Interpretation and Modelling of Airborne Geophysical Data
Maranoa, Queensland

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The Maranoa Prospect was covered by an airborne magnetic and radiometric survey in 2007. The data show a considerable amount of near surface magnetic activity assumed to be due to tertiary basalt. The magnetic data also show a number of buried magnetic features including a distinctive magnetic intrusion in the north of the survey area that is surrounded by radiating magnetic structures, probably dykes. In the southeast of the survey area the Darkwater magnetic complex is seen in the magnetic data to be considerably larger than the magnetic rocks that are mapped at surface. In the subtle magnetic features at depth, are some circular features that may be due to large non-magnetic intrusive bodies. Radiometric data that was measured with the airborne magnetic survey closely reflect the mapped geological stratigraphy.

Figure 1 shows the magnetic data reduced to pole so that magnetic highs and lows lie directly over their sources. Many broad magnetic highs are apparent in these data but the majority of these lie at depths in excess of 2 kilometres and are thus of little exploration interest. Also visible in these data are the sharp highs and lows that represent the surficial, remenantly magnetised near surface magnetic bodies that are assumed to be tertiary basalt.

In order to examine the near surface magnetic sources in more detail, the magnetic data were processed with a high pass filter to enhance the magnetic effects of sources within one kilometre of the surface. The filtered magnetic data are shown in Figure 2. The distinctly different magnetic character of the surficial magnetic sources is very clear and these have been mapped and highlighted in Figure 3. Many of the near surface magnetic sources are negatively magnetised and appear as strong negative magnetic anomalies. This is common for tertiary basalt bodies in Eastern Australia. Areas of more intense and often circular negative magnetic anomalism are assumed to possibly be due to tertiary basalt pipes as detailed in Figure 3.

A comparison with the topography, measured with the geophysical data with the interpreted surficial magnetic sources, is shown in Figure 4. This shows that the surficial magnetic sources are largely associated with topographic highs. This is consistent with these being due to basalt capping on hilltops due to resistant material being subject to less weathering than surrounding areas.

Within the top kilometre of so, are other magnetic features that are not from the surface basaltic material. An interpretation of possible sources of these magnetic features is shown in Figure 5. In the north of the survey area at approximately 557,000E / 7,247,000N (MGA Zone 55 GDA94) is a very distinct circular magnetic high that is probably due to a magnetic intrusive plug or possibly the central pipe of an intermediate or mafic volcano. Radiating linear magnetic highs surround the central high. These are probably radial dykes associated with the central body. A 3D model of this area has been generated and a perspective view of this is shown in Figure 6. A cross section though this model is shown in Figure 7. This suggests that the top of the source of the magnetics is approximately 400 metres below the surface.

In the southeast of the survey area is a large, complex magnetic zone called the Darkwater complex (See Figure 5). This zone is approximately 9 kilometres across. Outcropping mafic rocks occur in the centre of this zone at approximately 572,000E / 7,195,500N but these are only about 1km in extent and the magnetic data suggest that this material is much more extensive at relatively shallow depths. Rocks mapped at this outcropping area include gabbros and serpentinites that are assumed to be of Early Paleozoic age.

A 3D magnetic model of this zone has been generated to determine the likely depth of magnetic material within this complex. Figure 8 is a cross section through the 3D model on line 7,195,500N. The area of outcropping intrusion appears in the centre of the complex in a relatively non-magnetic zone. The form of the magnetic anomaly complex (Fig.2) is quite circular and is suggestive of a dome or an intrusive complex. The steep dips indicated in the magnetic modelling (Fig.8) indicate the latter. The Darkwater complex is likely to be some sort of intrusive complex with either more magnetic chilled margins or a magnetic aureole.

Because the area of outcrop in this area is much smaller than the size of the complex indicated in the magnetic data, virtually none of the magnetic rocks within this complex are outcropping. The magnetic model suggests that the magnetic parts of this complex are quite close to the surface. The depths to magnetic material indicated on the cross section through the model (Fig.8) are of the order of 100 metres. Figure 9 shows a plan-view slice through the magnetic model at RL 500, which is about 50 metres below the surface. Many of the magnetic units are apparent at this depth and would be easily tested by drilling.

Figure 9 also shows some possible drill targets for testing the magnetic parts of the Darkwater complex. Two areas on the circumference of the zone are shown at 569,800E / 7,192,900N and 572,700E / 7,196,700N. These are the areas where the model indicates magnetic effects are strongest near the surface. Also highlighted is a possible target at 568,200E / 7,194,200N which has been selected as a distinct magnetic low (Fig.1) that may represent magnetite destructive alteration within the complex.

Since the bulk of the Darkwater Complex rocks are relatively close to the surface, they would easily be tested by Induced Polarisation surveying. Surveying with IP is advised if other geological or geochemical indicators suggest that this is an area for further investigation.

In the centre of the survey area is a large sill like body of basalt on the surface, which is centred at approximately 545,000E / 7,222,000N. The more subtle magnetic features from depth suggest that there may be a very large circular body that is non-magnetic and is about 16km across. This is a very subtle feature in the magnetic data and may simply be an artefact of the folding in the basement rocks. However, rule of thumb interpretation of the depth of the subtle surrounding magnetic aureole suggests that the depth of this feature is only about 500 metres. Such a large body at a relatively shallow depth may be of exploration significance, though there are no particular areas within this, which look specifically of interest.

Immediately west of this, centred at approximately 540,000E / 7,209.000N are buried magnetic bodies that have similar magnetic character to the Darkwater complex. Since all of this area is buried under Jurassic sediments that are likely to be several hundred metres thick, and there is no obvious specific target within the buried zones, there is little indication why these should be tested by drilling. These basement features may, however be of interest in terms of the regional geological setting.

There are several other subtle magnetic features visible at depth, which are assumed to be folded weakly magnetic strata or volcanic rocks. These features are defined in Figure 5.

The radiometric data for the area are shown as a composite RGB image in Figure 10. These data simply reflect the surface geology, which is available in published government maps. In order to gain more information from the radiometric data, these were processed through a classification algorithm. The classification found only 4 significant groups within the radiometric data. These correspond closely to the mapped geology, so no additional information has come out of the radiometric data.

