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ORIGINAL PAPER

Subsurface tectonic pattern and basement topography as interpreted from aeromagnetic data to the south of El-Dakhla Oasis, western desert, Egypt

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Abstract The study area lies to the south of El-Dakhla Oasis in the central part of the western desert, Egypt. It is limited by the latitudes 24–25°N and the longitudes 28–30°E. The main purpose of this work is the investigation of the subsurface structure and the delineation of the main structural elements at different subsurface levels. This study aims also to estimate the basement depth, the basement relief, and consequently, the thickness of the sedimentary cover. The study is based on acquired aeromagnetic data prepared by "La Compagnie General De Géophysique" for the Egyptian General Petroleum Company and Conoco (1977), geological information and results of previous studies in the region. The study involves the analysis for the aeromagnetic data and generating of reduced to pole magnetic map from which different magnetic maps are calculated. The calculated maps are first vertical derivative map and downward continuation map at depth level 400 m. Trend analysis technique is used to define the fault pattern affecting the studied area at different subsurface levels. It is applied to the reduced to pole magnetic map, the first vertical derivative map, and the downward continuation map at depth level 400 m of the study area. All results obtained from the interpretation process were combined together to draw the general view of the subsurface structures of the area. The NE–SW, E–W, and N–S trends are important surface and subsurface (basement) structural trends. This is attributed to the rejuvenation of movements on these old (basement) tectonic trends after the deposition of the sedimentary cover. Basement depth calculation from the aeromagnetic data is achieved using different techniques. The applied techniques included natural spectral analysis and Euler deconvolution. The depth values obtained vary from 400 to 1,700 m.

Keywords Aeromagnetic · Basement · Euler · Spectral · Lineaments · Trends

Introduction

The study area is located to the south of El-Dakhla Oasis in the central part of the western desert of Egypt. It is limited by the latitudes 24°00′–25°00′N and the longitude 28°00′–30°00′E (Fig. 1), the area represents a part of the great African desert.

The present study aims to evaluate the surface and subsurface tectonic pattern in the studied area. It also aims to study the basement depth, relief, and tectonics to evaluate the topography of basement. These aims were achieved through the following:

- Detection of surface and subsurface structural trends at different subsurface levels, from which subsurface trends of zones of mineralization can be detected.
- Determination of the depth to the basement complex (consequently detecting the thickness of sedimentary cover) and delineation of its relief.

The present study was achieved by using the following available geological and geophysical data:

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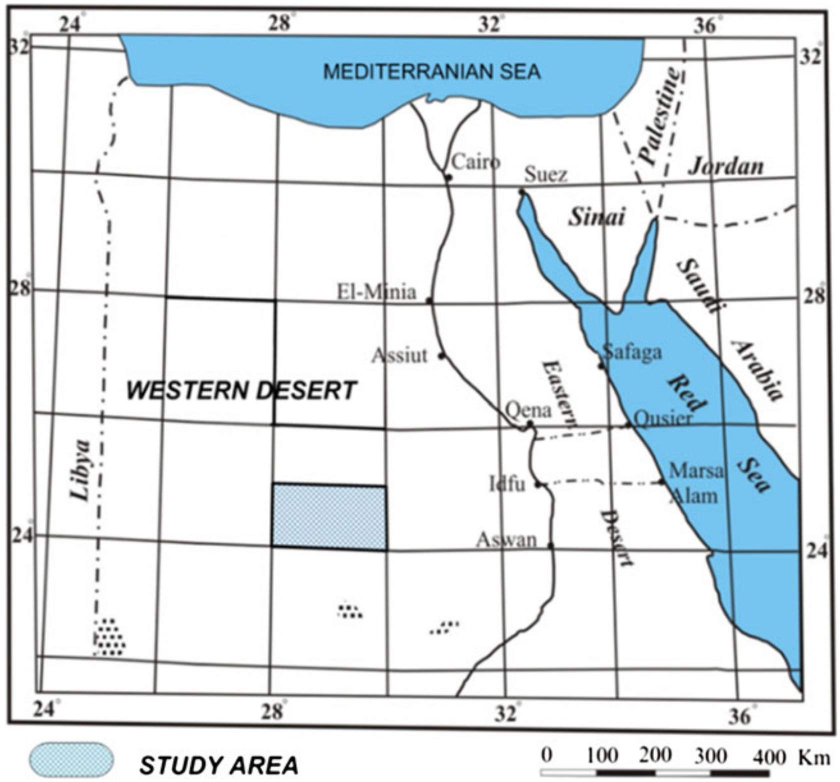


Fig. 1 Location map of the study area

- The aeromagnetic map of the studied area (scale 1:500.000) prepared by "La Compagnie General De Géophysiques" for the Egyptian General Petroleum Company (EGPC) and Conoco (1977).
- The geological map of Egypt (scale 1:500.000) published by EGPC and Conoco (1987), which was used to trace the surface structural lineaments and the different rock units.
- The available software (Surfer 2011; Arcinfo 2010; Geosoft 2007; Rockware 2010).
- The available results of the previous geological and geophysical studies in the region.

General geology

The oases of El Kharga, El Dakhla, and El Farafra, and their surrounding areas in the southern and central parts of the western desert of Egypt, give excellent exposures of Cretaceous and Lower Tertiary. Many authors have investigated these oases (Hermina, et al. 1961; Awad and Ghobrial 1965; Ghobrial 1967; Hermina 1967; Hermina, et al. 1989). The main lithological units in the study area are shown in Fig. 2 and traced from the geological map of Egypt prepared by EGPC and Conoco (1987) using Arcinfo software ver.10

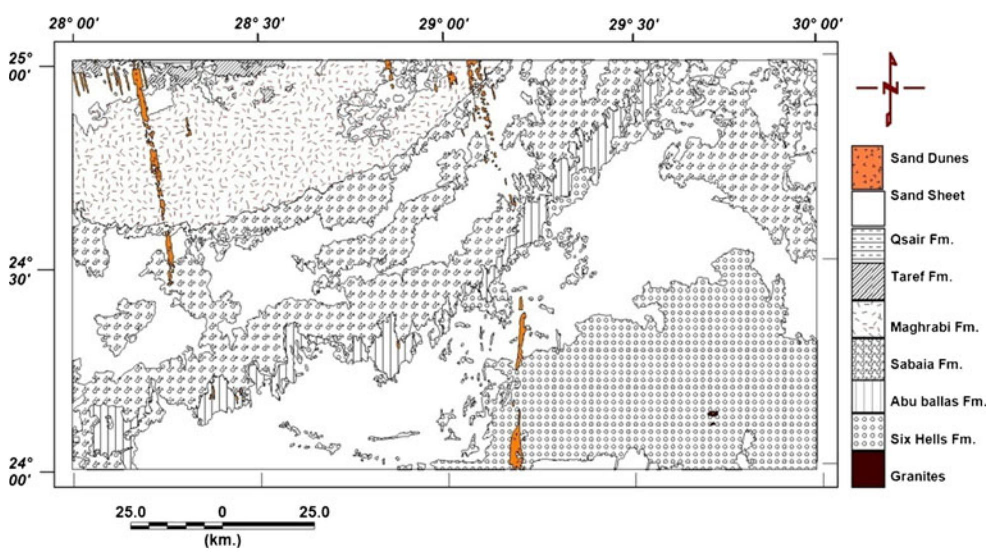


Fig. 2 Geological map of the study area (simplified after EGPC and Conoco, 1987)

(2010). They are arranged from the oldest to the youngest as follows: Precambrian rocks, Jurassic to Cretaceous formations, and Quaternary sediments.

