



COALTECH 2020

**FINAL REPORT
CONFIDENTIAL**

**Task 1.3.6
Multi-client Aeromagnetic Data Merge &
Interpretation – Witbank Coalfield**

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EXECUTIVE SUMMARY

Coaltech 2020 – Geological and Geophysical Steering Committee Task 1.3.6 has been completed. The aims of Task 1.3.6 were to:

- Determine the aeromagnetic data coverage over the Witbank area.
- Identify gaps in the aeromagnetic coverage that may require “filling-in surveys”.
- Source the available magnetic datasets from the government (Council for Geoscience) as well as the Coaltech 2020 participants.
- Merge these datasets in order to provide maps as well as Geographical Information System (GIS)-compatible products for the Coaltech 2020 participants.
- Complete a lineament (dyke) interpretation for the area and provide the data in a GIS-compatible format.

The envisaged benefit of the project was that all the Coaltech 2020 participants would be able to trace magnetically susceptible dykes through their properties, using this aeromagnetic and dyke interpretation dataset, which covers most coal mining operations and exploration areas. The regional 1 km line-spacing government aeromagnetic data were used as a “backdrop” to all maps. Late in 2004, it was learnt that the Council for Geoscience was in the process of completing a 200 m line-spacing aeromagnetic survey of the Witbank area. These data were acquired through this project at a very reasonable price, at a fraction of the actual survey cost. This eliminated the need for any additional airborne surveys to cover gaps between the industry aeromagnetic datasets. In addition to the aeromagnetic data, a Digital Elevation Model (DEM) was also provided. This DEM was derived from the Global Positioning System (GPS) height and altimeter data and not accurate and should not be used for navigation / planning purposes. Aeromagnetic imagery was sourced from Anglo Coal, BHP Billiton, Ingwe, Sasol and Total Coal RSA.

A₀ size maps have been prepared and delivered to the parties involved. These maps include:

- Combined total field magnetic images with the government magnetic image as a backdrop (colour);
- Combined greyscale shaded first vertical derivative images with the government magnetic image as a backdrop (greyscale);
- Map of the Digital Elevation Model (DEM); and
- Dyke lineament interpretation map.

GIS-compatible data have been prepared on CD. These include:

- Geotiff images of the combined products and each individual survey of:

- Total field magnetic colour images;
 - First vertical derivative greyscale images; and
 - DEM.
- DXF line work of the interpreted dykes.

This project has been highly successful in providing useful and cost-effective geological and geophysical datasets. This project is also an excellent example of what benefits can be achieved through government and industry collaboration on projects such as Coaltech 2020.

The main benefit of this project is that the Coaltech 2020 participants will be able to trace magnetically susceptible dykes on their properties, using the aeromagnetic and dyke interpretation dataset that covers most coal mining operations and exploration areas. Mining companies could potentially also identify previously unknown dykes.

Pre-knowledge of a dyke in the underground workings is valued at approximately R15 million by Total Coal South Africa. This is the costs associated with encountering an unknown dyke – i.e. costs for standing time, mining through the dyke, re-planning and redesign of the mining panels etc. This project highlighted the traces of approximately 1200 dykes, which equates to an approximately R18 000 million benefit to the South African Coaltech 2020 participants when using the above approximation.

For opencast mines the estimated mining cost associated with negotiating an unforeseen dyke will be less than in the case of underground operations. However, even for opencast mines encountering an unexpected dyke probably costs millions of rand due to loss of reserves resulting from burning or potential increases in the depth of weathering that devalues the coal quality. Also, where opencast operations currently exist, deeper, thinner coal seams may be extracted in future. The information produced by this project may provide pre-knowledge of such dykes, which at deeper levels may have an even higher value than Total Coal's R15 million estimate.

CIRCULATION LIST

Copies of this Coaltech 2020 report will be circulated to:

- 1 Copy - Mr. Chris Goodale, Chairman, Coaltech 2020 Geological & Geophysical Steering Committee
- 1 Copy - Mr. Johan Beukes, Coaltech 2020 Programme Manager
- 1 Copy - Anglo Coal
- 1 Copy - BHP Billiton
- 1 Copy - ESKOM
- 1 Copy - Eyesizwe
- 1 Copy - Ingwe
- 1 Copy - Kumba
- 1 Copy - Sasol
- 1 Copy - Total Coal RSA
- 1 Copy - Anglo Technical Division - Geosciences Resource Group (Records)

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1 INTRODUCTION

A Coaltech 2020 project (Task 1.3.6) to source and put together the available aeromagnetic coverage for the Witbank area commenced in April 2004.

The aims of Task 1.3.6 were to:

- Determine the aeromagnetic coverage over the Witbank area.
- Identify gaps in the aeromagnetic coverage that may require “filling-in surveys”.
- Source the available magnetic datasets from the government (Council for Geoscience) as well as the Coaltech 2020 participants.
- Merge these datasets in order to provide maps as well as Geographical Information System (GIS)-compatible products to the Coaltech 2020 participants.
- Complete a lineament (dyke) interpretation from the provided data sets.
- Provide the data (line and images) in a GIS-compatible format.

The envisaged benefit of the project was that the Coaltech 2020 participants would be able to trace magnetically susceptible dykes through their properties, using this aeromagnetic and dyke interpretation dataset. The work for this project was carried out by S.J. du Plessis, divisional geophysicist for the Anglo American Technical Division. A locality plan for the study area is presented in Figure 1.1.

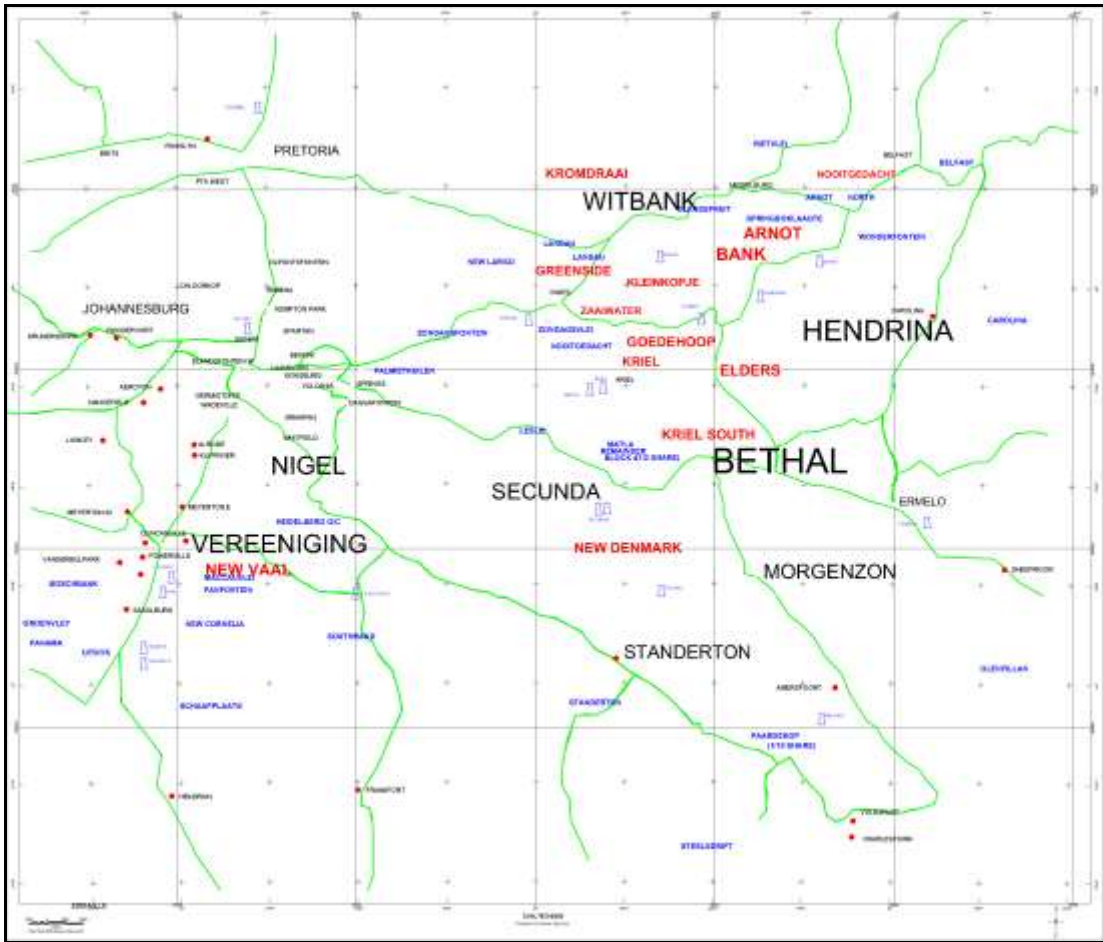


Figure 1.1 Locality map, showing the area of interest for Coaltech Task 1.3.6

2 DATA SOURCING

The following companies provided aeromagnetic data:

- Anglo Coal
- BHP Billiton/Ingwe
- Sasol
- Total Coal RSA

The original flying specifications were not provided with the data. In most cases only gridded aeromagnetic images were available, which were supplied in Geosoft Oasis Montaj format.

The sourced data were provided in a variety of different resolutions and ages. This made merging all the datasets together into a single useable image a very difficult task. A large amount of time was spent preparing the data for stitching; i.e. gridding all the datasets with a common grid cell size. It was found that an acceptable result was not readily achievable. An easier and more acceptable solution was to display the datasets together in one map, without stitching the various datasets into a single gridded image. The individual images can be viewed, either separately or together using GIS software. This was thought to be the best approach,

since it allows for zooming into specific areas, providing a high resolution view, where high resolution data are available. In addition to the data supplied by industry, the government 1 km line-spacing aeromagnetic dataset was also utilised. Late during 2004, it was learnt that the government (Council for Geoscience) had nearly completed a 200 m line spacing aeromagnetic and radiometric survey of the Witbank area. These aeromagnetic data were then acquired at a fraction of the actual survey cost. The outlines of the various contributors' datasets are shown in Figure 2.1.

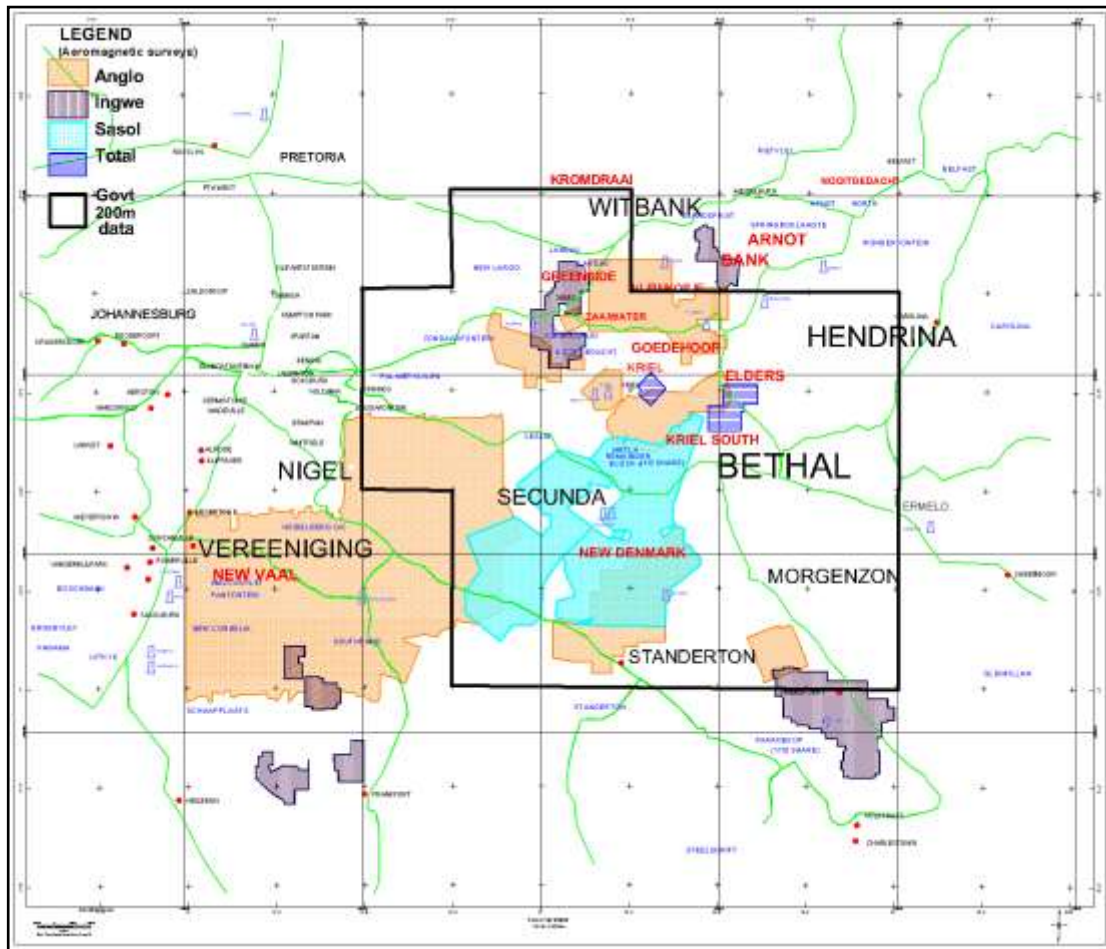


Figure 2.1 *Outlines of the aeromagnetic data contributed by Coaltech 2020 participants and the 200 m line-spacing data bought from the Council for Geoscience*

3 DATA DESCRIPTION

3.1 Anglo Coal

Data from 29 aeromagnetic surveys were provided by Anglo Coal. The names of the data images do not always relate directly to the area that was surveyed, but appear to refer to a project number of some sort. However, by plotting the data, it is possible to see where the surveys are located. A large number of the surveys overlap and they are of varying ages and resolution.

A map showing all the Anglo Coal total field aeromagnetic data is presented in Figure 3.1.1.

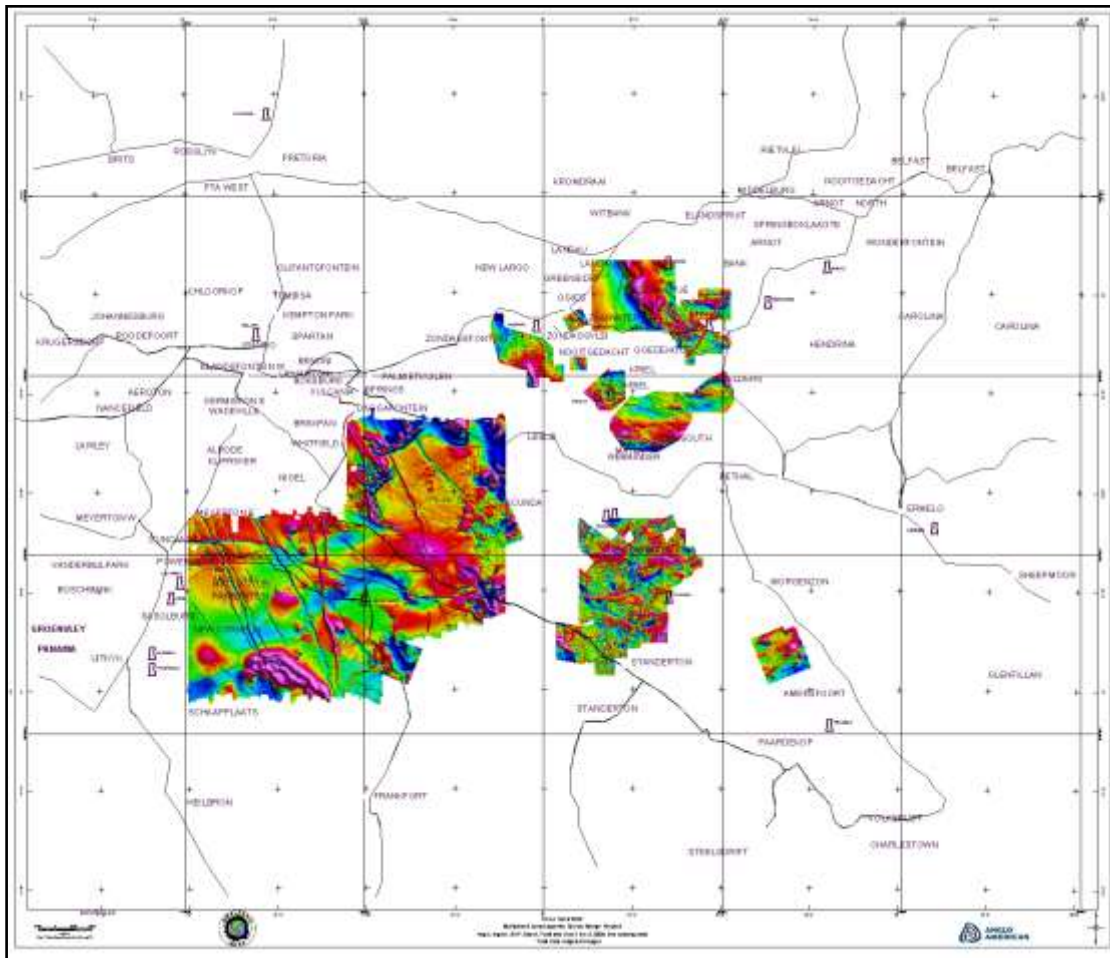


Figure 3.1.1 Location of the Anglo Coal total field aeromagnetic surveys

The Anglo Coal aeromagnetic survey image names, resolutions as well as figure numbers are listed in Table 3.3.1 below.

Table 3.1.1 List of Anglo Coal aeromagnetic surveys

Survey name	Location	Image Resolution cell size in metres	Figure number
Block 6ea	Heidelberg/New Vaal South Rand/Vaal River	65,9	3.1.2
Blouk	Amersfoort	52,6	3.1.3
Dougl1	Komati	19	3.1.4
Dougl2	Komati	18,9	3.1.4
Goede	Goedehoop (Komati)	15,8	3.1.5
GoedhoopHorgradenhanced	Goedehoop (Komati)	12,5	3.1.6

Harteb	Secunda	20,3	3.1.7
Kriel	Kriel (Matla)	26,3	3.1.8
Kriel2	Kriel (Matla)	25,3	3.1.9
Kromdraai	Kromdraai (Kleinkopje)	64,2	3.1.10
Ks_mag	Kriel South (Matla)	10,1	3.1.11
Newdcf	New Denmark	7,6	3.1.12
Newden	New Denmark	60,7	3.1.13
Newden_grad_enhanced_join	New Denmark	12,5	3.1.14
Newdes	New Denmark	25,3	3.1.15
Nooitg	Nooitgedacht	12,5	3.1.16
Sec1	New Denmark	13,2	3.1.17
Sec3s	New Denmark	13,2	3.1.18
SecA	Secunda	13,2	3.1.19
SecB	New Denmark	13,2	3.1.20
SecC	New Denmark	13,2	3.1.21
SecE	New Denmark	13,2	3.1.22
SecExt	New Denmark	13,2	3.1.23
SecJ	New Denmark	13,2	3.1.24
SecK	New Denmark	13,1	3.1.25
SecN	New Denmark	13,2	3.1.26
Vaald	South Rand	58,8	3.1.27
Zaai	Zaaiwater (Kleinkopje/Dhuva)	15,8	3.1.28
Zondag	Zondachsfontein (Kendal)	12,5	3.1.29

The individual aeromagnetic survey images are displayed in figures 3.1.2 to 3.1.29.

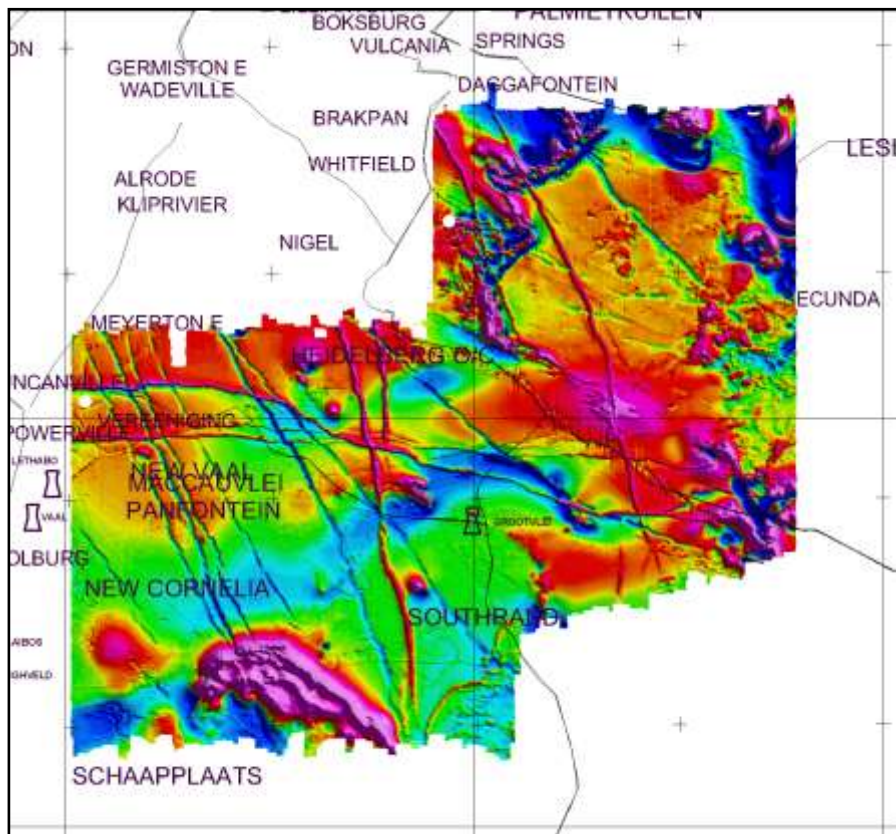


Figure 3.1.2 Anglo Coal aeromagnetic image: "Block 6ea", centered over Heidelberg. Image resolution: cell size of 65,9 m.

