



# GRAVITY DATA INTERPRETATION FOR THE PURPOSE OF STRUCTURAL MAPPING

Presented by

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## OBJECTIVE OF THE STUDY

The present study aims to interpret the gravity data over a part of **central Sinai, Egypt** in order to detect the **subsurface structure** controlling the **surface stream segments**.

## GENERAL BACKGROUND

Sinai Peninsula is located at the northeastern part of Egypt. It has a triangular shape where its base is to the north extending along the Mediterranean coast and its apex is to the south at Ras Mohamed. It is bounded in the eastern side by the Gulf of Aqaba and the international border and in the west by the Gulf of Suez and the Suez Canal.



Fig.1 Map of Egypt showing the main geographical provinces .

# GENERAL BACKGROUND

## Geomorphological and Geological Background

The **southern part** of the Sinai Peninsula is consisting of a complex of **high mountains** (such as Gabel Sant Katherine) while its **central part** consists of two plateaus; **El-Tih and El-Egma plateaus** with northward sloping toward Wadi El Arish and the **northern portion** consists of **mountains and hills** separated from the Mediterranean Sea coast by long, parallel lines of dunes ( Said, 1962 ).

## Structural Background

The north central part of Sinai is characterized by the presence of **several domes** with little slope and symmetrical shapes namely **Syrian Arc Folding System** . This folding system is crossed by numerous strike slip and normal faults having different directions of Gulf of Suez ( NW-SE ) , Gulf of Aqaba ( NE-SW ) and Syrian arc system ( NEE-SWW) trends.

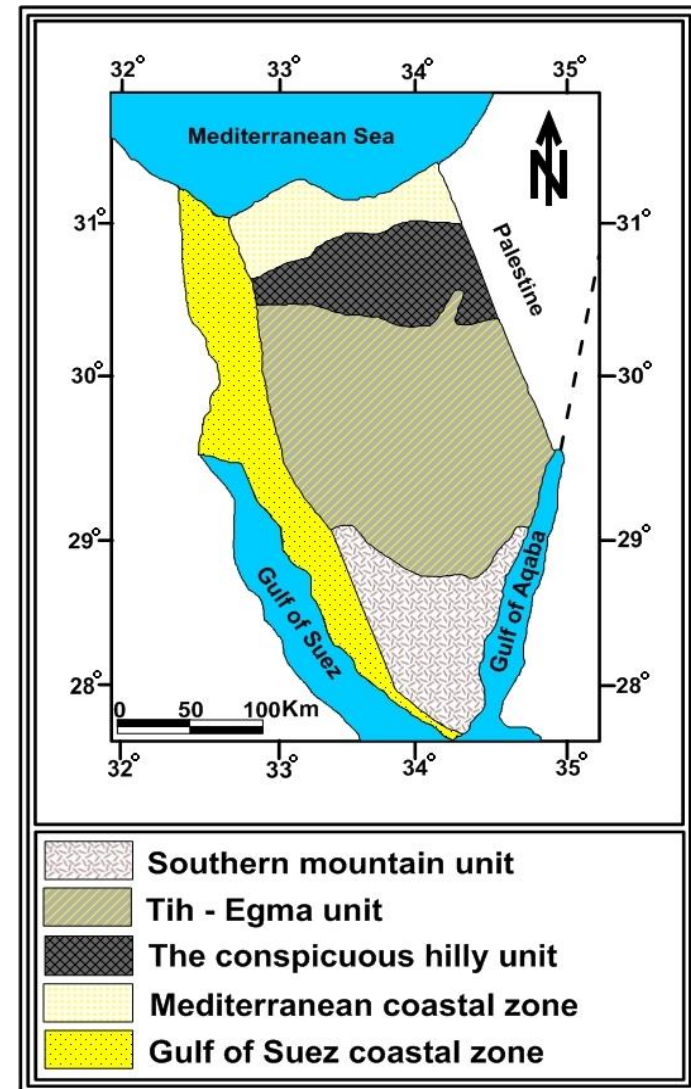


Fig.2 Geomorphological map of Sinai Peninsula.

## LOCATION OF THE STUDY AREA

The study area is located in Central Sinai between latitudes of 29° 15` N and 29° 43` N and longitudes of 33° 15` E and 34° E.