The Precambrian rocks in the study area are represented by pink granite, this granite outcrops at the southeastern part of the study area. The Jurassic to Cretaceous sequence include Six Hills Formation, Abu Ballas Formation, Sabaya Formation, Maghrabi Formation, Taref Formation, and Quseir Formation briefly described in the following:

- The Six Hills Formation is composed of medium to course grained flood plain sandstone assigned to Late Jurassic–Early Cretaceous age (Klitzsch and Lejal-Nicol 1984).
- Abu Ballas Formation consists of marine clay stone and mudstone in lower parts, grading into siltstone or shoreline sandstone in upper parts. An Aptian age is proposed for this rock unit.
- Sabaya Formation overlies the Abu Ballas and follows the Albian regression, it is made up of a sequence of clearly fluviatile sediments (Barthel and Boettcher 1978) =Desert rose beds (Klitzsch 1978). It is generally assigned to Albian to Early Cenomanian age.
- Maghrabi Formation is composed mainly of interbedded clay stones, siltstones, and sandstones which represent the Cenomanian transgression.
- Taref Formation unconformably overlies Maghrabi Formation. It is composed of fluviatile and locally eolian sandstone, fine to medium-grained with interbedded channel and soil deposits. It was deposited during Early Touronian.
- Quseir Formation (Youssef 1959)=Mut Formation (Barthel and Herrmann-Degen 1981). It consists of varicolored shale, siltstone, and flaggy sandstone, containing freshwater gastropods and plant and vertebrate remains (Awad and Ghobrial 1965; Hendriks et al. 1984). It may be of Middle or Late Campanian.

Quaternary sediments are represented by sand sheets and sand dunes. The sand sheets cover large part of the study area which makes the accessibility to this area very difficult. The sand dunes exist in the northern part of the area oriented in NW–SE direction, they are longitudinal dunes.

Surface tectonic trend

The main surface structural lineaments traced from the geological map of Egypt (EGPC and Conoco 1987) are shown in Fig. 3a. For quantitative analysis of the surface structural lineaments within the study area, the length of each structural lineament is measured. Also, the azimuth of each structural lineament is measured relative to the true north. All these data have been tabulated in classes or units of 10° of arc. Thus, the number (*N*), length (*L*), and the direction around the north of the total were determined. All the processes are run in automated mode by using the Rockware v.15 (2010) software.

From the azimuth frequency diagram of the surface structural lineaments of the studied area (Fig. 3b), the most predominant trends are the ENE–WSW, NE–SW, E–W, and N–S trends.

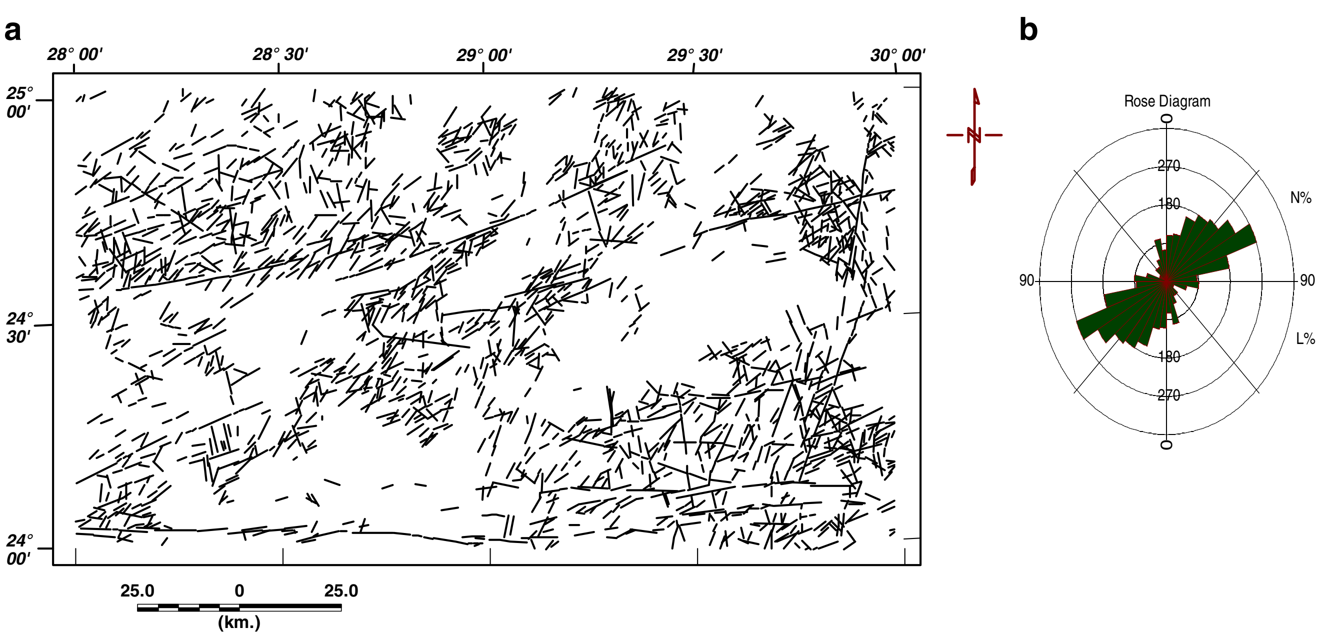


Fig. 3 Surface structural lineaments of the study area (**a**) as traced from the geological map of Egypt, El-Dakhla sheet, EGPC, and Conoco, 1987 and (**b**) the corresponding azimuth frequency diagram

Methods and techniques

In the present study, the used aeromagnetic map of the studied area was prepared by "La Compagnie General De Géophysiques" for the EGPC and Conoco (1977) with scale 1:500.000.

The study involves the analysis for the aeromagnetic data and the generation of reduced to pole magnetic map (according to Baranov and Naudy 1964) from which different magnetic maps are calculated for the study area. The calculated maps are first vertical derivative (FVD) map and downward continuation (DWC) map.

The FVD techniques act as a filter to emphasize the expressions of local features and to remove the effects of large anomalies or regional influences. Therefore, the FVD maps magnify the effect of the smaller and shallower structure with respect to the large-scale features characterizing bodies at great depths.

The downward continuation technique involves the transformation of the potential field data measured on a certain level into a field that would be measured at a lower horizontal plane buried at some specified depth. So, the downward continuation is used to enhance the response from deep sources by bringing the plane of measurement closer to the source; this filter is classified as sharpening filter. The observed magnetic field data can be analytically projected downwards using various formula treated by many authors (e.g., Constantinescu and Botezatu 1961; Grant and West 1965; and others).

The Geosoft Oasis Montaj software ver. 6.4.2 (2007) and Surfer software ver. 10 (2011) are used in this study to prepare and process the aeromagnetic data. The International Geomagnetic Reference Field (IGRF) parameters used in the calculation process (as obtained from MagPick Software 2006) are magnetic inclination 31°, magnetic declination 0.9° and magnetic field 4,0250 nT.

In the present study, the depth to the basement rocks was determined by using the Euler deconvolution and the spectral analysis techniques. Euler deconvolution technique is recently used for rapid interpretation of potential field data. It is a particularly powerful tool for delineating contacts and rapid depth estimation. The quality of depth estimation depends on the choice of structural index (SI) and adequate sampling of data. Euler deconvolution has come into wide use as a tool to determine source location of potential field anomalies (Thompson 1982; Reid et al. 1990).

