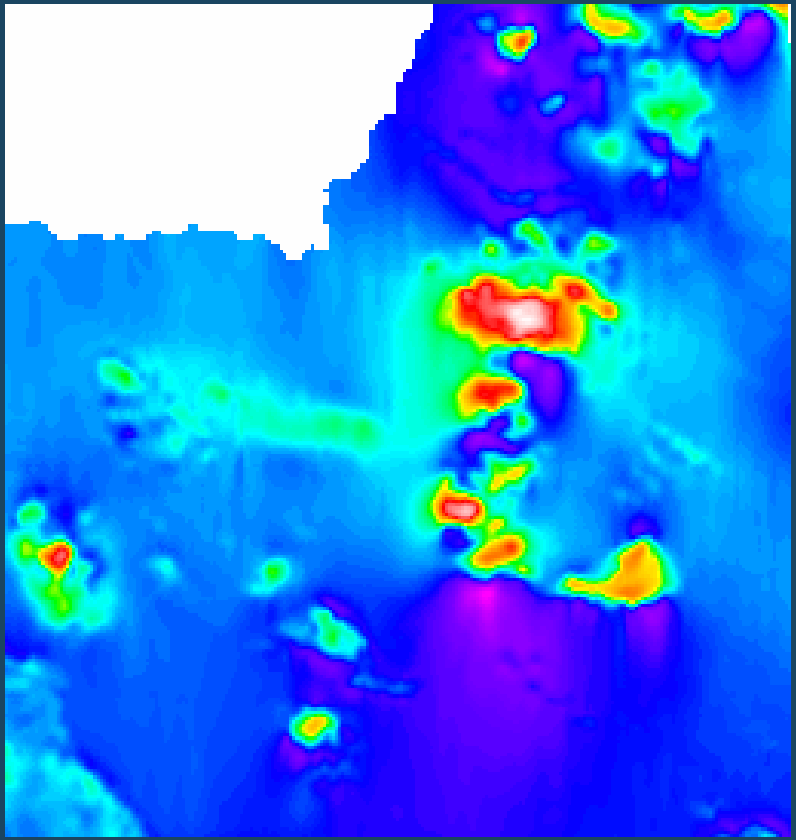


OK Tedi District, PNG

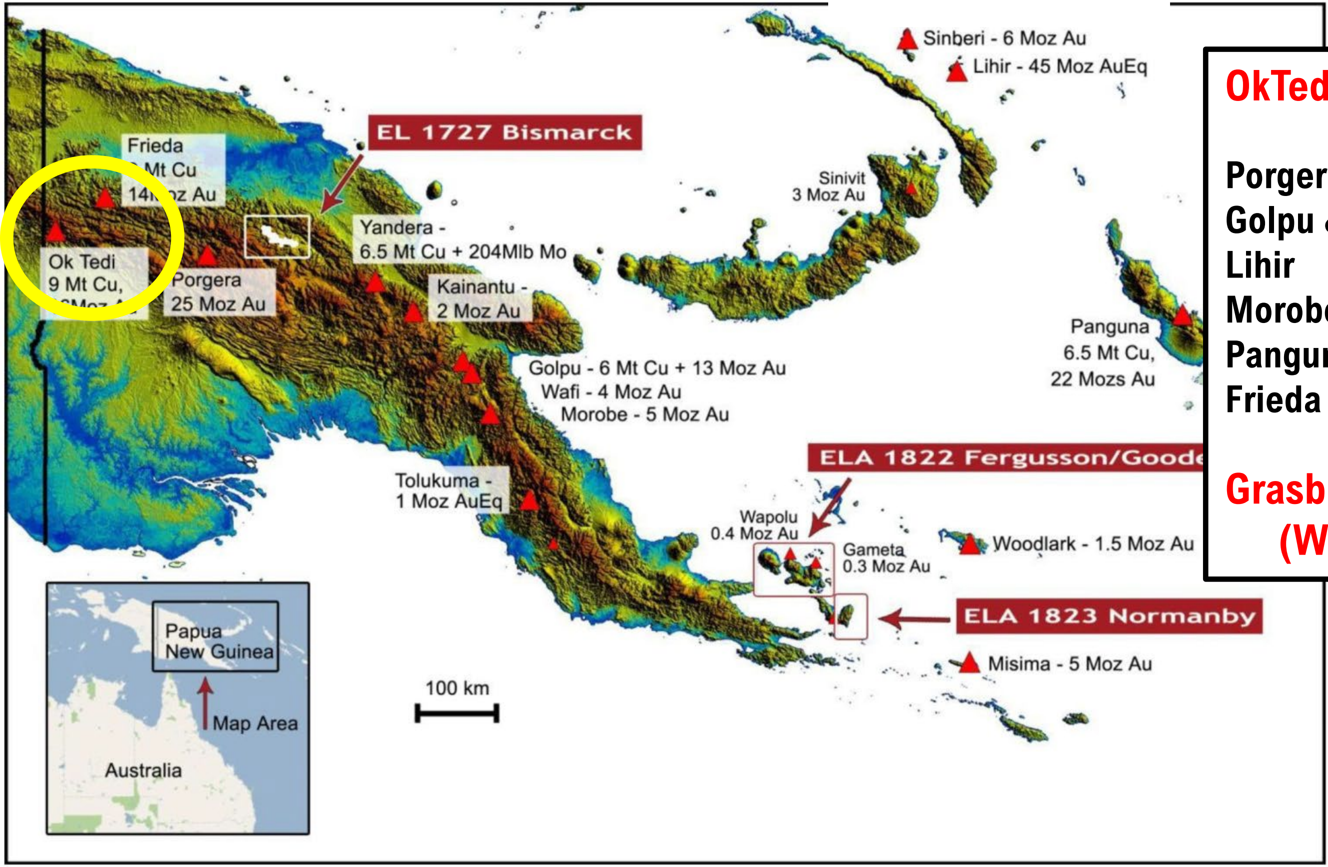
Aeromag Integration Project
2024

- What does the aeromagnetic (& radiometric) survey data add to the geological picture?
- Does rugged terrain limit the contribution of these data?
- Are there any new exploration ideas/targets?

Complied by Dave Isles, Yvonne Wallace and Pavel Jurza

- Objectives
- Data
- Methodology
- Terrain Effects
- Solid Geology Interpretation
- Ok Tedi mining district
- Next Steps
- Open discussion

Papua New Guinea – World Class Porphyries



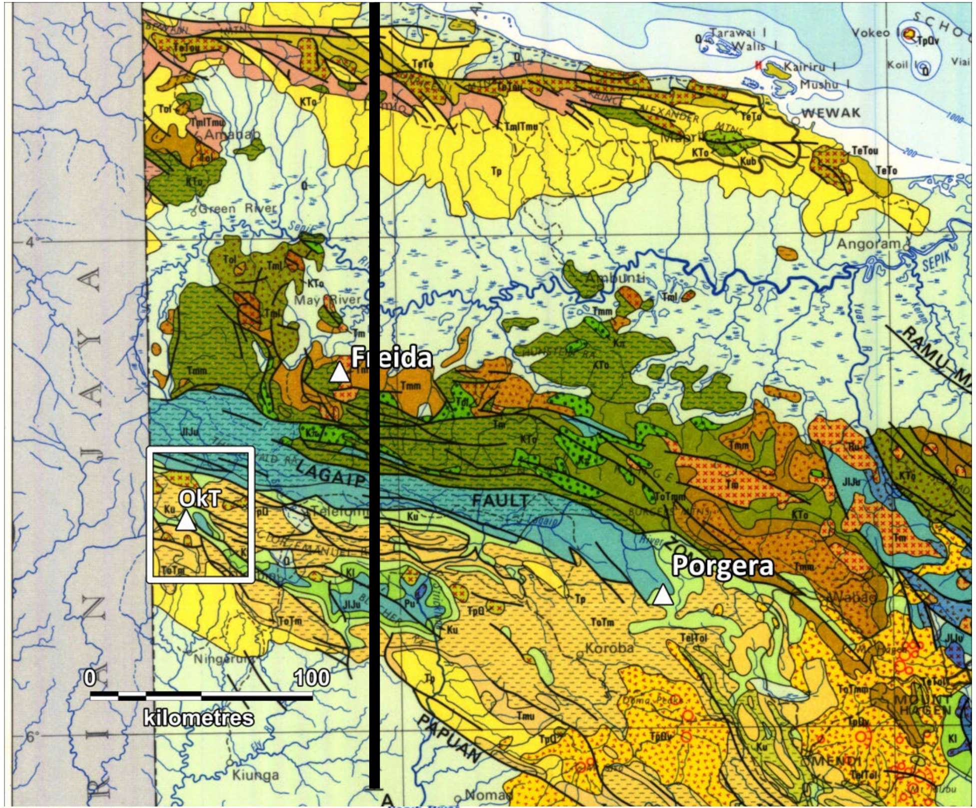
OkTedi 16Mozs Au 9Mt Cu

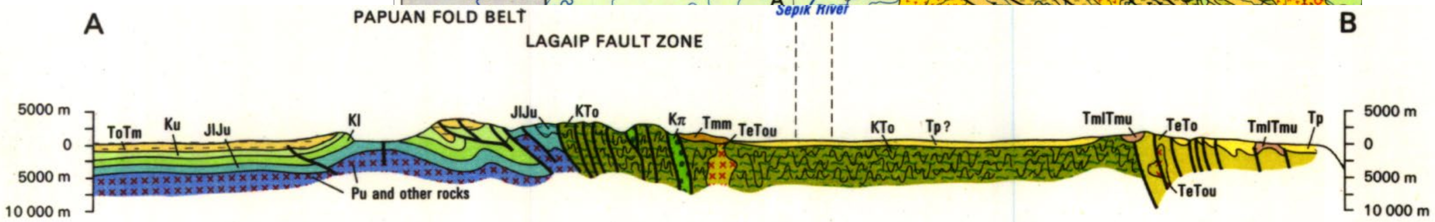
Porgera	**>26Mozs Au**
Golpu & Wafi Deposit	**>30Mozs Au**
Lihir	**>45Mozs Au**
Morobe	**5-10Mozs Au**
Panguna	**>16Mozs Au +5Mt Cu**
Frieda	**>15Mozs Au +17Mt Cu**