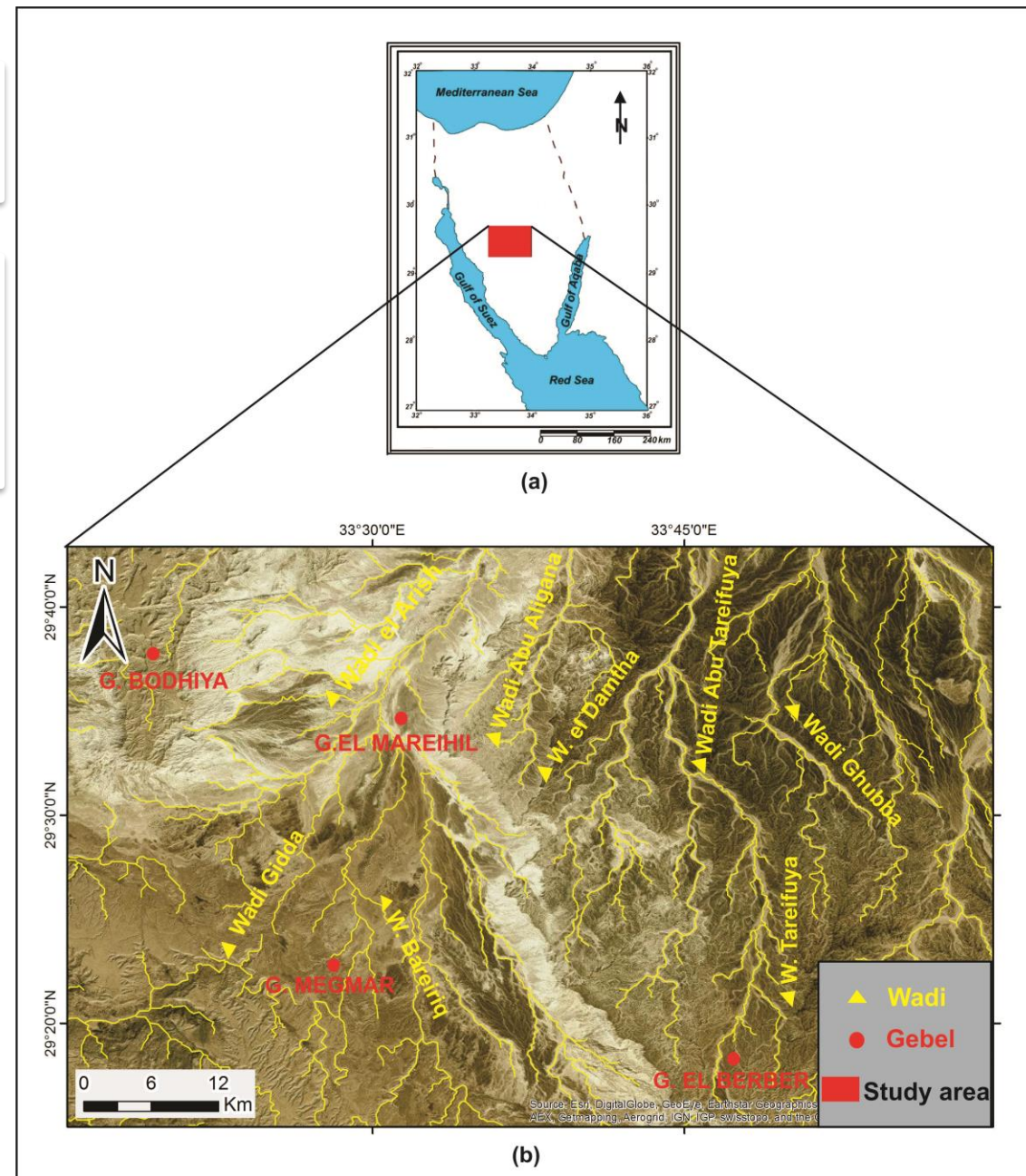


Fig.3 (a) Location map of the study area and (b) Land sat image showing the main stream segments of the study area.



# TOPOGRAPHY OF THE STUDY AREA

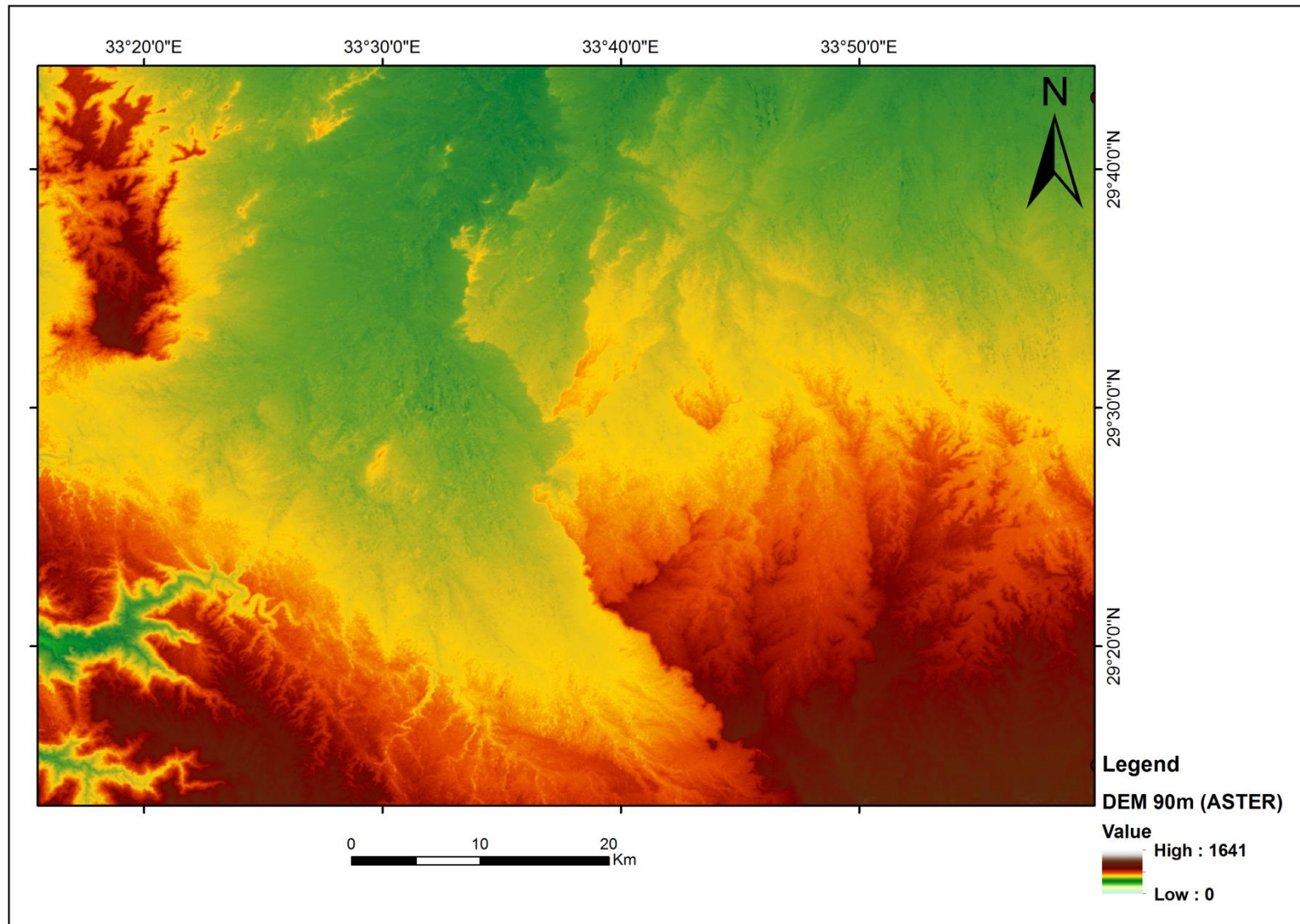


Fig.4 Digital Elevation Model (DEM) of the Study Area.