The spectral analysis technique represents an important tool of interpretation to determine the average depth values of the buried causative bodies. Many authors have proposed the spectral analysis technique for the analysis of the potential field data (Solovyev 1962; Gudmundsson 1966).

The structural trend analysis in this study involves the surface and subsurface structural lineaments. The surface structural lineaments are traced from the geologic map of Egypt (scale 1:500,000) published by EGPC and Conoco (1987). The subsurface structural lineaments were traced from the reduced to pole magnetic field map, the first vertical derivative map, and the downward continuation map at depth level 400 m.

More details about interpretation of magnetic data are found in many references (Nettleton 1976; Parasniss 1997; Reynolds 1997).

Results and discussions

The processing of the available aeromagnetic data of the study area includes the following:

- The generation of the reduced to pole magnetic map (according to Baranov and Naudy 1964) from which different magnetic maps are calculated for the study area. The calculated maps are FVD and DWC maps.
- Structural trend analysis to define the surface and subsurface structural trends in the studied area.
- Basement depth estimation using Euler deconvolution and natural spectral analysis techniques.

Geomagnetic maps

In the present study; the Geosoft Oasis Montaje software (2007) was used to calculate the different magnetic maps. The calculated maps are the reduced to pole (RTP) map, the FVD map, and the DWC map. The IGRF parameters used in the calculation process are magnetic inclination 31°, magnetic declination 0.9°, and magnetic field 4,0250 nT.

The reduced to the pole map

- The RTP map is prepared in order to eliminate the shift in the spatial location of the polarized magnetic sources.
- The obtained RTP map of the study area is shown in Fig. 4; it is characterized by circular to oval and linear anomalies. Most of the anomalies extend in the E–W, N–S, and NE–SW directions.
- The magnetic anomalies have high magnitude and density in the central and eastern parts of the study area, while they have low density and magnitude in the northwestern and southeastern parts.
- In the central and eastern parts of the study area, there is a remarkable high and dense magnetic anomaly which may be associated with basement rocks with shallow depths.

The first vertical derivative map

- The FVD map of the study area shown in Fig. 5 is obtained from the RTP magnetic data. In this map, the

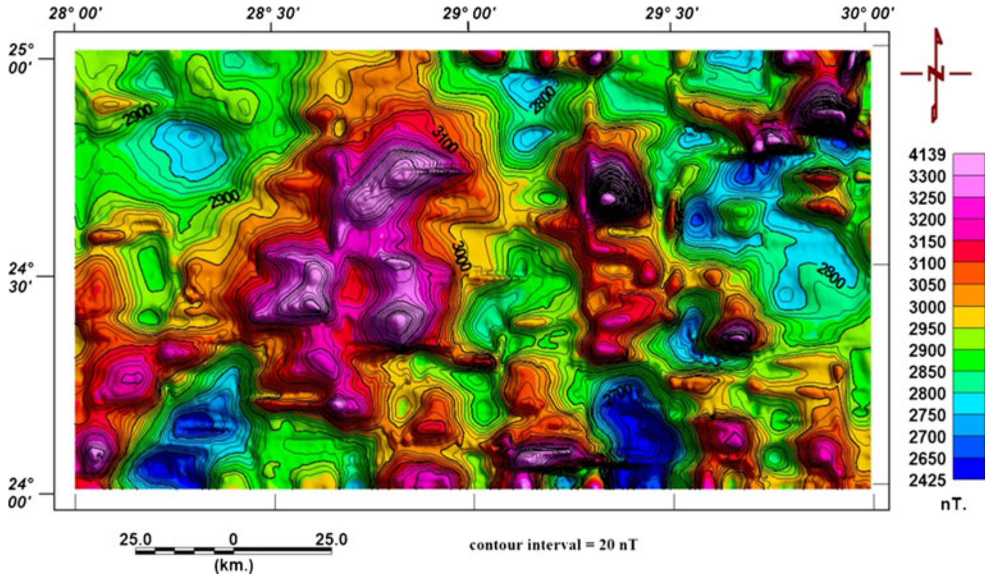


Fig. 4 Reduced to pole magnetic field intensity map for the study area generated according to Baranov and Naudy (1964)

zero contour lines very clearly outline most of the magnetic sources and give a magnificent figure about the magnetic anomalies distribution.

- In the obtained FVD map, the magnetic anomalies in the eastern part are characterized by small aerial extension compared with those in the western part of the studied area reflecting the size of causative bodies. In the north-western part of the area, there are a remarkable low number of anomalies.
- Most of the FVD anomalies are oriented in the E–W, N–S, and NE–SW directions.

Downward continuation map at depth level 400 m

- The downward continuation is used to enhance the response from deep sources by bringing the plane of measurement closer to the source; this filter is classified as sharpening filter. The downward continued map of the study area at depth level 400 m is shown in Fig. 6.
- The oval, circular, and linear anomalies in the downward continued map with depth level 400 m are located in the same place in the RTP magnetic map but with sharper gradient and higher magnitude.
- The elongated and linear anomalies extend mainly in the E–W, N–S, NE–SW, and NW–SE directions.
- The central and northeastern parts of the study area are occupied by sharp and narrow magnetic anomalies which may be due to the shallow basement depth in these parts. While the northwestern and southeastern portions are occupied by flat and wide anomalies, this may indicate that the basement is deep at this portion of the area.