It seems likely that aside from any potential within the surficial basalt bodies, the most prospective geological unit within the geophysical data is the Darkwater complex. The complex is relatively shallowly covered and drill testing of some of the magnetic aureoles or the distinct magnetic low within this complex may be warranted.

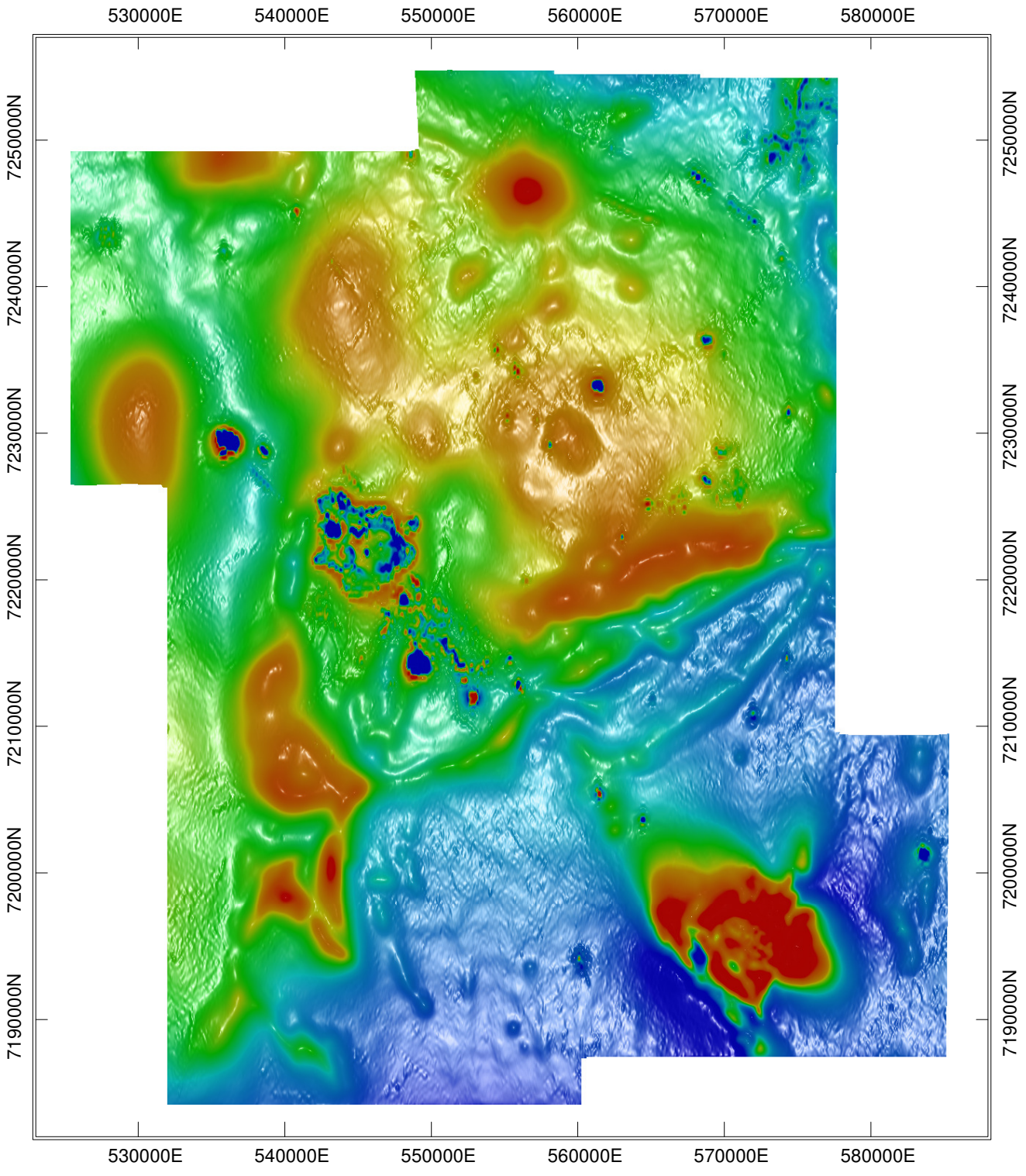
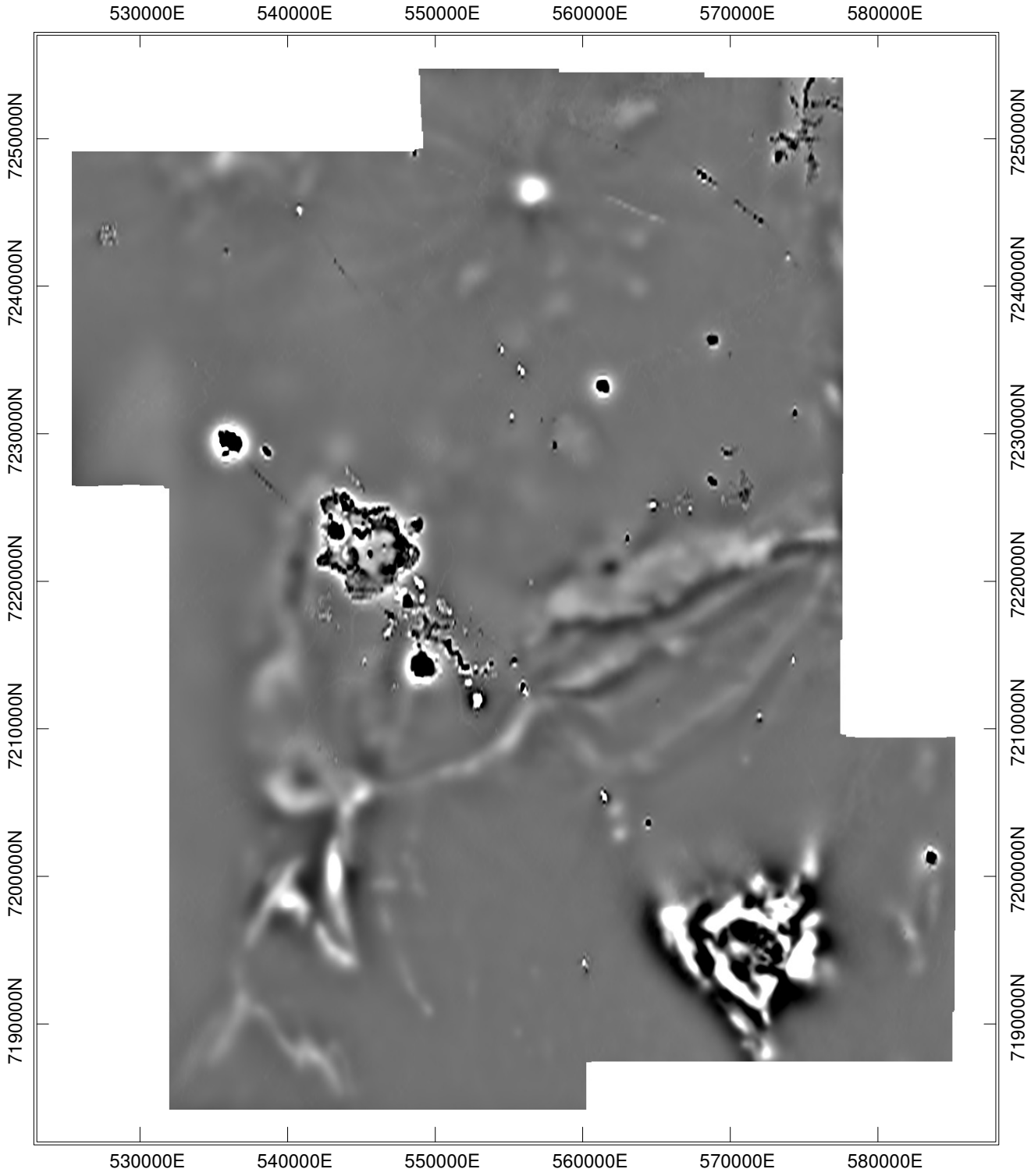