Grasberg 116Moz Au, 41Mt Cu
(West Papua, Indonesia)

Regional Geology

1:2,500,00 Map, BMR 1976





Objectives

- Update, improve solid geology interpretation
- Evaluate effect of terrain on aeromagnetics
- Seek new clues for exploration targeting

Data → all very good

1979 PNG GS 1:100,000 mapping
Arnold, G O, Griffin, T J, and Hodge C C, 1979.
Geological Survey of Papua New Guinea Report 79/3

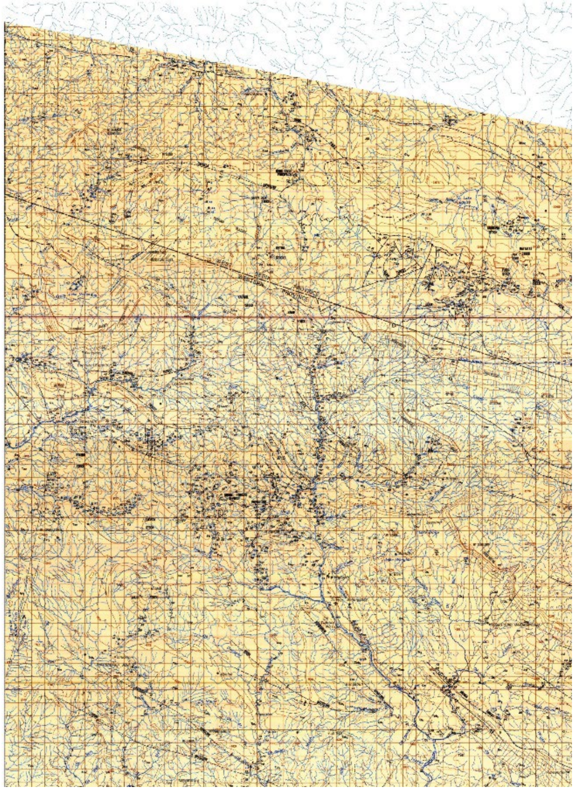
1984 BHP aeromagnetics (and radiometrics)
Irvine, R J and Robertson, I, 1987. ASEG Special Publications 1987 (1)

2015 MRA Regional aeromagnetics (&radiometrics)
Mosusu, N, McKenna, K, and Saroa, D, 2016. ASEG-PESA-AIG Conference Abstracts pp869-872

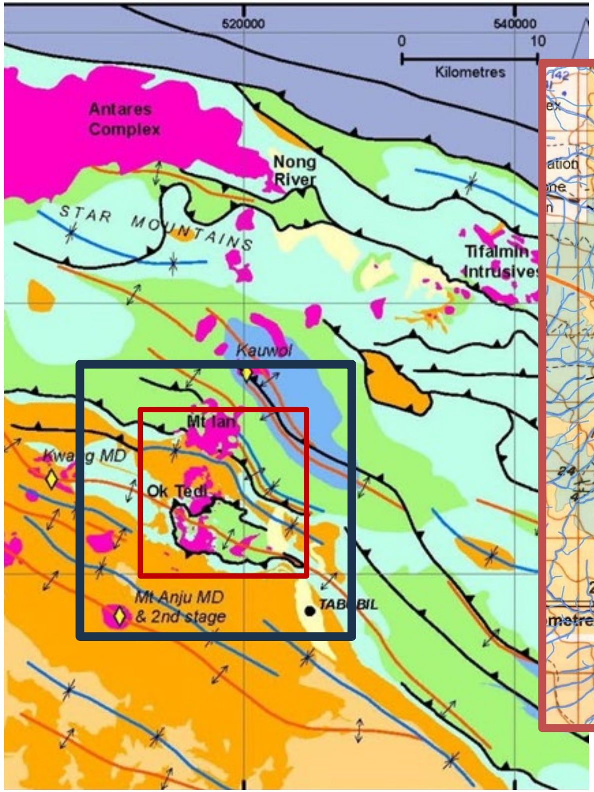
Recent geological studies by Pollard et al
Pollard, P J, Jongens, R, Stein, H, Fanning, M C and Smillie, R, 2021. Economic Geology v.116 no.3 pp533-558