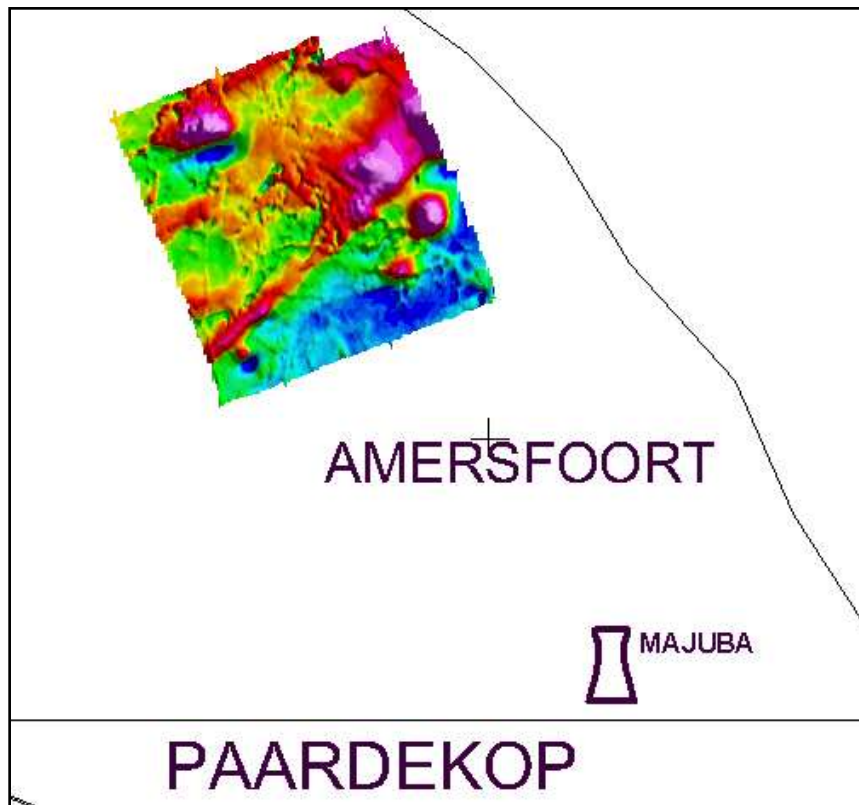


Figure 3.1.3 Anglo Coal aeromagnetic image: “Blouk”, situated close to Amersfoort. Image resolution: cell size of 52,6.

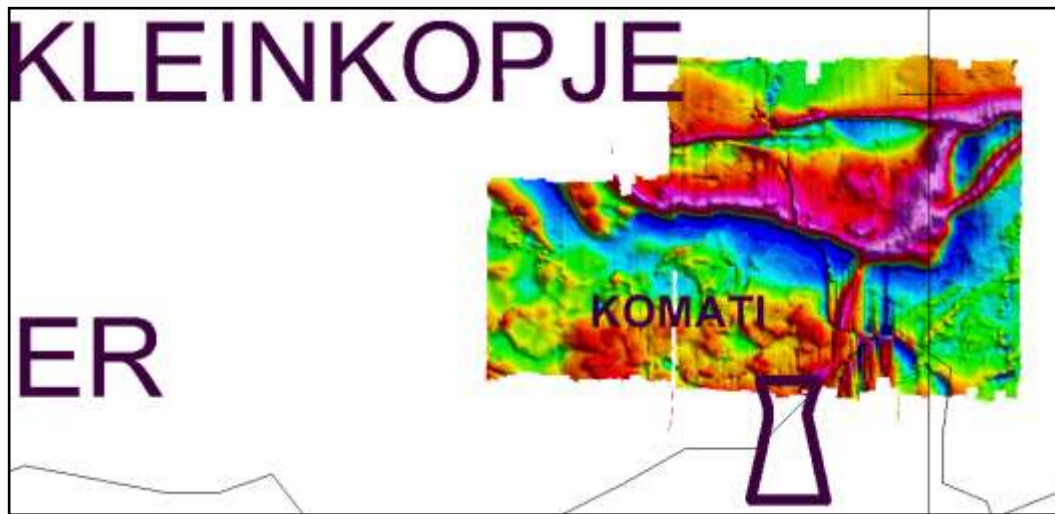


Figure 3.1.4 Anglo Coal aeromagnetic image: “Doug1” and “Doug2”, situated close to Komati power station. Image resolution: cell sizes of 19 m and 18,9 m, respectively.

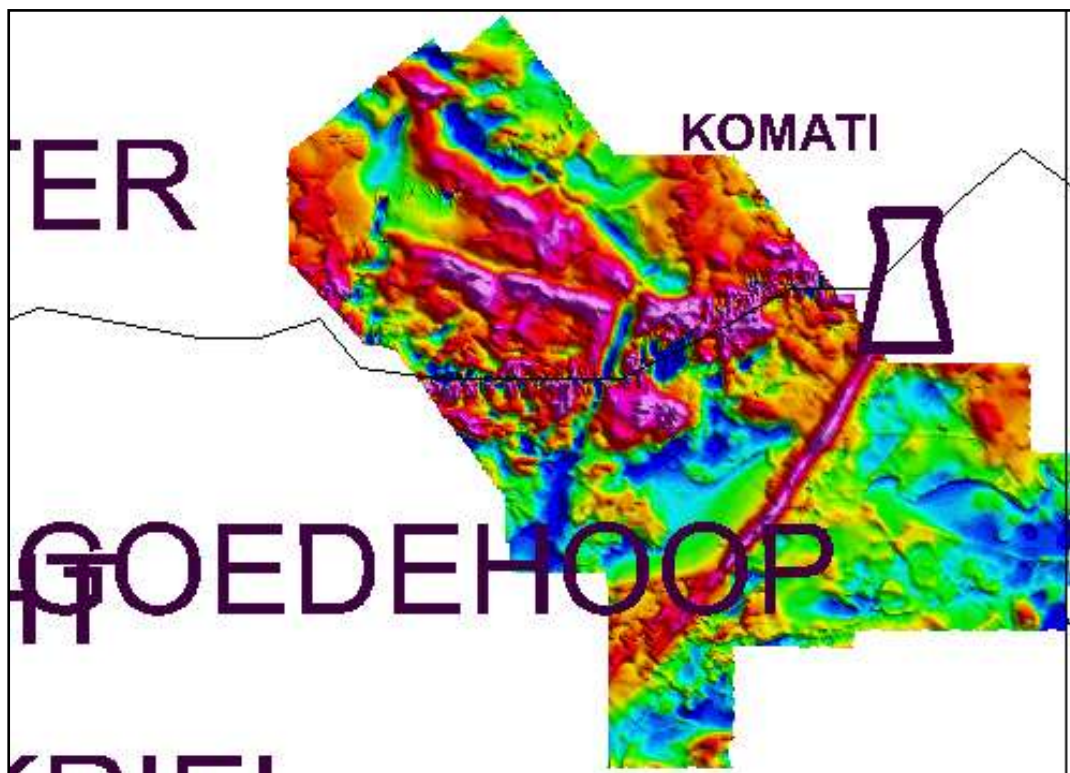


Figure 3.1.5 Anglo Coal aeromagnetic image: “Goede”, situated close to Goedehoop colliery. Image resolution: cell size of 15,8 m.

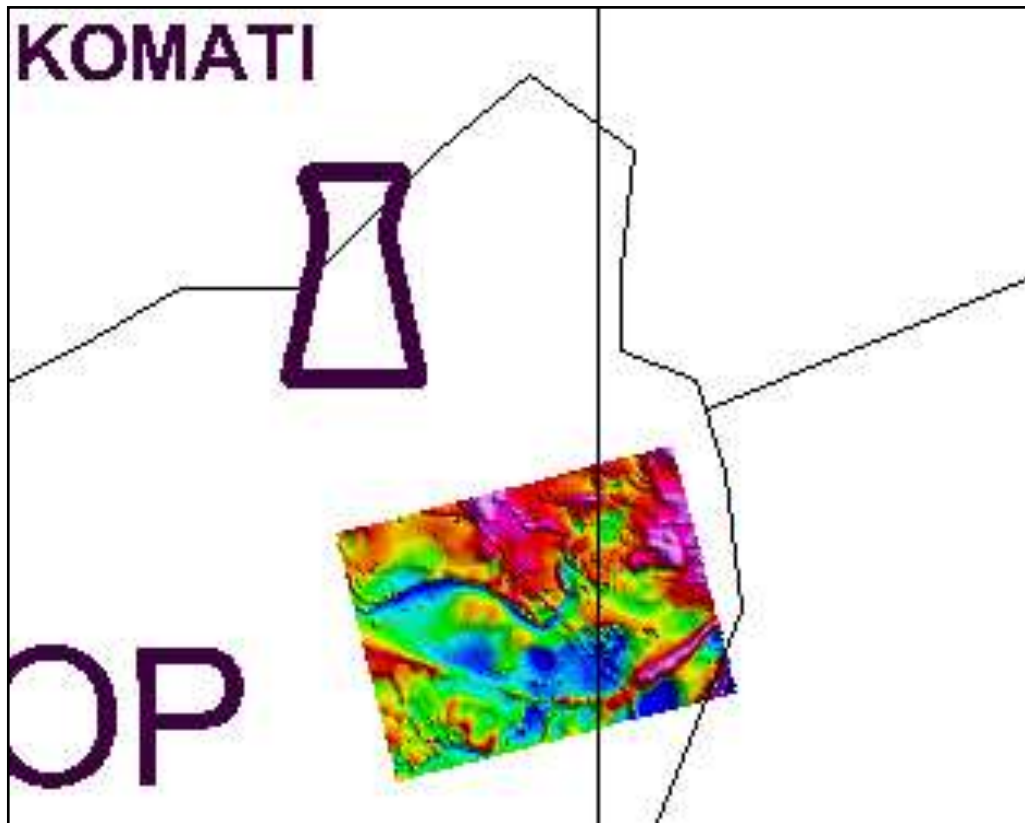


Figure 3.1.6 Anglo Coal aeromagnetic image: “Goedehoophorghradenhanced”, situated close to Goedehoop colliery. Image resolution: cell size of 12,5 m.

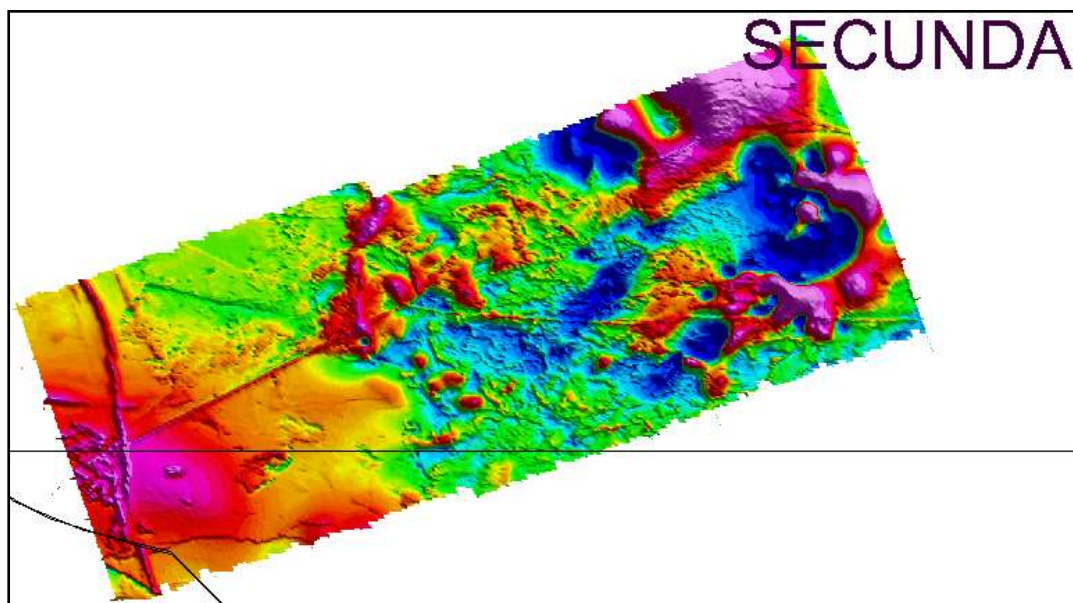


Figure 3.1.7 Anglo Coal aeromagnetic image: “Harteb”, located close to Secunda. Image resolution: cell size of 20,3 m.

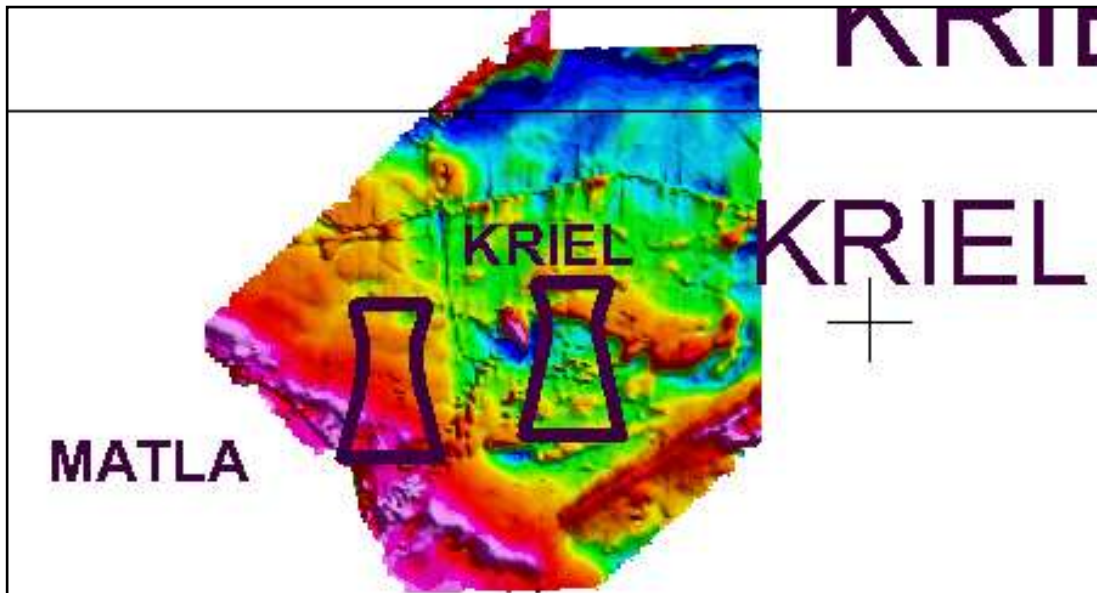


Figure 3.1.8 Anglo Coal aeromagnetic image: “Kriel”, situated close to Kriel colliery. Image resolution: cell size of 26,3 m.

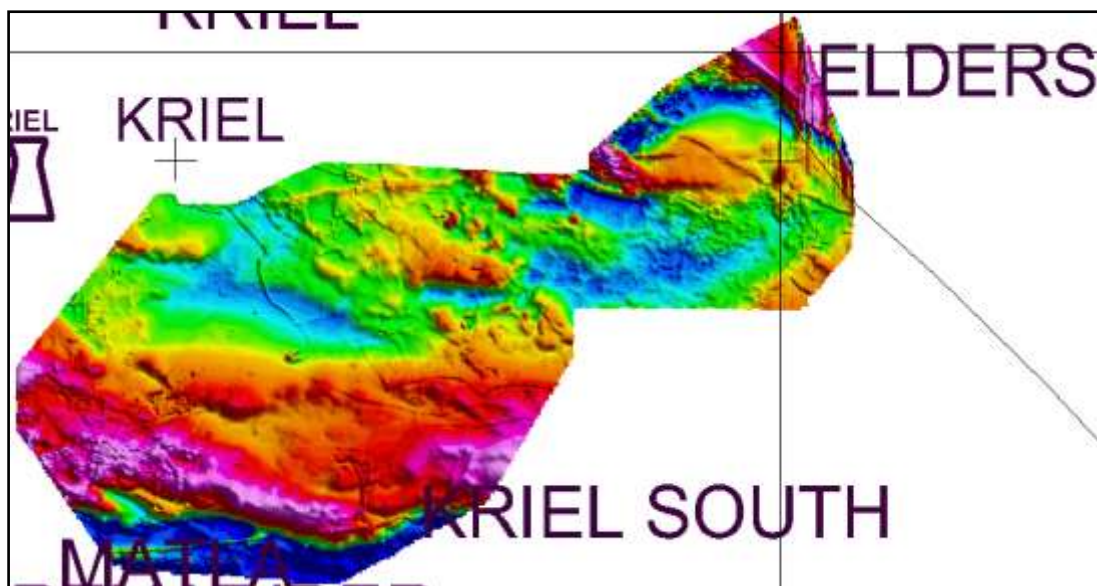


Figure 3.1.9 Anglo Coal aeromagnetic image: “Kriel2”, located close to Kriel colliery. Image resolution: cell size of 25,3 m.

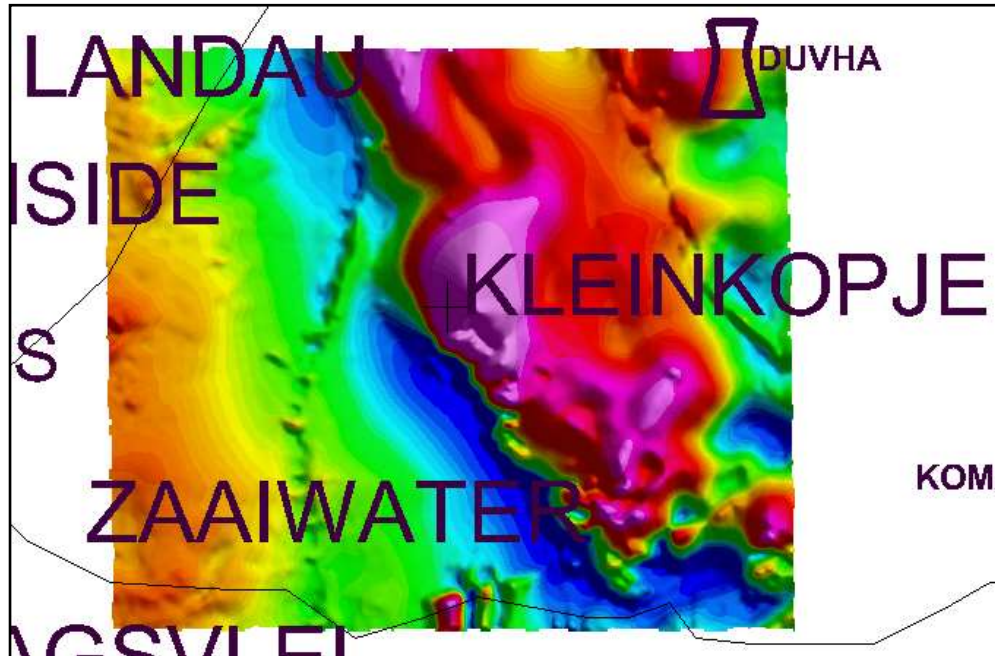


Figure 3.1.10 Anglo Coal aeromagnetic image: “Kromdraai”, situated close to Kromdraai colliery. Image resolution: cell size of 64,2 m.



Figure 3.1.11 Anglo Coal aeromagnetic image: “Ks_mag”, located close to Kriel South. Image resolution: cell size of 10,1 m.

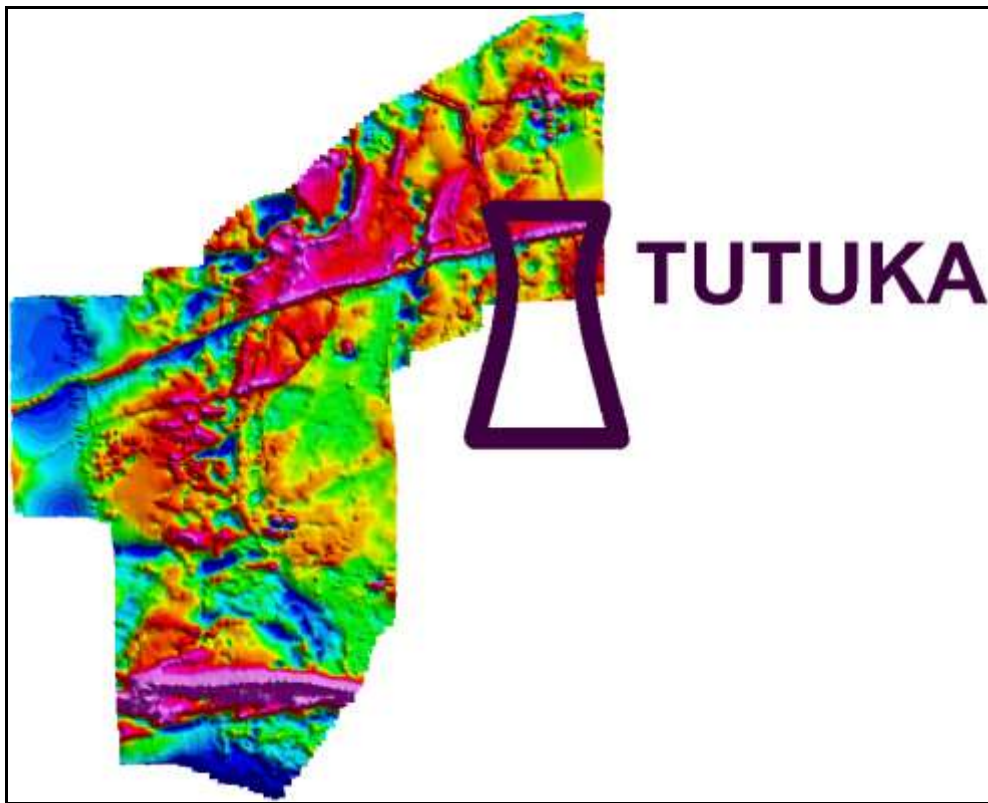


Figure 3.1.12 Anglo Coal aeromagnetic image: “Newdcf”, situated in the New Denmark area. Image resolution: cell size of 7,6 m.

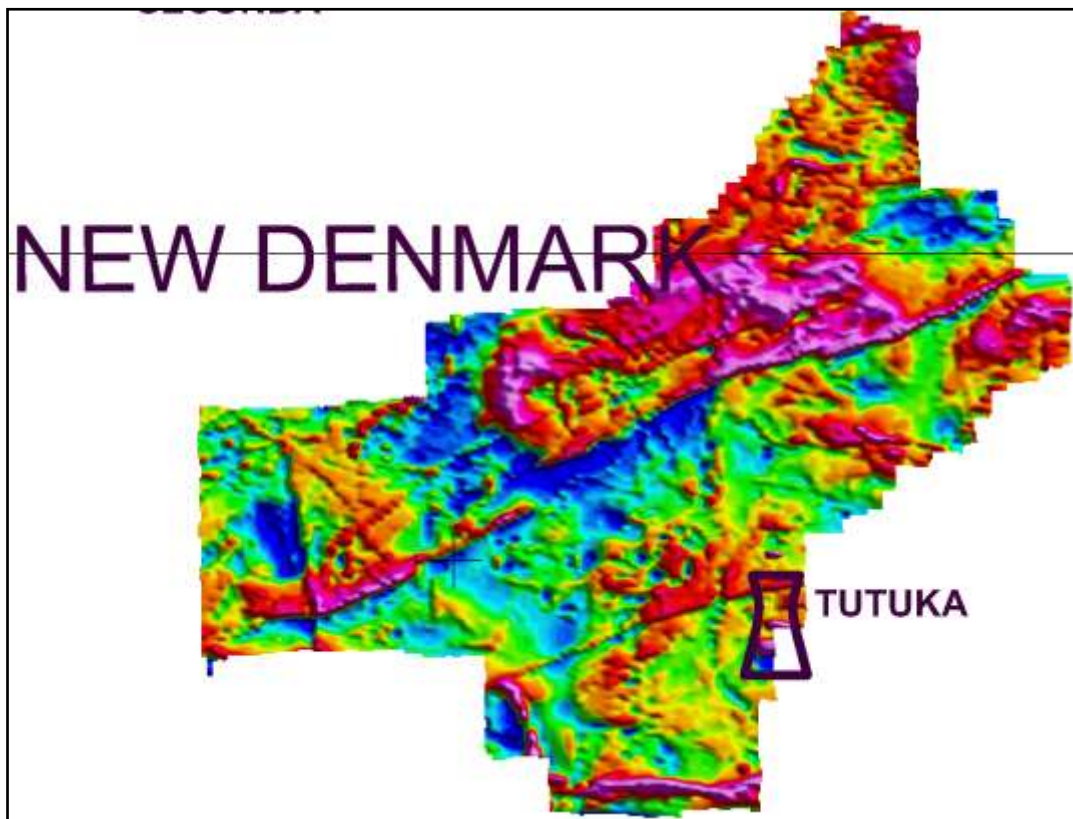


Figure 3.1.13 Anglo Coal aeromagnetic image: “Newden”, situated in the New Denmark area. Image resolution: cell size of 60,7 m.