Figure 1 Maranoa Project Reduced to Pole Magnetics



Scale 1:400,000

Coordinates are
MGA Zone 55 GDA94

Greyscale range
Black <= -100nT
White >= 120 nT
Around local mean

Figure 2 Maranoa Project Reduced to Pole Magnetics
High Pass Filtered with 1km Halfwidth Gaussian Filter

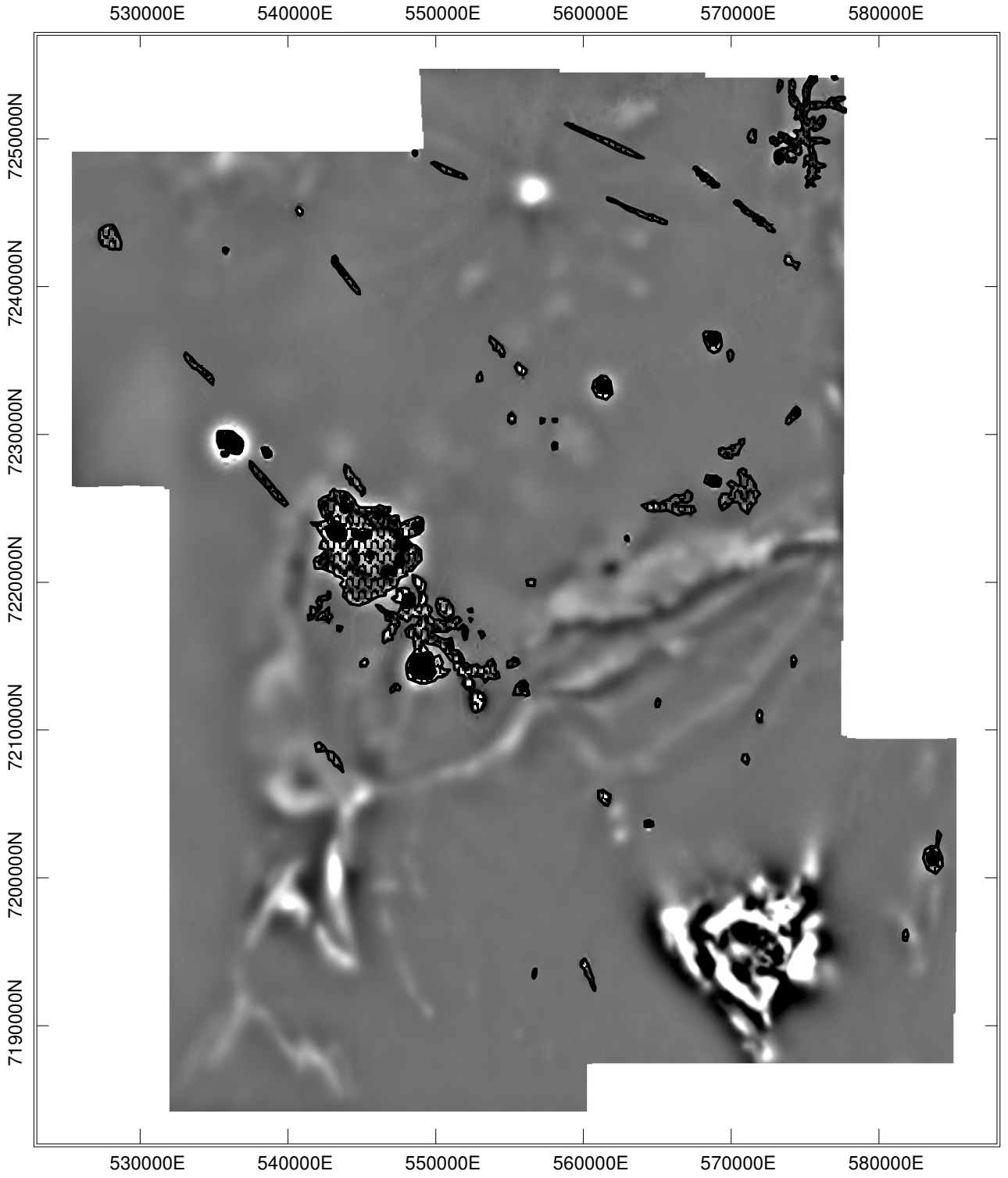


Figure 3 Maranoa Project Highpass Filtered RTP Magnetics
With Near Surface Magnetic Features Highlighted