# SURFACE GEOLOGY

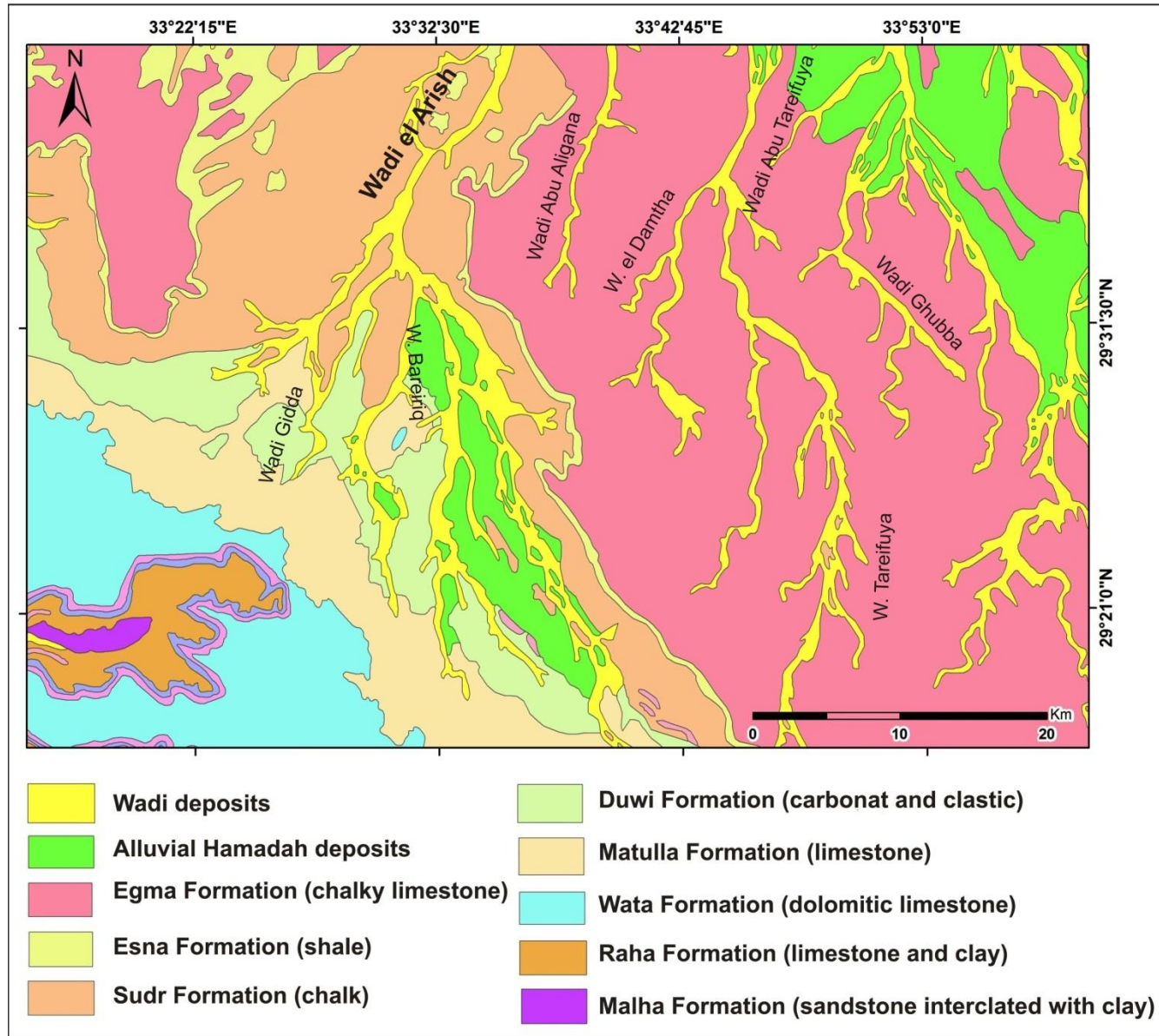


Fig.5 Geological map of the study area (modified after UNESCO, 2005).

# GRAVITY METHOD

## Gravity Data Acquisition

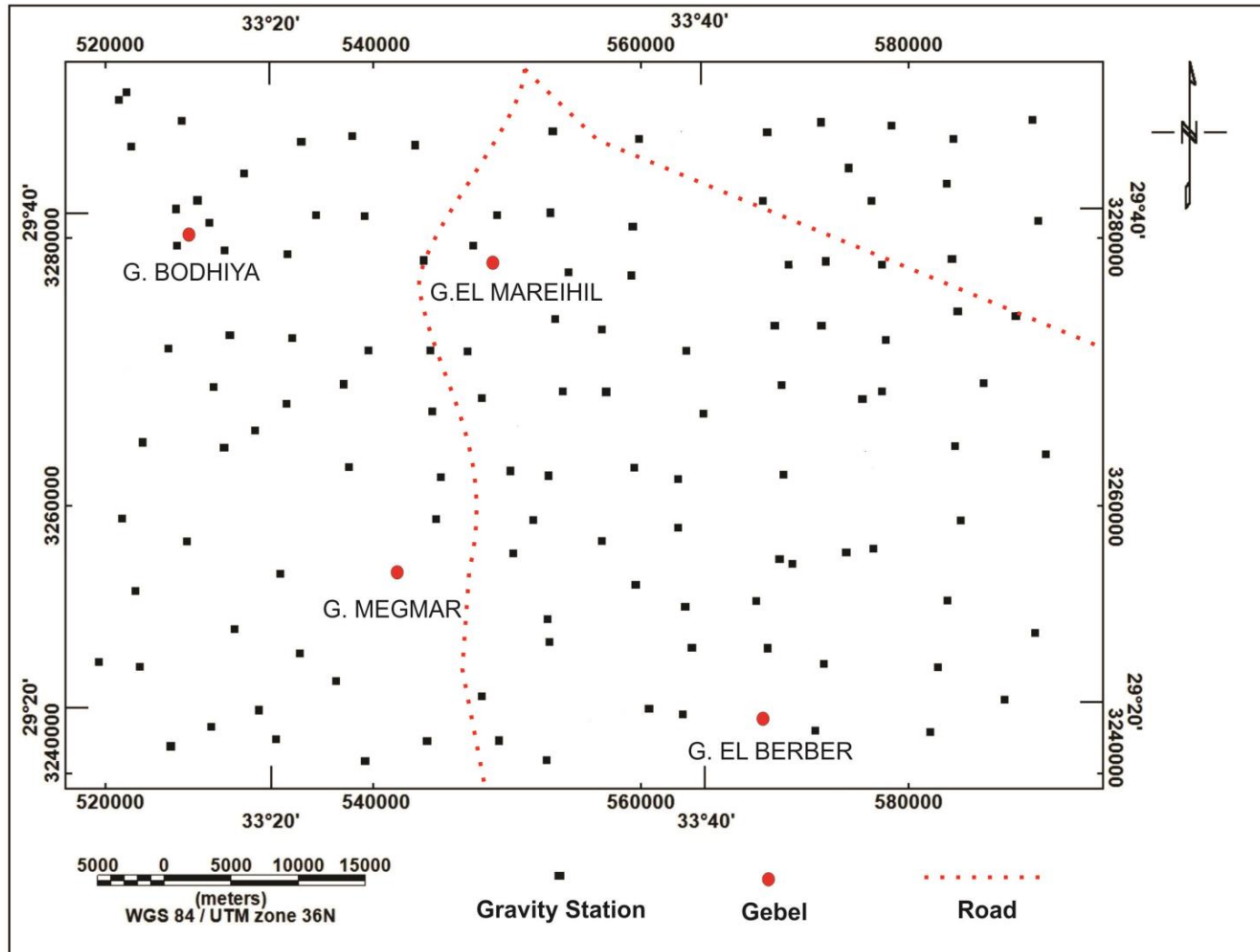
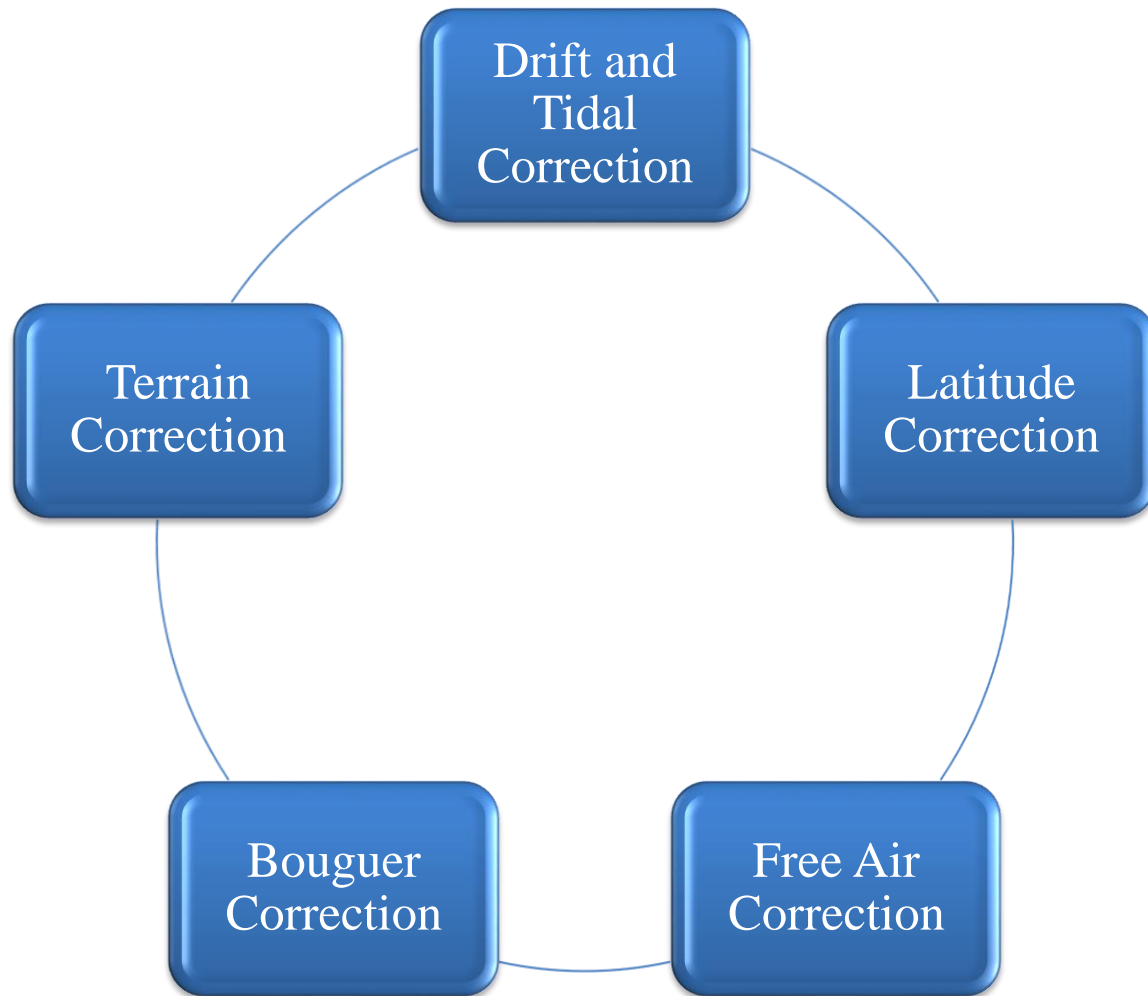