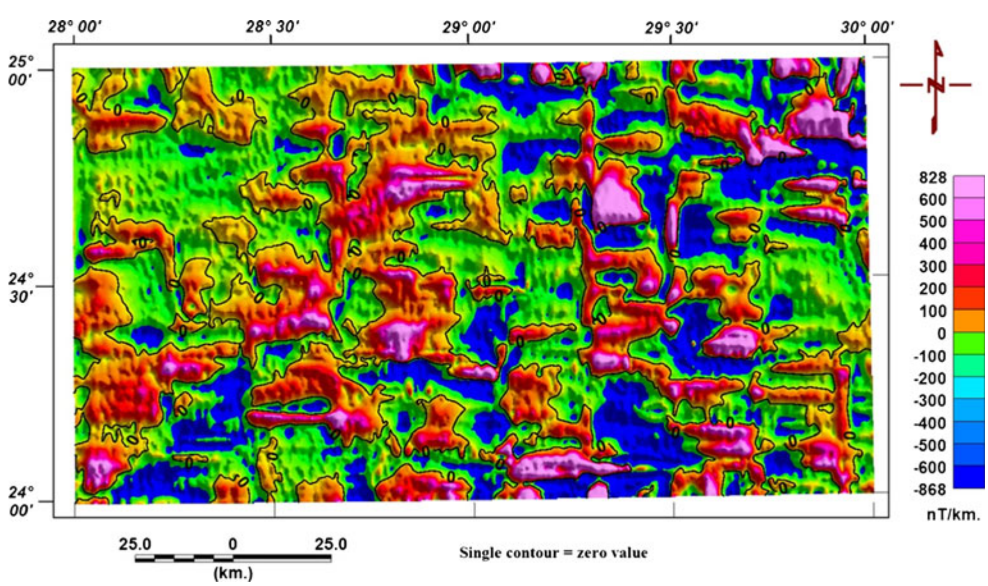


Fig. 5 The first vertical derivative magnetic map of the studied area

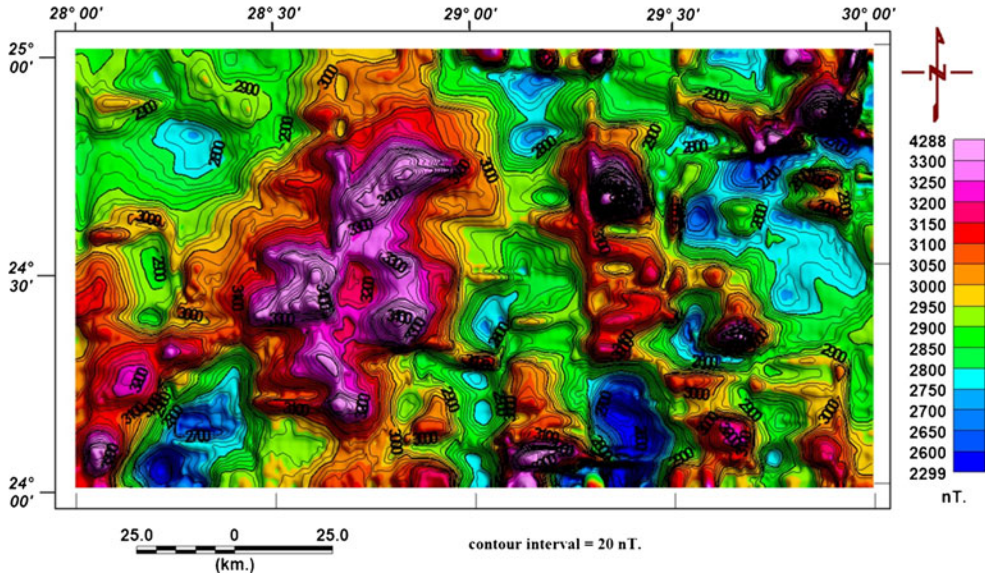


Fig. 6 The downward continued magnetic map of the studied area at depth level 400 m

Surface and subsurface structural pattern

The trend analysis technique is used to determine the location of the structural lines and their trends. Also, this technique classifies quantitatively the trends of fault lines according to their lengths, abundance, and magnitude with respect to azimuth.

In general, fault lines align themselves along definite axes-forming anomalies of definite trend and gradient. These are traced out and marked since they represent structural lines that may exist within the sedimentary cover or the crystalline basement complex.

Surface structural trends

As previously mentioned (see Surface tectonic trends), the main surface structural lineament are traced from the geological map of Egypt (EGPC and Conoco (1987); they are shown in Fig. 3a. From the azimuth frequency diagram of the surface structural lineaments of the studied area (Fig. 3b), the most predominant trends are the ENE–WSW, NE–SW, E–W, and N–S trends.

Subsurface structural trends

In the present study, the Gay technique (1972) was used in tracing the magnetic structural lineaments from the RTP aeromagnetic map, the first vertical derivative map, and the downward continuation map at depth level 400 m. The obtained magnetic structural lineaments and the corresponding azimuth frequency diagrams are shown in Fig. 7.

The Rockware software (2010) is used for tracing and digitizing the magnetic structural lineaments, and finally plotting the corresponding azimuth-frequency diagrams. The following is a brief discussion of the obtained results:

- The magnetic structural lineaments traced from the reduced to pole map of the studied area are shown in (Fig. 7a). From the azimuth frequency diagram of these lineaments, the predominant obtained trends are the E–W, N–S, NE–SW, and finally the less abundant NW–SE direction.
- The magnetic structural lineaments traced from the first vertical derivative map of the studied area are shown in (Fig. 7b) from the azimuth frequency diagram of these lineaments, the predominant obtained trends are the E–W, N–S, NW–SE, and NE–SW trends.
- The magnetic structural lineaments traced from the downward continuation map at level 400 m of the studied area are shown in (Fig. 7c). From the azimuth frequency diagram of these lineaments, the predominant obtained trends are the E–W, N–S, NE–SW, and NW–SE trends.

Structural interpretation and discussion

The study area is considered as a part of a relatively stable tectonic sector that lies in the stable shelf of Egypt Youssef (1968). The surface and subsurface structural trends in the study area were traced from the available geological and geophysical data to evaluate the tectonic framework of the studied area. A comparison between the predominant fault trends deduced from geological map and the different magnetic maps is shown in Table 1.

The most predominant deduced surface structural trends are the ENE–WSW, NE–SW, E–W, and N–S trends. The most predominant subsurface magnetic fault trends are the E–W, N–S, NE–SW, and NW–SE trends. The following represents a brief discussion of the most important deduced surface and subsurface structural trends in the studied area.