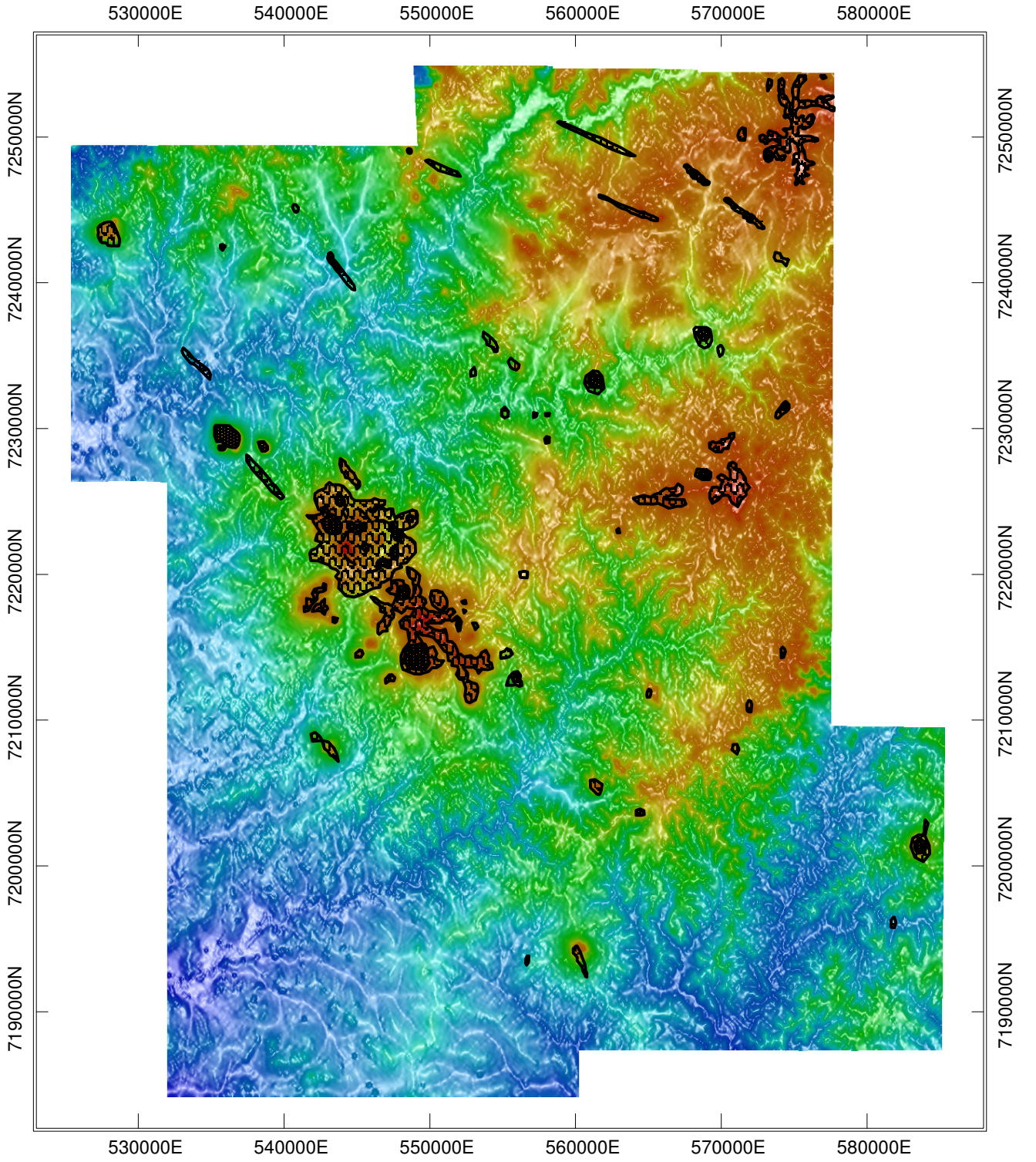


Figure 4 Maranoa Project Topography
With Near Surface Magnetic Features

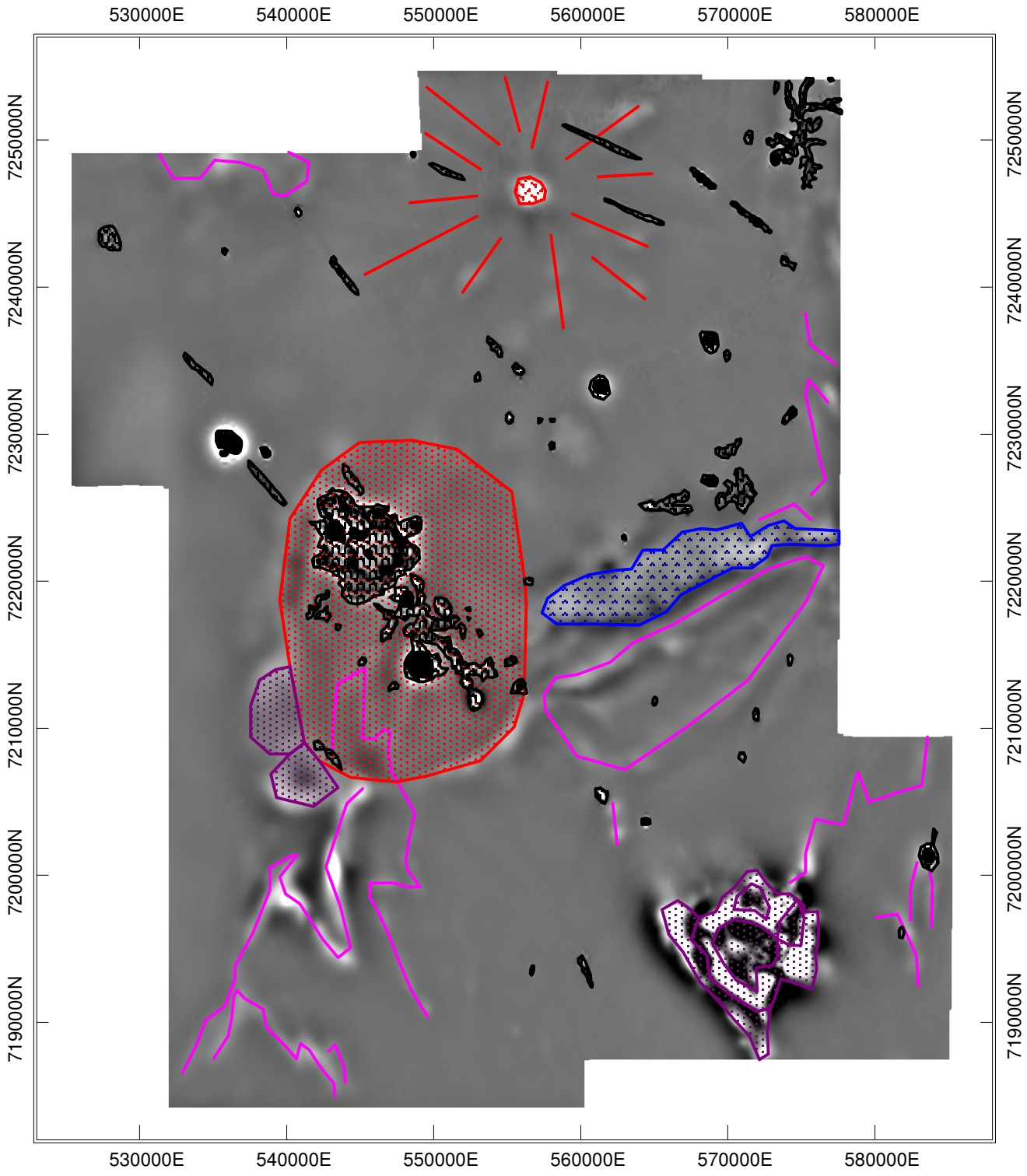


