CHAPTER VIII

SUMMARY AND CONCLUSIONS

The study area represents the central part of the northern Eastern Desert, occupying the area between the northern scarps of the El Galala El Bhariya plateau to the southern scarp of Gabal Ataqa to the north. It is bounded by latitudes 29° 30' - 30° 00' N and longitudes. 32° 00' - 32° 30' E. The main wadis in the study area downstream into the coastal plain and the Gulf of Suez, these are from north to south, Wadi Hagoul, Wadi Beda, Wadi Akheider and Wadi Ghoweiba.

The western side of Gulf of Suez is one of the proposed promising sites for anew urbanization programs industrial national projects. As the scope of the study is to build up a geoenvironmental database for the area in a Geographic Information System (GIS) and to give the suitable recommendations to the development strategy of the area under investigation with respect to all available data.

It also aims to study the benefits of the integration between remote sensing and geophysical information in correlation between surface and subsurface structure to delineate the active faults. Geophysical study was carried out for ground water exploration.

In the study area different rock units were identified. They range in age from Carboniferous to Quaternary. Eocene, Oligocene and Miocene are the most widespread rock units in this area.

Carboniferous rocks consist of alternating thick beds of sandstone; crossed-bedded sandstone and dark green shale.

Jurassic unit consists of varicolored, cross-bedded sandstones with mudstone and siltstone interbeds.

The Cretaceous succession in the study area is classified into three rock units, which are (from base to top) the Malha, Galala, and chalky limestone unit The Eocene rocks are the nummulitic limestones which form the main parts of the Gabal Ataqa and Galal as well as the faulted blocks of Akheider- Rammlyia and Um Zeita-Kahallya. The Eocene succession is subdivided into from base to top; the upper part of the Esna Shale Formation, the Farafra Formation, the Thebes Formation, the Muweilih Formation, the Mokattam Formation, the Observatory Formation, the Qurn Formation, the Wadi Garawi Formation and the Wadi Hof Formation. The Oligocene rocks are differentiated into two units; the lower unit is varicolored, unstratified sands, gravels, and sedimentary quartzites; the upper unit crop out in the central part of the study area and consists of basalt sheets of Gabal Ahmer Formation.

The Miocene succession exposed in the Sadat area that lays 30 km to the south west of Suez city, is subdivided as follows from base to top: Sadat Formation (Early Miocene), Hommath Formation (Middle Miocene) and Hagul Formation (Late Miocene). Recent deposits are represented by sands, gravels, clays, sabkha and sand accumulation.

Landsat Enhance Thematic Mapper (ETM+) data have been used to study geological and lineament analysis using the ERDAS imagines version 9.1. Two scenes (Landsat ETM+data) covering the investigated area have been geometrically corrected and radio metrically balanced.

Digital image processing of Landsat (ETM+) for the study area generated several products ranging from single band images, false color composite images (7,4,2 in RGB) respectively, principal component analysis (PC1, PC2, PC3, in R,B,G), and ratio images (5/7, 5/4, 3/1), (5/7, 3/1, 4/3) and (5/7, 5/1, 4) in (RGB).

False color composite images (bands 7, 4, 2) should fair to good contrast between the Tertiary basalts and the sedimentary rocks. The near infrared bands 7 and 3 indicate high reflectance in the iron zones and also indicate low reflectance in band 1. Typically, the more iron rich rocks are slightly brownish. Thus the Tertiary basalts are indicated by dark brown color, the limestone beds are whitish brownish, the Wadi deposits are whitish to whitish blue color. The man made areas are dark blue color.

The false color composite Landsat ETM+ images (7, 4, 2 in RGB) are suitable for regional tectonic structure and provide an excellent base map in which rock units are easily discriminated and geologic structures (mainly faults) are highly inferred. Also they show brightness and fair drainage pattern.

In the present study following ratio images were used: (5/7, 3/1, 4/3), (5/7, 5/4, 3/1) and (5/7, 5/1, 4) in (R, G, and B) respectively. Ratio images (5/1, 5/7, 4) were used for lithological discrimination of different rock types.

