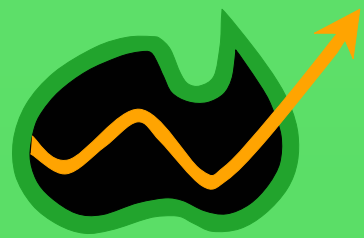# Chalcophile and Key Element Distribution in the Eastern Goldfields

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*predictive* *mineral* *discovery*

Chalcophile and key element distribution in the Eastern Goldfields

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- The geochemical approach to exploration for gold has been used successfully in the past in the Eastern Goldfields.

- Gold and arsenic have been identified as the best indicators of mineralisation.

- Most exploration has therefore been constrained both spatially (to company leases), and chemically (to gold and arsenic).

- It is therefore important to assess the geochemistry, chalcophile, and key element distribution in the bedrock on a regional scale through contouring and geochemical profiling.

- Although the geochemical data used here is not as dense (spatially) as company data, it has the advantage of being well distributed on a regional scale, as well as encompassing a suite of elements.

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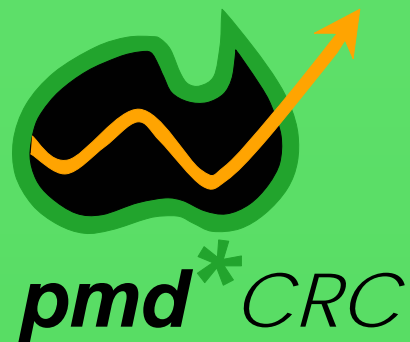
Petrosys regional geochemical grids and contour maps

- Petrosys, although usually applied to petroleum geology, was fairly successful at producing geochemical grids and contour maps.

- Data from Geoscience Australia's geochemical database (*Ozchem*) was used to produce geochemical grids and contour maps for the Eastern Goldfields.

- Grids were generated using the Distance Weighted Averages (DWA) interpolation method and unless stated otherwise, a 200m x 200m cell size was used.
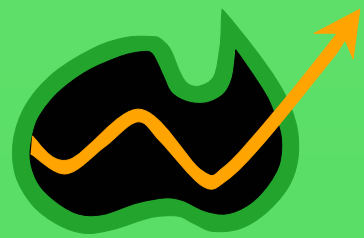
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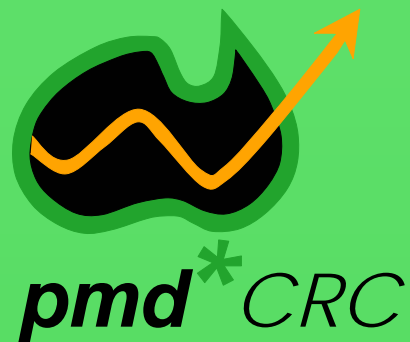
Petrosys regional geochemical grids and contour maps

- Minimum values were generally set at an estimated background level to eliminate background 'noise'. Input values were adjusted to produce the best grids. These values are stated next to the images.

- Major faults were included in the final stages of the gridding process. These faults were current in January 2003.

- A combination of the best grids and contours is presented here* together with a small reference geological map on each slide which can be enlarged as needed.

  *One way to compare the grids and contour maps of elements is to use the scroll wheel on the mouse (in powerpoint) to move up and down through the slides (grids are located in the same place on every slide)

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Geochemistry - Setting

- The area covered by the grids is the entire Eastern Goldfields region from 119°45' to 123°00E and 33°00 to 25°00S.
- The next slide shows the exact area on three images:
  - 1:2500000 <u>geology</u> (left)
  - <u>faults</u> used in the gridding process (centre)
  - <u>sample sites</u>, around 4000 in total (right). The seismic line EGF01 is represented by closely spaced samples (red line) in the southern half of the area.

  A key to the images is located on the far left.

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Key:

Greenstone

Granites

Felsic volcanics

Sediments / basins

Granulite metamorphics

Towns

Faults

Sample sites

Wiluna

Kalgoorlie

Coolgardie

Norseman

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200000mE 300000mE 400000mE 500000mE
200000mE 300000mE 400000mE 500000mE
200000mE 300000mE 400000mE 500000mE