Figure 5 Maranoa Project Highpass Filtered RTP Magnetics With Near Surface and Buried Magnetic Features

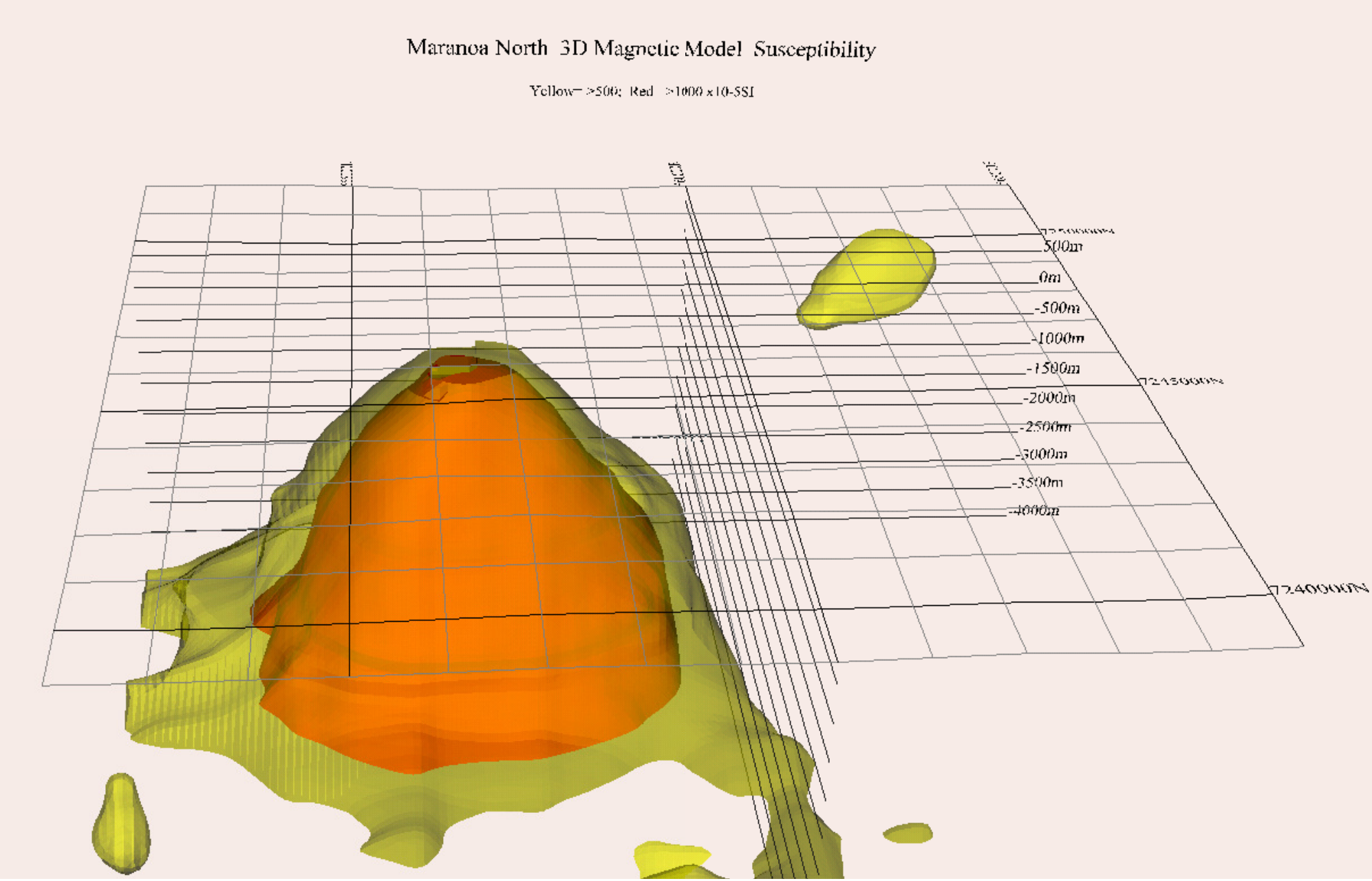
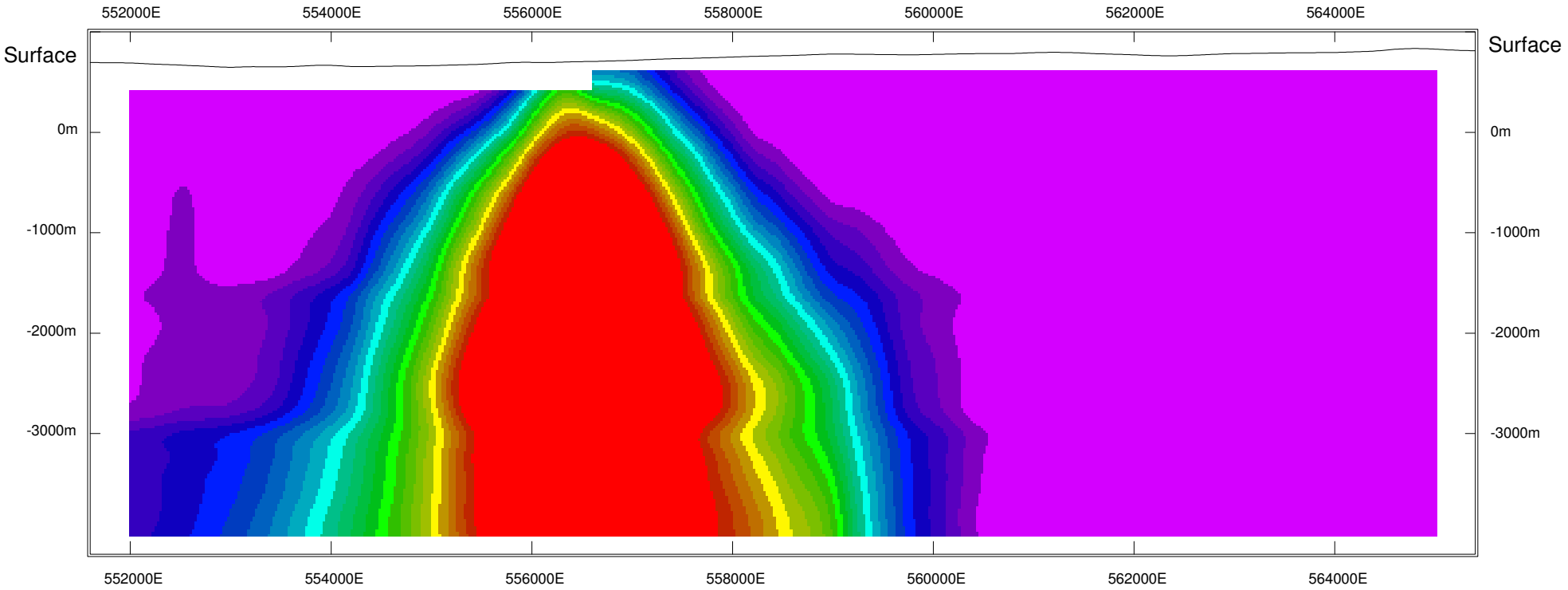