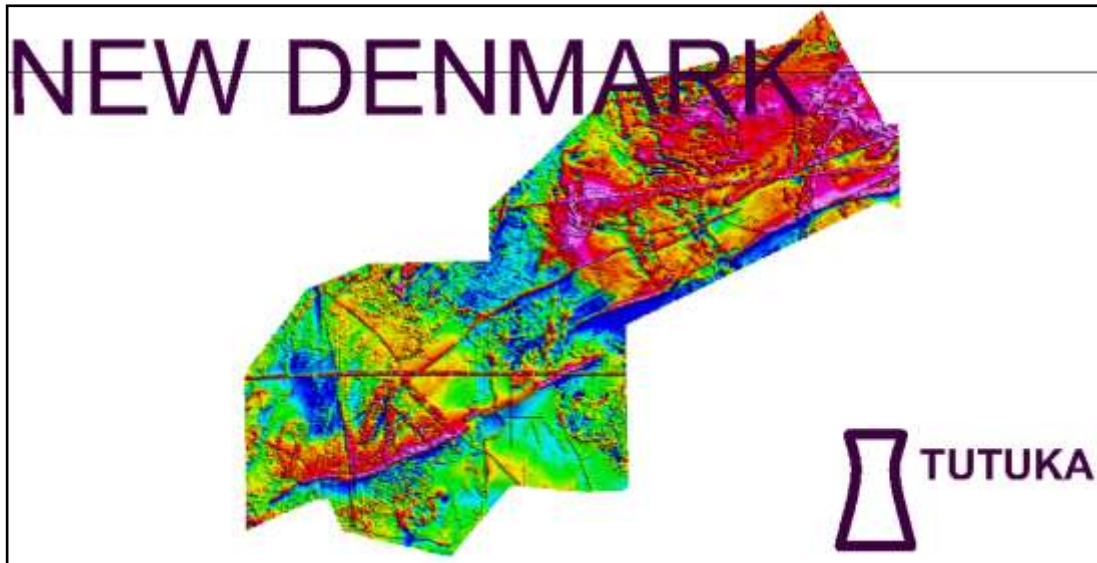


Figure 3.1.14 Anglo Coal aeromagnetic image: “Newden_grad_enhanced_join”, situated in the New Denmark area. Image resolution: cell size of 12,5 m.

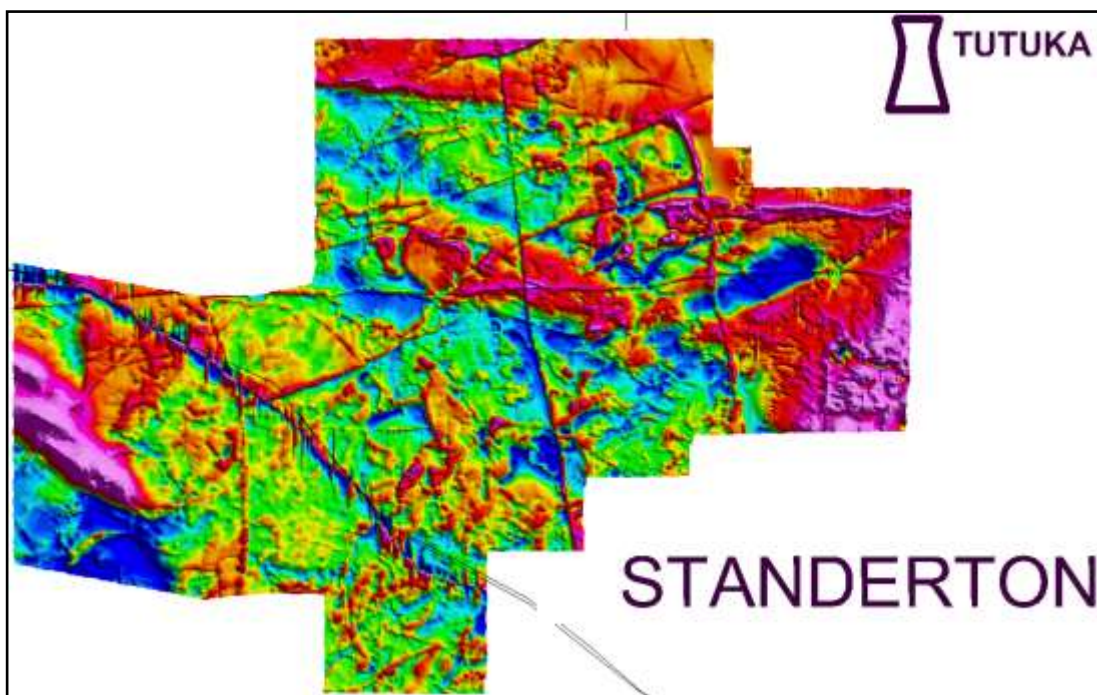


Figure 3.1.15 Anglo Coal aeromagnetic image: “Newdes”, situated in the New Denmark area. Image resolution: cell size of 25,3 m.

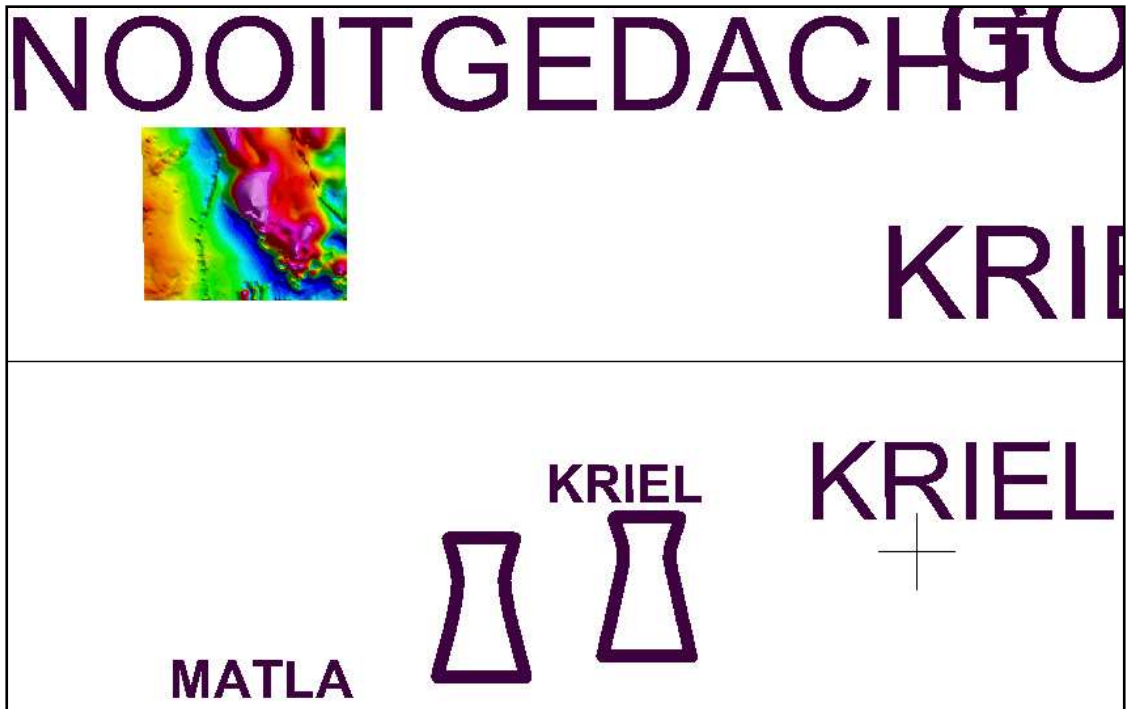


Figure 3.1.16 Anglo Coal aeromagnetic image: “Nooity”, situated in the Nooitgedacht area. Image resolution: cell size of 12,5 m.

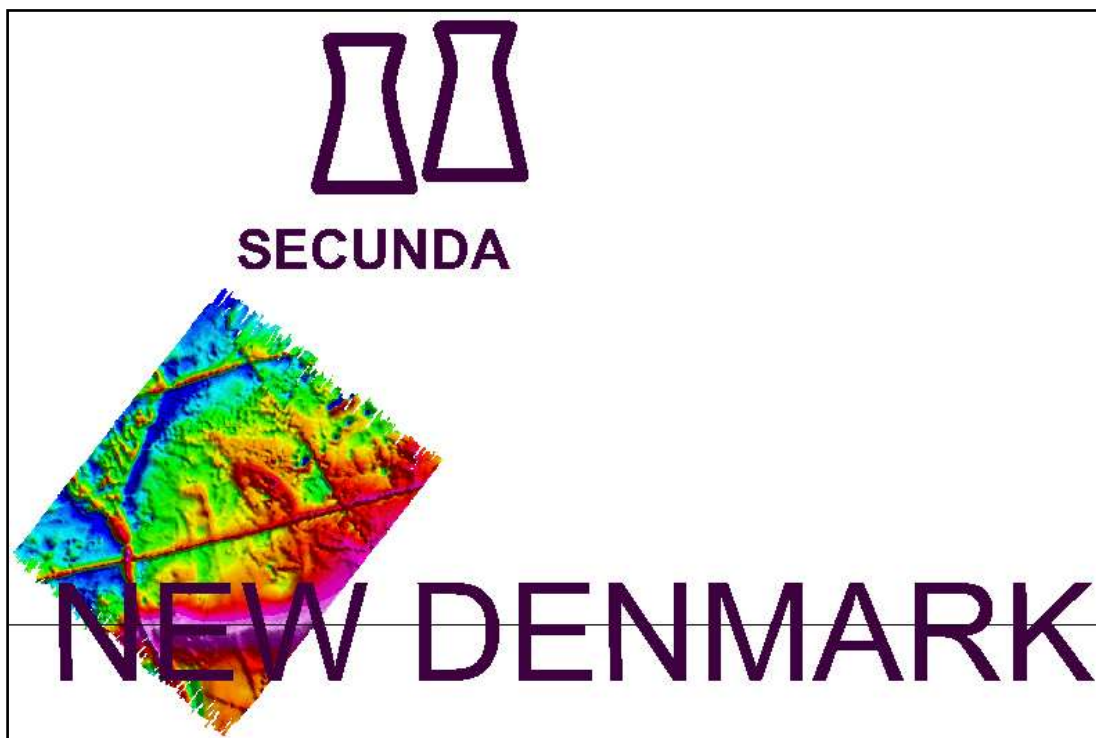


Figure 3.1.17 Anglo Coal aeromagnetic image: “Sec1”, situated in the New Denmark area. Image resolution: cell size of 13,2 m.

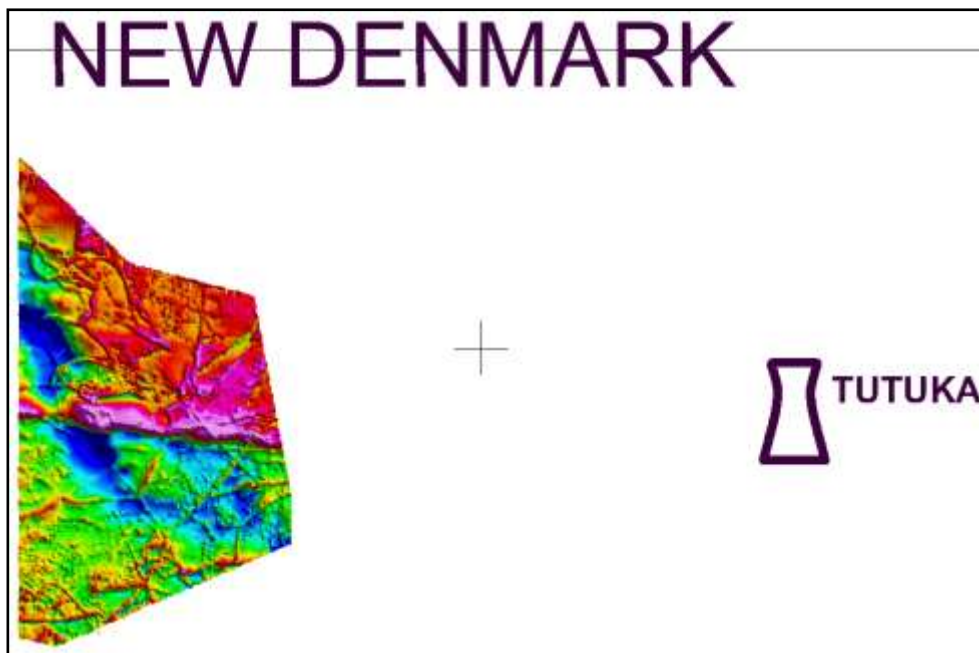


Figure 3.1.18 Anglo Coal aeromagnetic image: “Sec3s”, situated in the New Denmark area. Image resolution: cell size of 13,2 m.

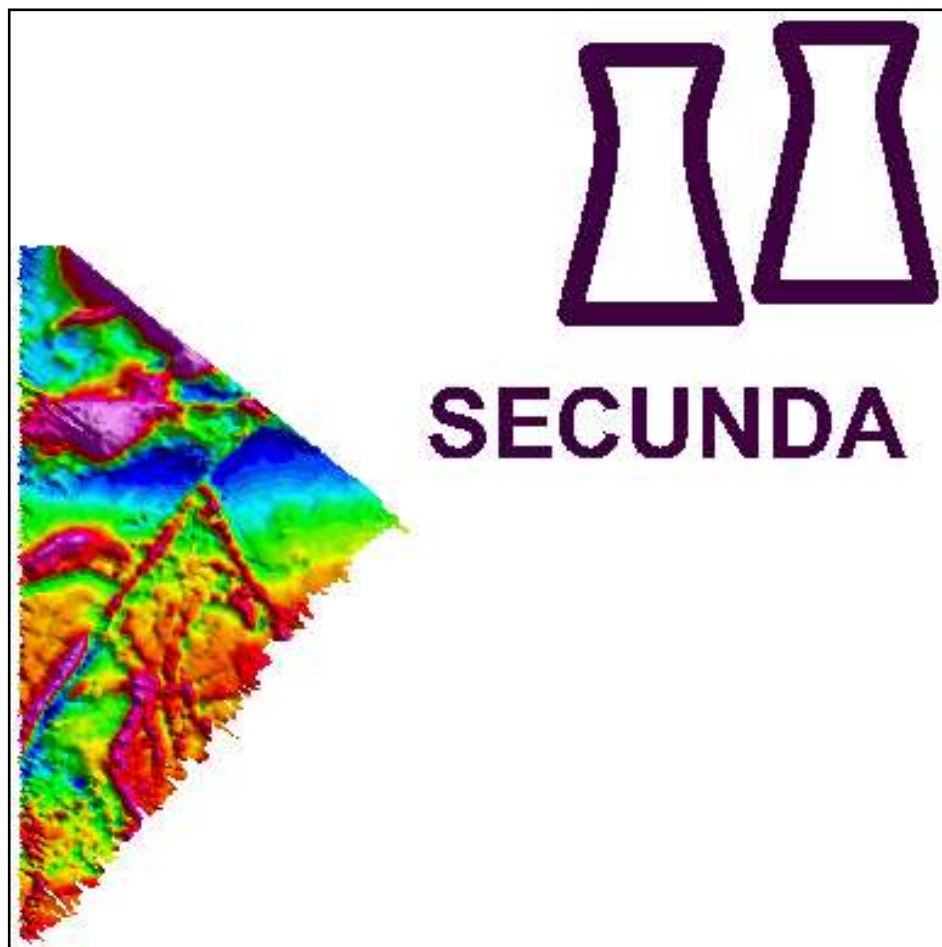


Figure 3.1.19 Anglo Coal aeromagnetic image: “SecA”, situated close to Secunda. Image resolution: cell size of 13,2 m.

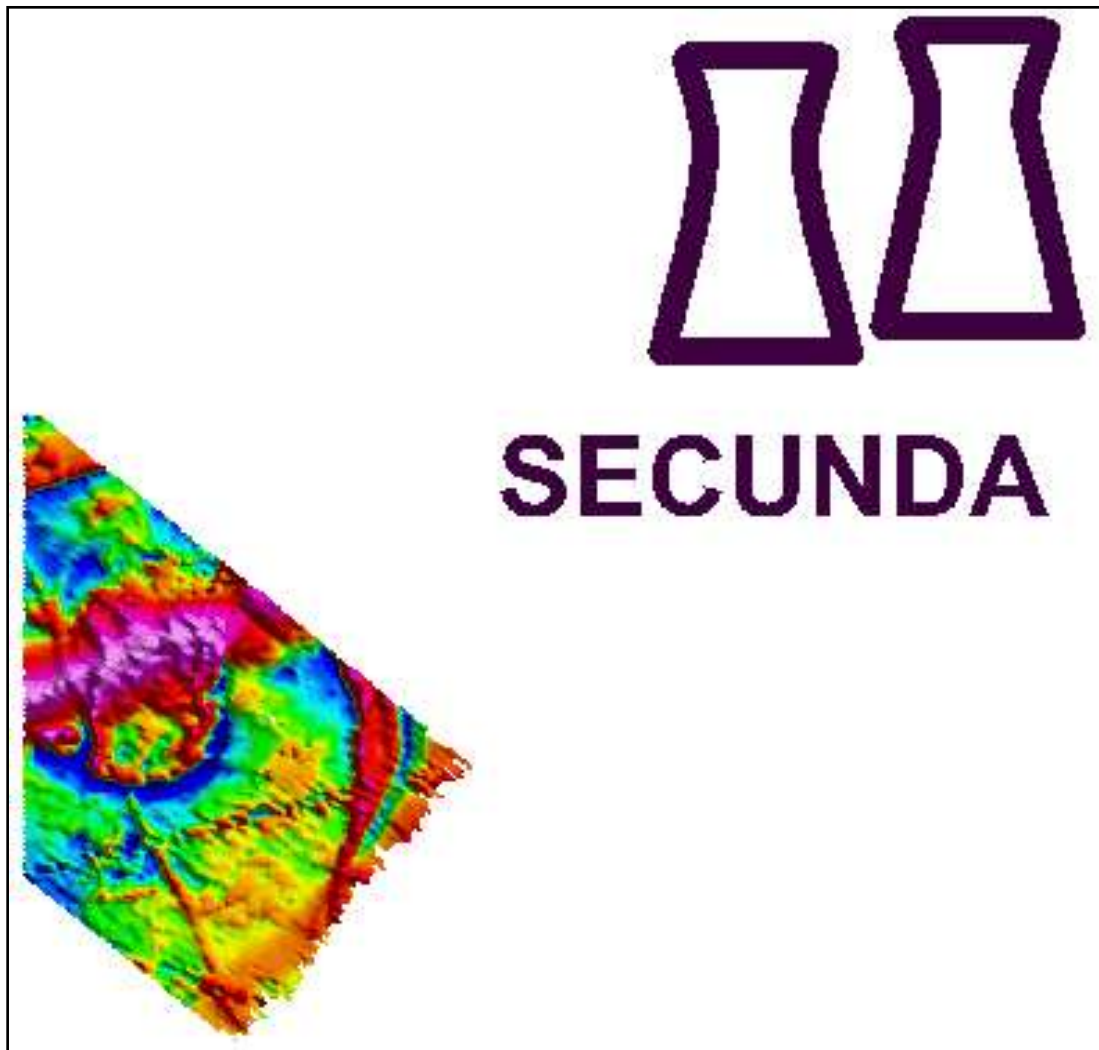


Figure 3.1.20 Anglo Coal aeromagnetic image: "SecB", situated in the New Denmark area. Image resolution: cell size of 13,2 m.

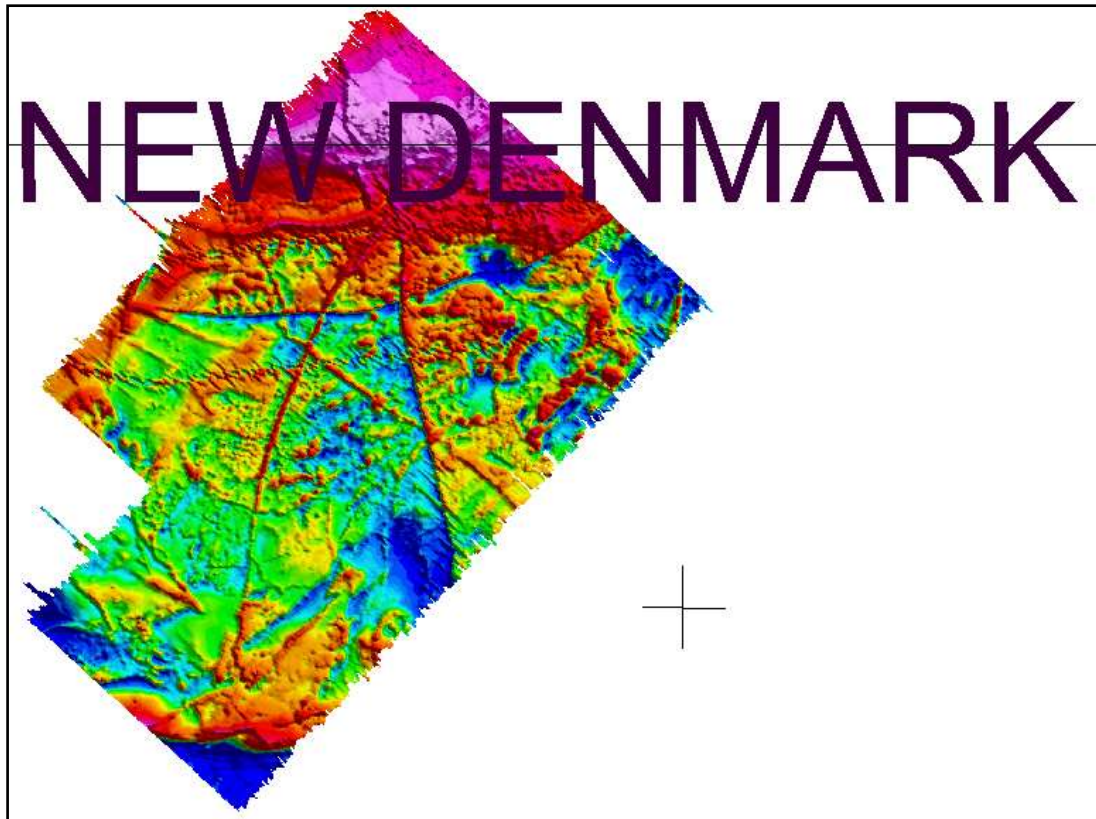


Figure 3.1.21 Anglo Coal aeromagnetic image: "SecC", situated in the New Denmark area. Image resolution: cell size of 13,2 m.