7200000mN

7000000mN

6800000mN

6600000mN

6400000mN

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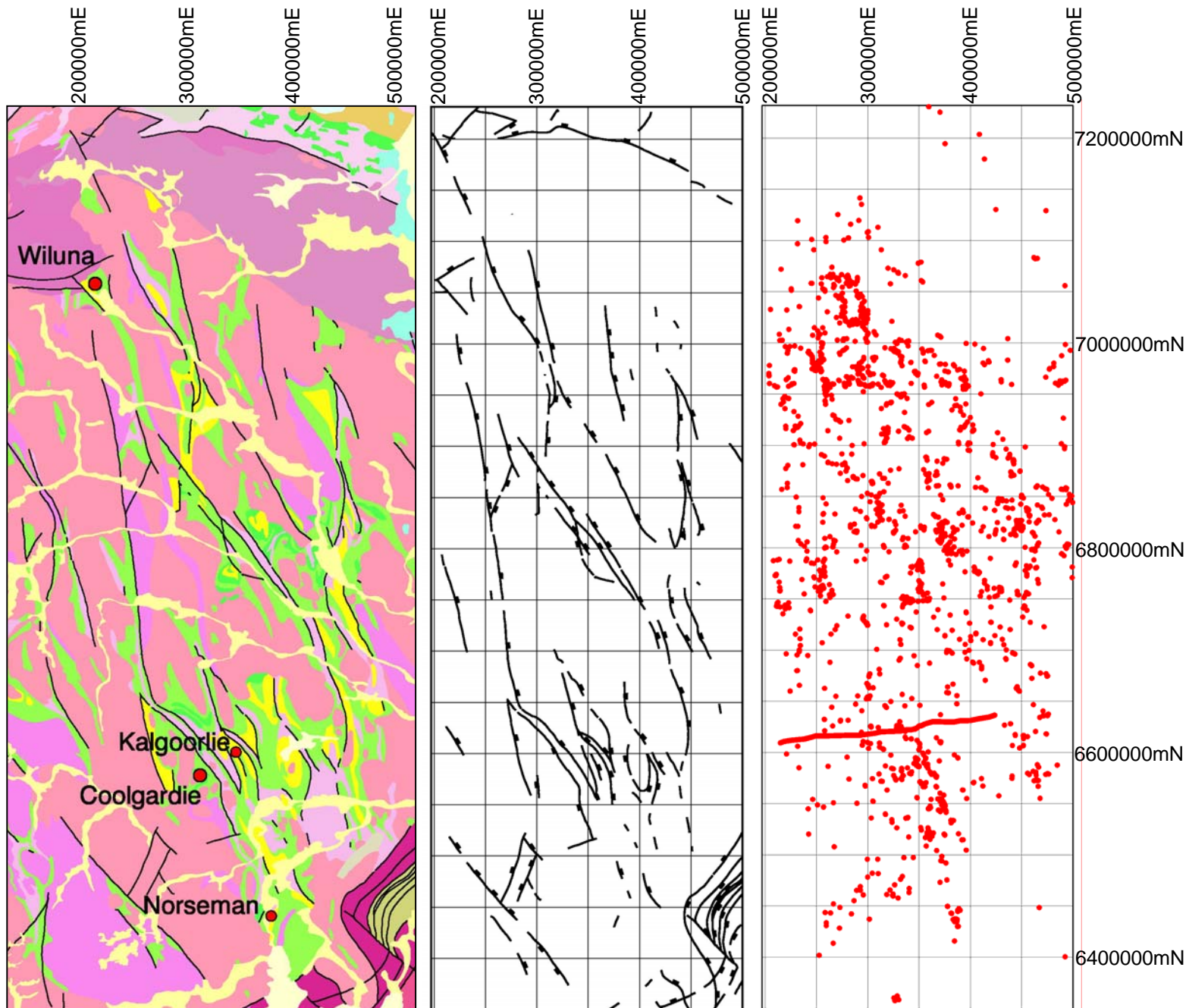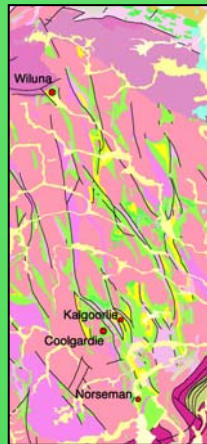
Gold

- Two grids for gold: 0 to 300 ppb (left) and 10 to 300 ppb (right)

- One area of high gold (6450000mN) where there doesn't appear to be an arsenic halo

- Small, discrete areas of anomalous gold

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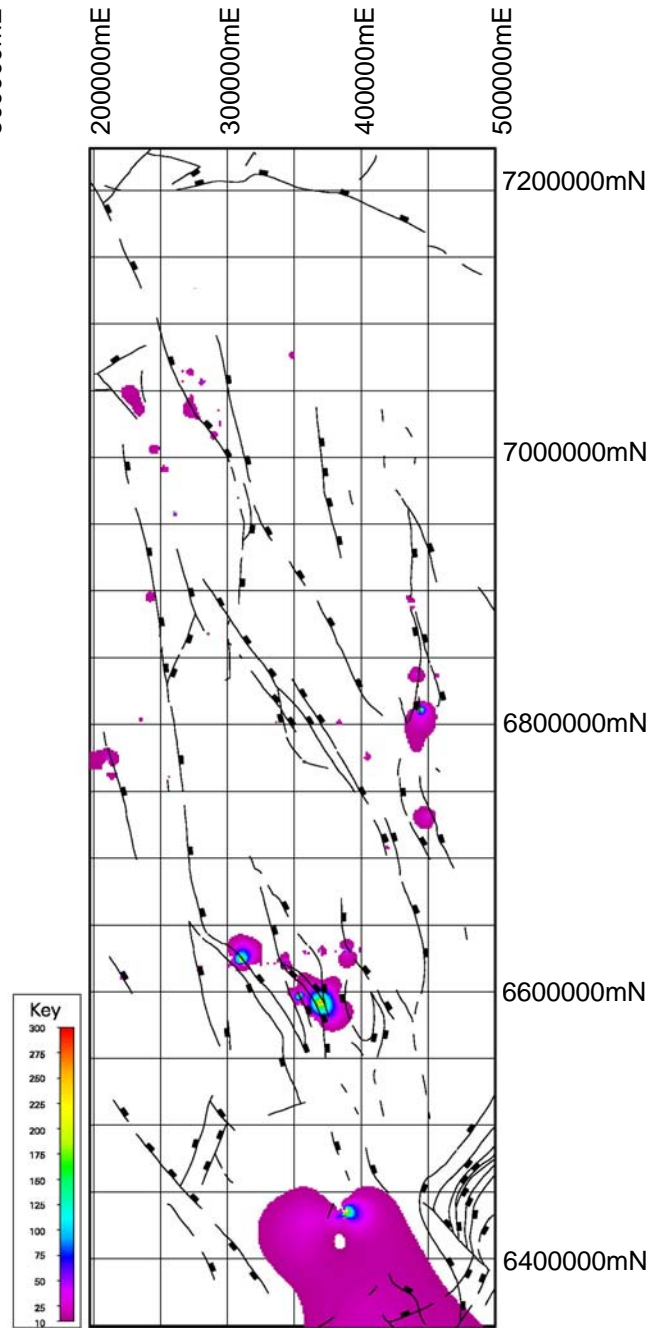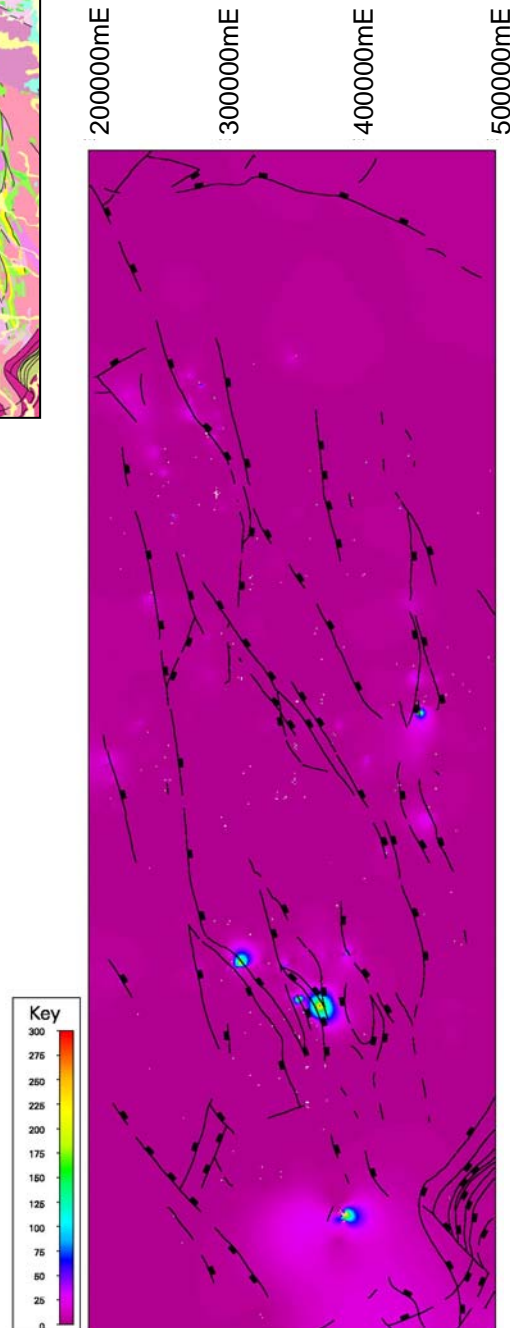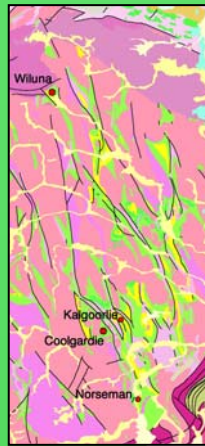
Arsenic