Figure 6 Maranoa Perspective of 3D Magnetic Model of Northern Mag High



Scale 1:60,000

Coordinates are
MGA Zone 55 GDA94

0 2,500 x10-5SI

Figure 7 Maranoa Project Northern Anomaly 3D Model
Cross section on line 7,246,500N

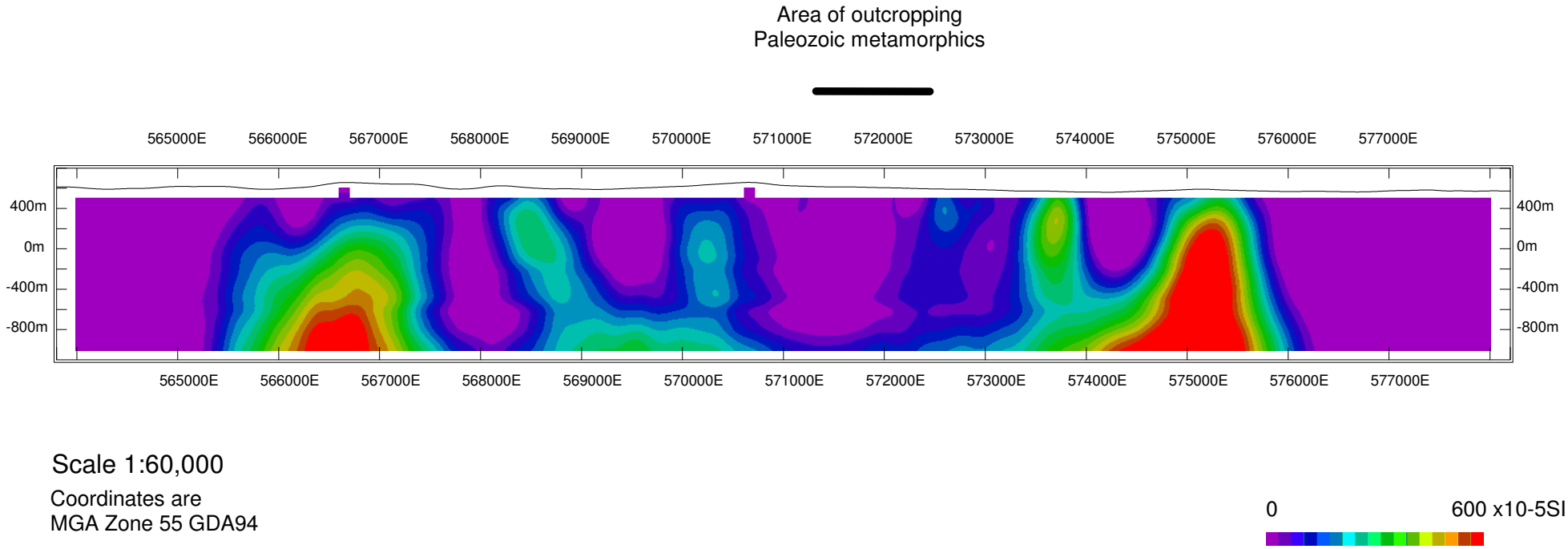


Figure 8 Darkwater Complex - 3D Magnetic Model - West to east Cross section on 7,195,500N