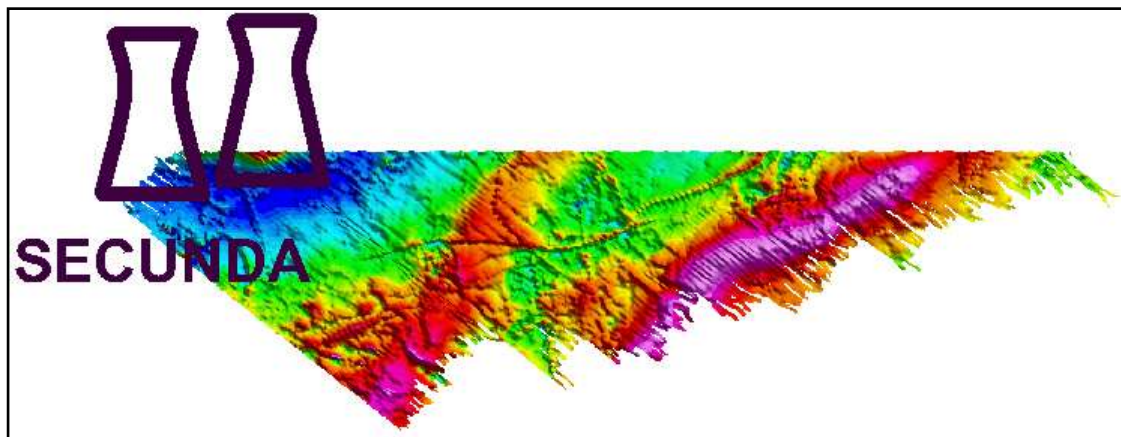


Figure 3.1.22 Anglo Coal aeromagnetic image: "SecE", situated in the New Denmark area. Image resolution: cell size of 13,2 m.

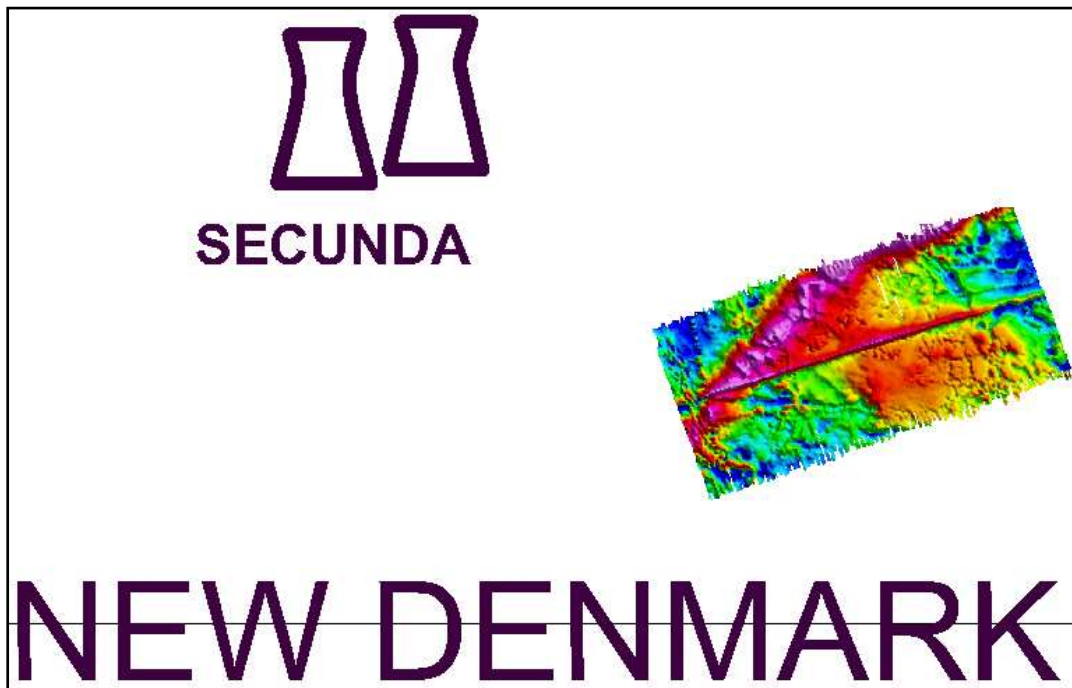


Figure 3.1.23 Anglo Coal aeromagnetic image: “SecExt”, situated in the New Denmark area. Image resolution: cell size of 13,2 m.

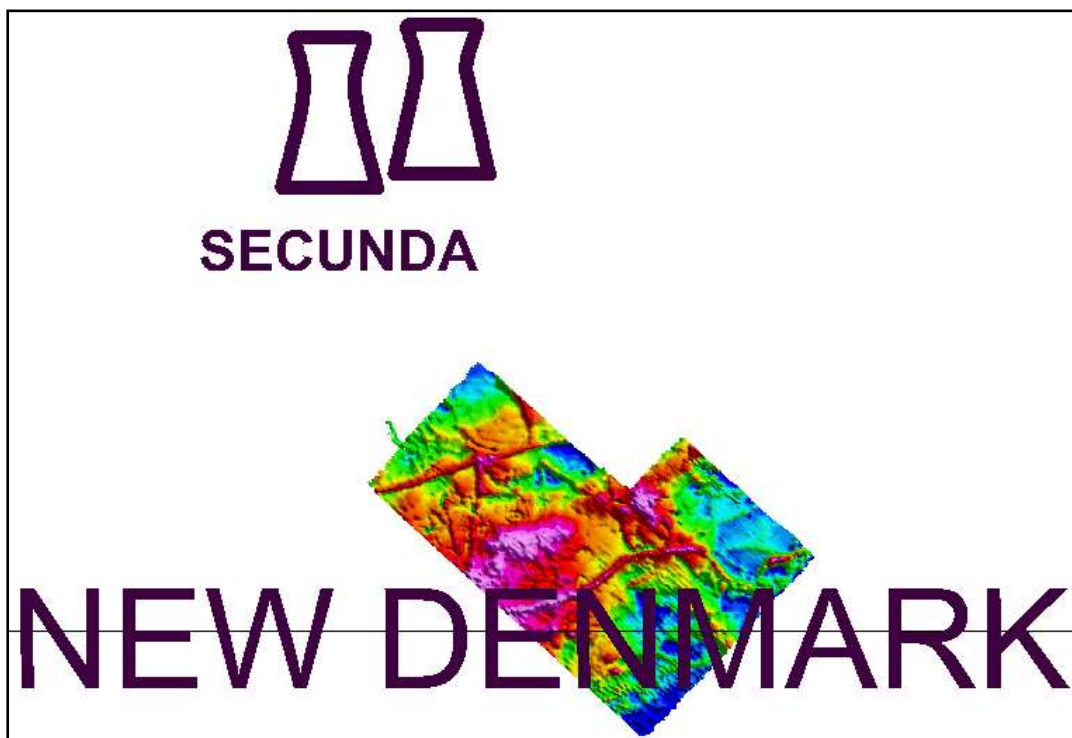


Figure 3.1.24 Anglo Coal aeromagnetic image: “SecJ”, situated in the New Denmark area. Image resolution: cell size of 13,2 m.

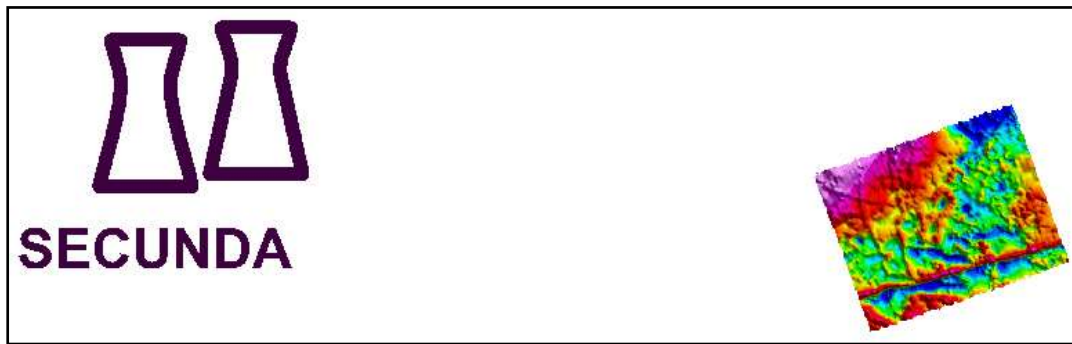


Figure 3.1.25 Anglo Coal aeromagnetic image: "SecK", situated in the New Denmark area. Image resolution: cell size of 13,1 m.



Figure 3.1.26 Anglo Coal aeromagnetic image: "SecN", situated in the New Denmark area. Image resolution: cell size of 13,2 m.

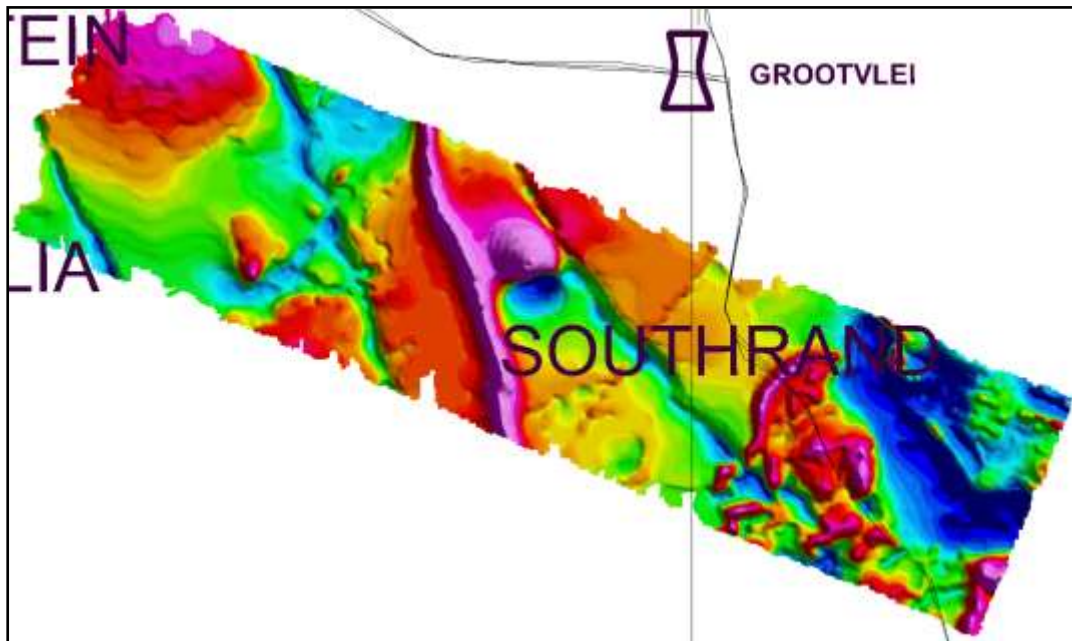


Figure 3.1.27 Anglo Coal aeromagnetic image: “Vaald”, located in the South Rand. Image resolution: cell size of 58,8 m.



Figure 3.1.28 Anglo Coal aeromagnetic image: “Zaii”, situated in the Zaiiwater area. Image resolution: cell size of 15,8 m.

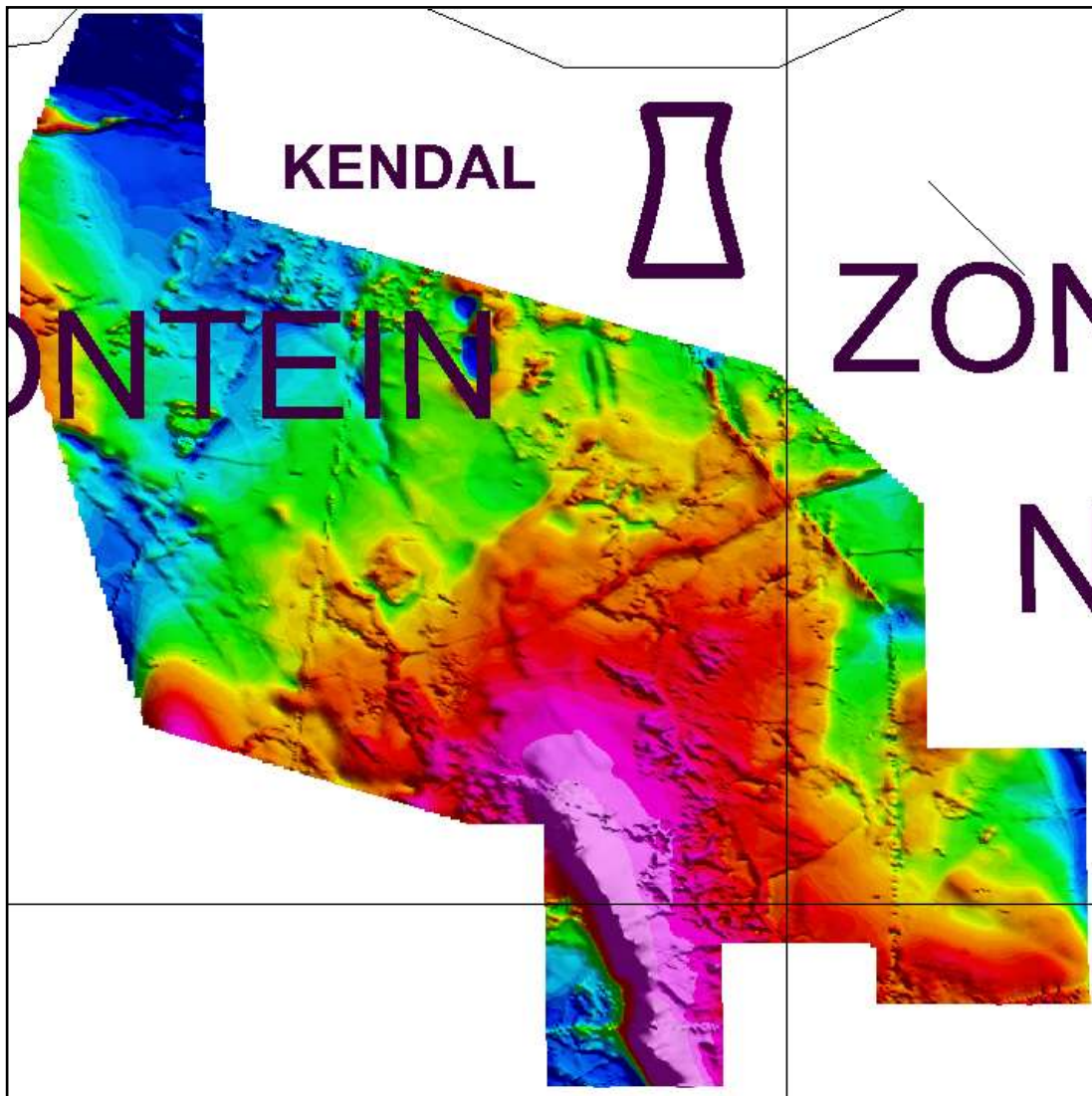


Figure 3.1.29 Anglo Coal aeromagnetic image: “Zondag”, situated in the Zondachsfontein area. Image resolution: cell size of 12,5 m.

3.2 BHP Billiton/Ingwe

A total of eight aeromagnetic survey datasets were provided by BHP Billiton/Ingwe. A map showing all the total field aeromagnetic data provided by BHP Billiton/Ingwe is presented in Figure 3.2.1.

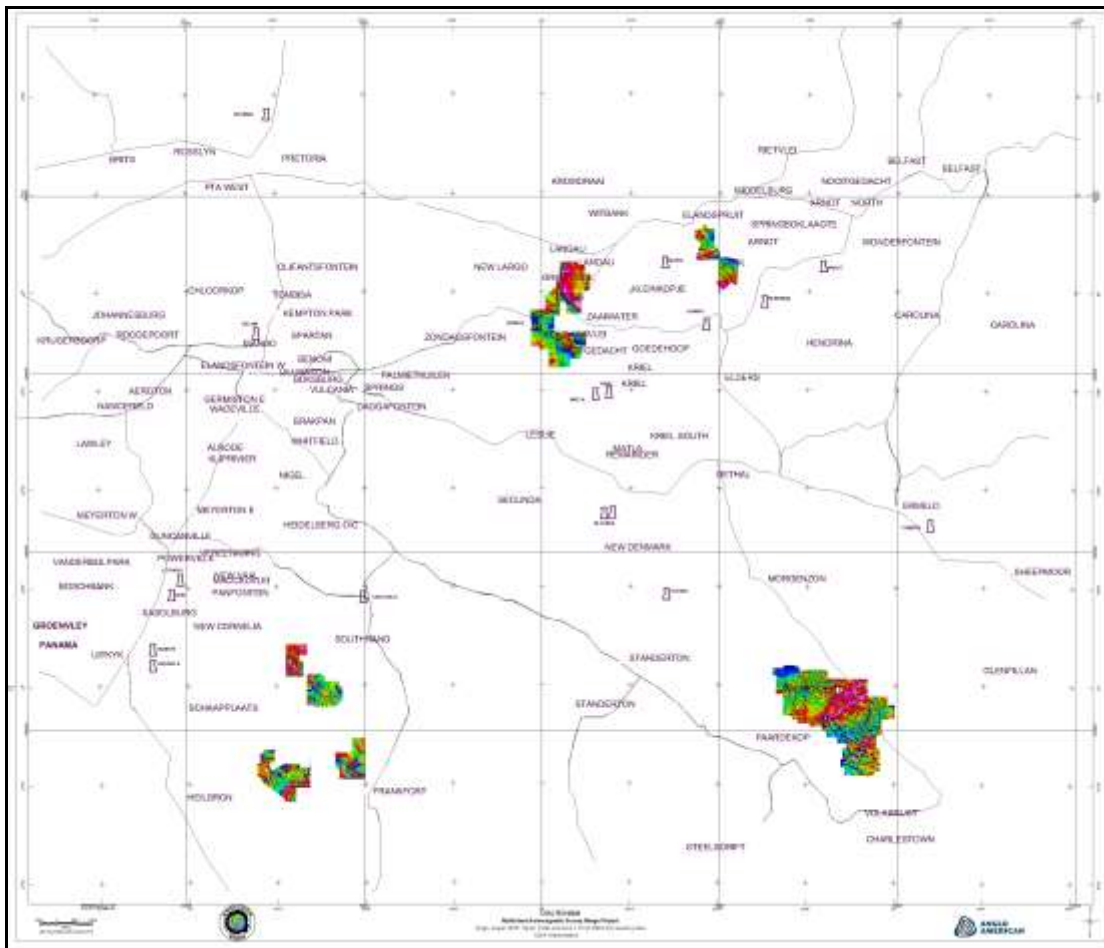


Figure 3.2.1 Location of the BHP Billiton/Ingwe total field aeromagnetic surveys

The BHP Billiton/Ingwe aeromagnetic survey image names, resolutions as well as figure numbers are listed in Table 3.2.1 below.

Table 3.2.1 List of the BHP Billiton/Ingwe aeromagnetic surveys

Survey name	Location	Image Resolution cell size in metres	Figure number
Dirkiesdorp	Frankfort	25	3.2.2
Khutala	Kendal/Ogies	12,5	3.2.3
Majuba	Majuba South/ Volsrust	100	3.2.4
Majuba2	Amersfoort	12,5	3.2.5
Maquassa	South Rand	15	3.2.6
Middelburg A	Duvha/Bank (North)	12,5	3.2.7
Middelburg C	Duvha/Bank (South)	12,5	3.2.8
Yzermyn	Heilbron	15	3.2.9

The individual aeromagnetic survey images are displayed in figures 3.2.2 to 3.2.9.