Ok Tedi Integration Project

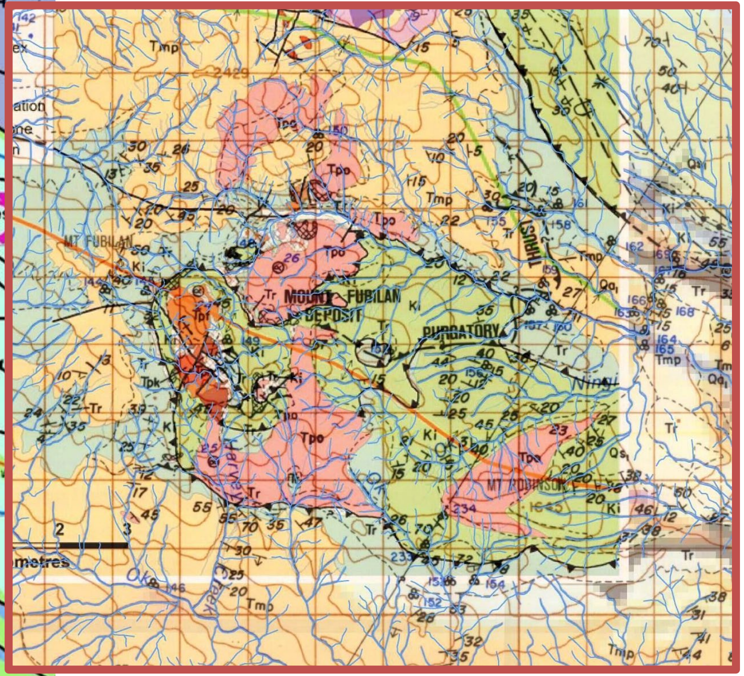
Geology Maps



Arnold et al 100k Map



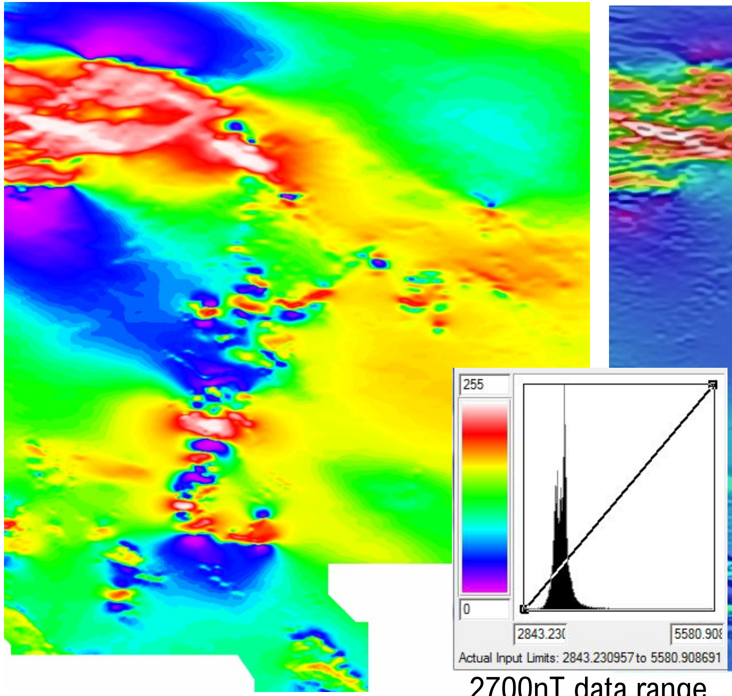
Pollard et al Regional Map



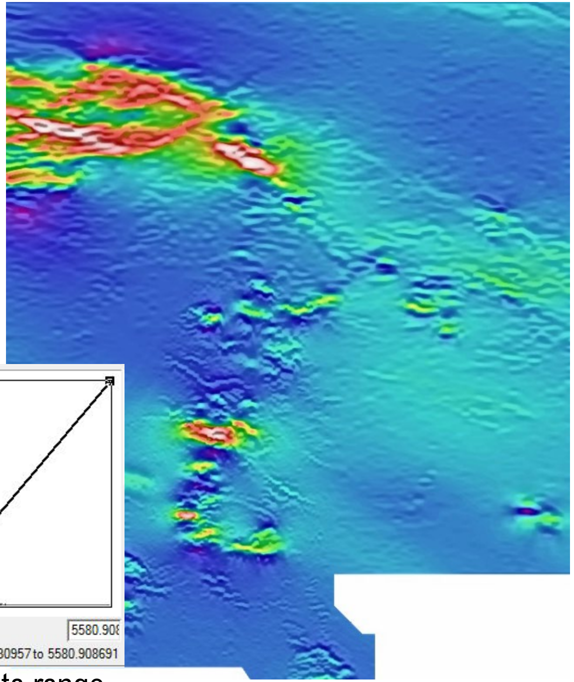
Detailed Maps

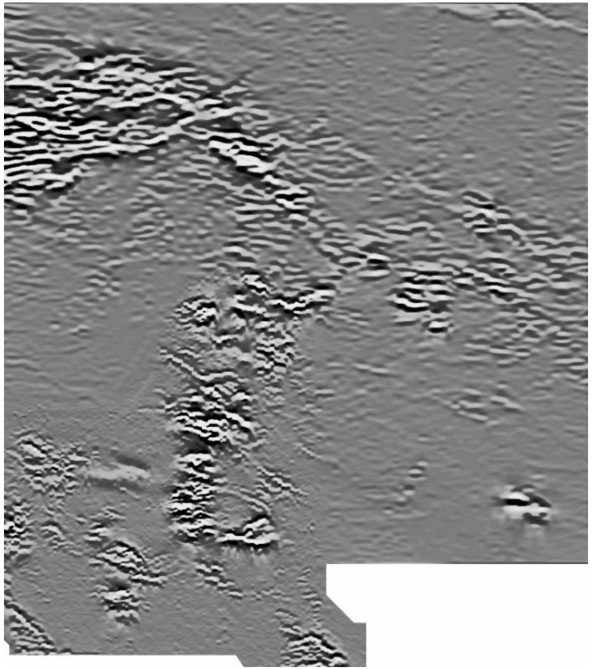
Ok Tedi Integration Project

Aeromagnetic Imagery



2700nT data range





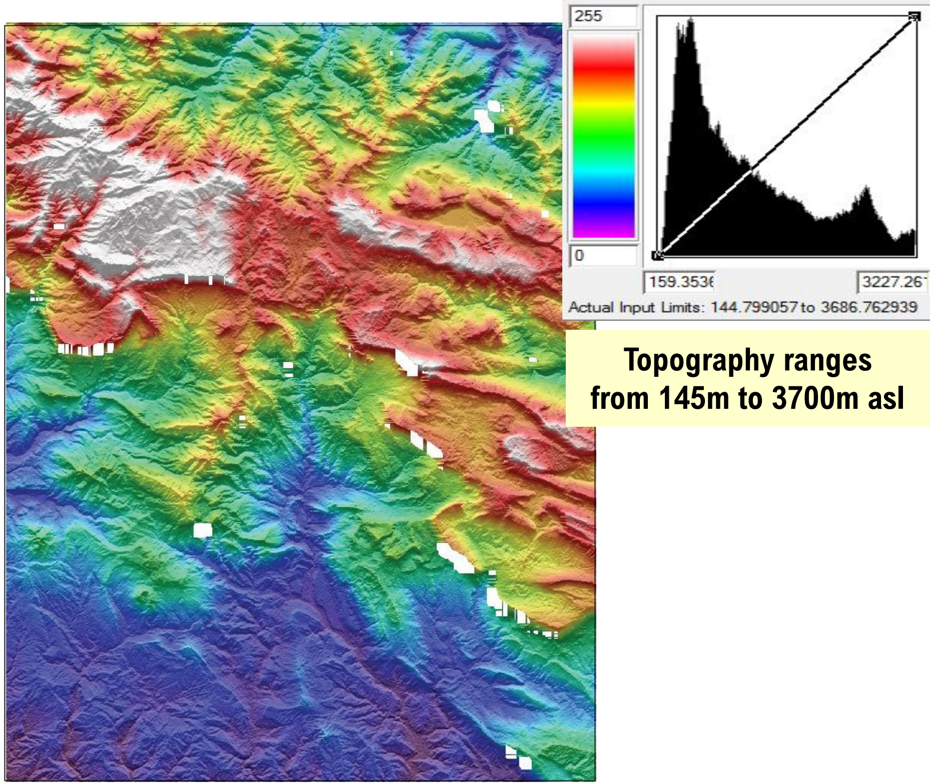
RTP (non-linear stretch)

RTP+2nd derivative composite

RTP2nd derivative

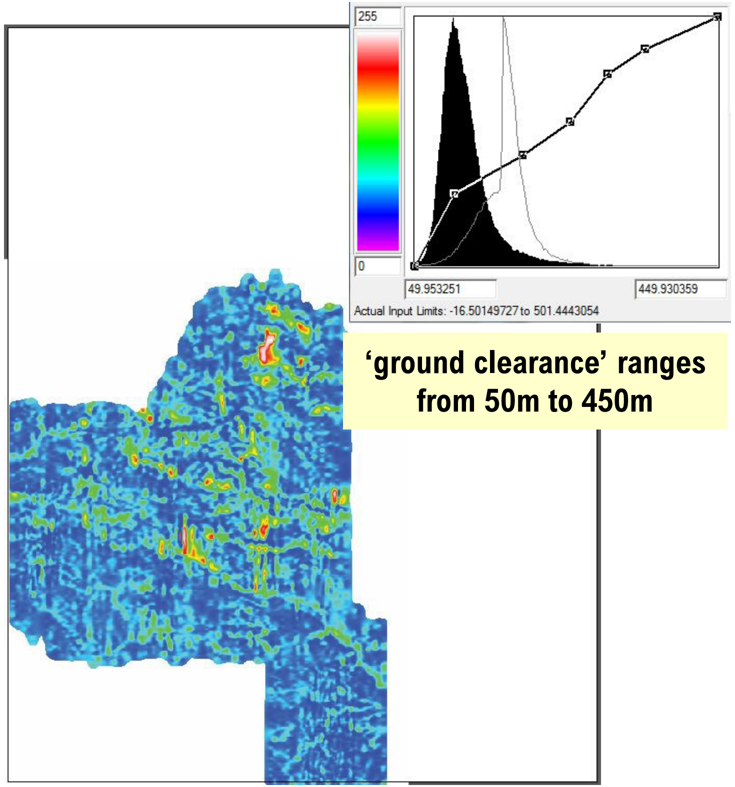
Ok Tedi Integration Project

Topographic Imagery



Topography ranges from 145m to 3700m asl

SRTM



'ground clearance' ranges from 50m to 450m

BHP survey- Radar Altitude

Radiometrics

The radiometric data has not been accessed as yet.

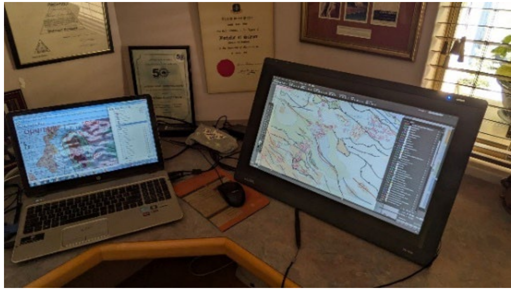
Both data sets are low resolution

The severe terrain clearance variations will impact strongly on signal strength

Reprocessing, merging and imaging will require careful attention

Interpretation is likely to be ‘coarse’

Methodology



‘Data Processing’

Reprocess BHP data, **Merge** with MRA data, (**RTP is VERY important** and successful), produce suite of images suitable for 1:50,000 scale analysis, include SRTM imagery

Register and (start to 🙂) colour 1:100,000 (1979, MRA) geology map

Register all other geological maps

‘Integration’

All data analysed using digitising tablet and exported to MapInfo

Empirical **observations** recorded in separate layers

Observations then cross-referenced with geology to produce **‘geopolys’**

Structures- new ones and those from existing geology with modifications/ extensions from mag

→ **Working solid geology map**

‘Interpretation’

Limited new interpretation as yet.. The working solid geology map needs some *field validation*

Terrain Effects

A simple model study

Assigning a range of magnetic susceptibilities to the existing terrain shows that only the larger, very strongly magnetic intrusive bodies will show significant changes in anomaly shape due to terrain/ ground clearance variations.