Fig.7 Distribution of the gravity stations in the study area.

# GRAVITY METHOD

## Gravity Data Corrections





# GRAVITY DATA INTERPRETATION

## ➤ Bouguer Gravity Anomaly Map

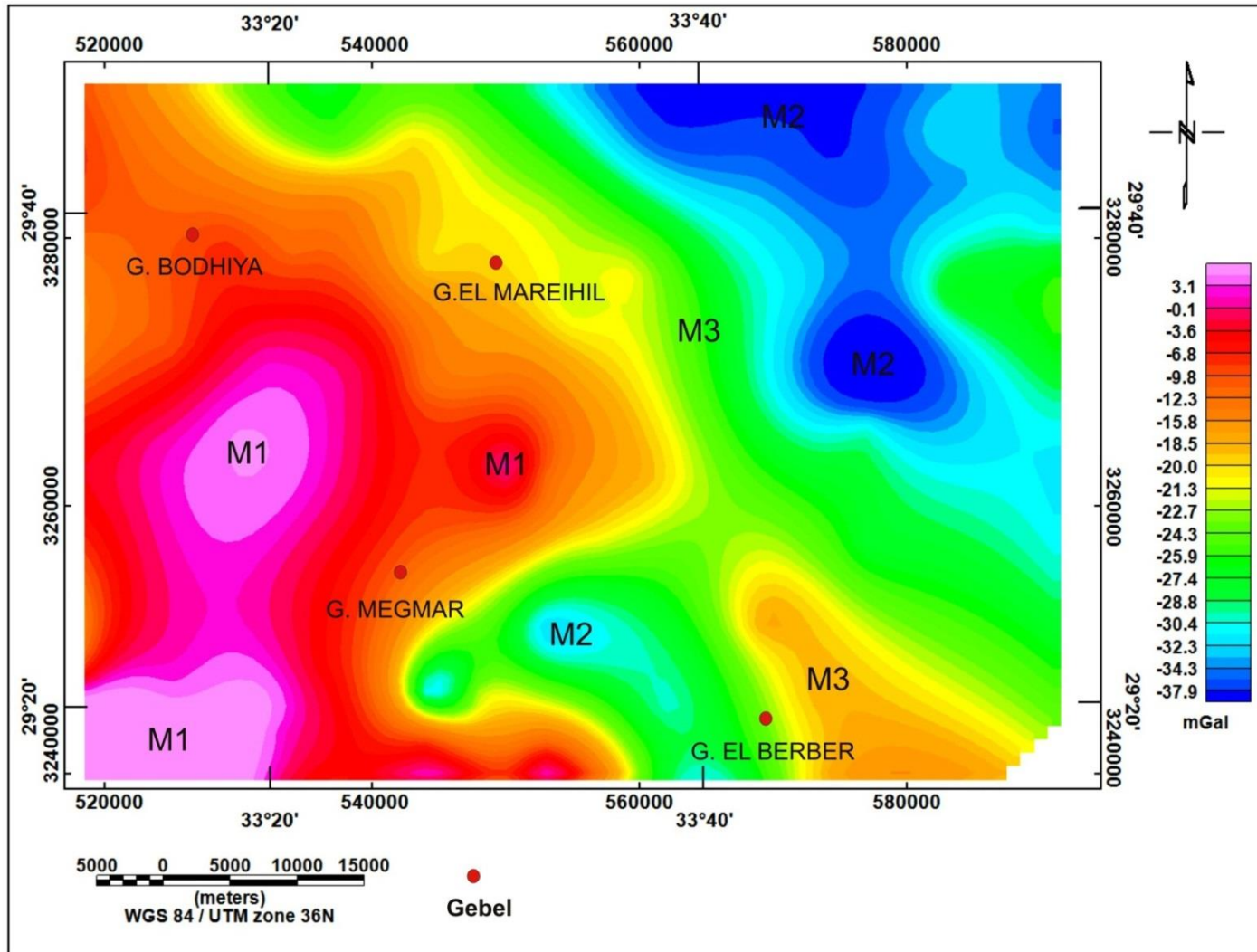
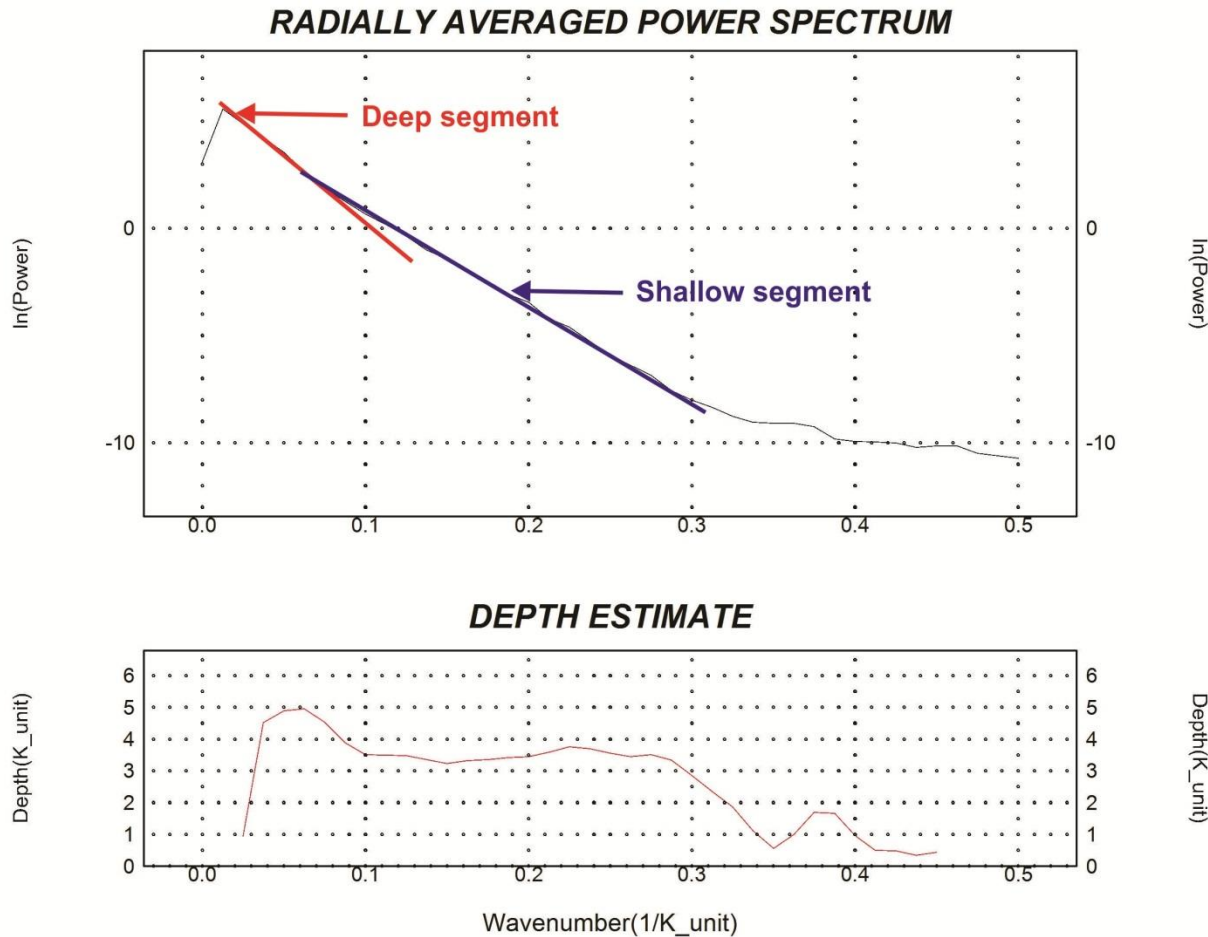


Fig.8 Bouguer gravity anomaly map.

# GRAVITY DATA INTERPRETATION

## ➤ Radially Averaged Power Spectrum Technique



$$H = -S / 4\pi$$

Where: H is the depth  
S is the slope  
of the log

The estimated average depths of the **shallow** and **deep** gravity sources are **1.5 km** and **4 km** respectively.

Fig.9 2D radially averaged power spectrum of the gravity data.