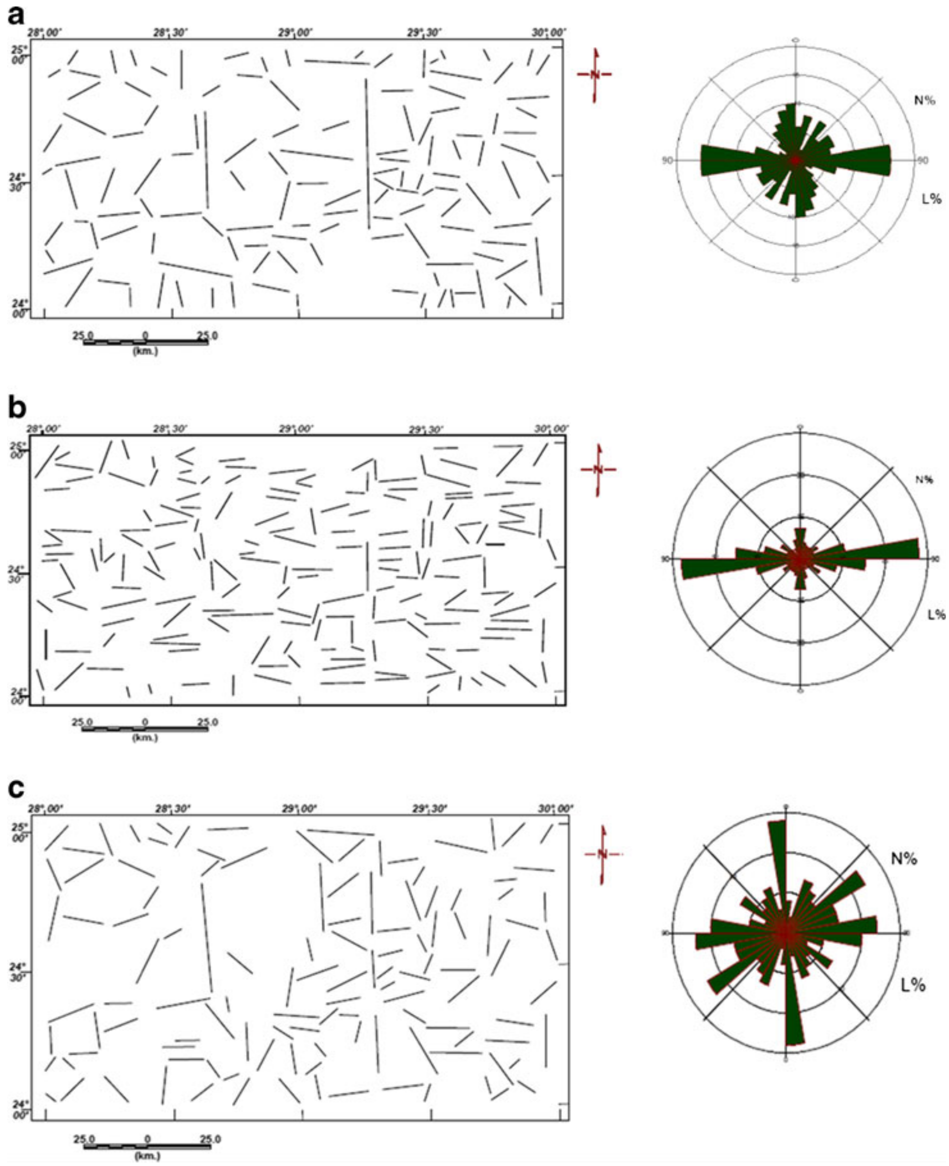


Fig. 7 Magnetic structural lineaments traced from the reduced to pole magnetic map (**a**), the first vertical derivative map (**b**), and the downward continuation map at level 400 m (**c**) of the studied area and the corresponding azimuth frequency diagrams

The E–W trend

This trend represents the most predominant trend in all the subsurface maps, but the third in the surface. Said (1962) named this trend as the Tethyian trend. El-Shazly (1966) stated that the E–W trend is the oldest tectonic trend affecting the Egyptian Precambrian basement rocks. Meshref and El-Sheikh (1973) and Meshref (1982) believed that the E–W trend resulted from the northern compressive force that developed during the

Table 1 Correlation between the predominant structural trends traced from the surface and the subsurface maps arranged in decreasing order of abundance

Trend order	Surface lineaments	Subsurface lineaments		
	Total	FVD	RTP	DWC
1	ENE–WSW	E–W	E–W	E–W
2	NE–SW	N–S	N–S	N–S
3	E–W	NW–SE	NE–SW	NE–SW
4	N–S	NE–SW	NW–SE	NW–SE

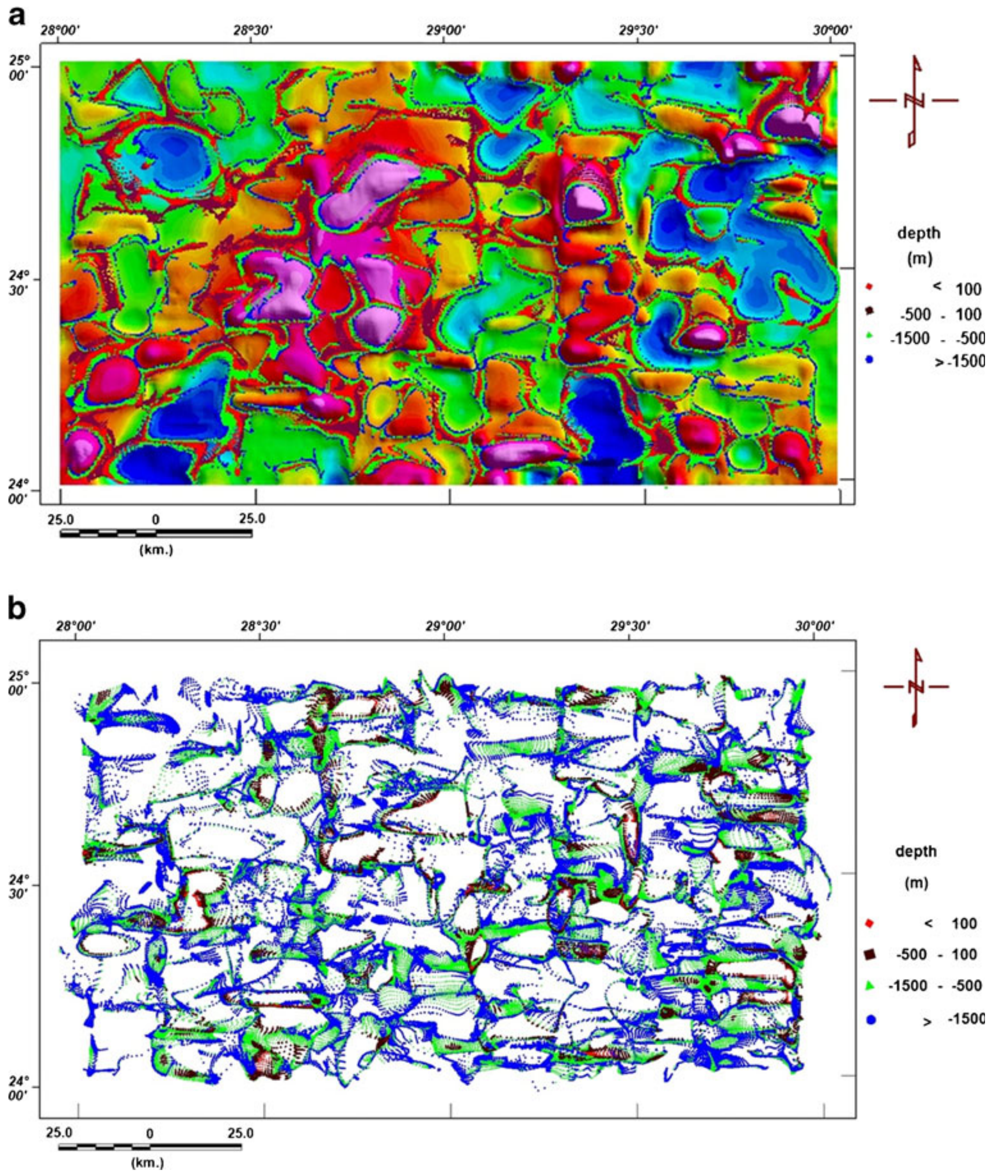


Fig. 8 Euler deconvolution map of the studied area prepared using structural index (SI)=0 corresponding to contacts with the RTP map in background (**a**) and SI=1 corresponding to dikes (**b**)

drifting of Eurasia super continent in the northern hemisphere and Gondwana land super continent in the southern hemisphere at different geologic times. Klitzsch (1986) and Schandelmeier et al. (1987) pointed out that the E–W faults in Egypt have initiated in the late Precambrian and are intermittently active till the present. The same conclusion was reached by Youssef et al. (1998) for the Sohag region where the E–W trend, which represents the most important subsurface trend, shows very weak extension to the surface. It may be due to the fact that most of the E–W lineaments are contacts between basement rock units with different magnetic susceptibilities. The E–W trend is observed as surface tectonic trend when the basement rocks are concealed under thin sedimentary cover, as noticed in the southwestern desert of Egypt.

The N–S trend

It represents the second more prevailing trend in the area under study and the fourth order in the major surface fault system. The N–S trend was termed East African trend by Said (1962) and considered as a permanent direction of faulting and dike intrusions in Egypt.

This trend was recorded by El Gaby et al. (1987), where they considered it as old faults that reactivated by couple shearing resulting from the northern movement of Arabia with higher rate relative to the Africa. Meshref (1990) stated that this trend, known as Nubian trend, is inherited in the basement rocks of Egypt and considered it to be the extension of the Mozambique belt. Brown and Colemen (1992) considered this trend as one of the old tectonic trends in Egypt related to Pan-African orogeny.

Thus, the N–S trend had probably developed in the Precambrian and actively rejuvenated during Late Tertiary and Early Quaternary.