The Cretaceous rocks are indicated by dark green color, the Eocene sediments are indicated by green to whitish green color the Oligocene rocks are indicated by orange color, the Pliocene sediments are indicated by whitish green color, the Miocene sediments are indicated by whitish blue color and Quaternary old terraces are indicated by yellowish color. The man made areas are purple color.

The Landsat ETM+ false color composite image bands 7, 4, 2 in RGB and the band ratios Landsat ETM+ images with the guidance of the geological map of EGSMA, scale of 1:100,000, to redraw the boundaries of the different rock units producing a new geological map of the study area.

The magnetic data are calculated and covert the total intensity magnetic data into reduced to the magnetic pole by aero-service company and the values of the reduced to the pole data (RTP) are replotted on a base maps and contoured with contour interval 10 gammas (nano tesla).

The description of the reduced to the magnetic pole map shows the high magnetic anomaly occupying the northeastern, northwestern and eastern parts of the study area, while the low magnetic anomaly occupying the southwestern part. Also, there are several high and low magnetic anomalies, which directed N-E trend, which are respectively for the common structural trend in the study area. The map reveals different magnetic gradients at the eastern and southern parts of NE- SW trend and at the northeastern part of NW-SE trend.

The reduced to the magnetic pole map are separated into residual and regional anomalies. The separation was carried out at wave number 0.0000287 (1/km) on the magnetic map reduced to the pole (Geosoft programs, 1994). Two maps are produced representing the two separated pattern features (regional and residual) of the magnetic map reduced to the pole.

The Mag Mode interactive software (Geosoft programs, 1994) used to determine the depth source parameters such as depth, half width and magnetic susceptibilities on twenty selected profiles distributed through out the consider area.

The results of the depth determination are used for the depth map construction using Oasis Montaj software. The depth map of the upper surface for the basement complex reveals that the depth of the basement surface is deeper at the southern part where the depth reach to 3500 m, also the depth of the basement surface is deeper at the northwestern part where the depth reaches to 3200 m. The central part of the study area is occupying by shallow depths of the basement surface where the depth is 1200 m.

In the present study, the GM-sys program (1999) was used to make the magnetic modeling along five magnetic profiles crossing the magnetic anomalies and covering the study area, P1, P2, P3, P4 and P5 are W-E trend using magnetic susceptibility of 0.00229 cgs units for the basement rocks.

The qualitative interpretation for the total intensity magnetic map show many high and low magnetic anomalies which can be resulting from up thrown for the basement blocks according to the fault elements which can dissect the study area. These fault elements have trends N-S, NE-SW, NW-SE and E-W directions.

In the present study, geoelectrical methods are carried out by Schlumberger configuration to detect the subsurface geologic section by constructing the geoelectric cross sections and also, to determine the thicknesses of the different lithologic layers through the subsurface section. Added, constructing the contour maps of the top surface of the different layers, isopah maps for the different subsurface layers

Seventeen vertical electrical soundings are measured in the area enclosed between Lat. 29° 38' - 29° 45' N and Long. 32° 12' - 32° 21' E. The well known Schlumberger configuration of electrode separation ranging from AB / 2 = 1.5 m to AB / 2 = 1500 m used for measuring 17 VES stations. The aim of the

quantitative interpretation of the vertical electrical soundings is to determine the thicknesses and true resistivity values of the successive strata below the different stations.

The quantitative interpretation of the vertical electrical soundings is carried out by using IPI2WIN program. The final results used for construction four geoelectrical cross-sections which exhibits the different geological units represented in the study area. The isopach maps are constructed to indicate the variation of the thicknesses of the first, second, third, fourth and fifth units through the studied area. The second layer represent the fresh water aquifer in the study area for Upper Miocene age the lithology of this layer consists of limestone and sandstone, its thickness rang from 5 to 65m. Also the isoresistivity maps of the six main layers show considerable variation in the resistivity values ranged between 1 Ohm.m in the Fifth geoelectrical unit to 8700 Ohm.m in the frist geoelectrical unit.