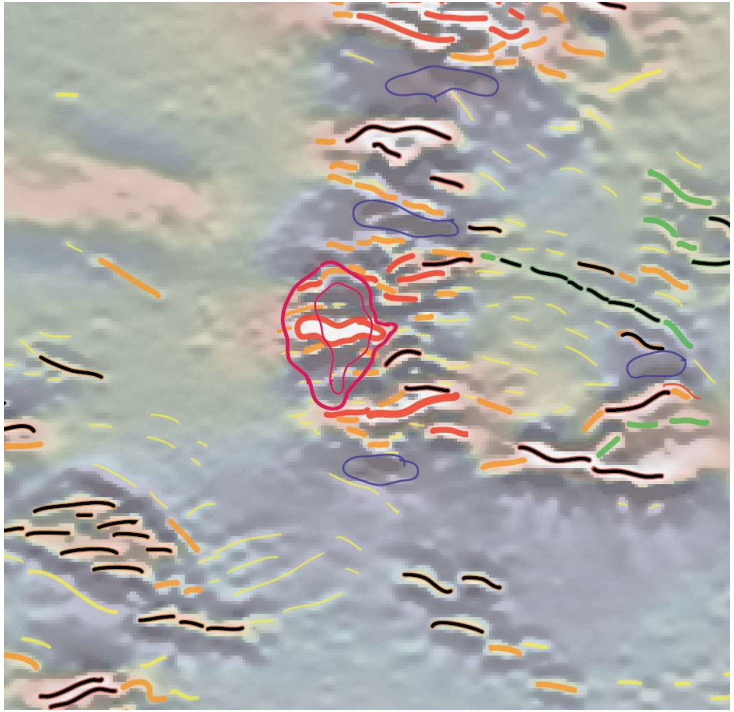
Direct observation

In fact, the instances where magnetic features correlate with topography are limited and have little or no influence on the identification of magnetic rock body locations or outlines.

The topographic magnetic anomalies are documented in the solid geology map.

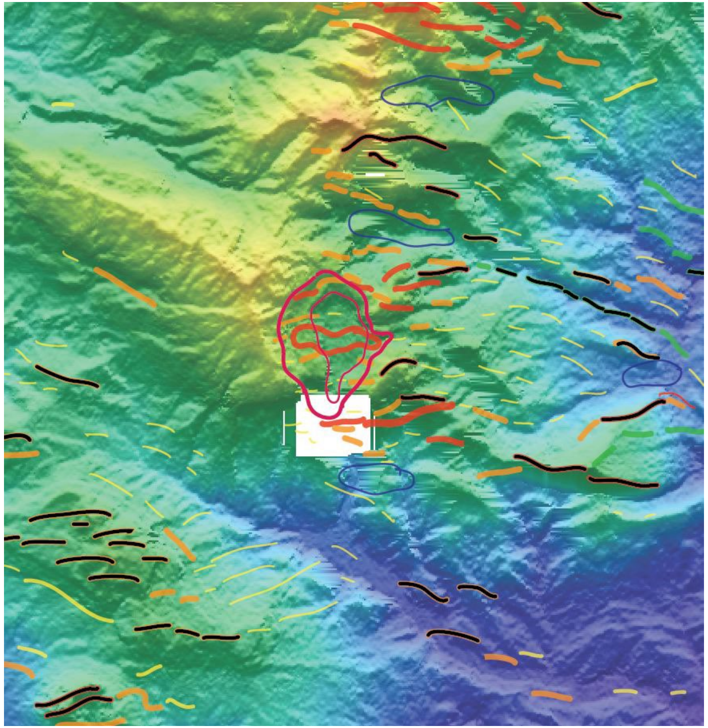
Ok Tedi Integration Project

Terrain Effects



Magnetic ‘rock units’
on composite RTP image

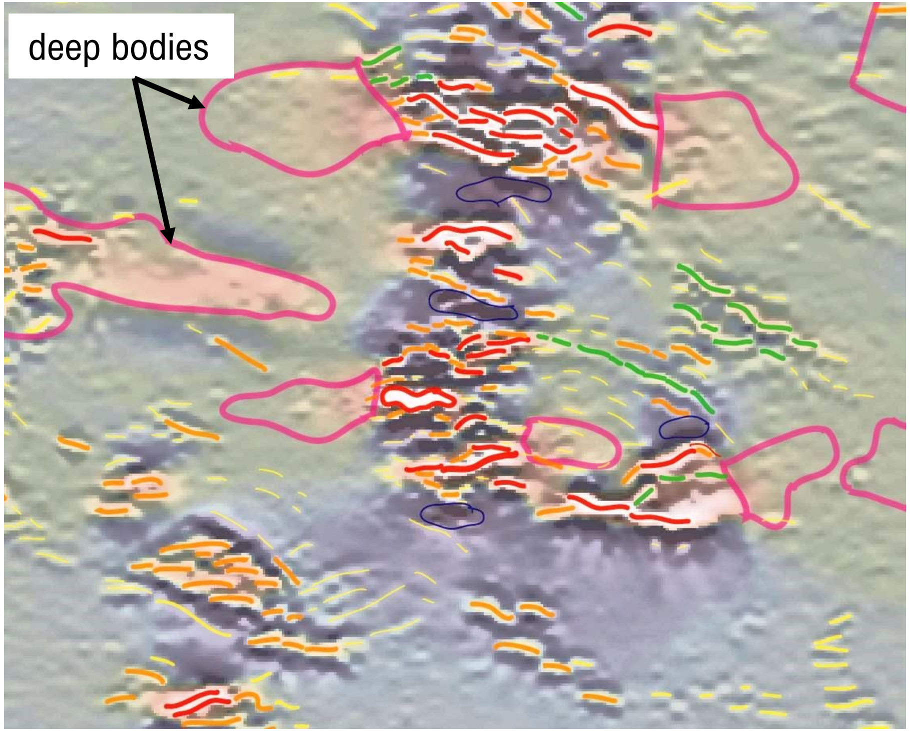
4 km



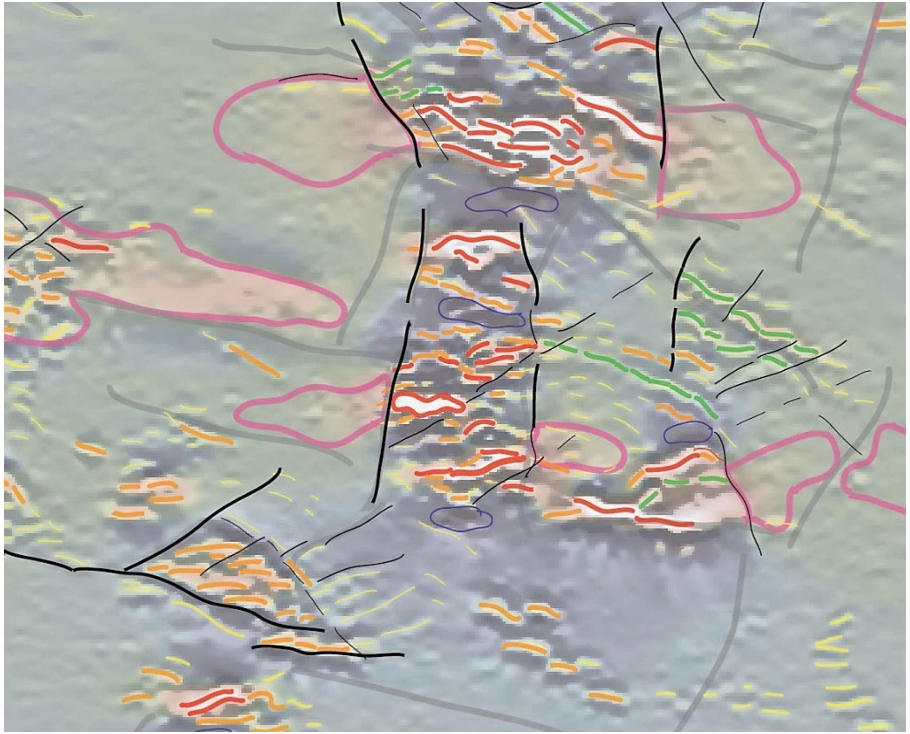
Magnetic ‘rock units’
on SRTM image

Ok Tedi Integration Project

Solid Geology Interpretation- Observation stage



Magnetic rock body observations
(shallow and deep)



add linear breaks, contacts, trends
(shallow and deep)