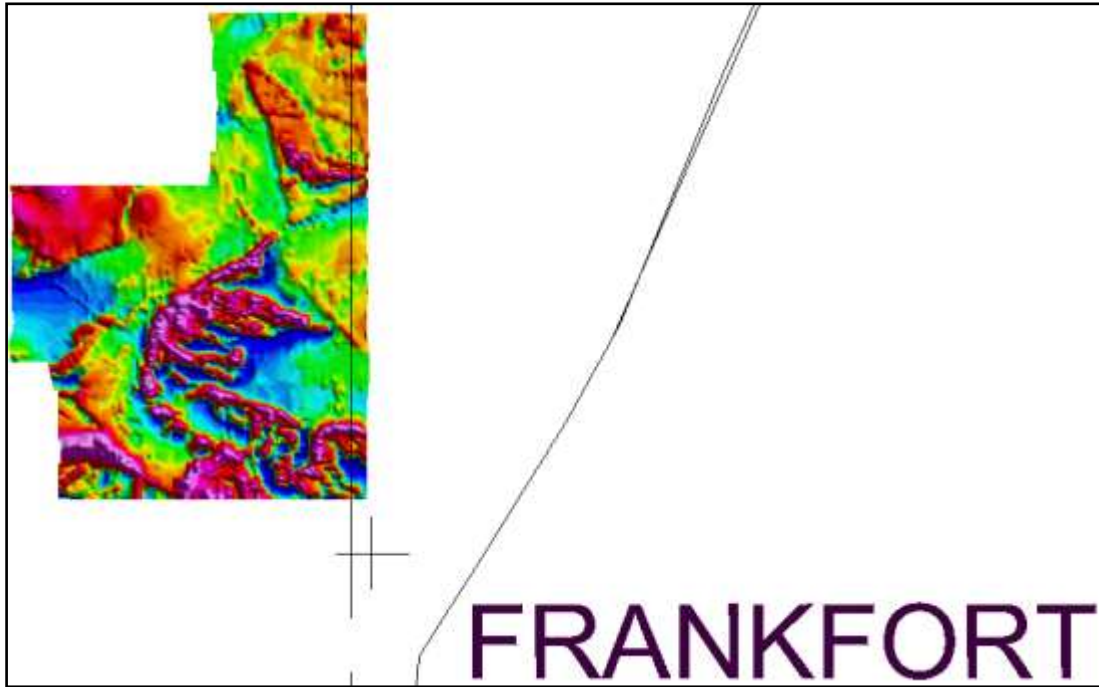


Figure 3.2.2 *BHP Billiton/Ingwe aeromagnetic image: “Dirkiesdorp”, located close to Frankfort. Image resolution: cell size of 25 m.*

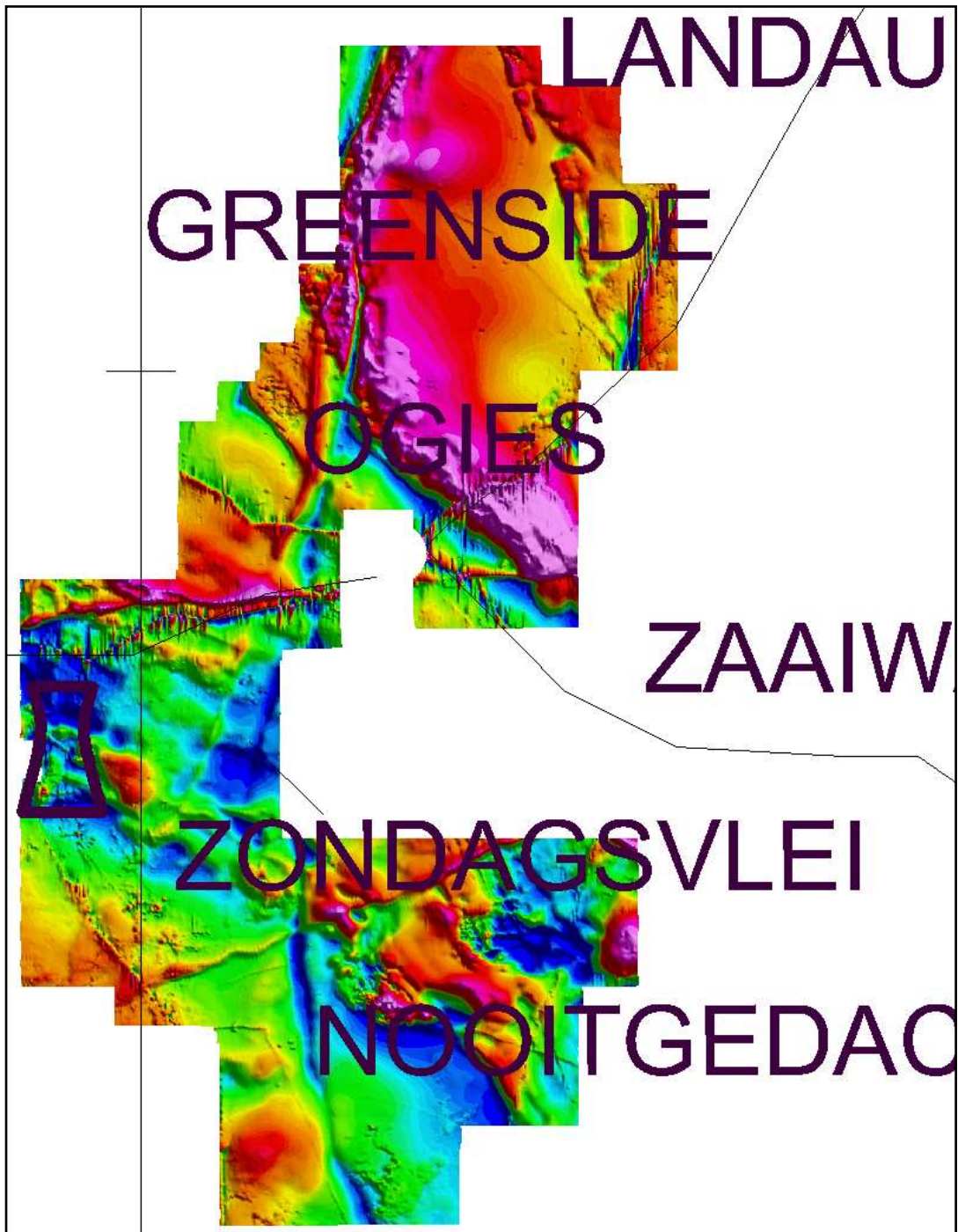


Figure 3.2.3 BHP Billiton/Ingwe aeromagnetic image: “Khutala”, situated in the Ogies area. Image resolution: cell size of 12,5 m.

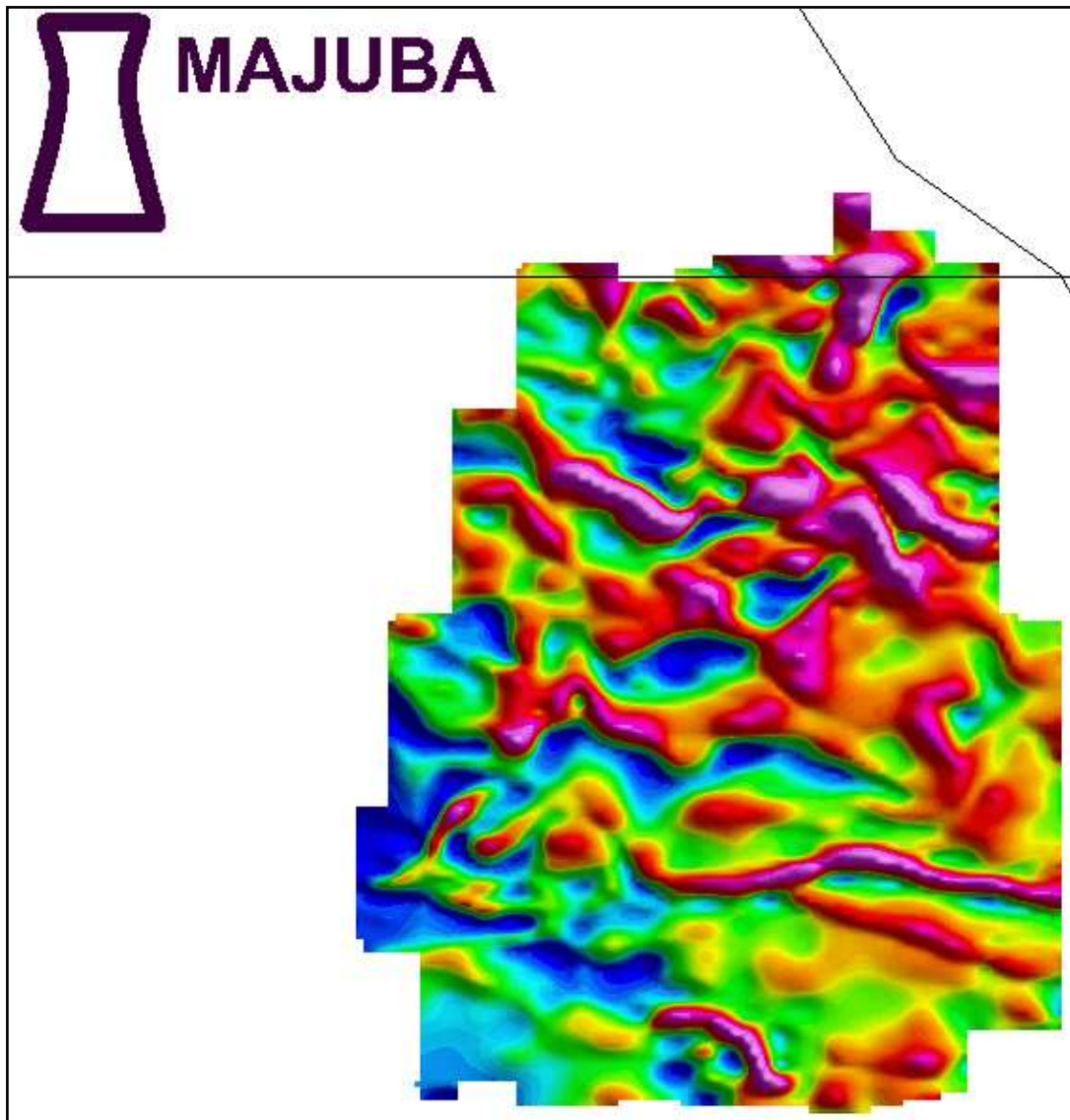


Figure 3.2.4 BHP Billiton/Ingwe aeromagnetic image: “Majuba” situated at Majuba South. Image resolution: cell size of 100 m.

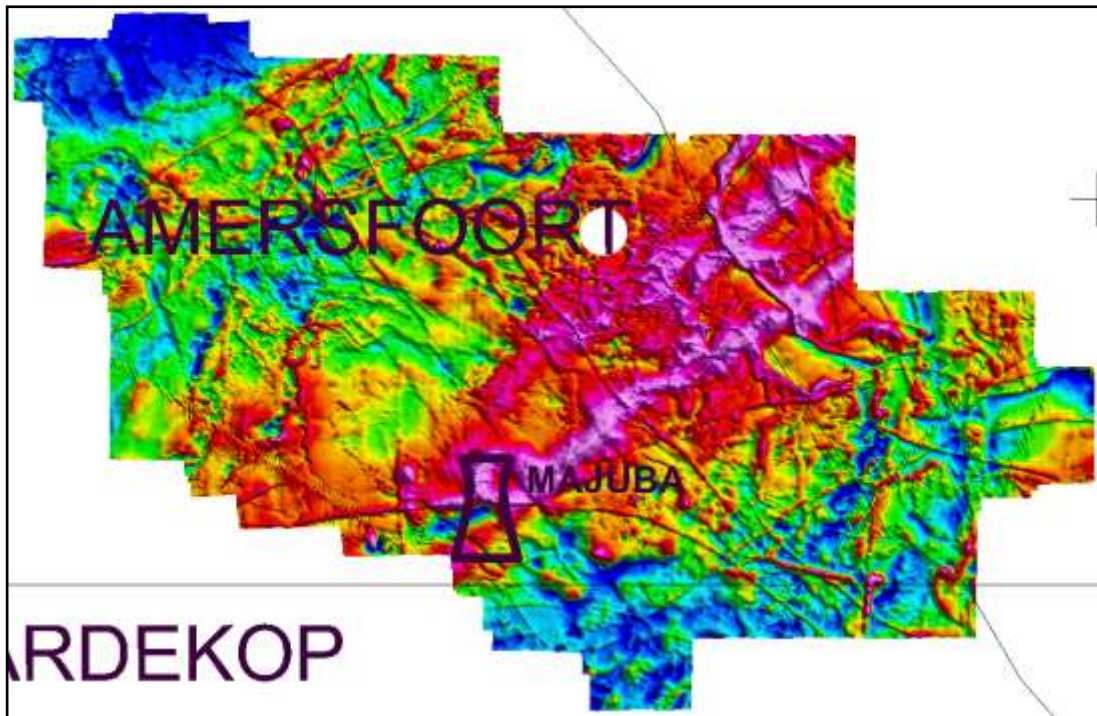


Figure 3.2.5 BHP Billiton/Ingwe aeromagnetic image: “Majuba2”, situated in the Amersfoort area. Image resolution: cell size of 12,5 m.

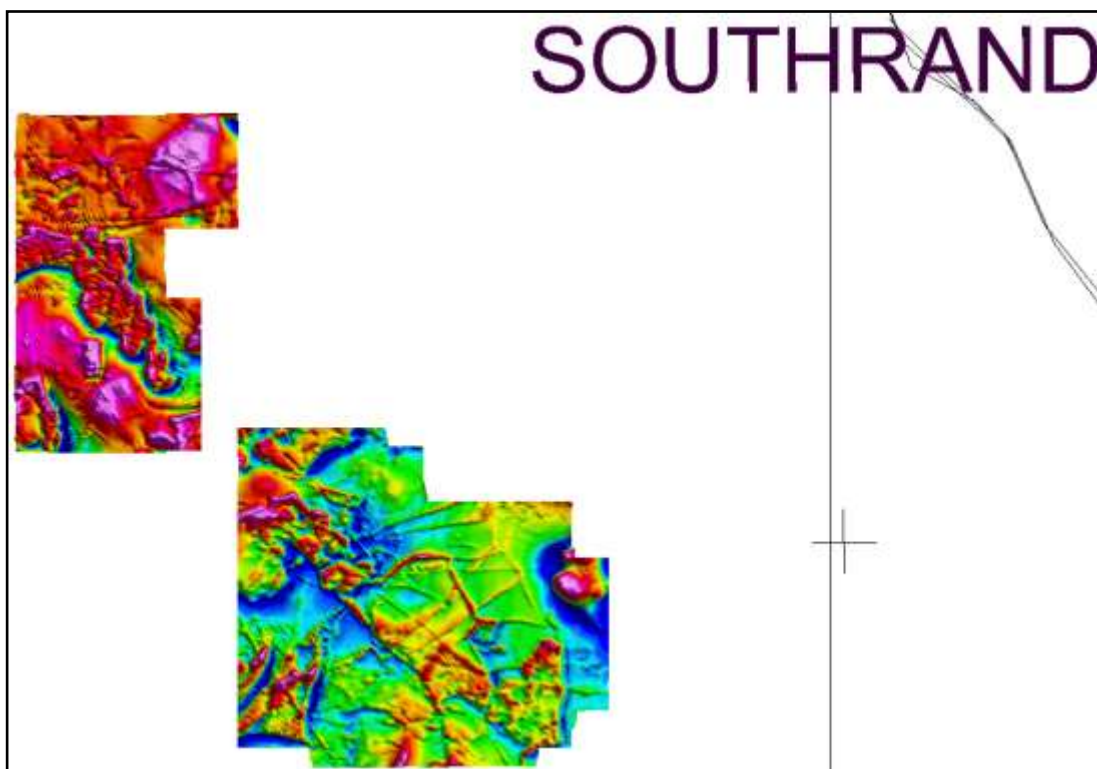


Figure 3.2.6 BHP Billiton/Ingwe aeromagnetic image: “Maquassa”, situated in the South Rand area. Image resolution: cell size of 15 m.

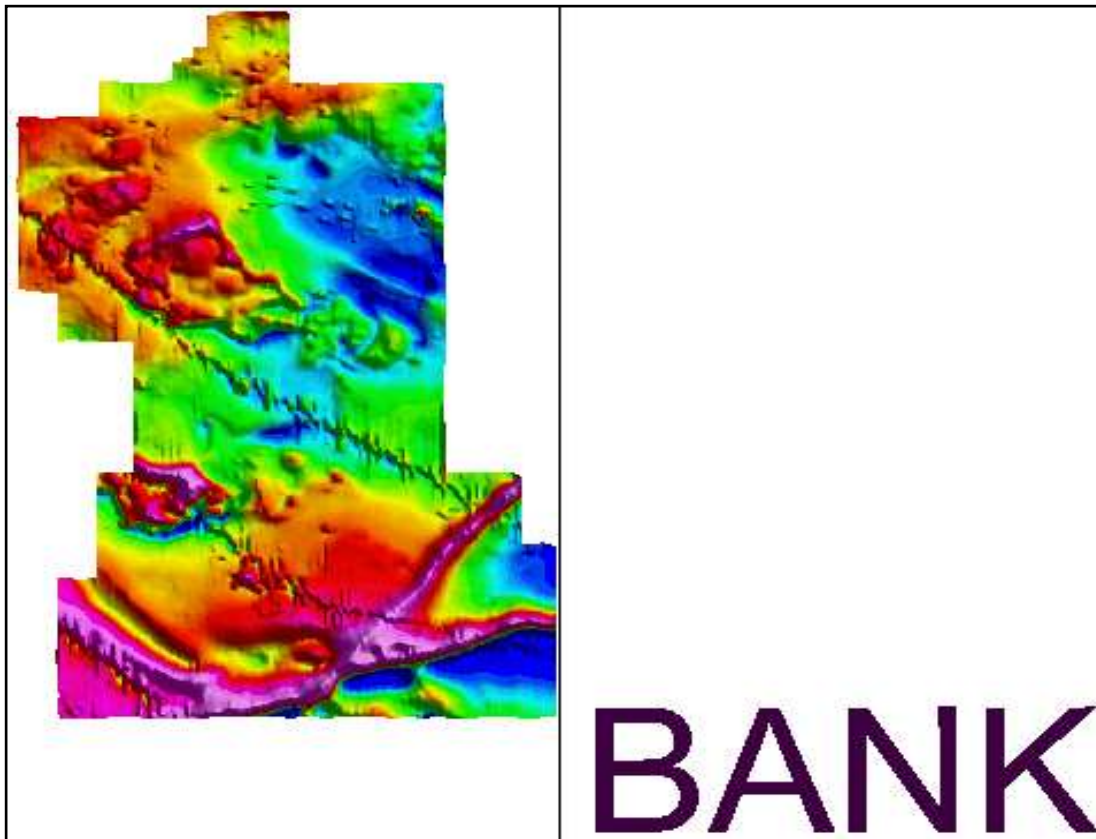


Figure 3.2.7 *BHP Billiton/Ingwe aeromagnetic image: “MiddelburgA”, situated close to Duvha power station. Image resolution: cell size of 12,5 m.*

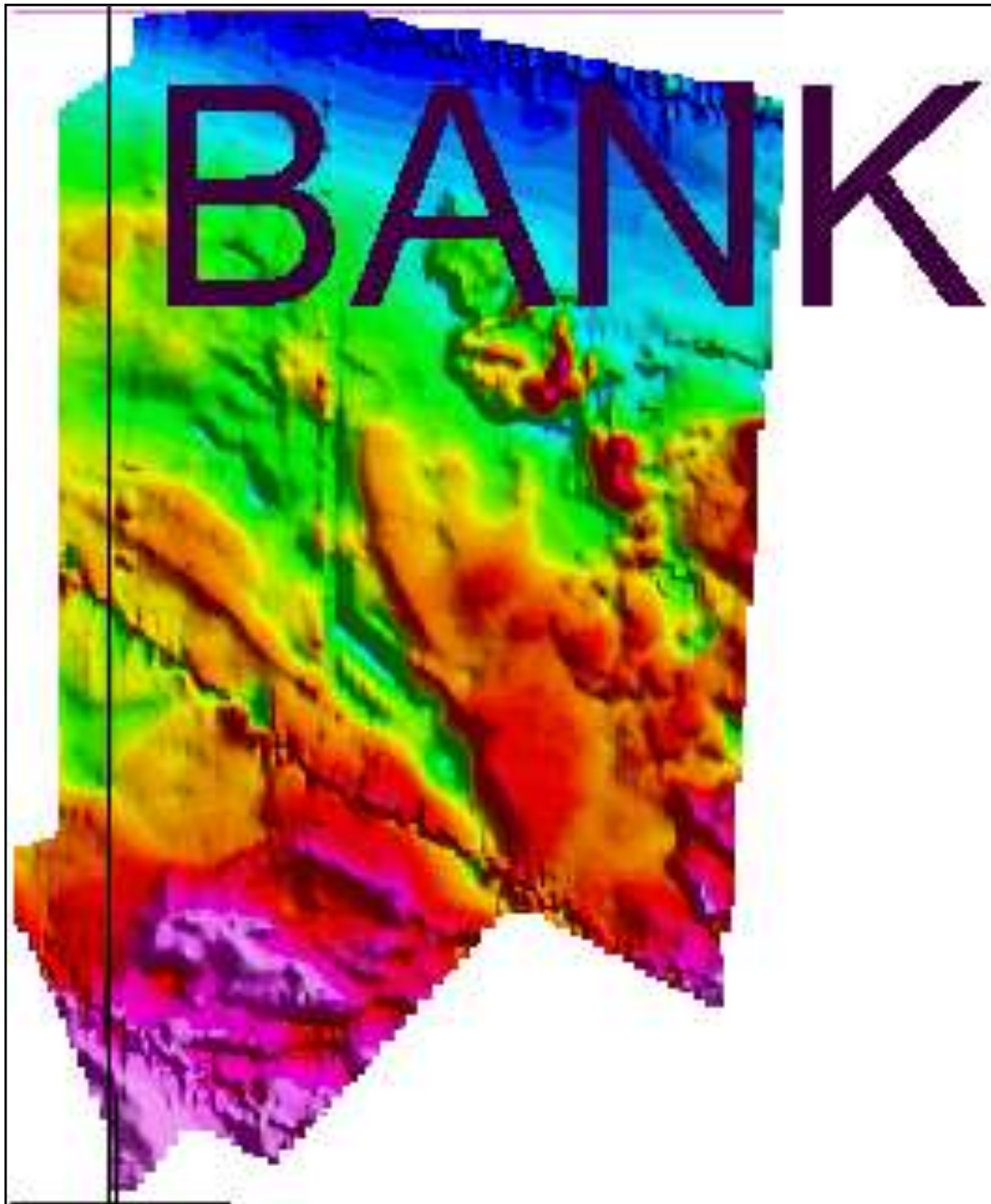


Figure 3.2.8 BHP Billiton/Ingwe aeromagnetic image: “MiddelburgC”, situated close to Duvha power station. Image resolution: cell size of 12,5 m.