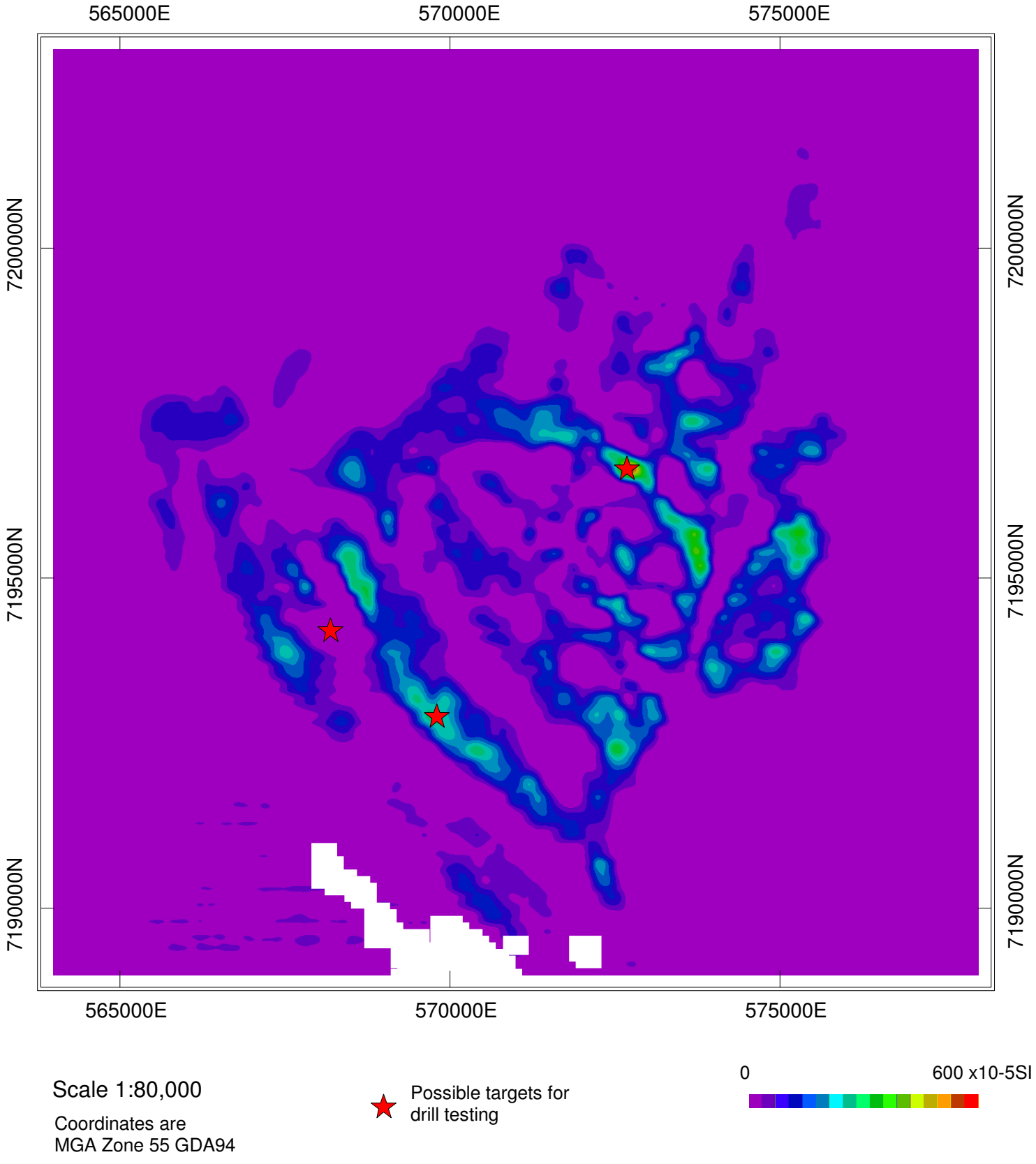
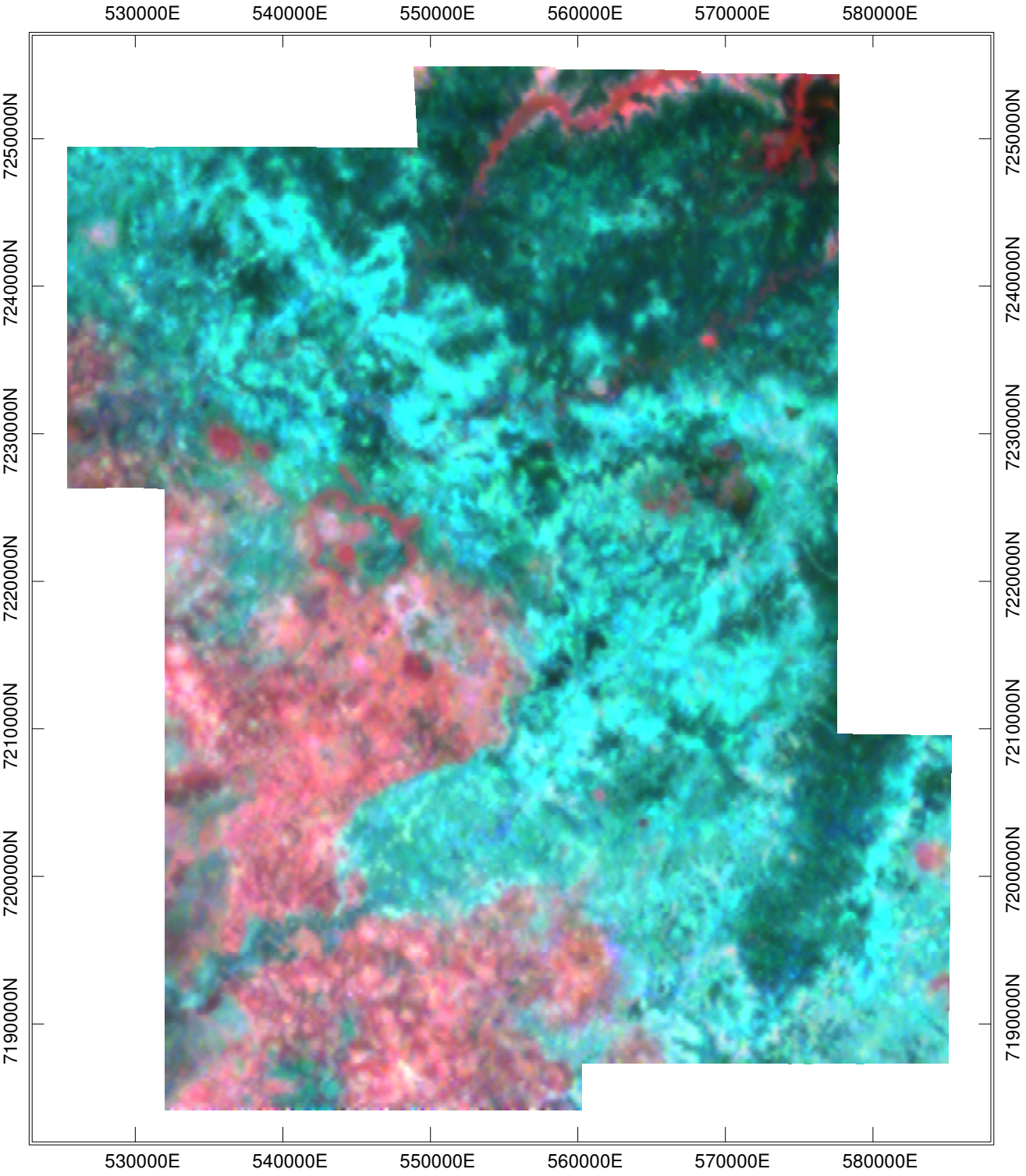