The ENE–WSW trend

This fault trend comes in the first order of predominance regarding to surface faults, and comes in the third order of predominance regarding to magnetic trends (included with the NE–SW trend).Halsey and Gardener (1975) stated that the ENE fault trend is a predominant direction of faulting and dike intrusion in the exposed Precambrian in Egypt. Garson and Krs (1976) have considered the ENE trend as one of the main fractures characterizing the Precambrian basement in Egypt. Also, they showed that this trend might have been rejuvenated during Hercynian orogeny as a direction of compressional folding and upthrusting. Bakheit (1989) has recorded the ENE trend in the area east of Assiut with a considerable abundance where it is represented by faults controlling the entrance of Wadi El Assiuti. Youssef et al. (1998) recorded the ENE fault trend in Sohag region and considered it as a right lateral simple shear.

The NE–SW trend

This trend is the third order in abundance on the area under study, and it corresponds to the Qattara trend in the tectonic framework of Egypt; it is recorded in all surface and subsurface studies.

The NE–SW trend is related to the Kharga uplift which separates between two main deposition basins. They are the Dakhla basin in the west and the Assiut upper Nile basin in the east (Hermina 1990).

El Gaby et al. (1987) defined the NE–SW trend as an important Precambrian trend with a right lateral sense of movement; the rejuvenation of this trend is due to the northward movement of Arabia with a higher rate relative to Africa.

The NW–SE trend

This trend is the less dominant in the area as subsurface trend and is not reported in the surface structures. This trend coincides with the Erythrean faults Said (1962) and the Gulf of Suez trend Youssef (1968).

Halsey and Gardner (1975) considered this trend as an old one, which has been rejuvenated periodically principally during Hercynian and Alpine (Late Tertiary) orogenies. El Gaby et al. (1987) considered the NW–SE trend as one of the old Precambrian fracture system which was essentially reactivated. Meshref (1990) considered this trend as a result of the Hercynian Precambrian subduction and was well developed during the Red Sea and Gulf of Suez rifting; this trend is expected to be found stronger in eastern than in western side of Egypt.

According to Fritz et al. (1996), the NW–SE structural trend represents Najd fault system (left lateral strike slip fault), the activity age of this trend was determined by the authors as 598–585 My. Youssef et al. (1998) considered the NW–SE trend as shear zones deforming the sedimentary cover in Sohag area during Late Eocene–Oligocene time.

From the above discussions, it is clear that there is a difference between the surface and the subsurface fault systems. Some major basement fault trends have no upward extensions in the sedimentary cover and others have. The E–W, N–S, and NE–SW trends are important surface and subsurface (basement) structural trends. This is attributed to a rejuvenation of movements on these old (basement) tectonic trends after the deposition of the

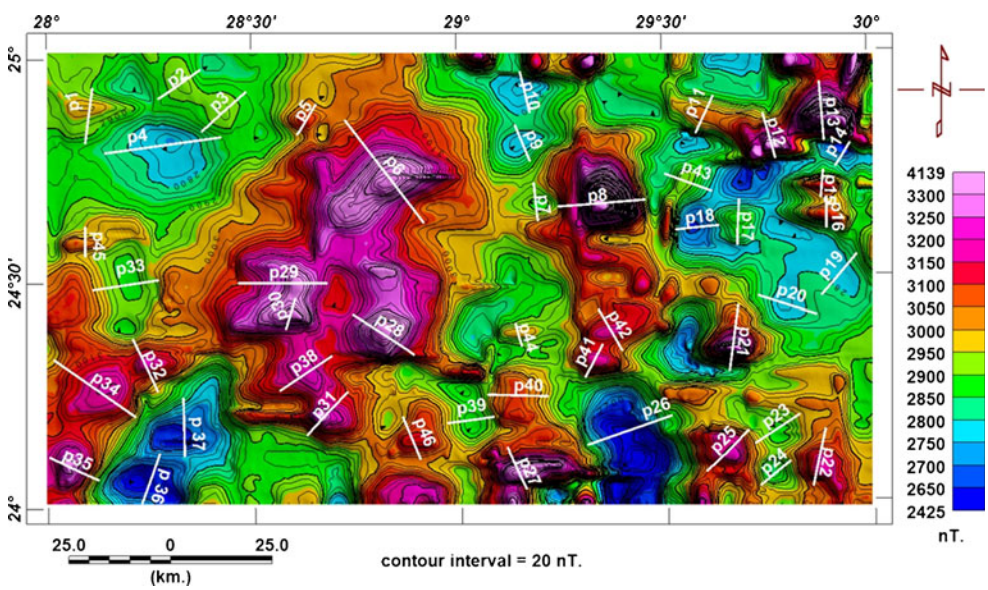


Fig. 9 Location of the selected magnetic anomalies for basement depth estimation using the spectral analysis technique in the study area