# GRAVITY DATA INTERPRETATION

## ➤ Regional Gravity Anomaly Map

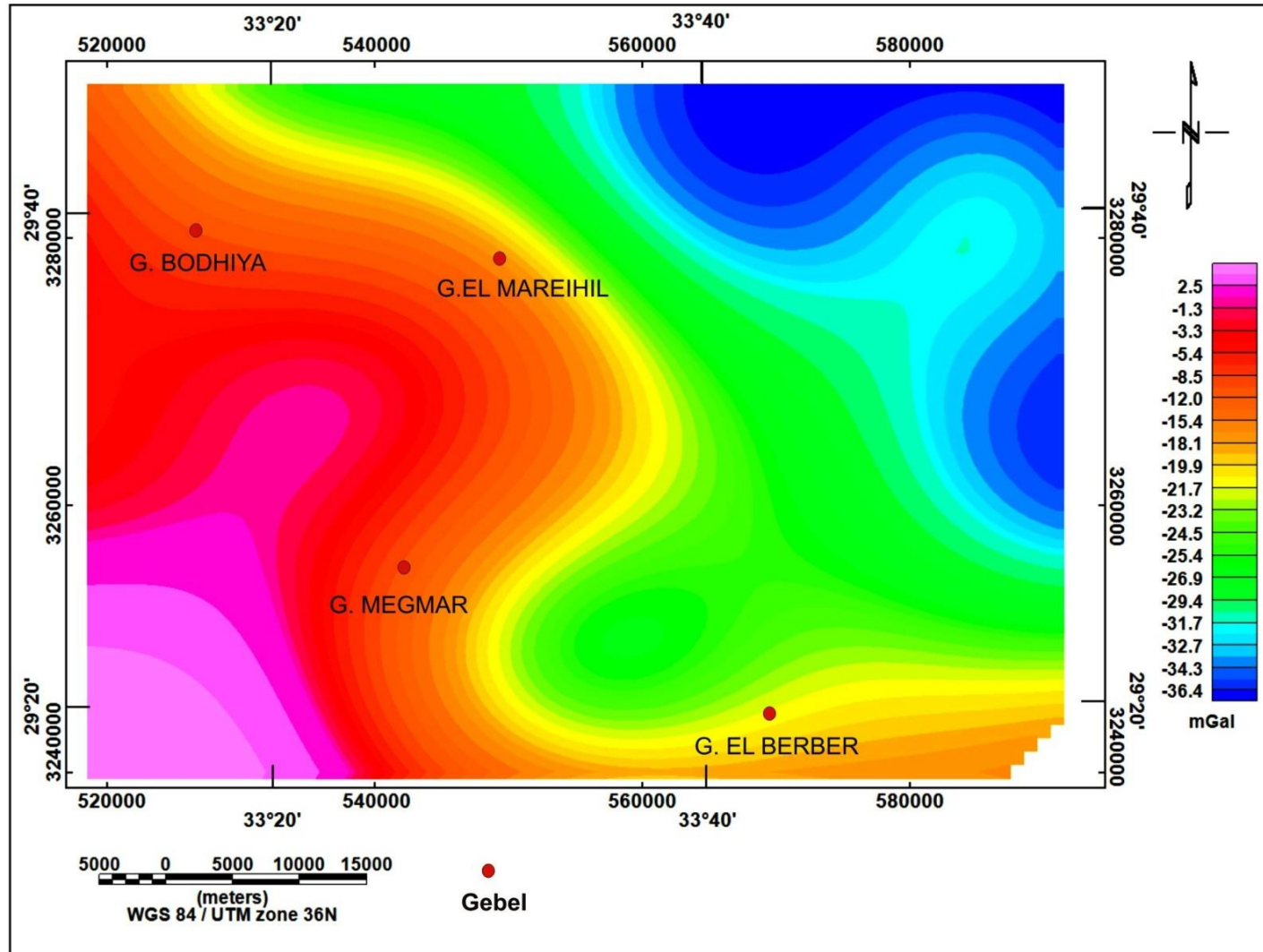


Fig.10 Regional gravity anomaly map.