Figure 9 Darkwater Complex - 3D Magnetic Model
Plan view at RL 500m (approx. 50m below surface)

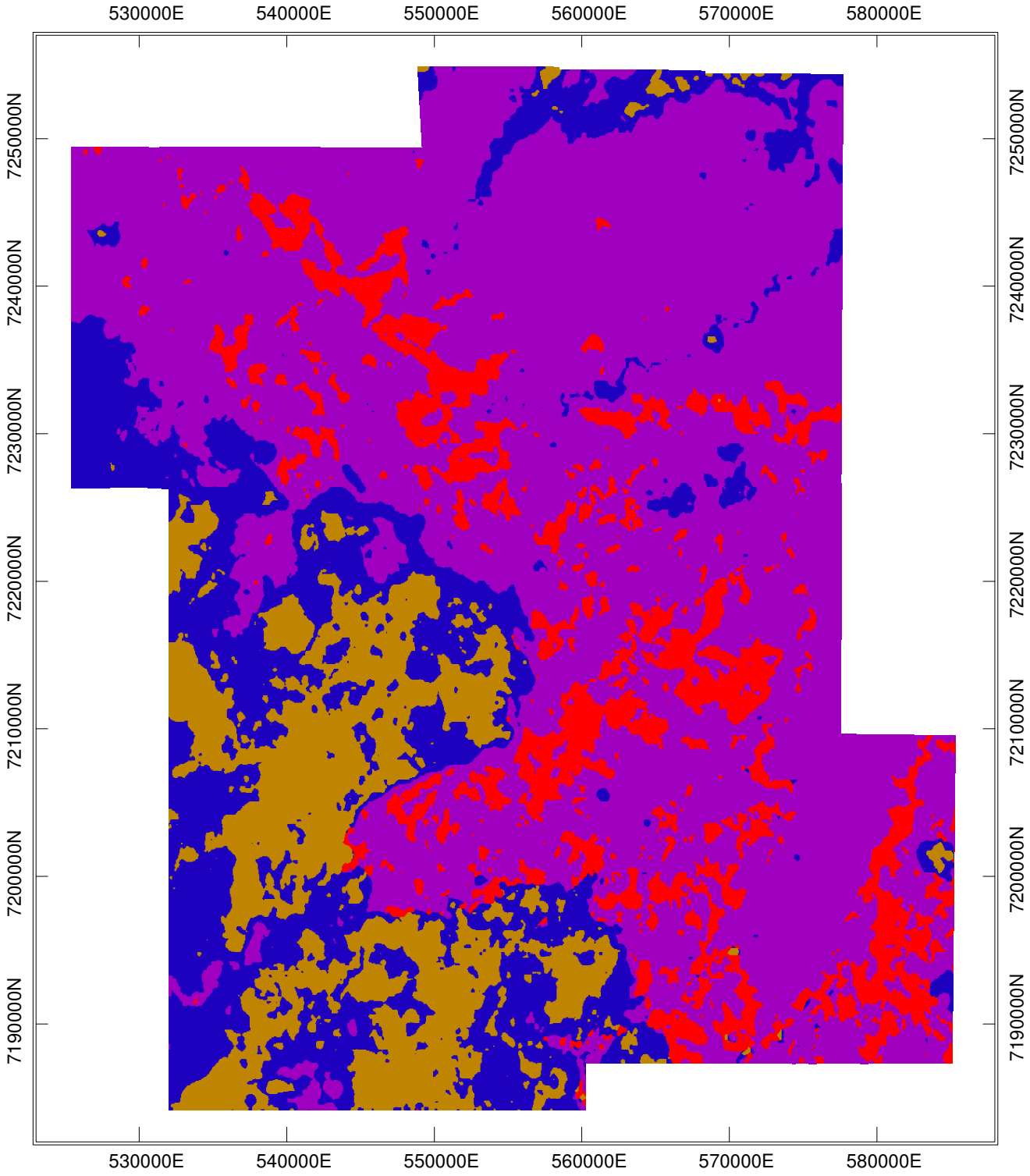


Scale 1:400,000

Coordinates are
MGA Zone 55 GDA94

Red = Potassium [0 to 150 cps]
Green = Thorium [0 to 70 cps]
Blue = Uranium [0 to 25 cps]

Figure 10 Maranoa Project Composite RGB radiometric data



Scale 1:400,000

Coordinates are
MGA Zone 55 GDA94

Colours are arbitrarily assigned to classes.
Based loosly on total radiometric count.

Figure 11 Maranoa Project Classified radiometric data