- Grid (left) and contours (right) of arsenic, from 0 to 700ppm

- Two prominent areas of high arsenic in the south, near Kalgoorlie

- The seismic line EGF01 is shown as a series of small contours just north of 6600000mN (right)
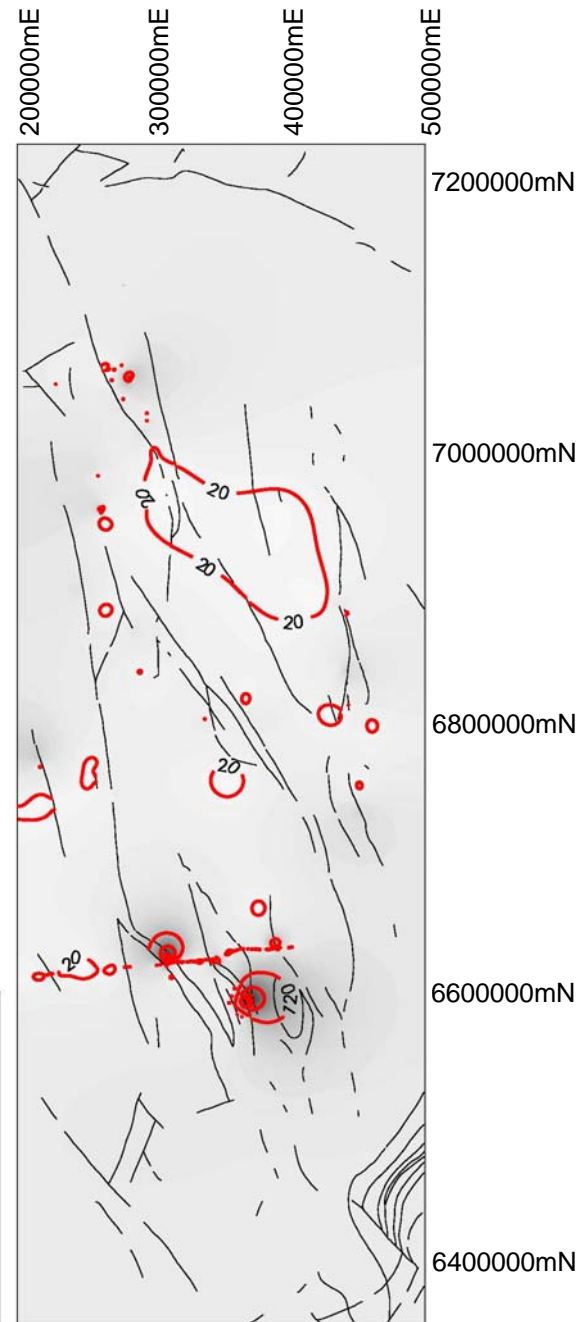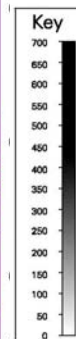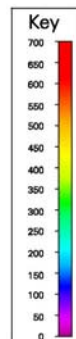
Au and As

- Compare the distribution of arsenic (left), with values 50 to 700ppm shown, and gold (right) with values 10 to 300ppb shown