# GRAVITY DATA INTERPRETATION

## ➤ Residual Gravity Anomaly Map

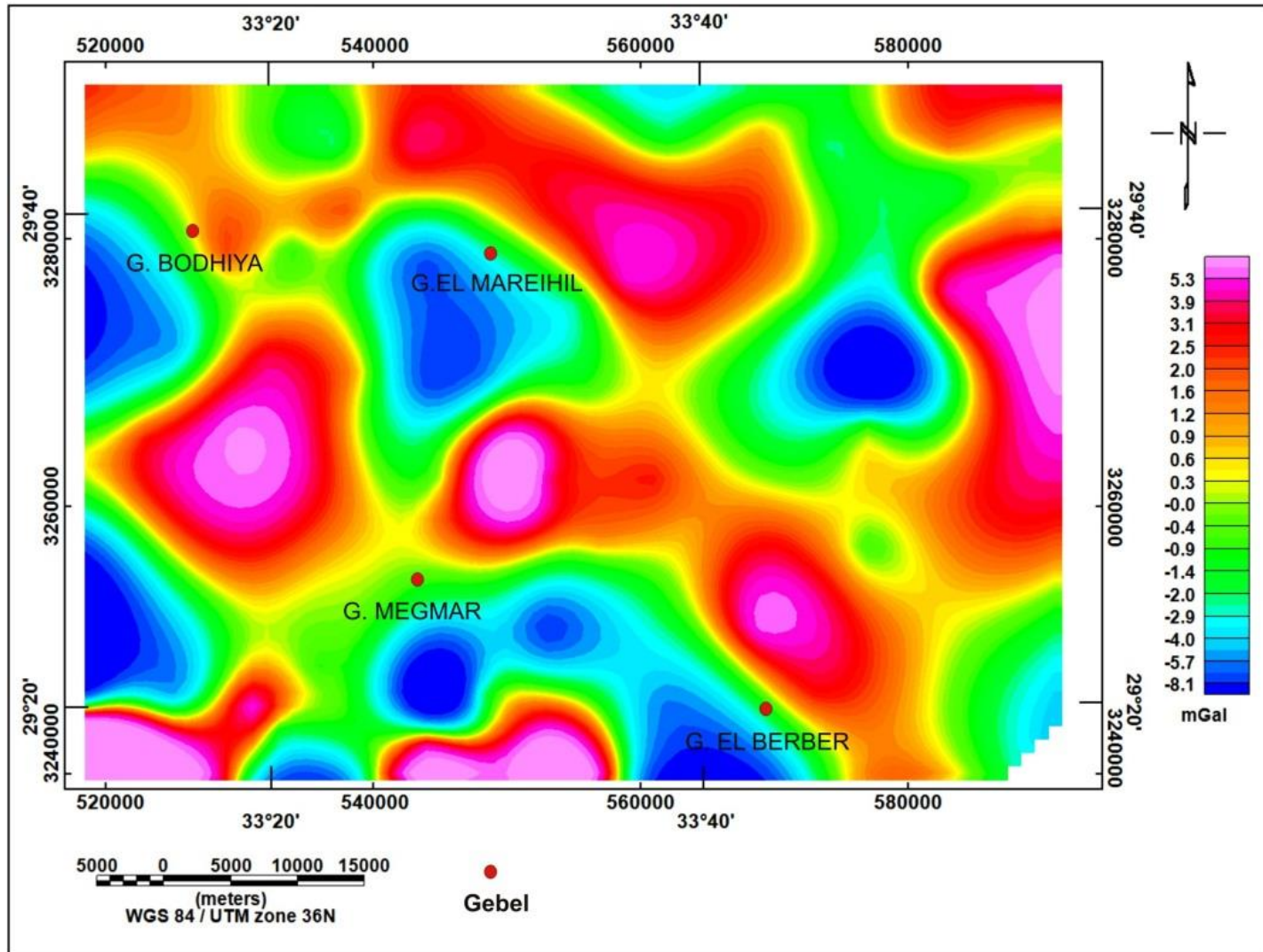


Fig.11 Residual gravity anomaly map