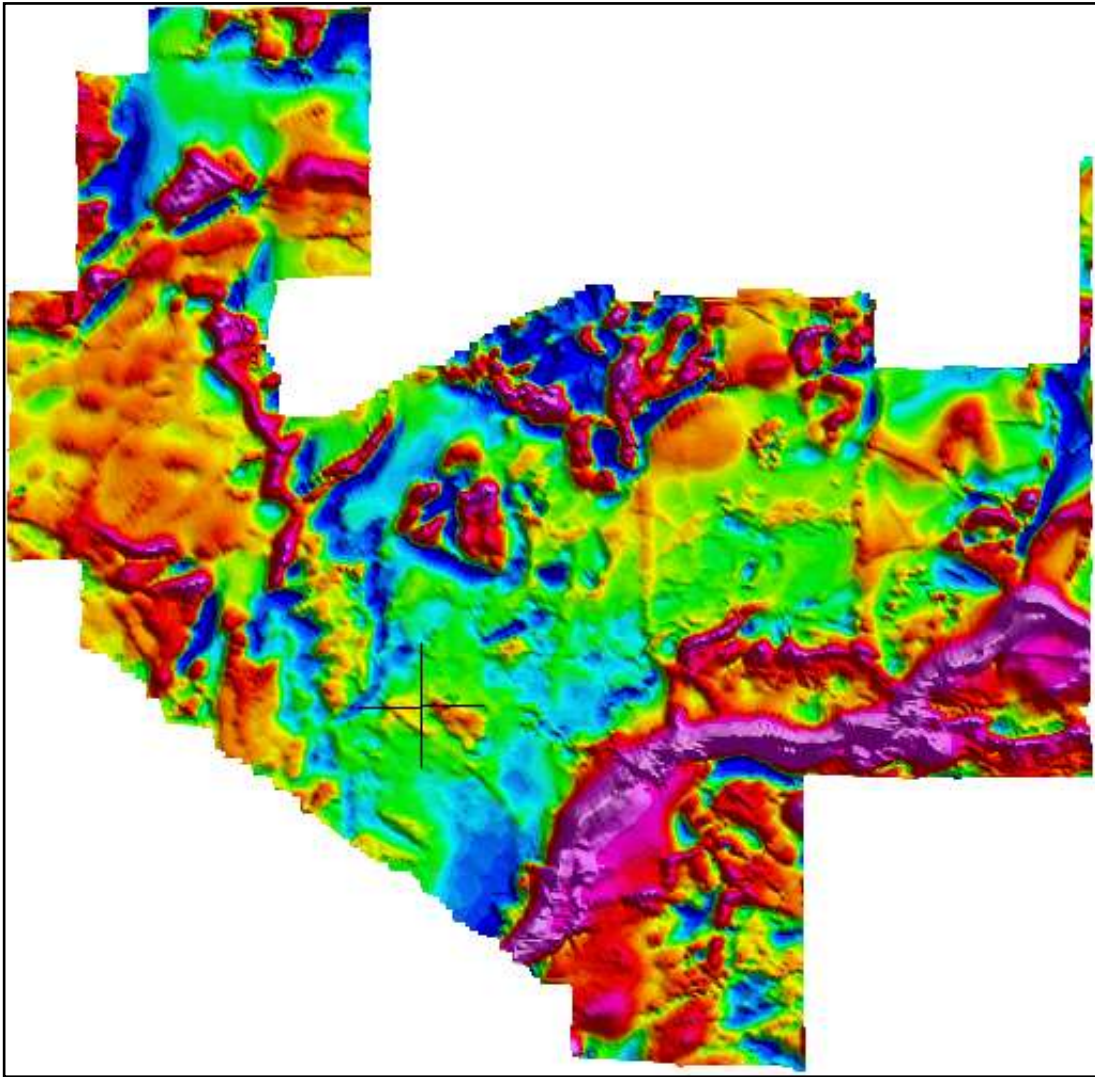


Figure 3.2.9 *BHP Billiton aeromagnetic image: “Yzermyn”, located close to Heilbron.
Image resolution: cell size of 15 m.*

3.3 Sasol

Sasol merged all of its aeromagnetic datasets into a single dataset a few years ago. This made it an uncomplicated dataset to use for this project. The Sasol dataset consists of a Geosoft format first vertical derivative magnetic image grid. The grid cell size for this data set is 25 m. The locality of the Sasol aeromagnetic image is shown in Figure 3.3.1.

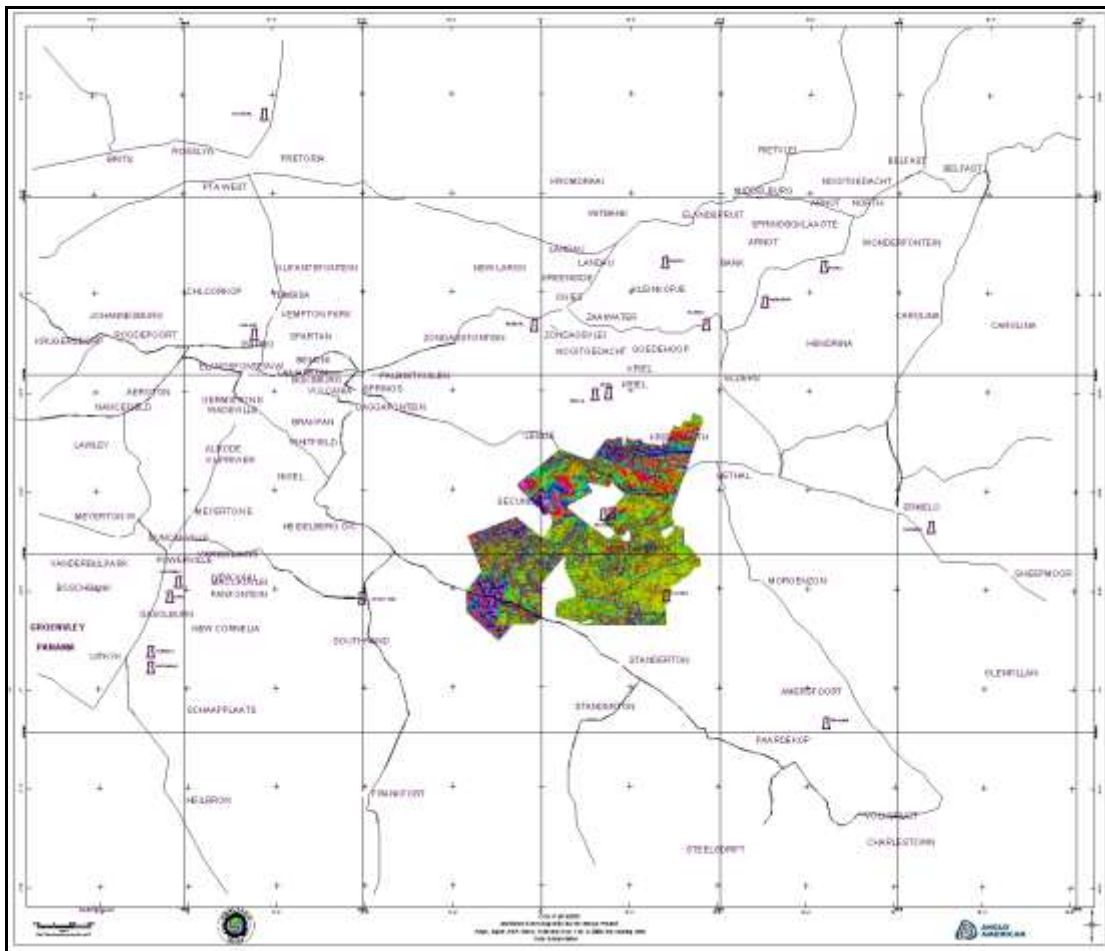


Figure 3.3.1 Locality of the merged Sasol aeromagnetic surveys

A colour image of the Sasol aeromagnetic data covering the Secunda area is displayed in Figure 3.3.2. The area covered is approximately 60 km by 53 km.

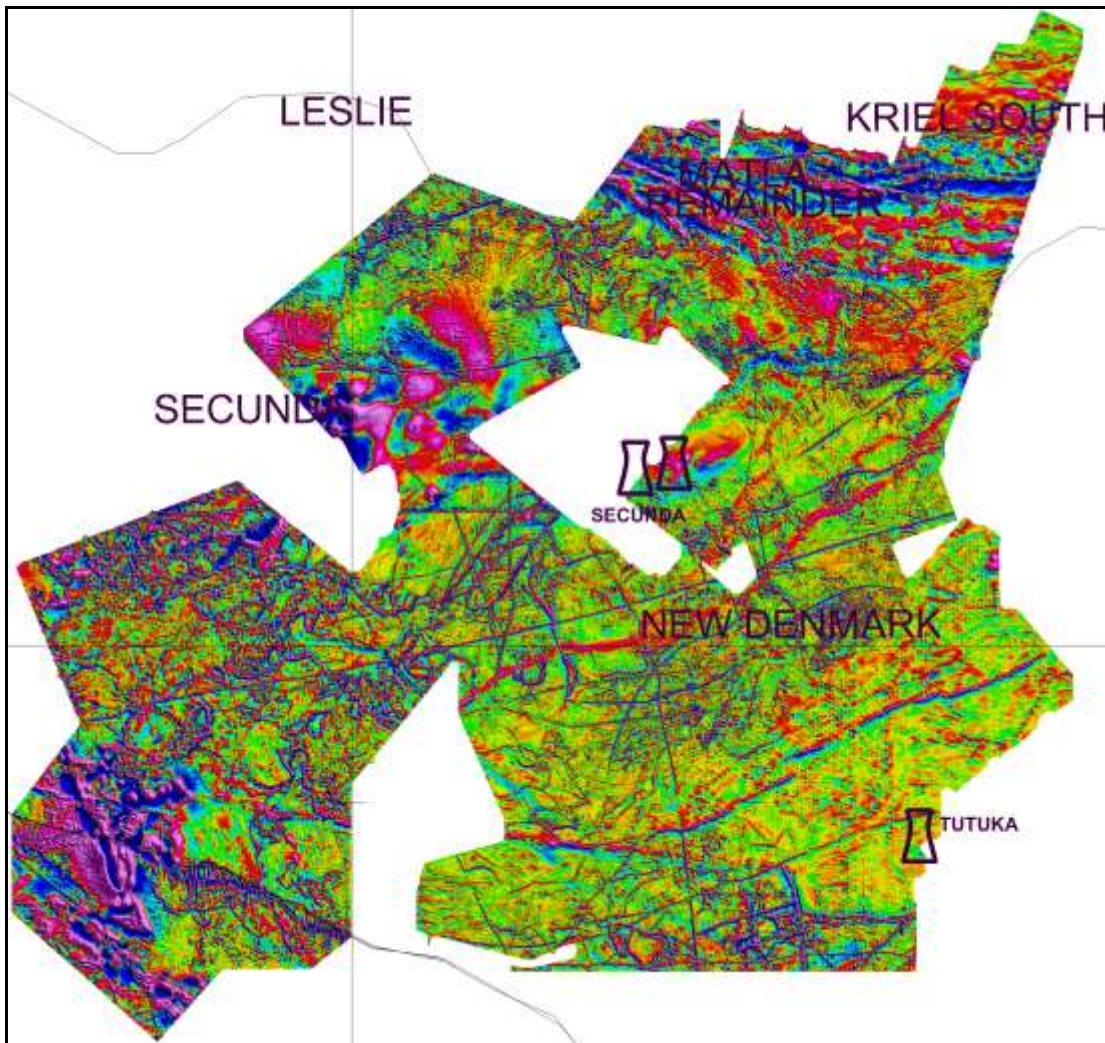


Figure 3.3.2 Sasol aeromagnetic data

3.4 Total Coal RSA

Total Coal RSA submitted seven sets of aeromagnetic data. These datasets were acquired at different times, resolutions and line orientations, which often overlapped completely. The magnetic data were acquired using standard helicopter aeromagnetics as well as Dighem surveys. The reason that various surveys covered the same area was that this enabled them to capitalise on the advantages provided by ever evolving or new airborne geophysical technologies. Total Coal RSA's aeromagnetic images are displayed in Figure 3.4.1.

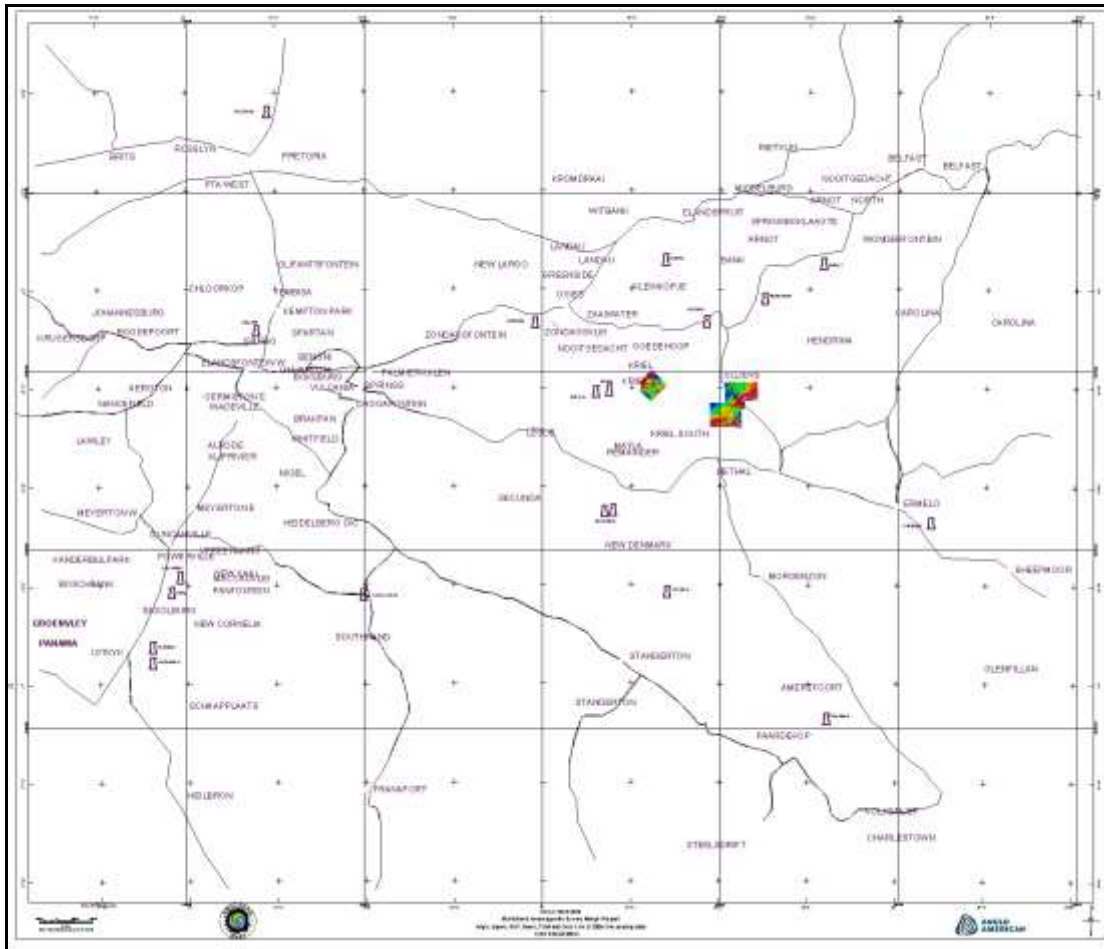


Figure 3.4.1 Total Coal RSA aeromagnetic data coverage

The Total Coal RSA aeromagnetic survey image names, resolutions as well as figure numbers are listed in Table 3.4.1 below.

Table 3.4.1 List of the Total Coal RSA aeromagnetic surveys

Survey name	Location	Image Resolution cell size in metres	Figure number
Bethal 1995	Kriel (East)/ Bethal	15	3.4.2
Dorstfonteinmag1	Kriel	15	3.4.3
Dorstfonteinmagnetic2	Kriel	15	3.4.4
Forzandomag1	Kriel	15	3.4.5
Forzmagl	Kriel	15	3.4.6
Koppiemagcol	Kriel	15	3.4.7

The Total Coal RSA aeromagnetic images are displayed in figures 3.4.2 to 3.4.7.

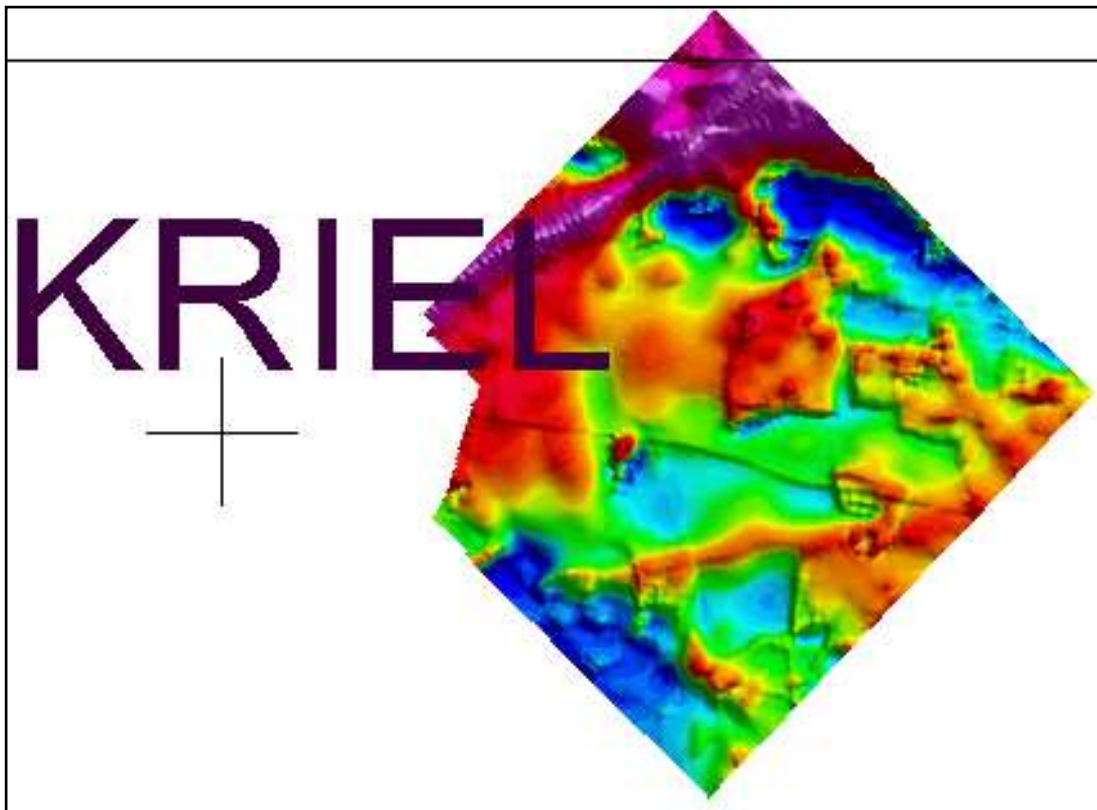


Figure 3.4.2 Total Coal RSA aeromagnetic image: “Bethal 1995”, situated close to Kriel. Image resolution: cell size of 15 m.

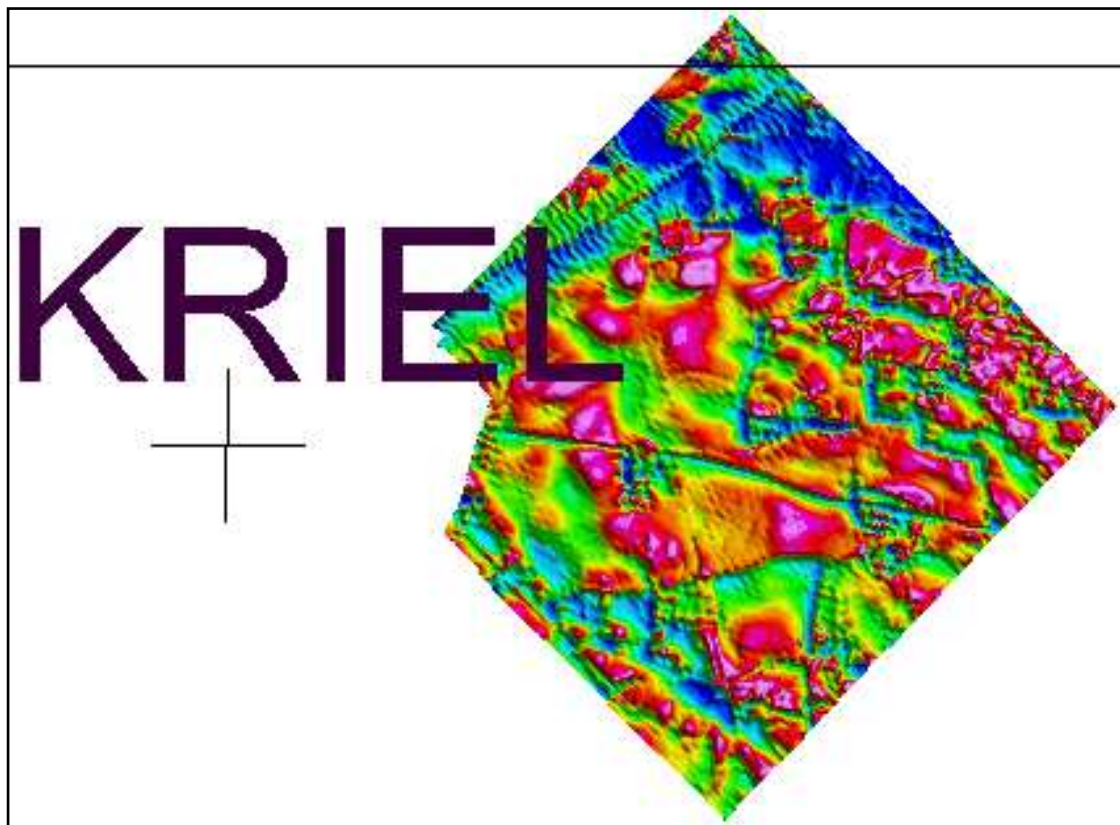


Figure 3.4.3 Total Coal RSA aeromagnetic image: “Dorstfonteinmag1”, situated in the Kriel area. Image resolution: cell size of 15 m.

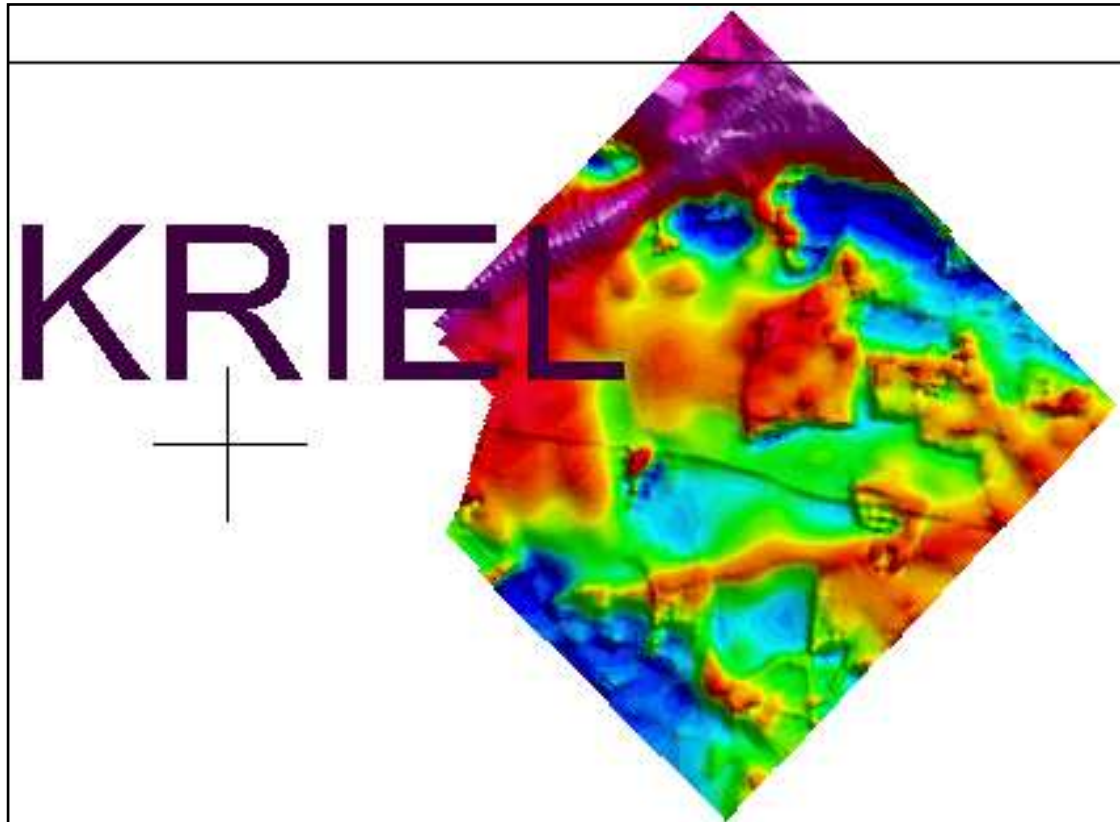


Figure 3.4.4 Total Coal RSA aeromagnetic image: “Dorstfonteinmagnetic2”, situated in the Kriel area. Image resolution: cell size of 15 m.