- Regionally, areas of high arsenic and gold coincide

- These areas also tend to coincide with faults or fault junctions
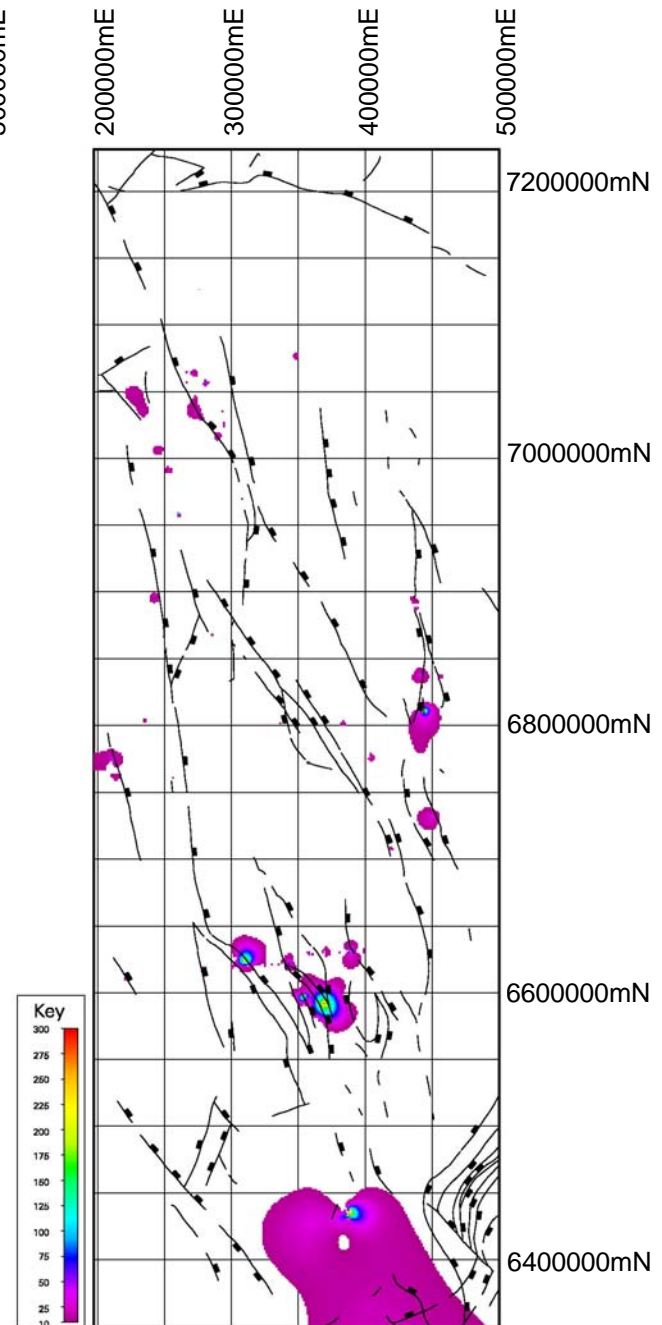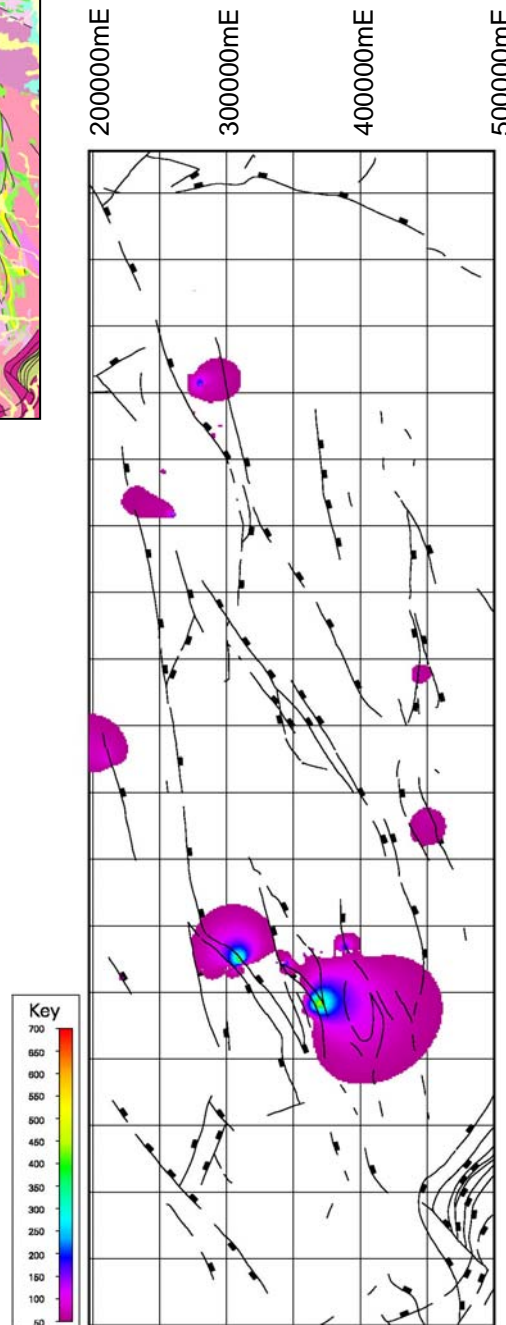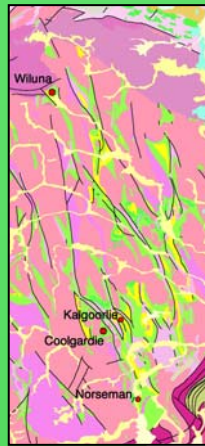
What does a comparison of Au and As distribution tell us?