# GRAVITY DATA INTERPRETATION

## ➤ Euler Deconvolution Technique

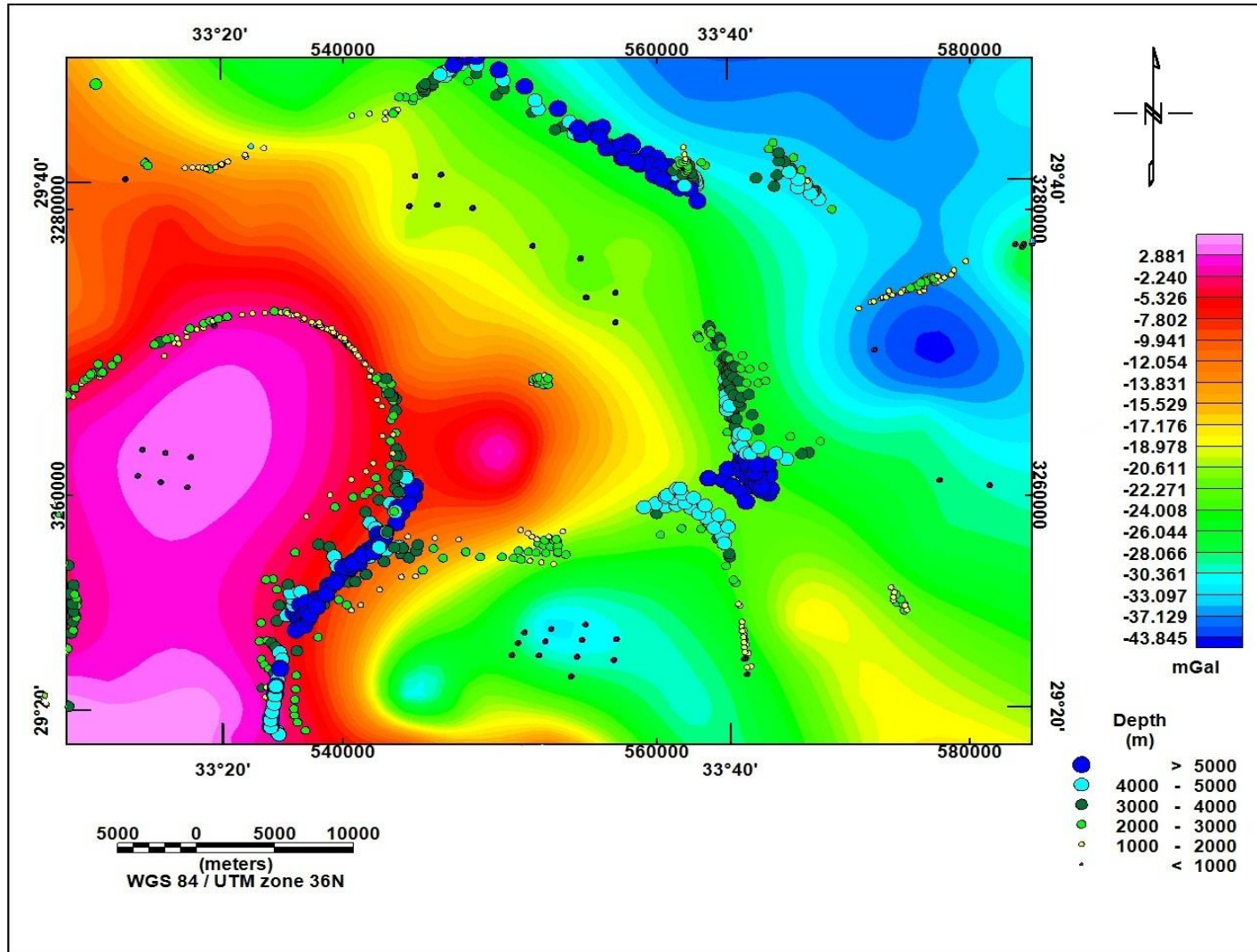
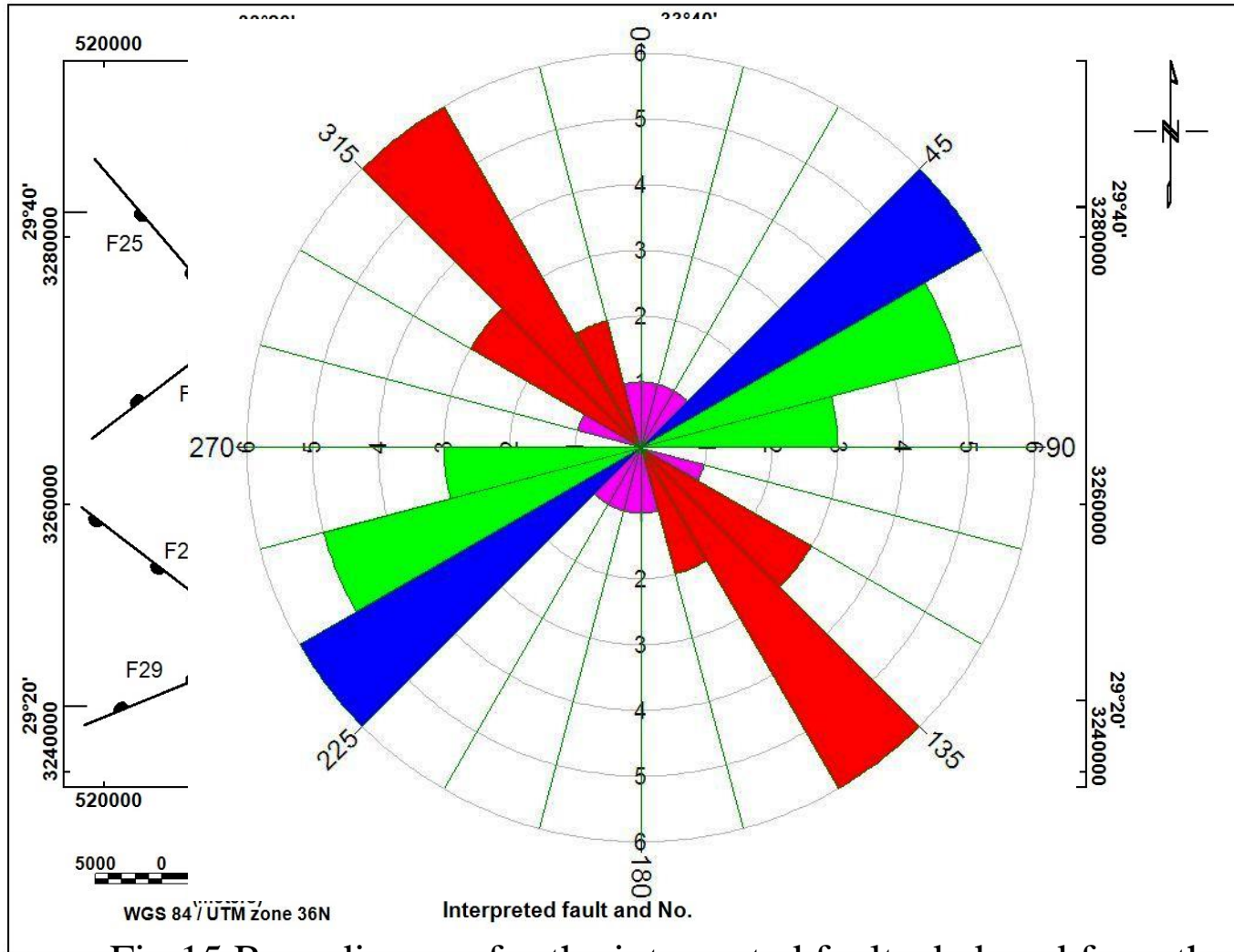