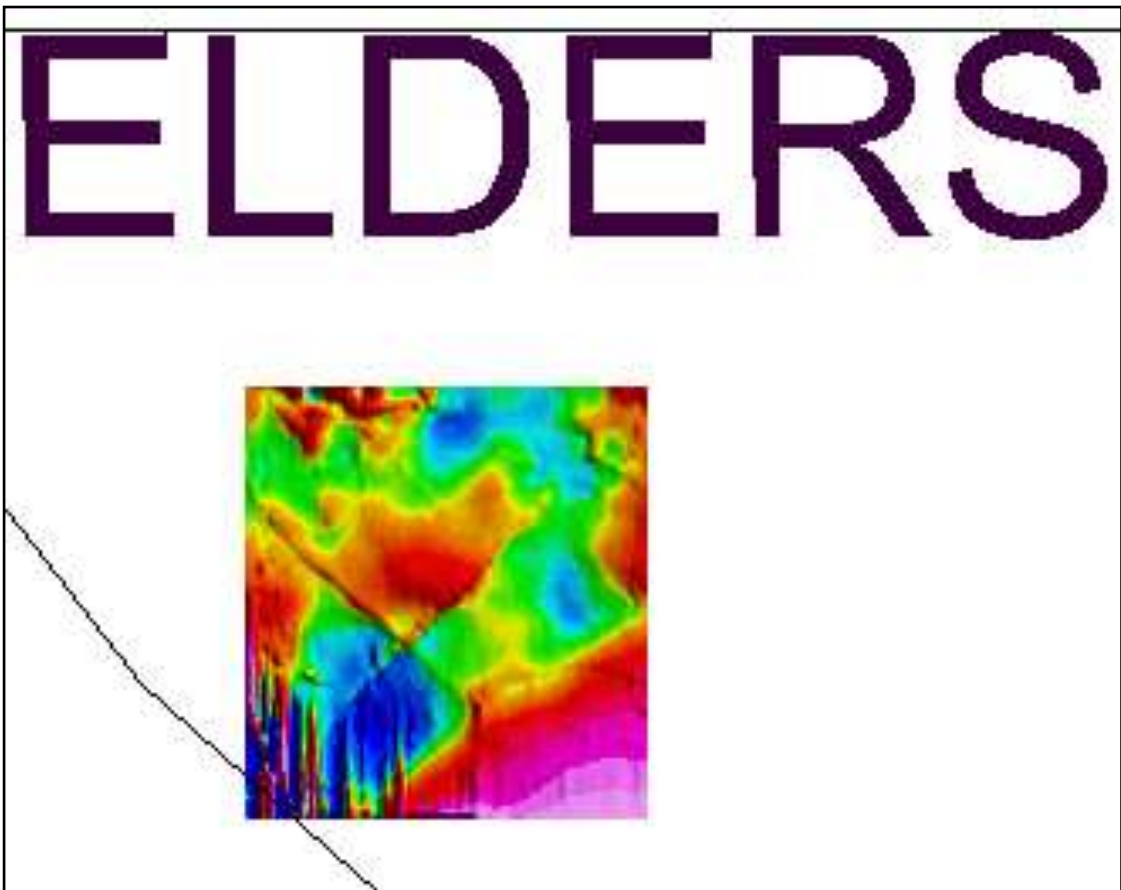


Figure 3.4.5 Total Coal RSA aeromagnetic image: “Forzandomag1”, situated in the Kriel area. Image resolution: cell size of 15 m.

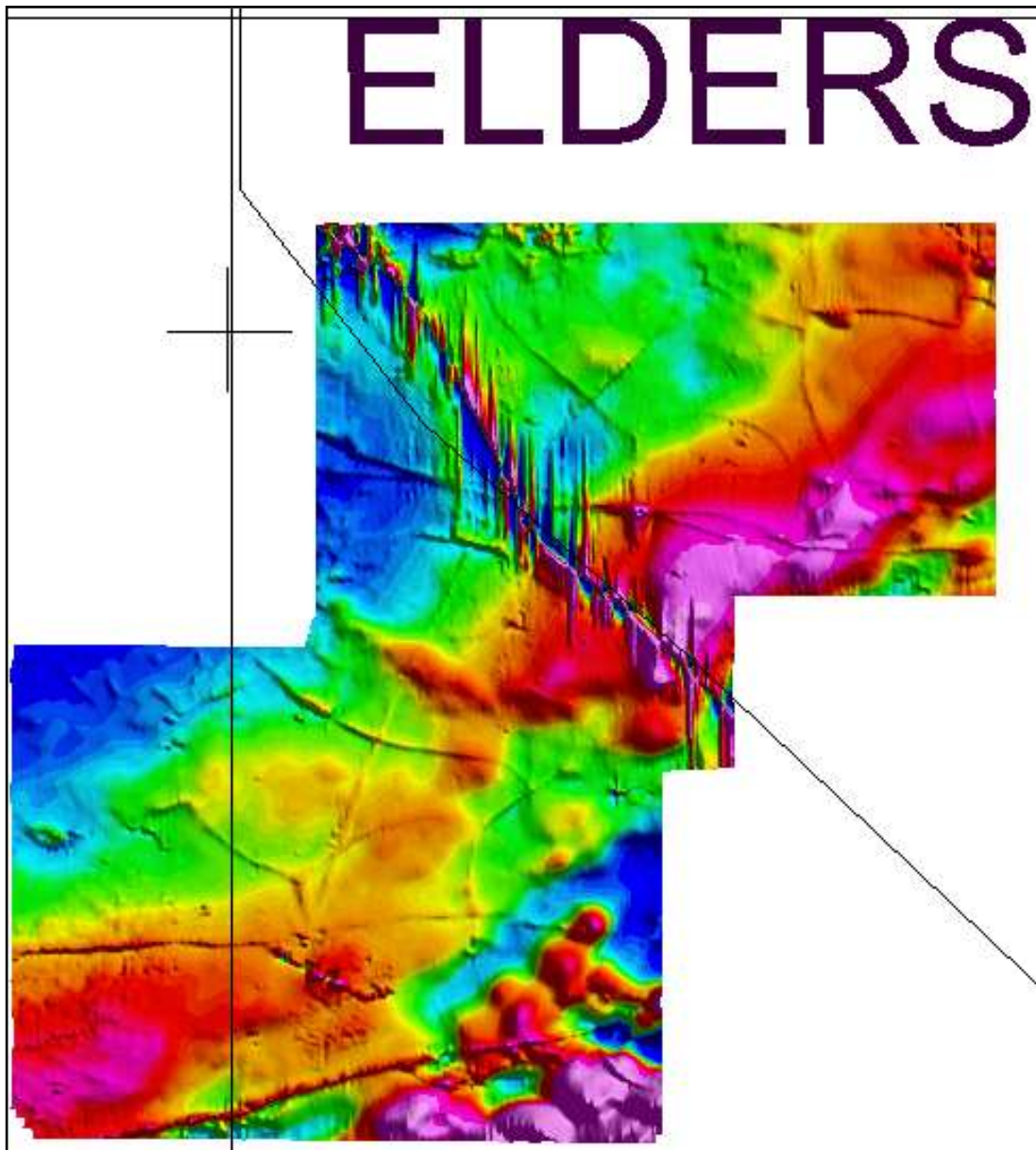


Figure 3.4.6 Total Coal RSA aeromagnetic image: “Forzmagl”, situated in the Kriel area.
Image resolution: cell size of 15 m.

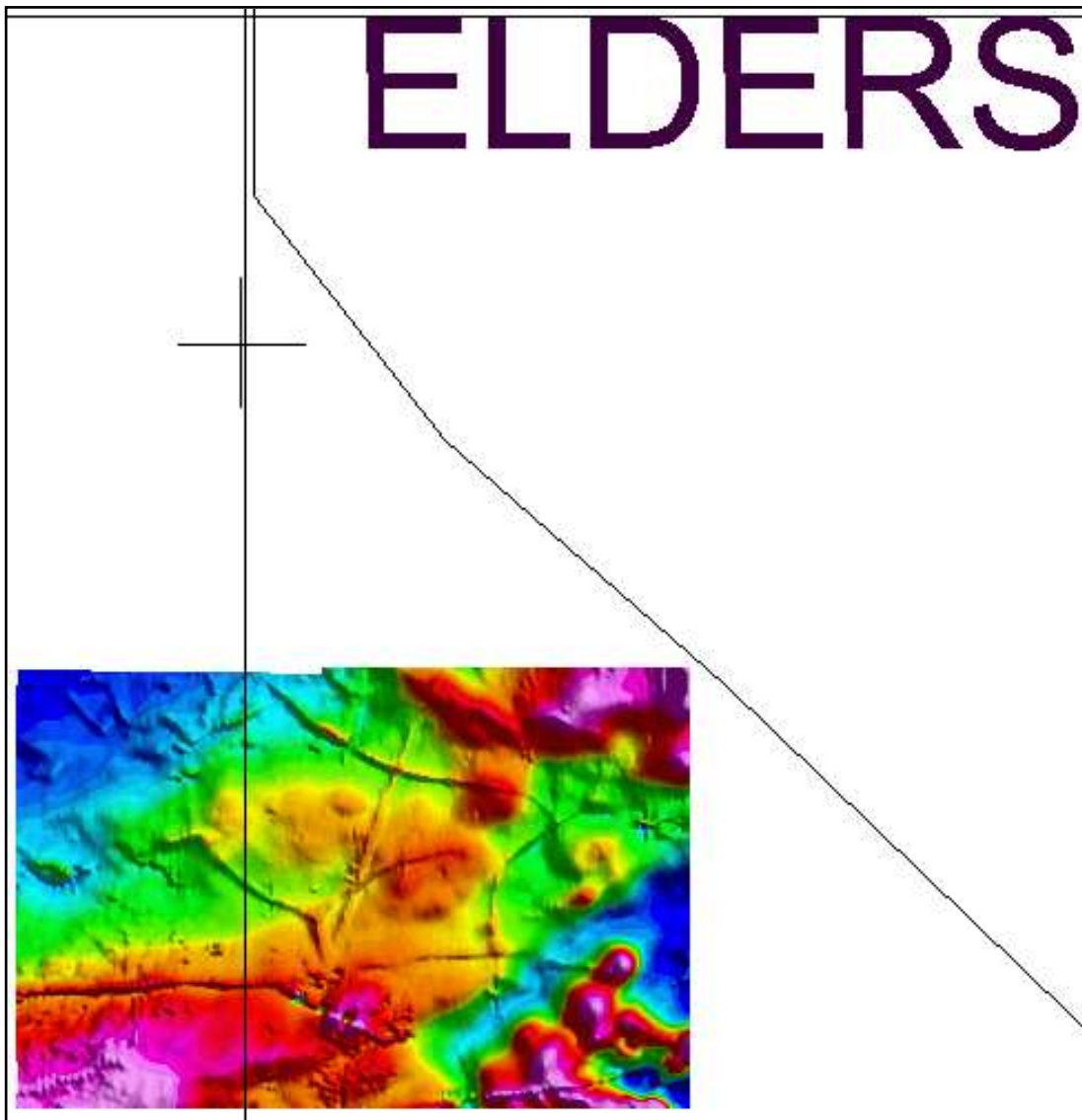


Figure 3.4.7 Total Coal RSA aeromagnetic image: “Koppiemagcol”, situated in the Kriel area. Image resolution: cell size of 15 m.

3.5 Government/Council for Geoscience

An image of the Government/Council for Geoscience’s regional 1 km line-spacing data is presented in Figure 3.5.1.

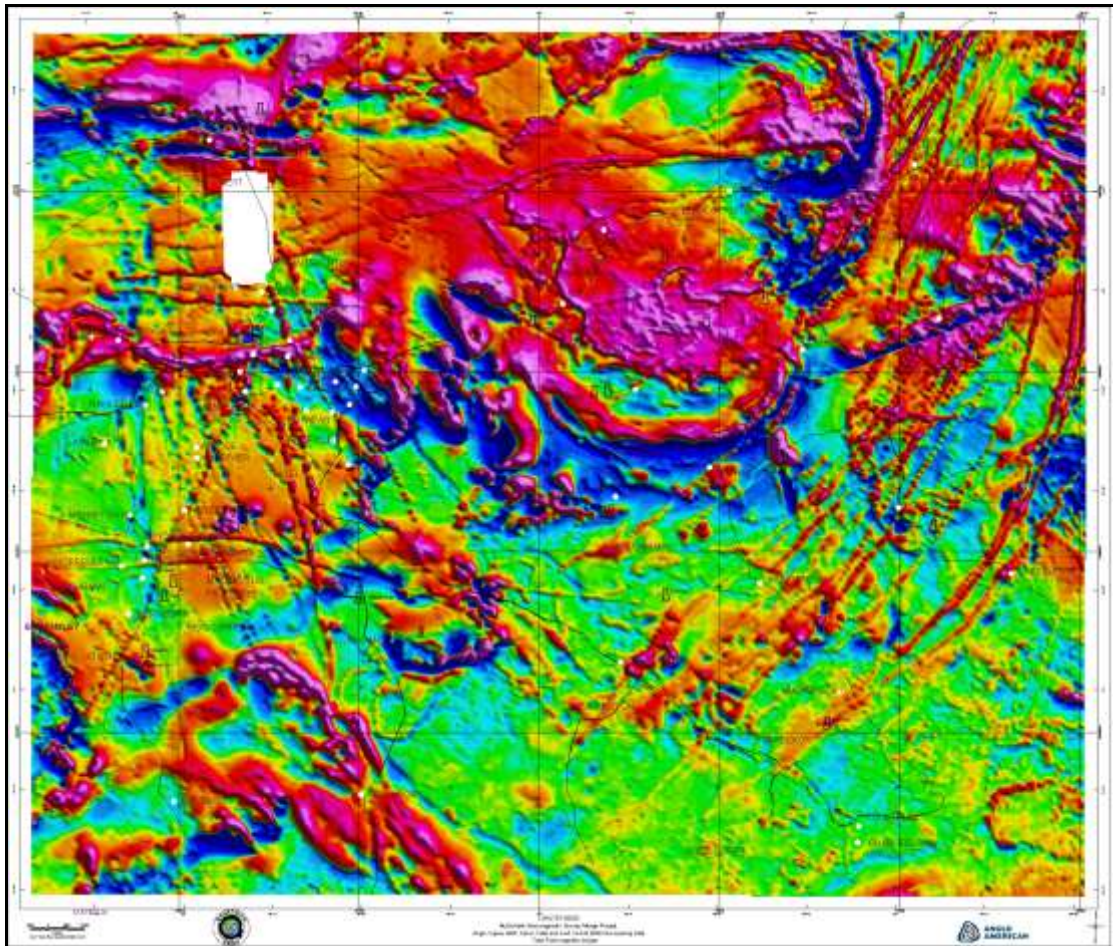


Figure 3.5.1 Council for Geoscience 1 km line-spacing regional (country) total field magnetic image

An image of the 200 m line-spacing Government/Council for Geoscience data is displayed in Figure 3.5.2.

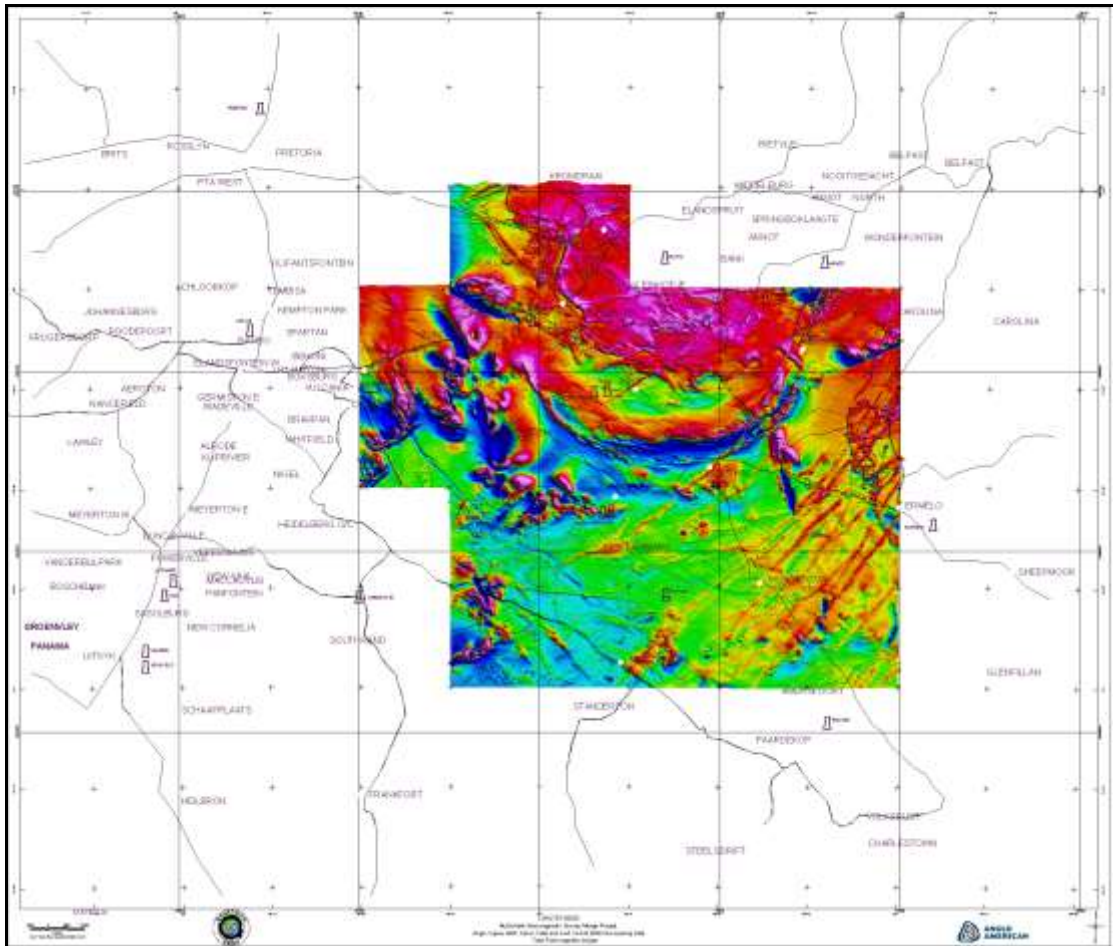


Figure 3.5.2 Council for Geoscience 200 m line-spacing total field magnetic image for the Witbank area

A magnified image of the 200 m line-spacing aeromagnetic data provided by the Council for Geoscience is presented in Figure 3.5.3.

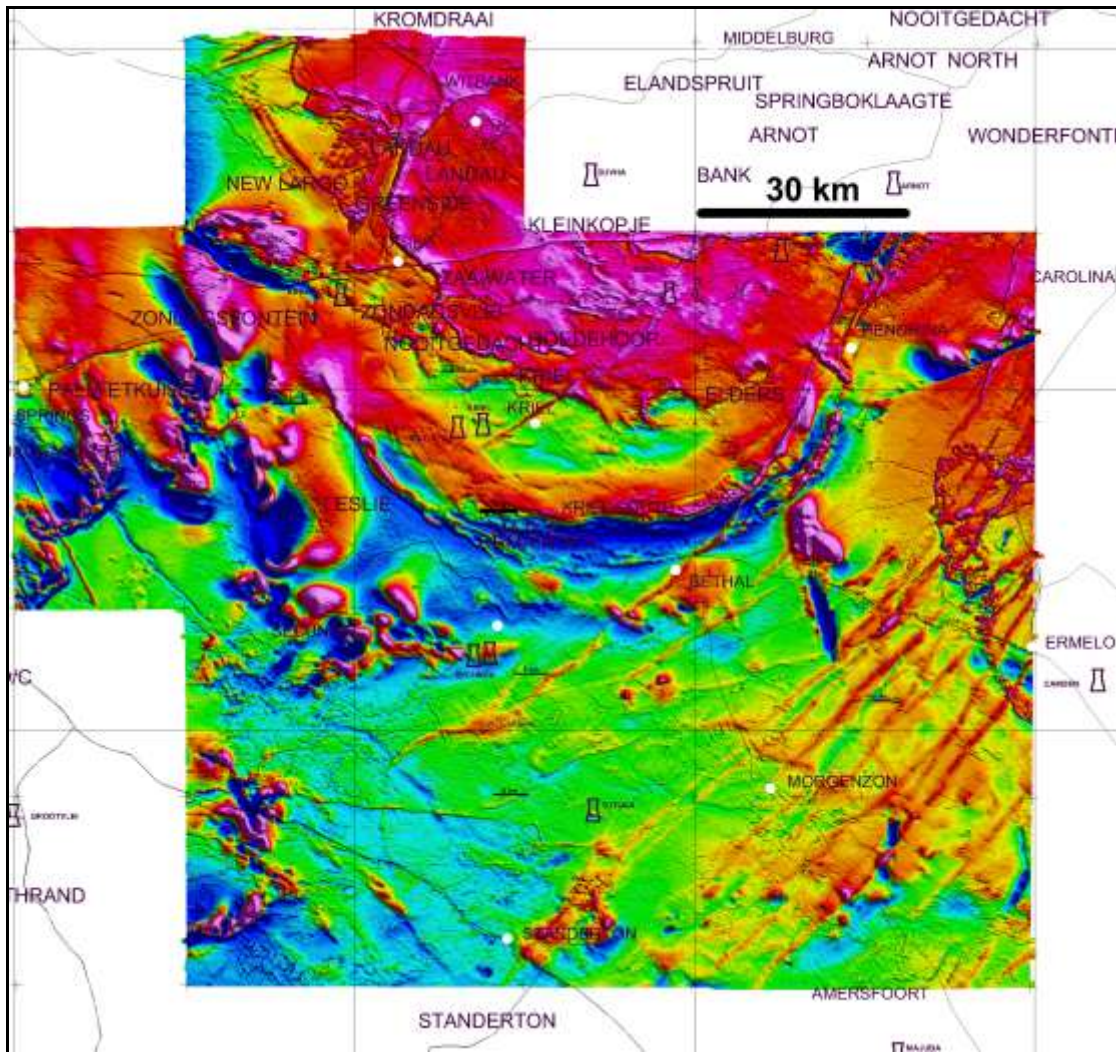


Figure 3.5.3 Council for Geoscience 200 m line-spacing total field magnetic image for the Witbank area, magnified

A digital elevation model (DEM), derived from the GPS height and aircraft radar altimeter data was delivered with the 200 m line-spacing aeromagnetic data. This DEM is not totally accurate and reflects relative elevation changes only. It is not advisable to use this DEM for navigation or detailed planning purposes. The DEM is displayed in Figure 3.5.4.