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- As expected from studies on a local scale, in general areas of high gold and arsenic coincide on a regional scale
  - → so arsenic should be a good indicator of mineralisation from a regional perspective
- However, arsenic 'halos' are spatially almost as restricted as gold anomalies (from a regional perspective)
- Neither of these elements are particularly useful as vectors to gold mineralisation
- They are much more useful as local indicators of mineralisation
- The distribution of Au and As seems to be more closely related to faults and fault junctions than lithology

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Nickel

- Nickel grid (left) and contoured grid (right), values 50 to 4000ppm (cell size 300m)

- The distribution of nickel is controlled much more by lithology than structure

predictive Mineral
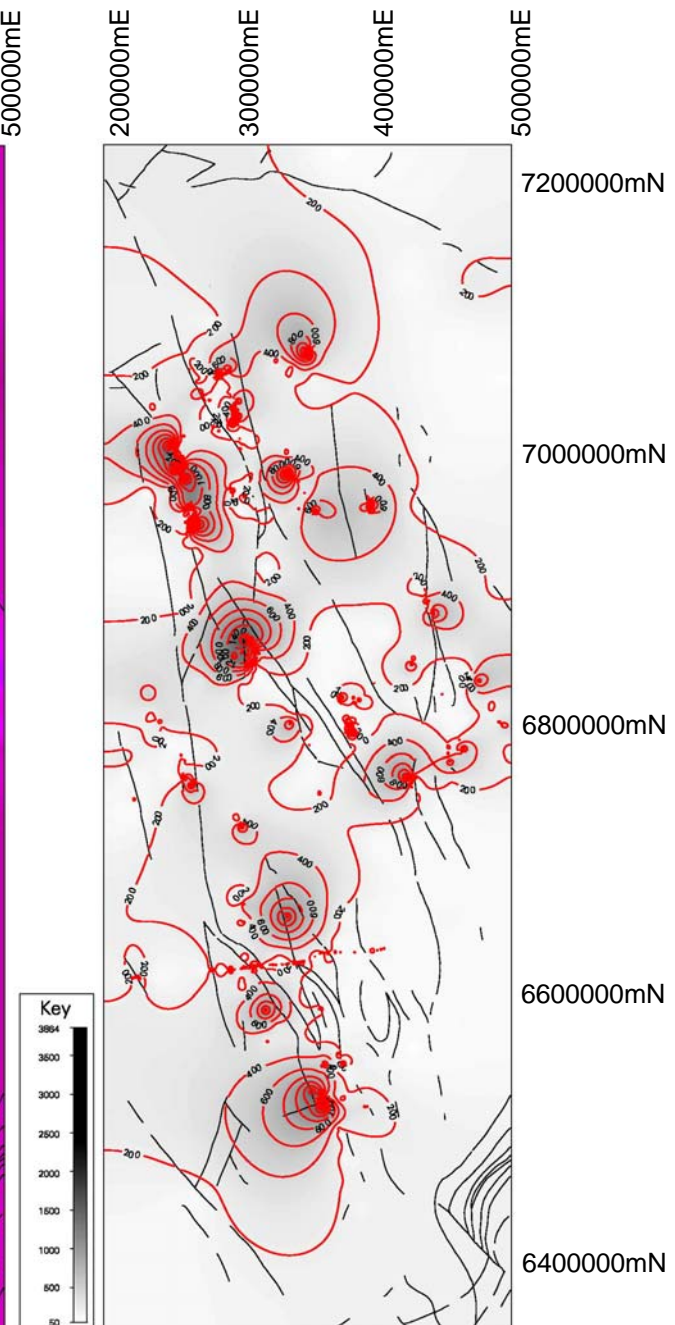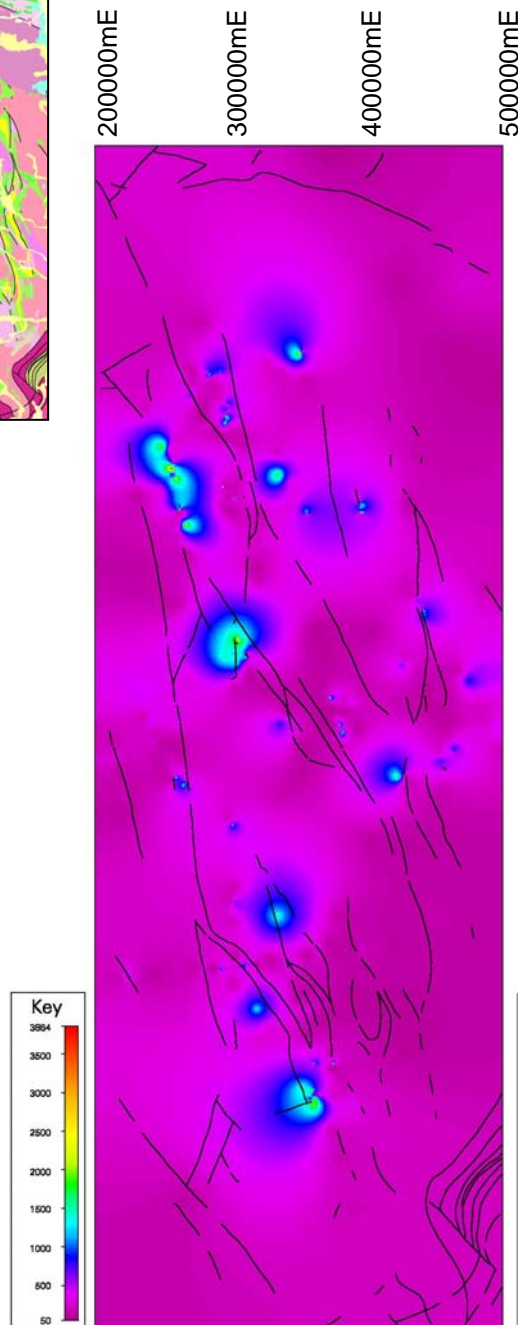
Chromium

- Chromium grid (left) and contoured grid (right), values 50 to 5000ppm (cell size 300m)