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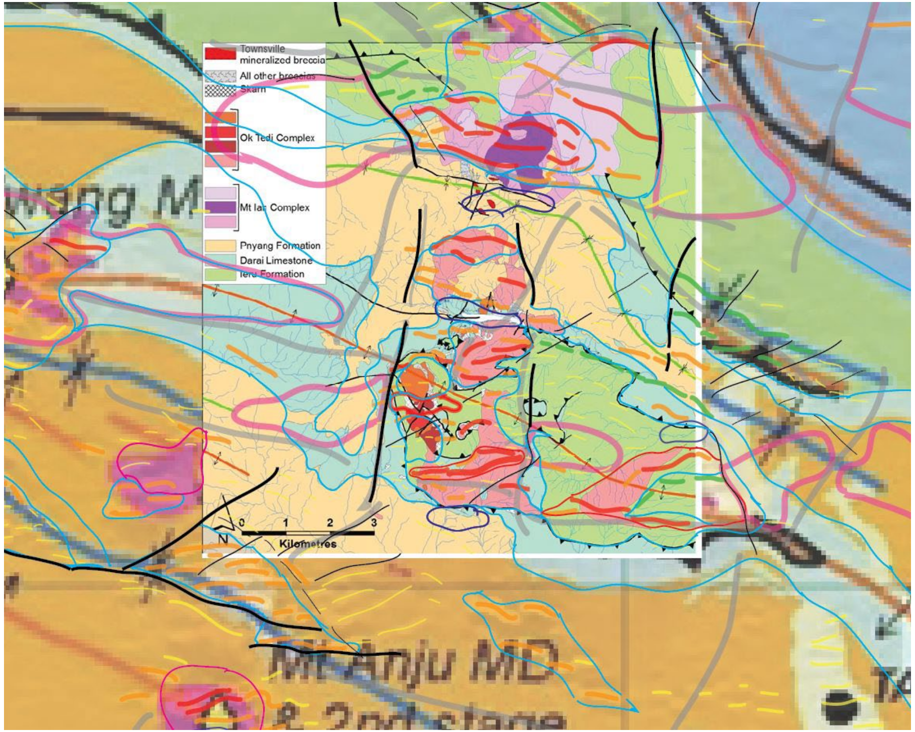
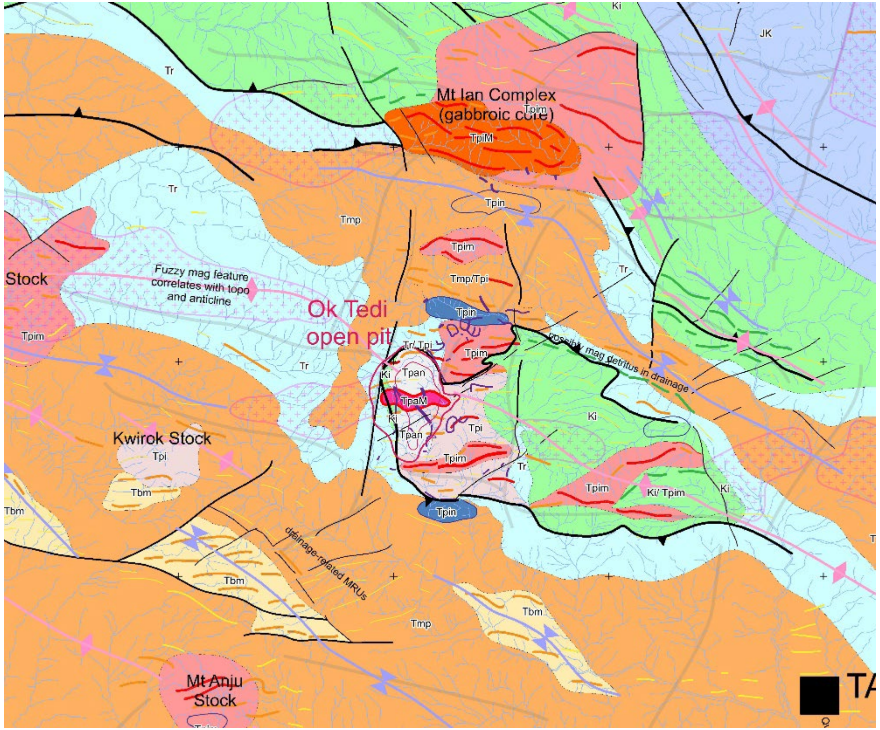
Solid Geology Interpretation- Integration stage



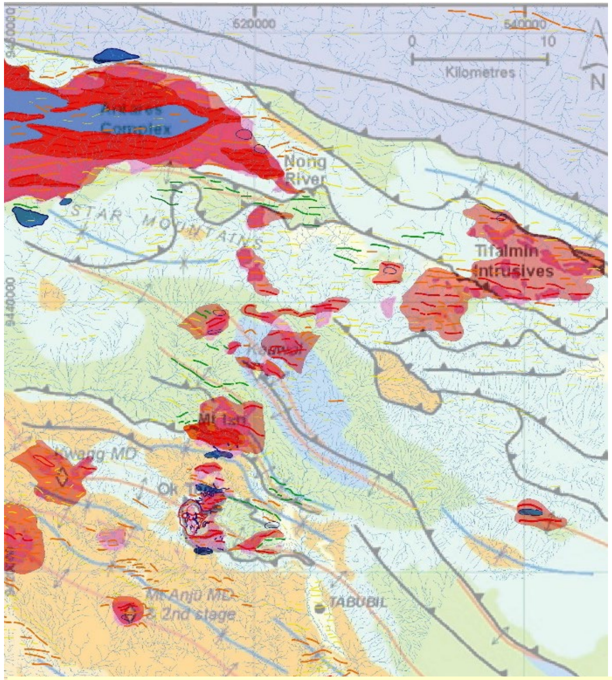
Cross-reference mag observations with geology

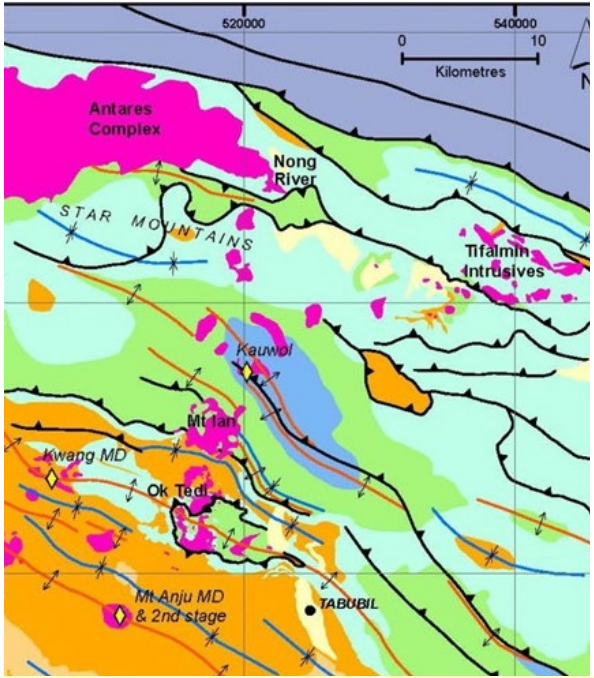


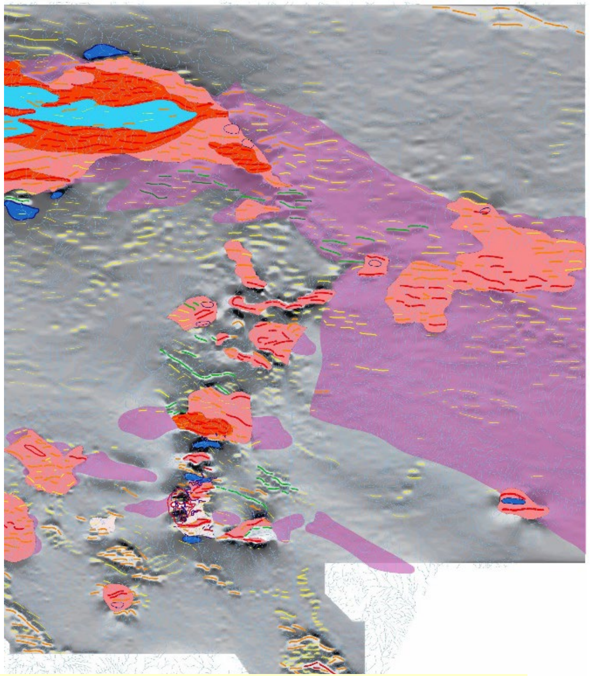
Revise geopolys and structures where appropriate- include magnetic rock bodies- they are part of the geology

Ok Tedi Integration Project

Solid Geology Interpretation- Intrusive Bodies







- Intrusive bodies are ‘extended’ along the strike of the host sediments
- They have significant magnetic ‘character’ which may improve mapping classification
- The younger, smaller intrusions correlate strongly with anticlines

Solid Geology Interpretation- Sedimentary Sequence

Sedimentary Sequence

Note that the Quaternary units are predominantly thin and localised and are not depicted on the Solid Geology map.

Tbm | Birim Formation. Volcaniclastic conglomerate, sandstone, and siltstone. Moderately- strongly magnetic with some suggestion of 'marker' units.