The study area is mainly controlled by faults and limited folds. After tracing all lineaments from the landsat image, their orientations and lengths were determined and measured, then analyzed by preparing histogram diagram for analysis, interpretation and comparison with geologic map and geophysical trend patterns. The results indicate that the f1, f2 at the southern part and f3 at the north western of the study area which detected from geological and magnetic map have the same extension which indicates that these faults are active faults (risk area). Also the shape of the shore line of the western side of the Gulf of Suez controlled by the subsurface faults. The fault system has trends NE that affected on the major part and NNW trend which affected on the small part of the shore line in the studied area.

Data analysis using GIS environment includes two processes (overlaying, and intersecting,). In this study the intersect processes used to be correlated between the surface faults from geological map and subsurface faults from magnetic map. The analysis includes the analysis of drainage basins, shaded hill, slope, and digital elevation model DEM. Considering the risks of the common natural disasters like earthquakes which is represented by the epicenter that is detected in the area, fault zones, active fault and flooding; a risk map of the studied area is constructed. The overlying of the risk map over the classification map resulted in the production of land suitability map of the studied area.

GIS analysis has been applied in three chapters in this thesis, and the result is generating a land suitability map of the area depending upon the database which has been available. This land suitability map shows that area is of great importance in sustainable development. It has a fantastic shore, well whether and archeological places for both internal and external tourism. The mountains and the wadies are a suitable for safari tourism.

Recommendation:

- I recommend for drilling the four boreholes in the study area for extraction the fresh water for drinking, domestic and agriculture.

- Avoided any constructions and engineering purposes in the risk areas because it consisting of tracks of the flood plains and active faults.

- To avoid the destructive impacts of the flooding in the studied area and to get benefits of the flooding water as it is urgently needed dams in the upstream as well at the mouths of each basin have to be constructed

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دراسات جيوبيئية على المنطقة الواقعة غرب خليج السويس باستخدام البيانات الجيولوجية و الجيوفيزيقية و الإستشعار من البعد

رسالة مقدمة من

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للحصول على درجة الدكتوراه فى فلسفة العلوم

كلية العلوم
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الملخص العربى

يقدم البحث دراسات جيوبيئية باستخدام بيانات الأقمار الصناعية و المعلومات الجيوفيزيقية لمنطقة غرب خليج السويس والمحصورة بين المنحدر الجنوبى من جبل عتاقة شمالا وحتى المنحدر الشمالى من هضبة الجلالة البحرية جنوبا فى الجزء الشمالى الشرقى من الصحراء الشرقية. وتمتد المنطقة بين خطى طول ٣٢ °-٣٢٣٠° شرقا وحتى خط عرض ٢٩°-. ٢٩٣٠ °شمالا.

و تهدف الدراسة إلى تحديد الطبقات الحاملة للمياة الجوفية خاصة فى وادى غويبة حيث أن منطقة غرب خليج السويس من المناطق التى تلقى اهتماما من الحكومة خاصة فى مجال التعمير و إنشاء المشاريع الكبرى.
معرفة التراكيب السطحية و التحتسطحية و عمل خريطة موضح عليها التراكيب الجيولوجية.
أيضا بناء قاعدة بيانات جيوبيئية لمنطقة الدراسة على أسس نظم المعلومات الجغرافية ووضع توصيات محددة ومناسبة لإستراجية التنمية المستدامة بناء على البيانات المتاحة.

باستخدام الابحاث السابقة و الدراسة الحقلية أمكن التعرف على الوحدات الصخرية المختلفة والتى تتراوح أعمارها من العصر الكربونى وحتى العصر الرباعى والوحدات الصخرية الأكثر انتشارا تتبع عصور الايوسين و الأوليجوسين والميوسين.

باستخدام المكونات الأساسية للصورة فى القنوات (٢،١،٤) فى الأحداثيات الألوان (أحمر- أخضر- أزرق)على التوالى أمكن التفرقة و الفصل بين الصخور المختلفة الموجودة فى منطقة الدراسة.
باستخدام الصور الناتجة من العلاقة النسبية (٧/٥ – ١/٥ – ٤) و العلاقات النسبية (١/٣- ٢/٤- ٧/١) فى إحداثيات الألوان (أحمر- أخضر- أزرق) أمكن فصل صخور الأوليجوسين (بنفسجى اللون) و صخور البليوسين (أصفر فاتح اللون)و صخور الإيوسين (أخضر اللون)و صخور العصر الرباعى الحديث (أزرق فاتح اللون).