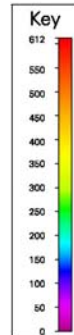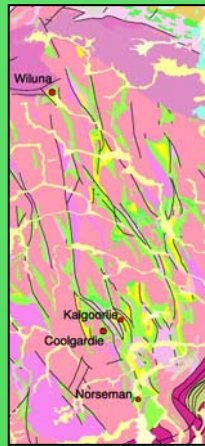- Like Ni, Cr distribution is mainly controlled by lithology
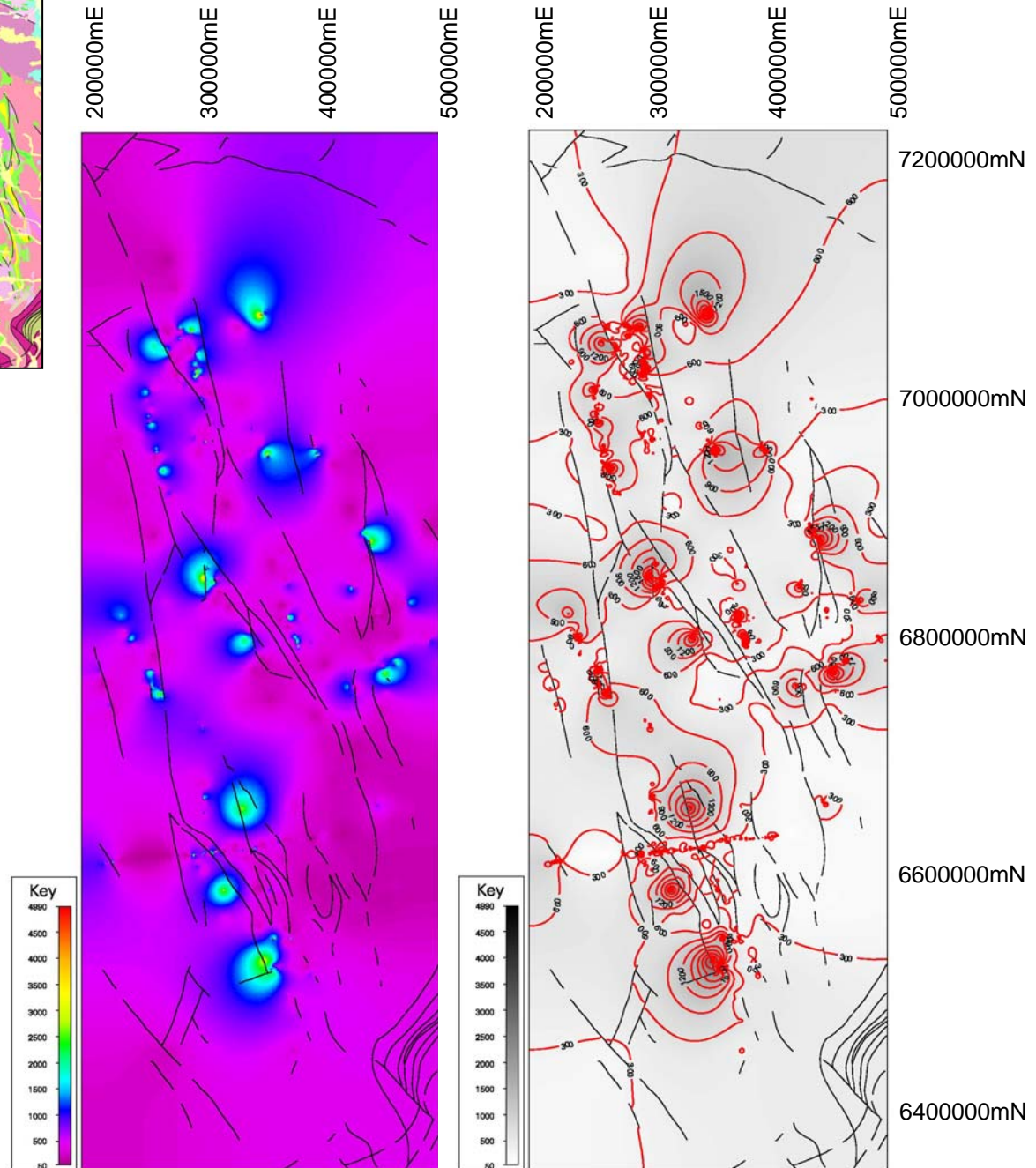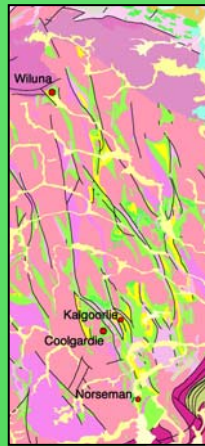
Copper

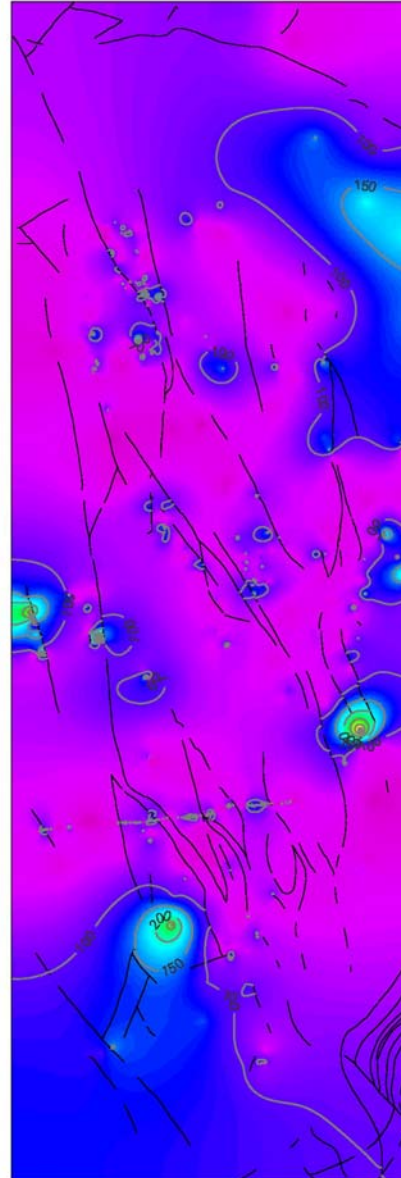- Copper grid with contours (left). Values 20 to 750ppm (cell size 300m)