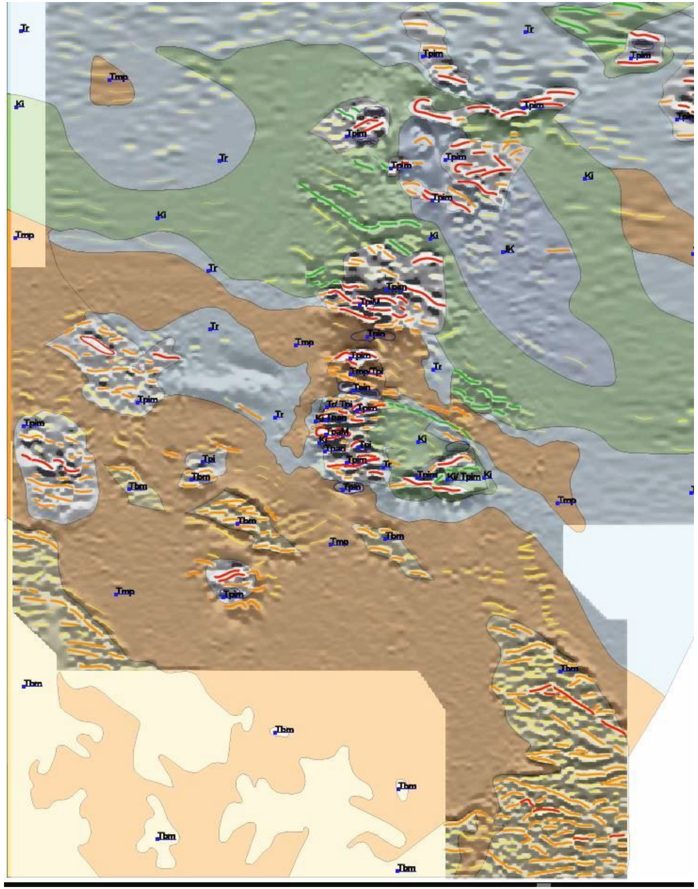
Tmp | Pnyang Formation. Calcareous mudstone, siltstone, and muddy sandstone. Predominantly non-magnetic.

Tr | Darai Limestone. Pale grey and buff micritic limestone. Nonmagnetic.

ki | Feing Group, mainly Leru Formation. Glauconitic sandstone and mudstone, grey mudstone, and shale. Note that an un-named, finer grained upper unit, JKf on Arnold et al map, is not differentiated here. Largely non-magnetic but contains at least one strong, coherent mag etic marker, highlighted in green.

JK | Kuabgen Group. Conglomeritic arkose, sandstone, mudstone with calcareous, micaceous and quartzose types. Weakly magnetic.

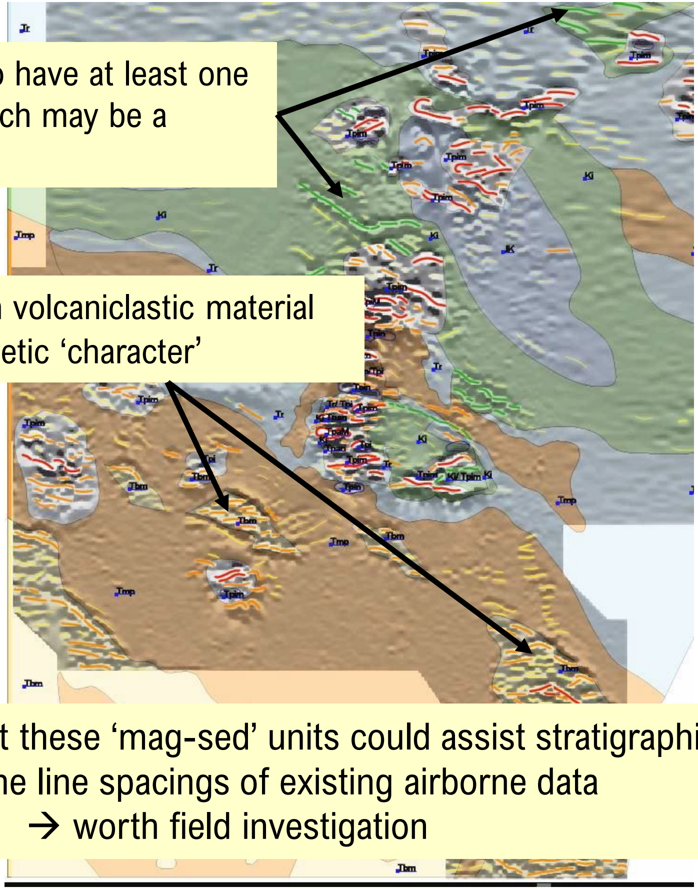
Jo | Om Beds. Black carbonaceous mudstone and siltstone with minor quartz sandstone.

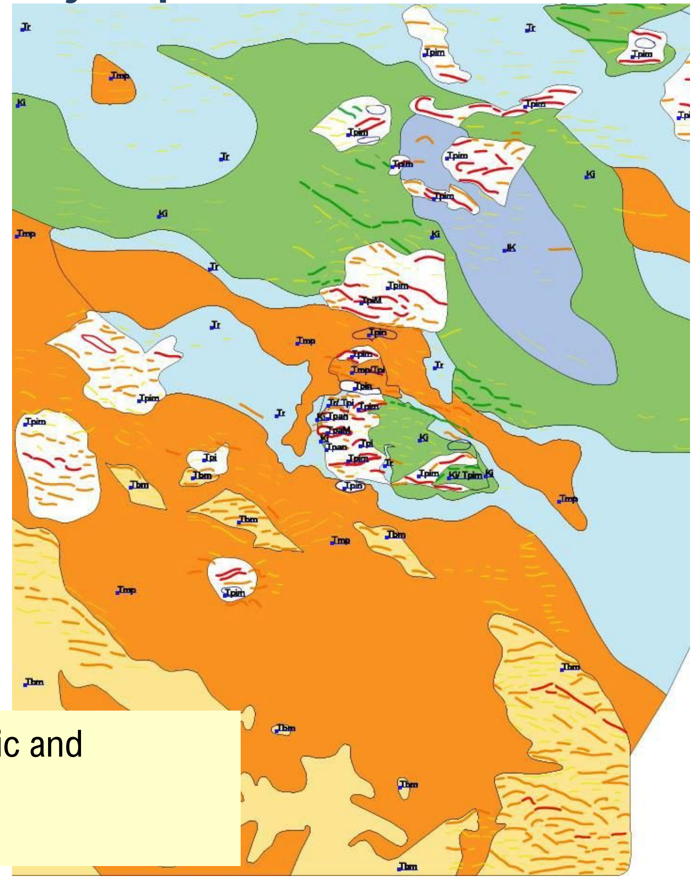


Solid Geology Interpretation- Sedimentary Sequence

The **Ieru Formation** appears to have at least one strongly magnetic subunit which may be a stratigraphic marker????

The **Birim Formation** is rich in volcaniclastic material and shows quite strong magnetic ‘character’

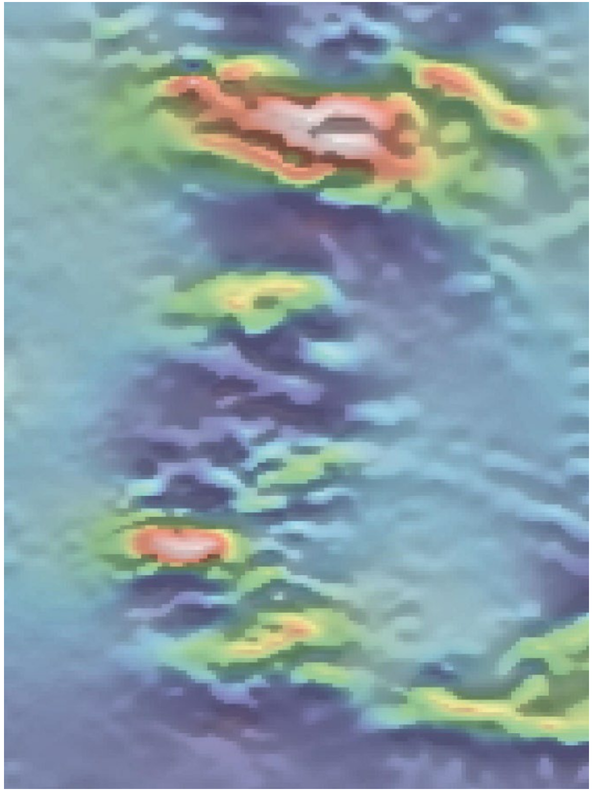




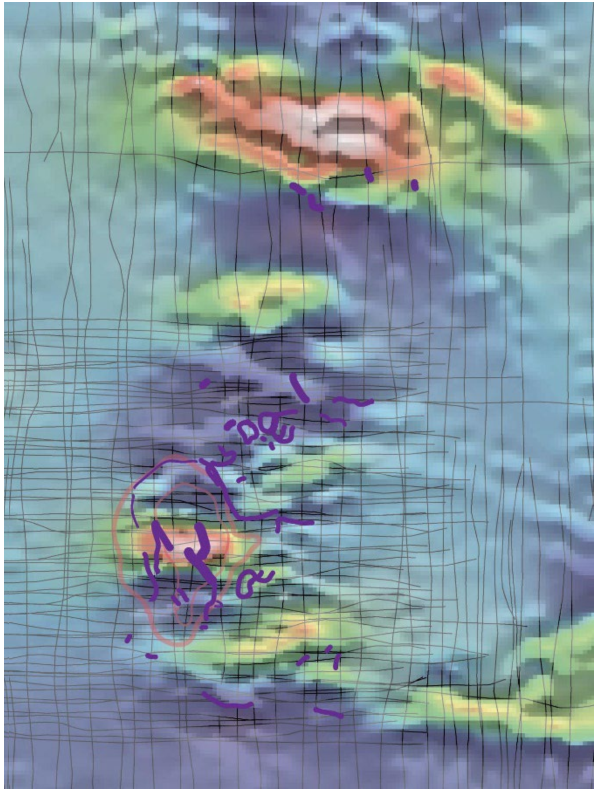
There is a suggestion that these ‘mag-sed’ units could assist stratigraphic and structural mapping, but the line spacings of existing airborne data place limitations on this → worth field investigation