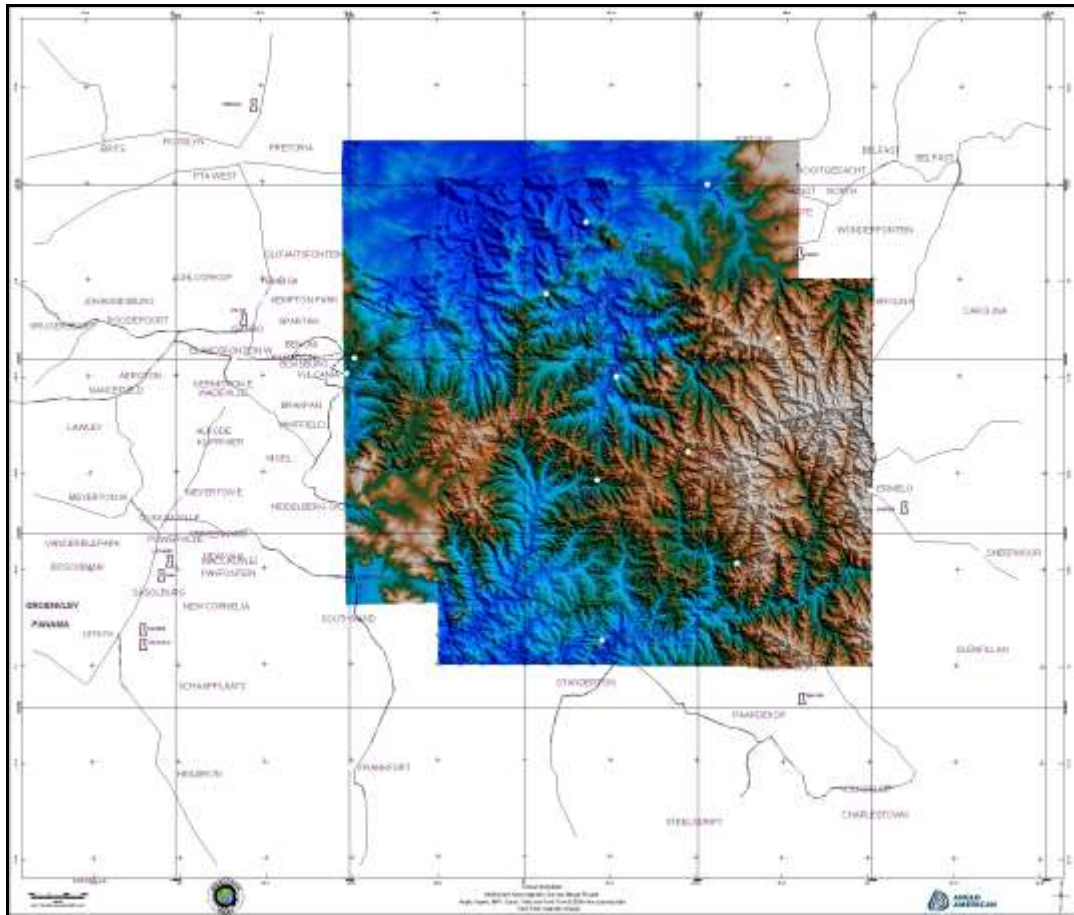


Figure 3.5.4 Council for Geoscience 200 m line-spacing pseudo-digital elevation model, derived from the GPS height and aircraft radar altimeter, for the Witbank area

4 COMBINED PRODUCTS

A total field magnetic colour image of all the aeromagnetic data supplied by the Coaltech 2020 participants only is displayed in Figure 4.1.

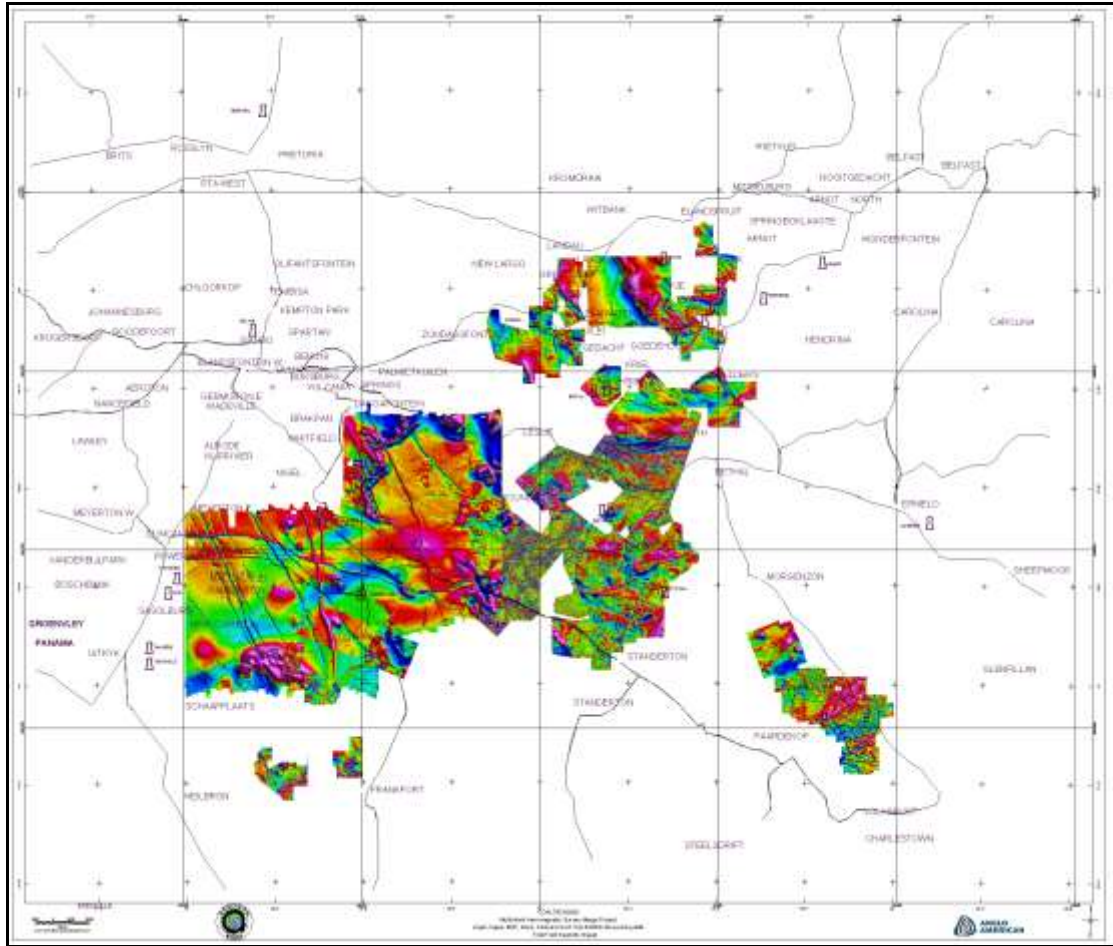


Figure 4.1 *Total field magnetic colour image – data supplied by Coaltech 2020 participants only*

A greyscale image of the first vertical derivative magnetic data from the Coaltech participants only is displayed in Figure 4.2.

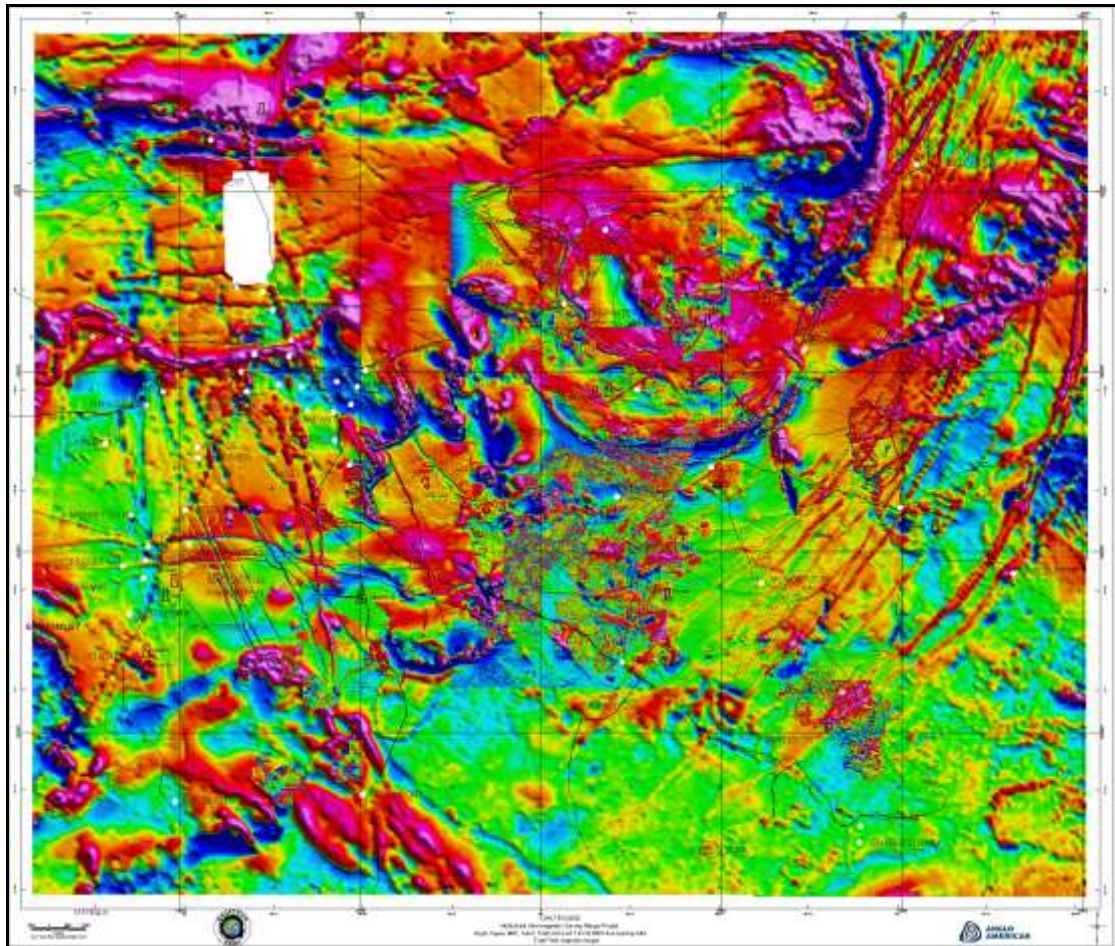


Figure 4.3 *Total field aeromagnetic image – all surveys*

A combined first vertical derivative greyscale image for all the data is displayed in Figure 4.4.

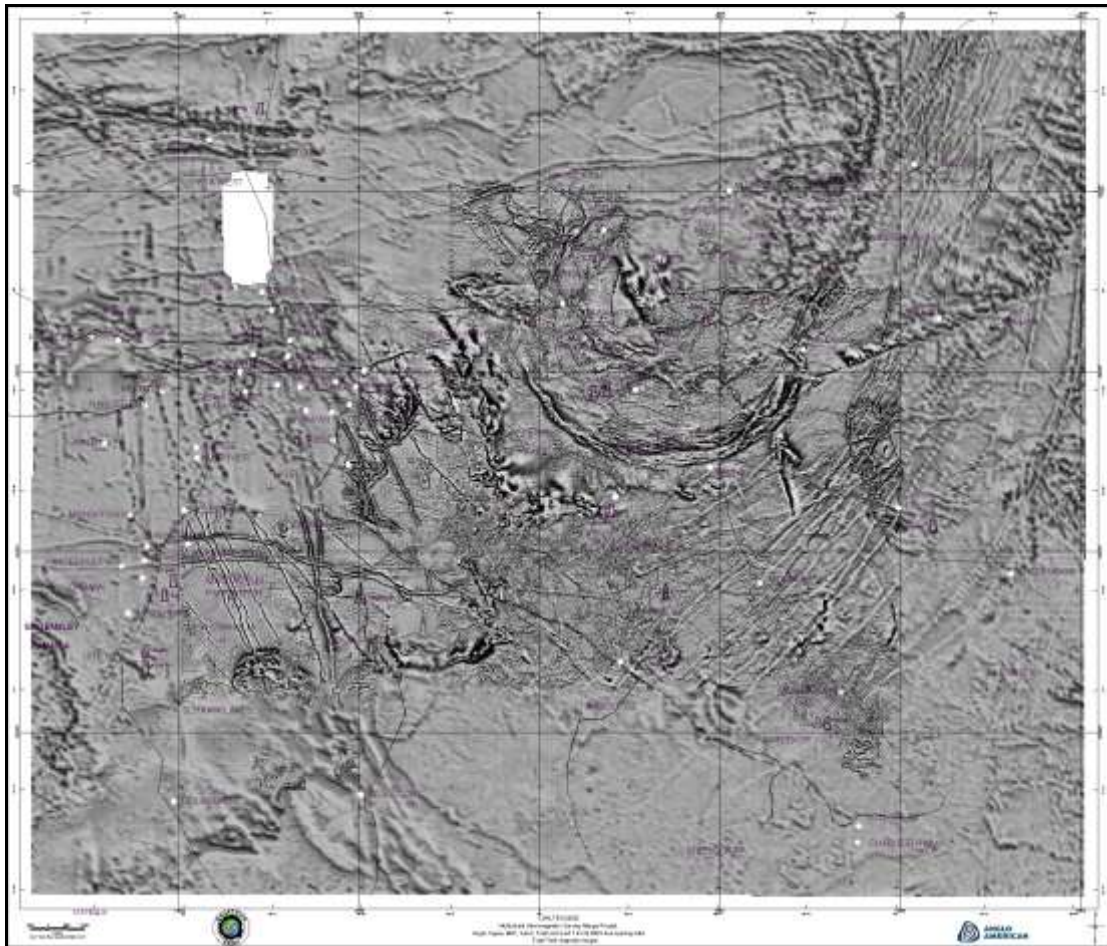


Figure 4.4 *First vertical derivative aeromagnetic image – all surveys*

5 DYKE INTERPRETATION

A lineament or dyke interpretation (Figure 5.1) was carried out using all the available aeromagnetic datasets. Some of the interpreted lineaments or dykes could, however, be of cultural origin or caused by sill edges.

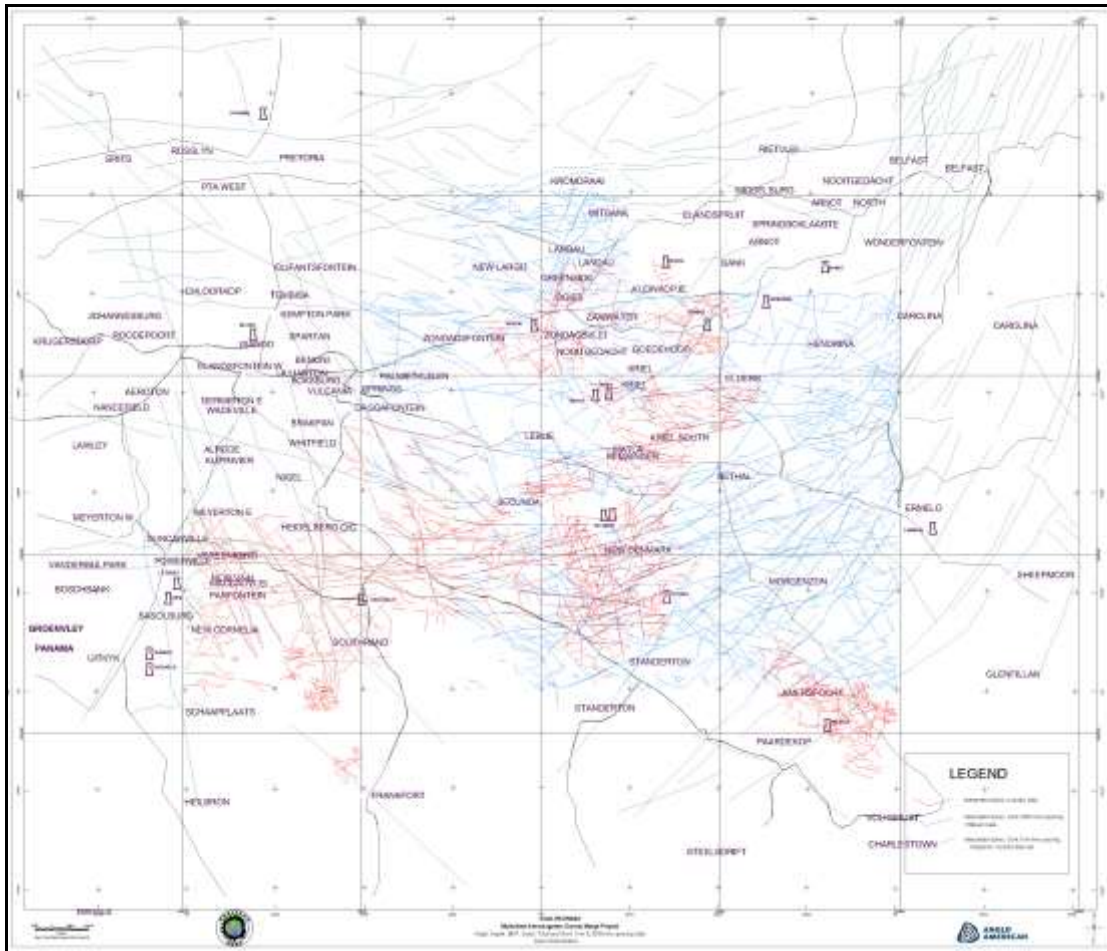


Figure 5.1 Dyke or lineament interpretation for all available aeromagnetic datasets

6 CONCLUSION AND RECOMMENDATIONS

It can be concluded that this project was highly successful in providing useful and cost-effective geological and geophysical datasets. This project is also an excellent example of the benefits that can be achieved through government and industry collaboration in projects such as those in Coaltech 2020.

The main benefit of this project is that the Coaltech 2020 participants will be able to trace magnetically susceptible dykes on their properties, using the aeromagnetic and dyke interpretation dataset that covers most coal mining operations and exploration areas. Mining companies could potentially also identify previously unknown dykes.

Pre-knowledge of a dyke in the underground workings is valued at approximately R15 million by Total Coal South Africa. This is the costs associated with coming across an unknown dyke – i.e. costs for standing time, mining through the dyke, re-planning and redesign of the mining panels etc. This project highlighted the traces of approximately 1200 dykes, which equates to an approximately R18 000 million benefit to the South African Coaltech 2020 participants when using the above approximation.

For opencast mines the estimated mining cost associated with negotiating an unforeseen dyke will be less than in the case of underground operations. However, even for opencast mines encountering an unexpected dyke probably costs millions of rand due to loss of reserves resulting from burning or potential increases in the depth of weathering that devalues the coal quality. Also, where opencast operations currently exist, deeper, thinner coal seams may be extracted in future. The information produced by this project may provide pre-knowledge of such dykes, which at deeper levels may have an even higher value than Total Coal's R15 million estimate.

Potential future research topics resulting from this Coaltech 2020 project are listed below. These topics could, for example, be ideal MSc or PhD study topics.

- Palaeomagnetic investigation – By collecting orientated samples from dykes for palaeomagnetic analysis age relationships could be determined and that could be used to do accurate dip modelling of the dykes.
- Hydrology - The dyke dataset could provide the framework for a study to better understand the hydrology of the Witbank coalfield.
- Environmental - The dyke dataset could provide the framework for a study to better understand the possible migration routes of pollution plumes.
- Structural Geology - Clear regional structural trends are visible from the dyke interpretation that could also be valuable for mine planning for new mines. This dyke

map could allow a structural geologist to determine regional stress fields and assist in optimising the mine layout to ensure minimum stress fields for safer mining.

A similar project to this aeromagnetic project could be carried out in order to collate other available remote sensing / airborne data sets such as:

- Quickbird
- Landsat TM
- Thermal imagery
- Radiometrics
- Dighem

In addition to this, other areas of interest could be motivated to the Council for Geosciences for coverage with higher resolution airborne geophysics (~ 200 m line spacing) than is currently available (1 km line spacing). Such areas may include:

- Arnot
- Waterberg
- Free State
- Natal

It has to be stressed that only magnetic susceptible dykes have been mapped with the aeromagnetic data sets. In some areas it is known that up to 50 per cent of the dykes are non-magnetic.

Airborne electromagnetic surveys (Dighem), has been proven in the past to be able to detect up to 50 per cent of the non-magnetic dykes in the Kriel / Bethal area. It should therefore be considered to do a regional scale airborne electromagnetic survey (Dighem) that is co-funded by the government and the coal industry.

APPENDIX A LIST OF DELIVERABLES

- A) A set of hardcopies (A0 size) has been delivered to all Coaltech 2020 participants with the report. The hard copies include the following.

High quality glossy photo paper

1. Total field magnetic image - colour – (all datasets)
2. First vertical derivative magnetic image – greyscale – (all datasets)
3. Total field magnetic image - colour – Industry only
4. First vertical derivative magnetic image – greyscale – Industry only

Paper plots

5. Outlines of the survey areas / data coverage from government and industry
6. Dyke interpretation from all the available data sets

- B) The data has also been provided in digital GIS compatible format on CD.

- The images as Geotiffs (georeferenced tiffs)
- The line data (dyke interpretations, survey outlines, towns, power stations etc. in DXF and Arcview / ArcGIS shapefile format)

- C) LIST OF CDs:

CD1:

ARC_SHAPEFILES & DXF

- Dykes,
- Survey outlines,
- regional GIS data (towns, power stations etc.)

GEOTIFFS1

- Government 1 km line spacing image
- Government 200 m line spacing image
- Sasol images
- Total Coal RSA images

POWERPOINT PRESENTATION

CD2:

GEOTIFFS2

- Anglo Coal images
- BHP-Ingwe images
- Combined images1
 - + First vertical derivative (1vd) Industry image
 - + First vertical derivative (1vd) Industry map

CD3:

GEOTIFFS3

- Combined images2
 - + Total field magnetic (TFM) Industry image
 - + Total field magnetic (TFM) Industry map

CD4:

GEOTIFFS4

- Combined images3
 - + First vertical derivative (1vd) All image
 - + First vertical derivative (1vd) All map

CD5:

GEOTIFFS5

- Combined images4
 - + Total field magnetic (TFM) All image

CD6:

GEOTIFFS6

- Combined images5
 - + Total field magnetic (TFM) All map

CD7:

GEOSOFT GRIDS

- Anglo
- BHP-Ingwe
- Sasol
- Total Coal
- Government