Zinc

- Zinc grid and contours (right). Values 50 to 1500ppm (cell size 300m)

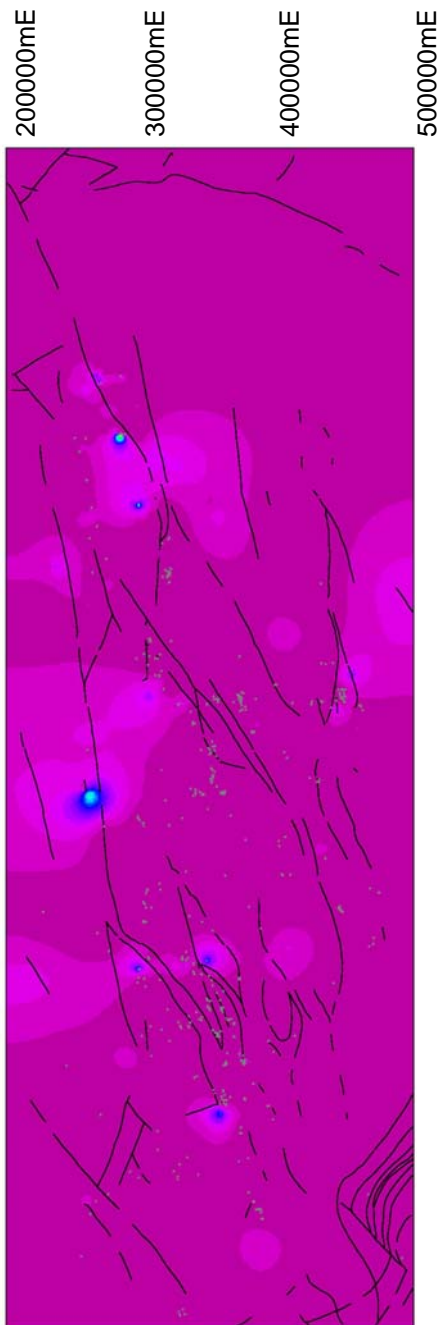- As with Ni and Cr, Zn and Cu distribution is related to rock type
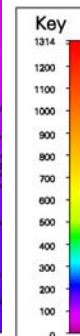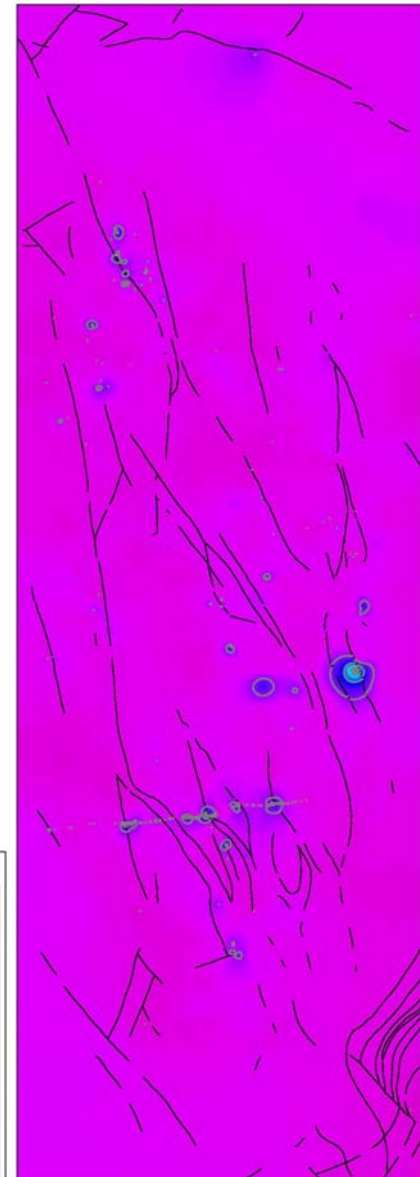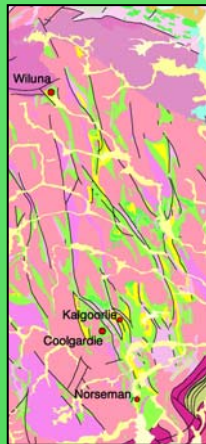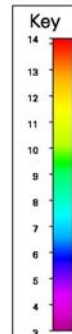
Bismuth