Ok Tedi Integration Project

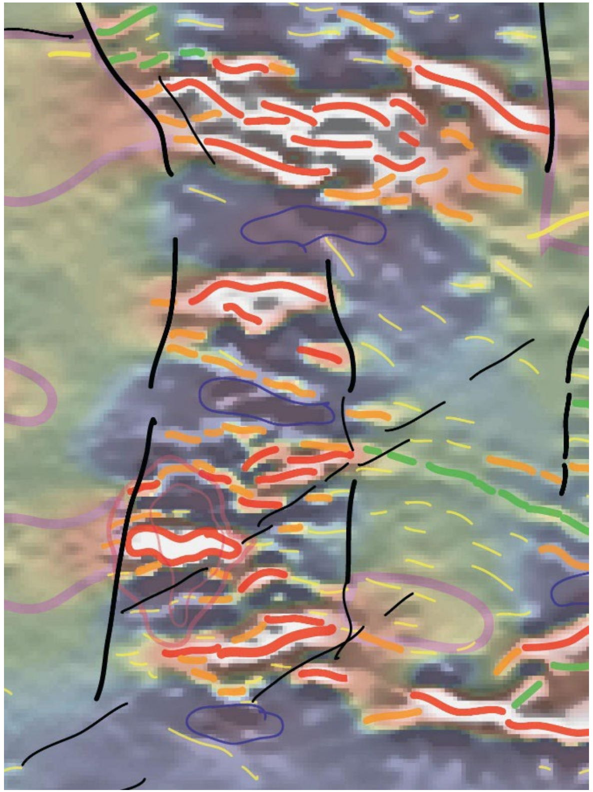
Solid Geology Interpretation- Ok Tedi mining district



RTP Linear colour stretch
with 2vd overlay



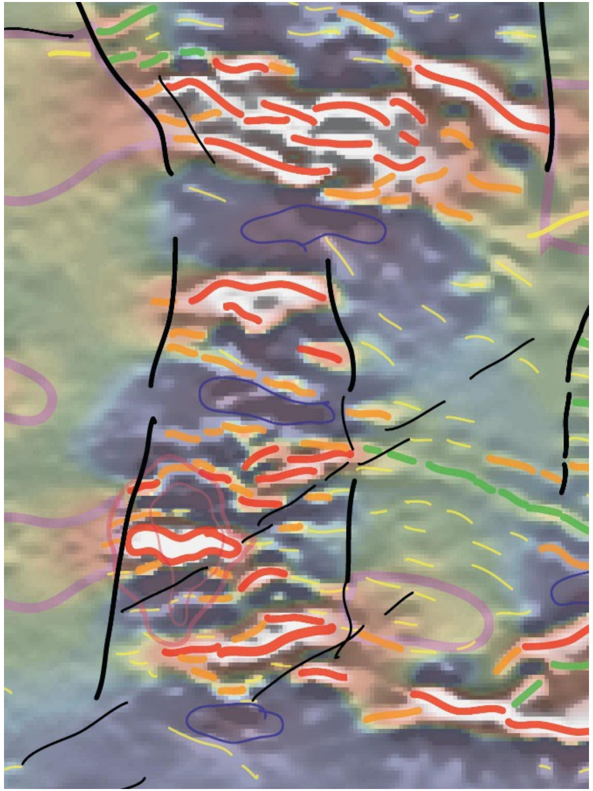
Showing flight path and OkT pit
and mapped mgt skarns



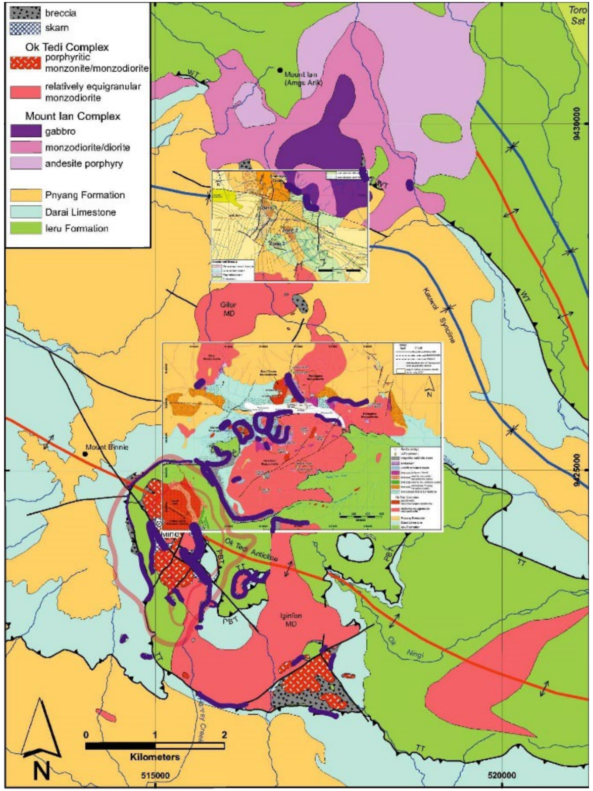
Mag Observations

Ok Tedi Integration Project

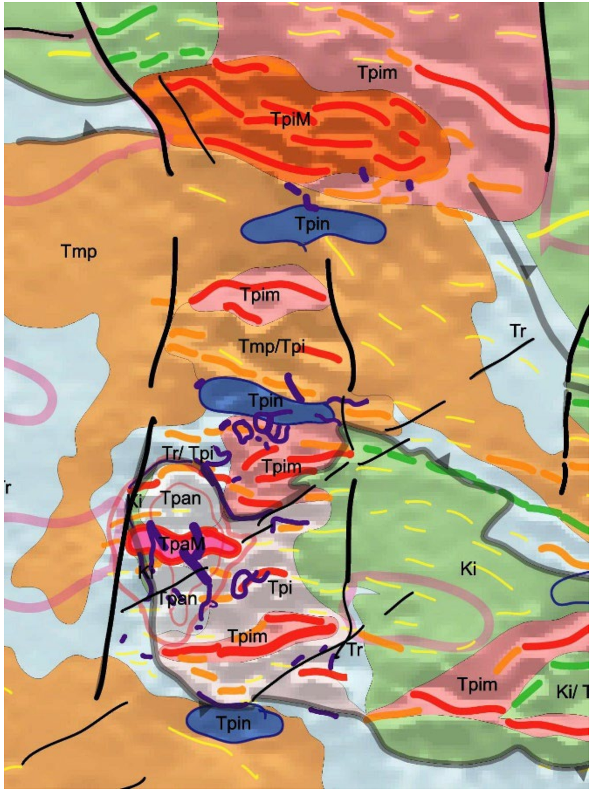
Solid Geology Interpretation- Ok Tedi mining district



Mag Observations



Geology Maps



Integrated Solid Geology

Solid Geology Interpretation- Ok Tedi mining district

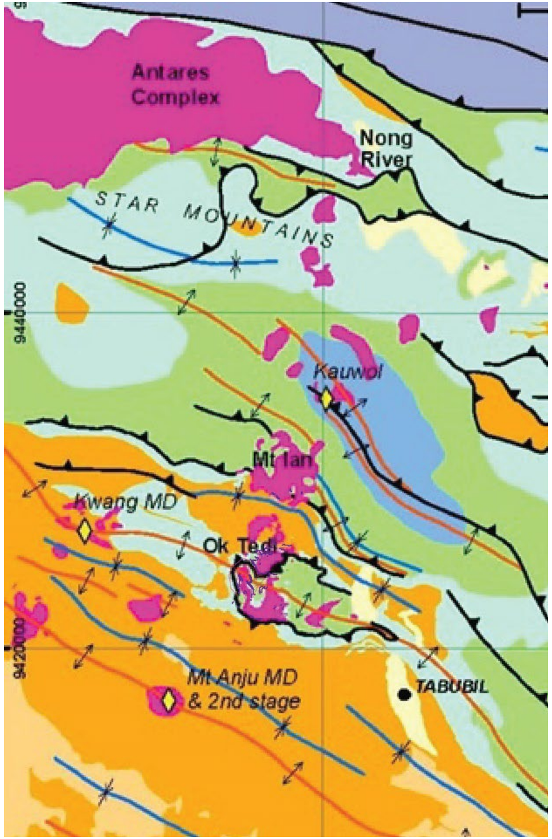
- The1500nT magnetic anomaly is interpreted as an ‘alteration overprint’
  - It is ‘anomalous’ in the regional context, so would attract early attention
  - It may mainly be due to the two strands of magnetite skarn that ‘underlie’ it
  - ..but appears to include contribution from the Sydney Monzodiorite- supported by the distinct EW extension of the mag zone

- The quiet magnetic zones north and south of this anomaly may directly relate to individual (non-magnetic) intrusive bodies, but could equally be due to magnetite-destructive alteration