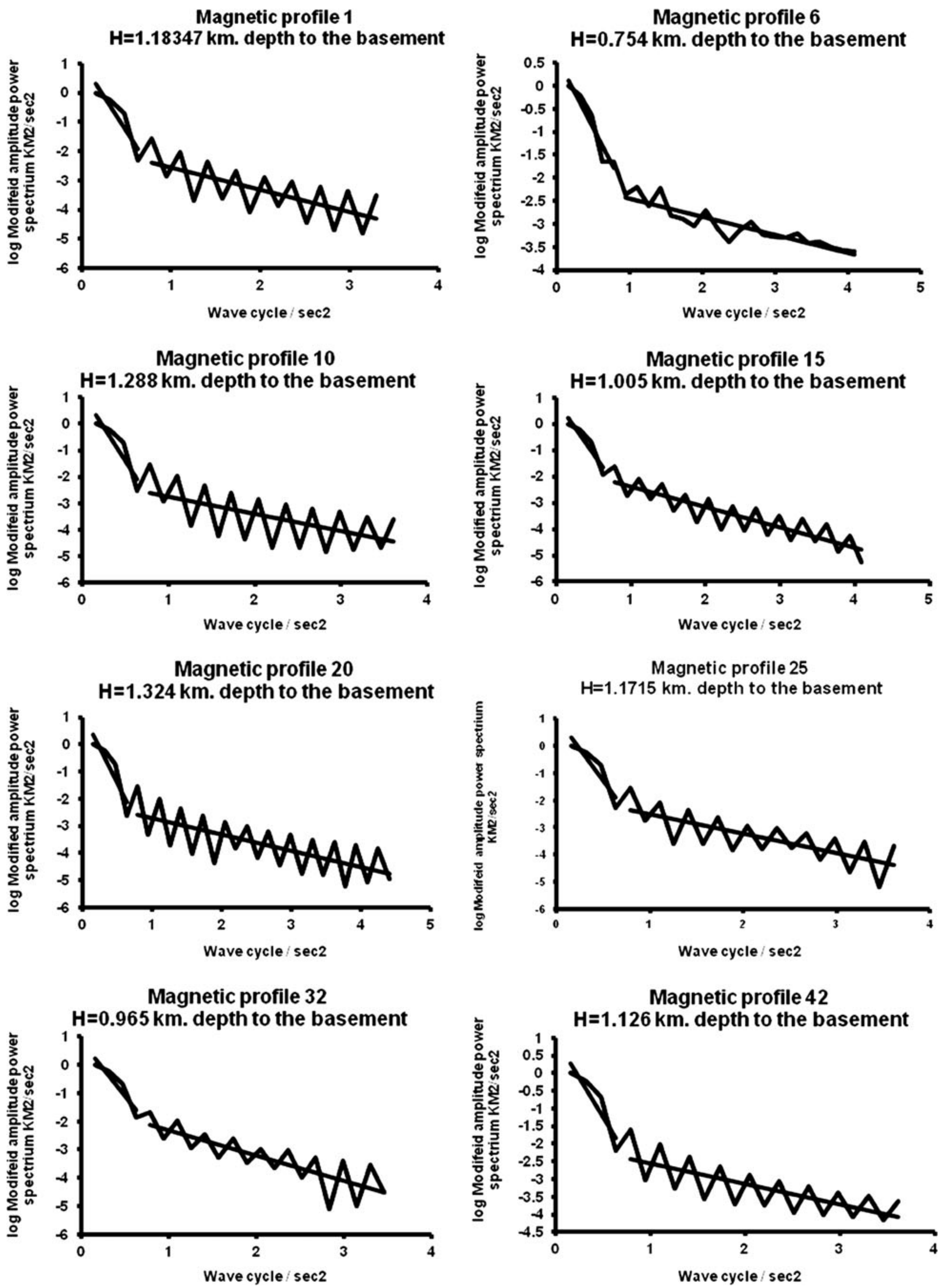


Fig. 10 Basement depth calculation along some selected RTP magnetic anomaly profiles in the studied area

sedimentary cover. The E–W structural trend, which is predominant as subsurface (basement) structural trend, is less abundant in the surface structural map. This may be due to the fact that most of the E–W lineaments represent contacts between basement rock units with different magnetic susceptibilities.

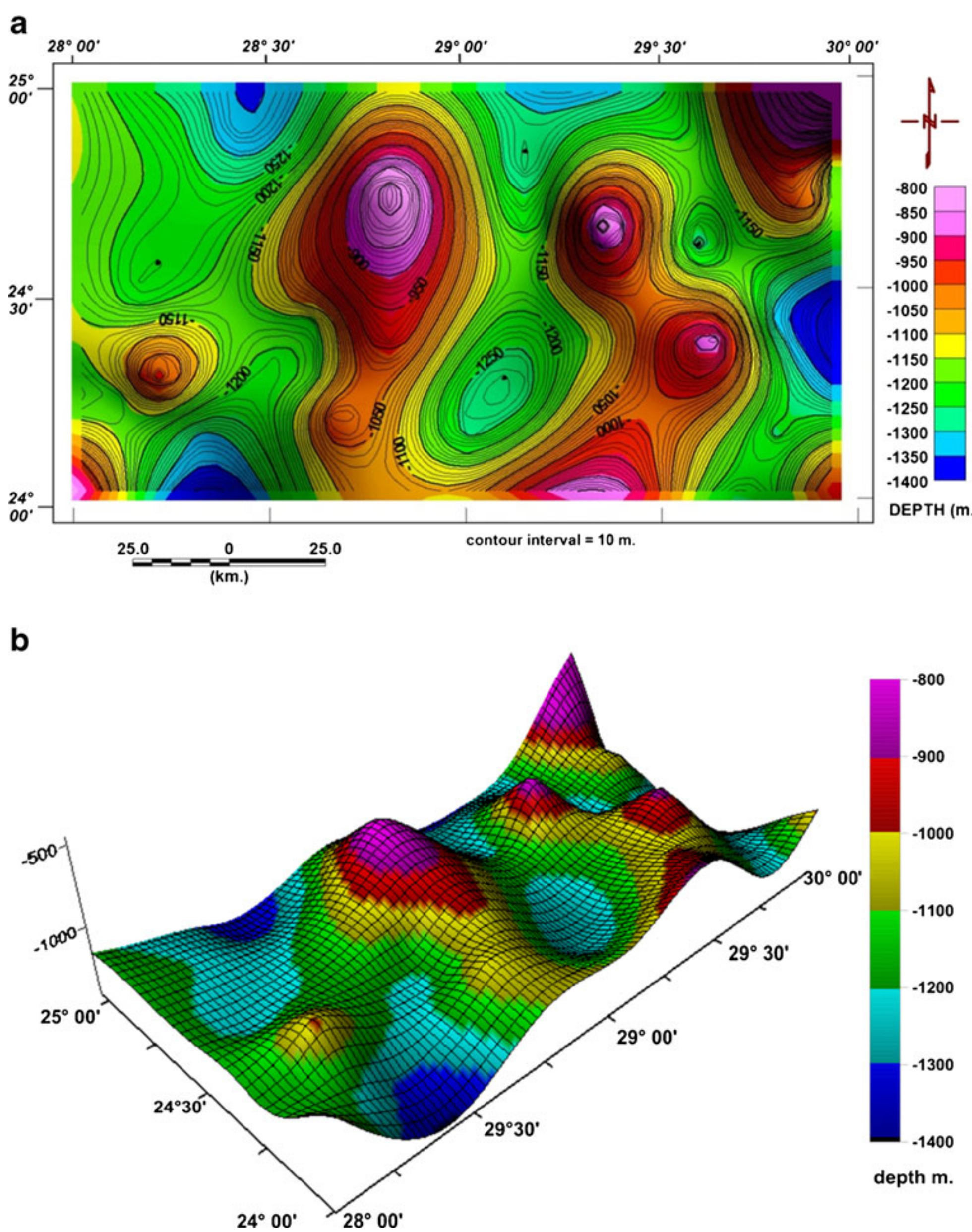
Basement depth estimation

The main purpose of the quantitative interpretation is to determine the main physical parameters of the causative body responsible for these anomalies. In this study, the basement depth estimate is achieved using Euler deconvolution, the natural spectral analysis, and the source parameters imaging techniques.

Euler deconvolution

The Euler solutions on the RTP aeromagnetic map of the investigated area were calculated according to Thompson (1982), Valéria et al. (1999), Reid et al. (1990), and João and Valéria (2003) using the Geosoft Oasis Montaj software (2007).Two maps were calculated applying SI equal to zero to detect geological contacts and SI equal to one to detect the possible dike location. The obtained Euler plots (Figs.8a, b) show more or less linear, accurate sigmoid Euler anomalies representing location, trend, and depth of the sources.

Fig. 11 Basement depth distribution in the studied area as interpreted from the RTP aeromagnetic data using the spectral analysis technique presented as contour map (**a**) and 3D block diagram representation (**b**)



The Euler deconvolution results with structural index equal to zero are shown in Fig. 8a with the RTP map in the background to show how the results coincide with the magnetic anomaly edges, in other words, the geomagnetic contacts. The prepared Euler map with structural index equal to one (Fig. 8b) is used mainly to detect dikes in the area under study.

The Euler homogeneity solution for depth estimation is a very powerful tool for detecting the geomagnetic boundary between magnetic sources and the result of using structural index equal to zero. On the other hand, we can conclude that the position of dikes estimated by using structural index equal to one is coincident with the peaks of the magnetic anomalies.

After visual inspection of the Euler calculated anomalies in the obtained maps, we can conclude that:

- The deeper clusters are concentrated in the northwestern, southern, and eastern parts of the study area.
- The depth results observed in the two maps (Figs. 8a, b) range from less than 100 m to more than 1,500 m.
- Most of the shallow depths coincide with the sharp high gradient anomalies appear in the RTP map, while deeper depths coincide with the gently low gradient anomalies in the RTP map.