- Bismuth grid (left), values 0 to 48ppm

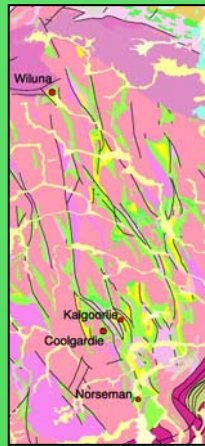# Antimony

- Antimony grid (right). Values 3 to 14ppm
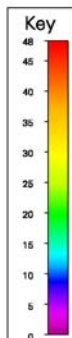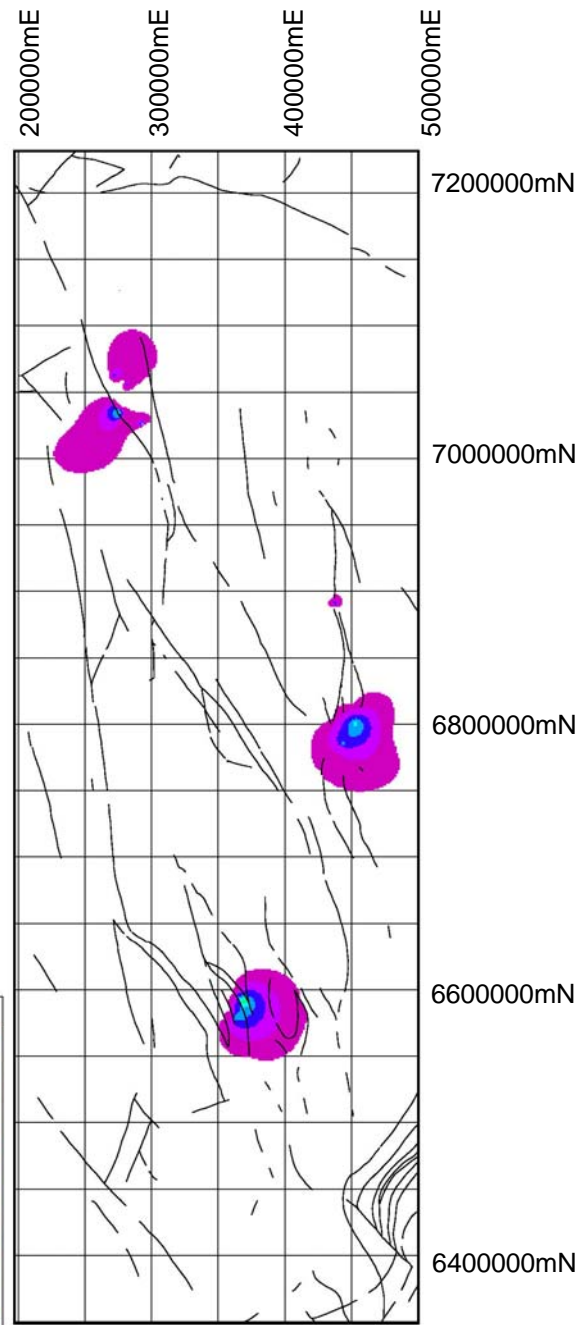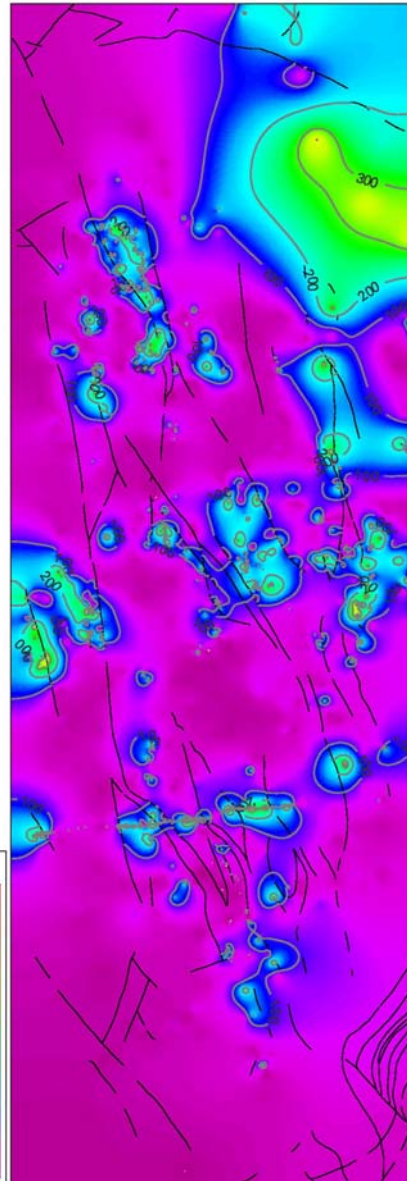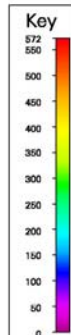
Vanadium

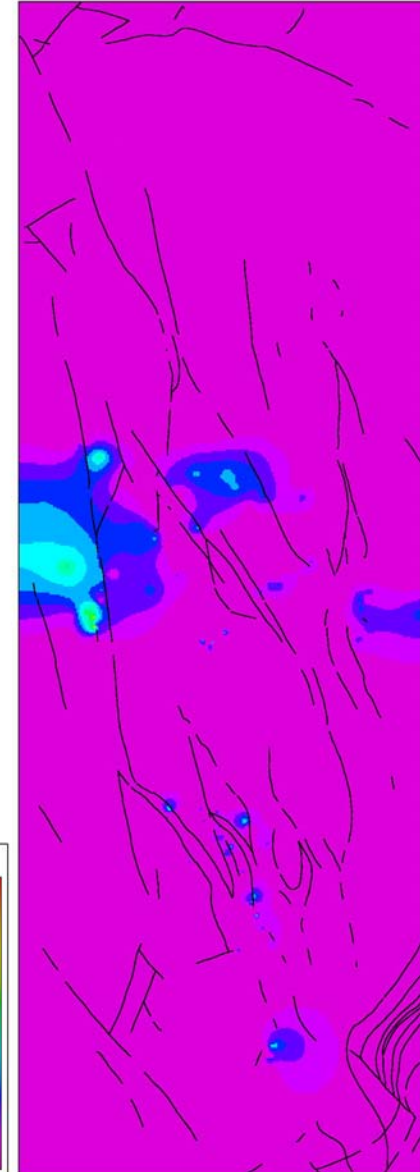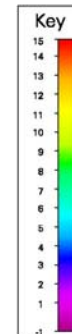- Vanadium grid with contours (left), values 0 to 572ppm (300m cell size)
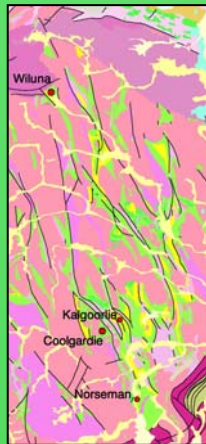
Tungsten

- Tungsten grid (right). Values 0 to 59ppm

Silver

- Silver grid (left), values 0 to 505ppm.

- The distribution of Ag is similar to that of Au, and so could be an indicator of mineralisation but not a vector to it

Sulphur

- Sulphur grid (right), values 0 to 30000ppm (300m cell size)