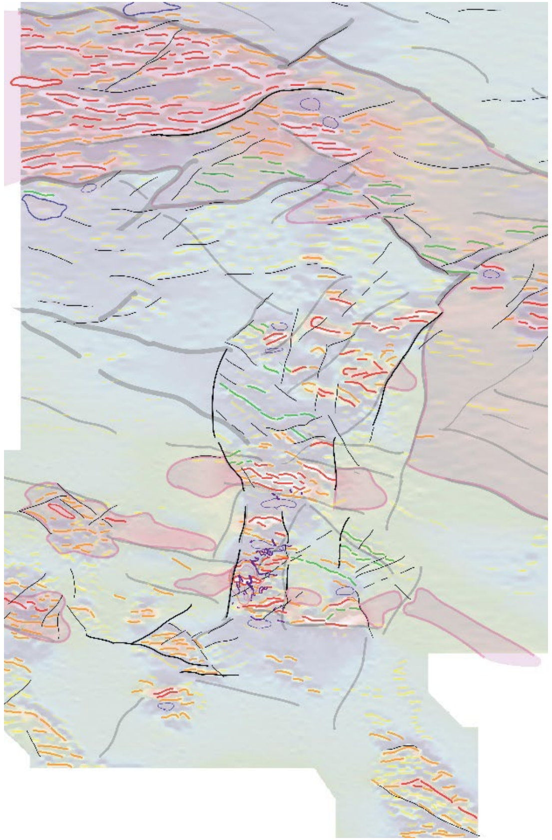
- The magnetite skarns are ‘detected’ but their loci are not ‘nailed’ by the existing mag coverage. There are signifciant unexplained magnetic anomales, but the uncertainties surrounding the BHP data, when viewed at this scale, prevent confident interpretation → there is a case for detailed drone mag.

Ok Tedi Integration Project

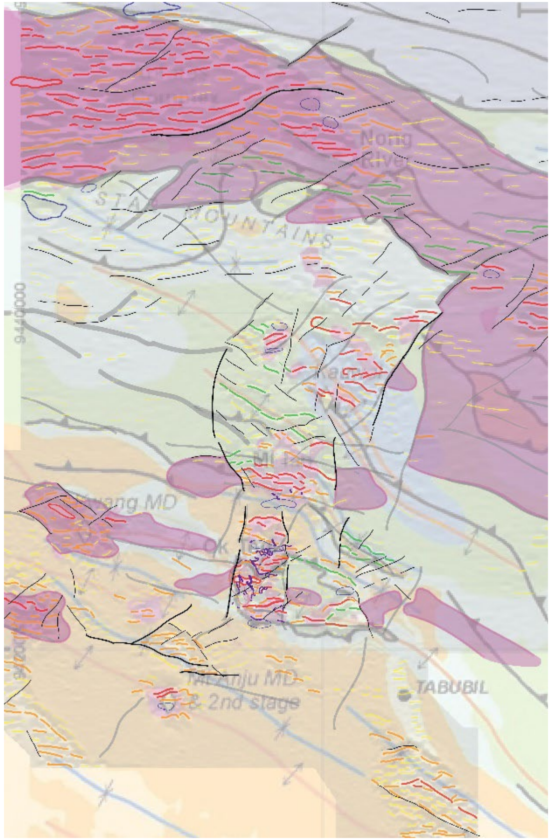
Solid Geology Interpretation- Structures



Existing solid geology



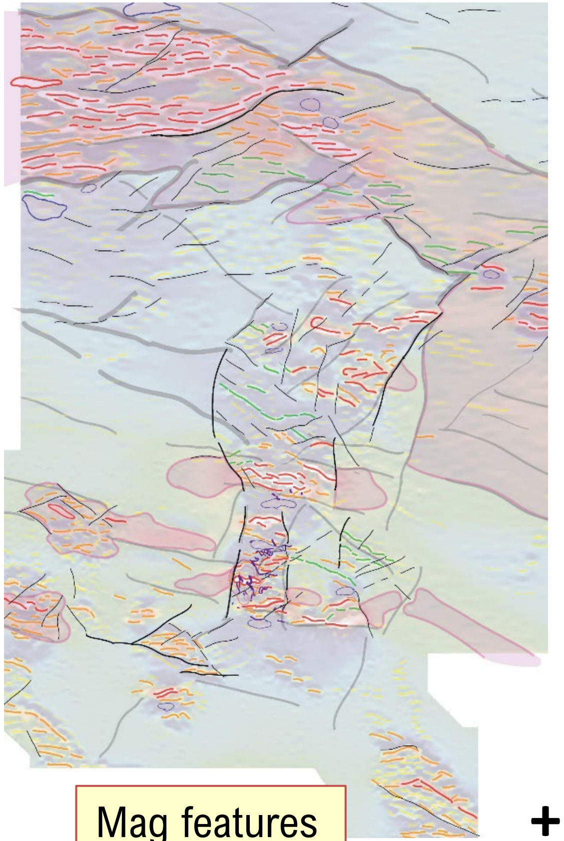
New structures from mag



New structures on existing geology

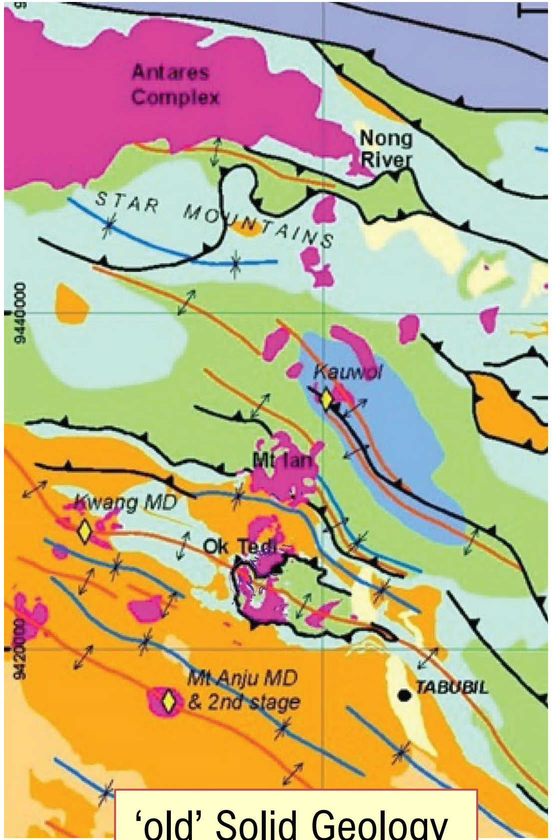
Ok Tedi Integration Project

Solid Geology Interpretation- Structures



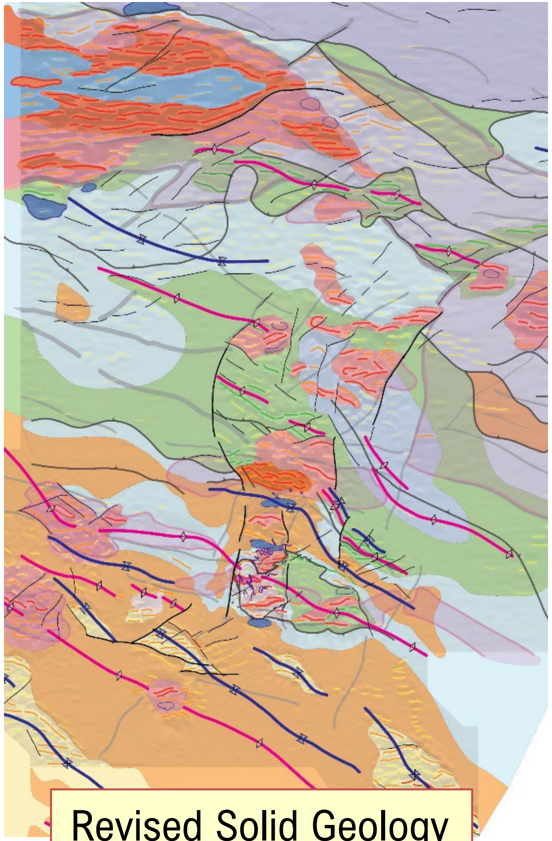
Mag features

+



'old' Solid Geology

→



Revised Solid Geology

Solid Geology Interpretation- Stuctures

- Folds and thrusts are taken directly from geology maps, except where the mag strongly suggests revision
- Smaller scale faults are based mainly on terminations/contacts of well-defined magnetic rock units– note that these can be identified at depth as well as near surface
- **The mag adds many useful, additional structures**
- Perhaps the most important being the arcute, NS – NE group of faults extending from the Ok Tedi mine area. These are evident at depth and near surface and may well be related to the inferred ‘arc-normal’ regional fault system inferred from very coarse gravity data.

Next Steps

- Revise Arnold et al cross-sections
- ?digitise and 'GIS' Arnold et al Map??
- Reprocess, image and integrate radiometric data into interpretation
- Formalise pre-field-check interpretation and recommendations for field investigation.
- Compile report
    - Data Processing and imagery
    - Integration Methodology
    - Key Observations
    - Working Solid Geology Interpretation
    - Recommendations