أما بالنسبة لخريطة المركبة الكلية للمغناطيسية الأرضية فقد تم عمل تصحيح لها بالنسبة للقطب المغناطيسى الشمالى لتلاشى التشوهات الناتجة عن بعد المنطقة عن القطب الشمالى و إرجاع القياسات المغناطيسية كما لو قيست عند القطب المغناطيسى. تم استخدام تقنية القدرة الطيفية مغناطيسيا للوصول إلى مستوى أعماق المصادر المسببة للشاذات المغناطيسية. وباستخدام برنامج (جيوسفت ١٩٩٤) تم فصل المجال المغناطيسى الكلى ورسم خريطتين تمثل الشاذات الضحلة والعميقة. وقد تم التفسير الكمى للمركبة الكلية للمغناطيسية الأرضية المصححة باستخدام برنامج (جيوسفت)١٩٩٤ لتحديد عمق صخور القاعدة من سطح الأرض وتم إنشاء خريطة كنتورية تبين عمق هذا السطح وقد أوضحت هذه الخريطة وجود سطح صخور القاعدة على أعماق ضحلة فى الجزء الأوسط من منطقة الدراسة على عمق (١٢٠٠ متر) ويزداد العمق فى الجزء الشمالى الغربى و الجزء الجنوبى ليصل إلى (٣٥٠٠ متر).

تم عمل ١٧ جسة كهربية رأسية فى المنطقة المحصورة بين خطى طول ١٢ ٣٢° - ٣٢،٢١° شرقا وحتى خط عرض ٣٨ ٢٩° - ٢٩،٤٥°شمالا. باستخدام طريقة توزيع شلمبرجير .

أدى التفسير الكمى للجسات الكهربية الرأسية باستخدام برنامـــج(IPI٢WIN) إلى إنشاء أربع قطاعات جيوكهربية. وقد أظهرت دراسة هذه القطاعات الجيوكهربية إلى وجود ستة طبقات وهى حصى ورمل وحجر جيرى وحجر رملى يحتوى على المياه الجوفية ويتراوح سمك هذه الطبقة من ٤,٥ متر إلى ٦٧ متر وتتبع عصر الميوسين الأعلى. وحجر جيرى ورمل متداخل مع الطين وحجر جيرى وحجر جيرى طينى وطين ورمال وحجر جيرى. كما تم تشييد خرائط توضح سمك ومقاومة هذه الطبقات.

تمت المقارنة بين التراكيب الجيولوجية الموجودة على الخريطة الجيولوجية و تلك التى تم استقراؤها باستخدام وسائل الإستشعار من بعد ثم مقارنة الملامح التركيبية السطحية بالتراكيب التحتسطحية للحصول على شكل واضح و كامل للوضع الجيولوجى بالمنطقة و قد أوضحت تلك الدراسة أن معظم الملامح التركيبية السطحية تمثل إمتداد لبعض التراكيب التحت سطحية بالمنطقة (صدوع نشطة).

و أخيرا تم الإستفادة من قدرات نظم المعلومات الجغرافية (برنامج ٩,١ Arc GIS) لتجميع كل البيانات لإنتاج الخرائط الرقمية وتصحيحها جغرافيا فى صورة طبقات معلوماتية أمكن مضاهاتها وإيجاد العلاقات بينها على النحو التالى :

١- إخراج نموذج الإرتفاعات الرقمى لمنطقة الدراسة والتى من خلالها تم الحصول على خريطة نسب الميول لصخور المنطقة بالإضافة لخريطة اتجاهات الميول والتى تساعد فى التعرف على أسلوب ونمط جريان المياه السطحية.

٢- عمل خريطة للوضع التركيبى و استنتاج خريطة للصدوع النشطة و خريطة مخاطر السيول و المخاطر الزلزالية.

٣- إنشاء خريطة توضح أنسب الأماكن المقترحة لحفر أبار المياه .

٤- - إنتاج خريطة استخدام الأراضى التى توضح أماكن التنمية المختلفة.