Natural spectral analyses technique

Natural spectral analysis technique (NSPT) for measuring the depth to potential field sources depends on the transformation of the space domain data into frequency domain by using Fourier transform. This transformation gives us the ability to deal with each single anomaly as a wave. Review

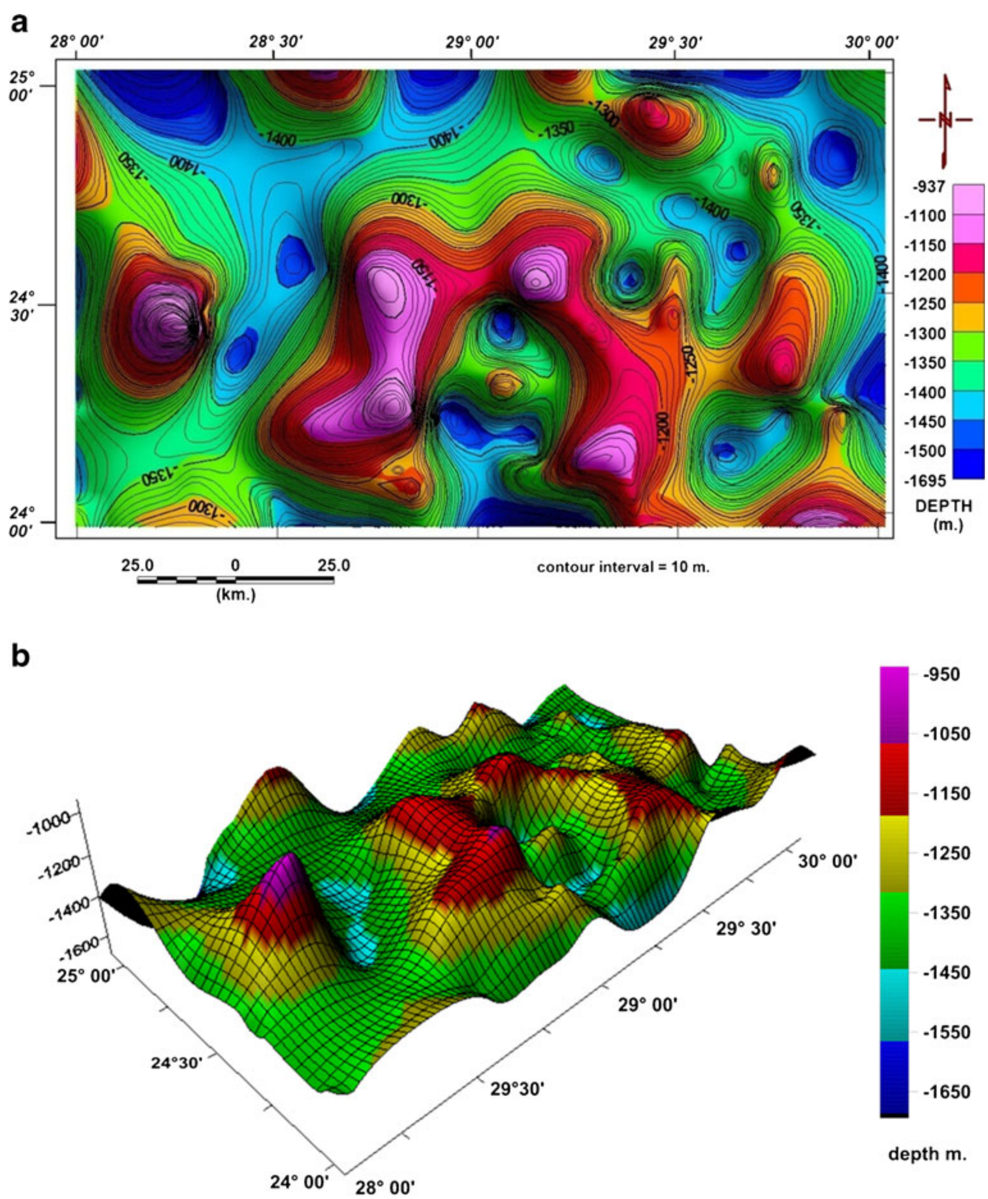


Fig. 12 Basement depth distribution in the studied area as interpreted from the RTP aeromagnetic data using the source parameter imaging presented as contour map (**a**) and 3D block diagram representation (**b**)

of the method is given by; Spector and Grant (1970), Nabighian (1972), Bath (1974), and Bhattacharyya (1978).

This method includes digitizing of each anomaly profile alone with constant spacing by using the NSPT software (1984). Using the digitized magnetic profile as "dat" file format, the NSPT software will calculate the log amplitude power spectrum value for the anomaly after a plot between the power spectrum on ordinate and the Wave number on the abscissa from the slope of the curve we can calculate the depth to the causative bodies. This method has been applied along 46 magnetic anomaly profile crossing most of the magnetic anomalies in the RTP map of the area. The locations of the selected anomalies for basement depth estimation in the study area are shown in Fig. 9.

Some interpreted examples from the selected magnetic profiles for basement depth calculation are presented in Fig. 10. The calculated basement depth values from the selected reduced to pole magnetic profiles using the spectral analysis technique were used to obtain the basement depth distribution in the study area. It is presented as contour map (Fig. 11a) and as 3D block diagram representation (Fig. 11b)

From the basement depth map (Fig. 11a) and its 3D block diagram representation (Fig. 11b), the basement depth ranges from 450 to 1,450 m.

Source parameter imaging

Source Parameter Imaging (SPI) is a powerful method for calculating the depth of magnetic sources, its accuracy has been shown to be +/−20 % in tests on real data sets with drill hole control. This accuracy is similar to that of Euler deconvolution, however, the SPI has the advantage of producing a more complete set of coherent solution points and is easier to use.

This technique uses the derivatives in X, Y, and Z direction and the tilt derivative then the peak must be detected using the Blakely test, this method is applied by Blakely and Connard (1989).

The map calculated from the source parameter imaging (Fig. 12a) and its 3D block diagram representation (Fig. 12b) gives the depth to basement rocks ranging from 900 to 1,700 m. The topography in the maps estimated by SPI and NSPT techniques are very similar to each other.

Conclusions

Based on the previous discussions, the following could be concluded

- The main surface structural trends in the studied area are the ENE–WSW, NE–SW, E–W, and N–S trends. While the most important subsurface structural trends traced from the interpretation of the magnetic data are the E–W, N–S, NE–SW, and NW–SE trends.
- The NE–SW, E–W, and N–S trends are important surface and subsurface (basement) structural trends. This is attributed to the rejuvenation of movements on these old (basement) tectonic trends after the deposition of the sedimentary cover.
- The obtained basement depth using the spectral analysis technique have values ranging from about 800 to about 1,400 m in the eastern and western parts of studied area respectively.
- The depths of Euler anomalies range from <100 to >1,500 m. Most of the Euler anomalies coincide with the magnetic anomaly edges, in other words, the geomagnetic contacts
- Source parameter imaging technique gives basement depth value range from <950 to >1,700 m, this range closer to different methods.
- The correlation between the obtained basement depth values indicate that it varies between <400 and about 1,700 m. The results obtained from the different methods used in the basement depth estimation confirmed each other.
- Finally, the results of this geophysical study could give an idea about the subsurface structural settings, the basement relief, and tectonics of the area south of El-Dakhla Oasis as a part of the western desert.

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