Fig.13 Euler deconvolution solution of gravity map with structural index (SI) = 0.

# STRUCTURAL TREND ANALYSIS

## ➤ Residual Gravity Map Trends



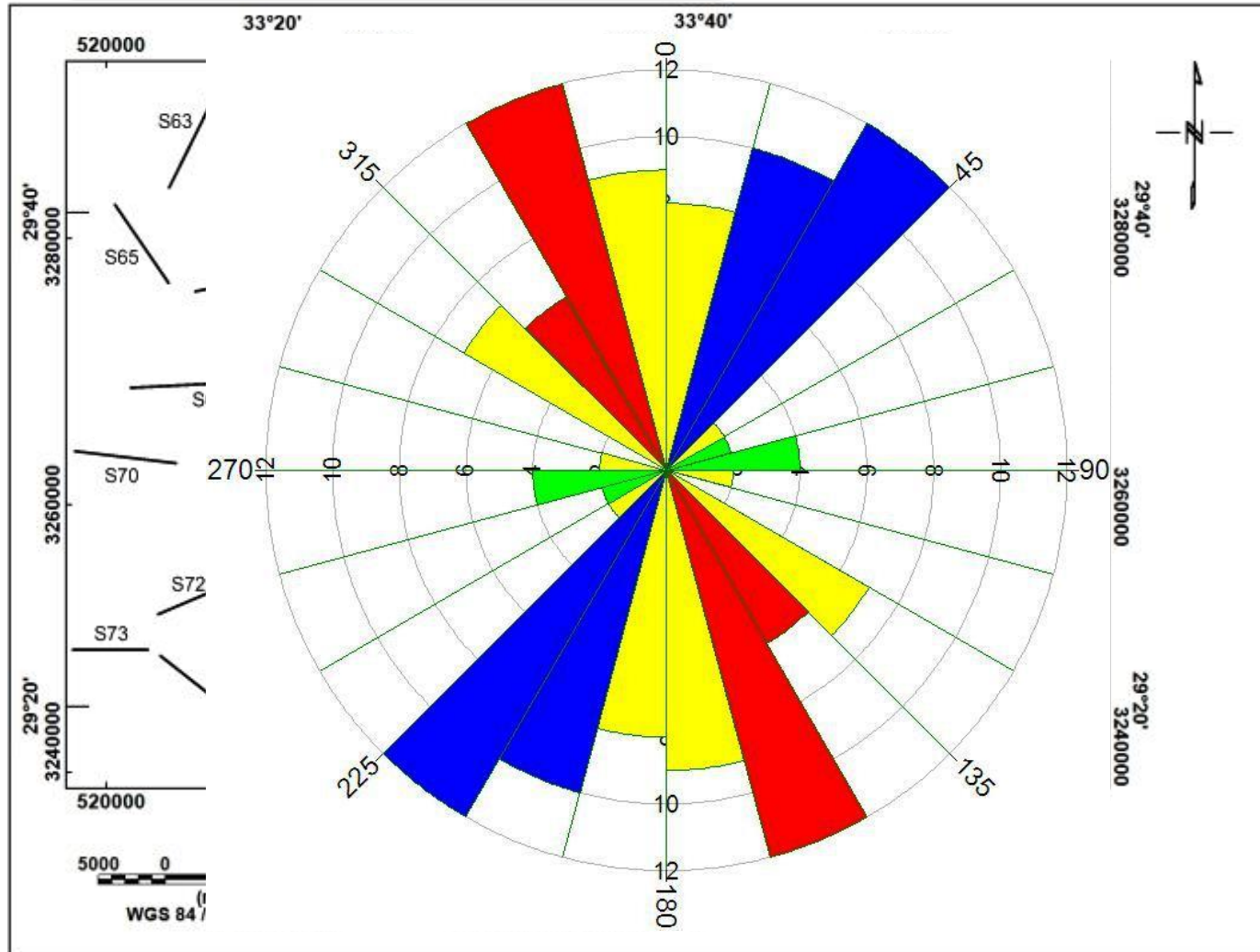
The interpreted subsurface **faults or lineaments** were traced out and classified into three major structural trends :

- **NW – SE** ( Gulf of Suez trend ).
- **NNE – SSW** ( Aqaba trend ).
- **NEE – SWW** ( Syrian arc system trend ).

Fig.15 Rose diagram for the interpreted faults deduced from the Fig.14 Interpreted Residual Gravity from the principal gravity anomaly map.

# STRUCTURAL TREND ANALYSIS

## ➤ Surface Stream Segments



The **stream segments** were traced out and classified into two main categories :

- ✓ Structurally controlled streams ;
- ✓ **NW – SE** (Gulf of Suez trend).
- ✓ **NNE – SSW** (Aqaba trend).
- ✓ **NEE – SWW** (Syrian arc system trend).
- ✓ Natural or physically controlled streams.

Fig.16 Distribution of the stream segments in the study area.  
Fig.17 Rose diagram for the surface stream segments dissecting the study area.

## CONCLUSIONS

- The average depths of the shallow and deep sources are estimated to be 1.5 km and 4 km respectively.
- The statistical analysis of the interpreted subsurface fault structures showed that, the study area is affected by three major subsurface structural trends ; NW – SE ( Gulf of Suez trend ) , NNE – SSW ( Aqaba trend ) and NEE – SWW ( Syrian arc system trend ).
- On the other hand, the surface stream segments are classified into two categories; structurally controlled streams which affected mainly by the subsurface fault structures and physically controlled streams due to the natural factors or conditions such as erosion and weathering process.



*Thank  
you!*

