A Reconnaissance Gravity and Magnetic Study in Aqra plain

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Abstract

A gravity and magnetic survey was carried out as a first study of this kind in Aqra plain area (NE of Iraq). The survey occupied 116 gravity stations a long the main roads, as well as some sub roads. In addition to that 29 magnetic readings along the main road between Aqra town and Bardarash village where taken. The aim of this work is to obtain the main subsurface, shallow and deep structural units. The regional and residual anomalies for both gravity and magnetic data have been analyzed qualitatively were related to the expected geological features. The study showed that the basement rocks slope towards north and northeast with a depth of a bout 6-7km.

Keywords:- Aqra, Gravity, Magnetic.

Introduction

Aqra plain locates between Maqlub anticline in the south and Aqra anticline to the north, Fig. (1). There are no published geophysical studies in the area, hence the present survey is hopped to be a qualitative addition and a contribution to the subsurface tectonic framework of the region. For those purposes (116) gravity and (29) magnetic measurements were carried out.

The area of study covers about 500 km^2 of the plain which is expected to be of thick sedimentary cover. The dominant geomorphology of the area is related to a river deposits bounded from the extreme northern corner by ridges of the skeleton of Aqra anticline and truncated at the western corner by the river Khazir.

The area is cut by small valleys and generally have a simple terrain topography elevation from about 400 m above the sea level at the western and southwestern parts to reach about 700 m at the north and northeastern parts, (Fig. 1).

General geologic and tectonic setting

From the structural point of view, the study area is located between two major anticlines, both trending almost E-W direction which are Maqlub and Aqra anticlines. The broad area between these two structures (abou 35km) suggests the presence of a broad syncline. This fact was introduced as a general sketch constructed by (1), of Fig(2).The southern limb of Aqra anticline (to the north) is a vertical to an overturned, while

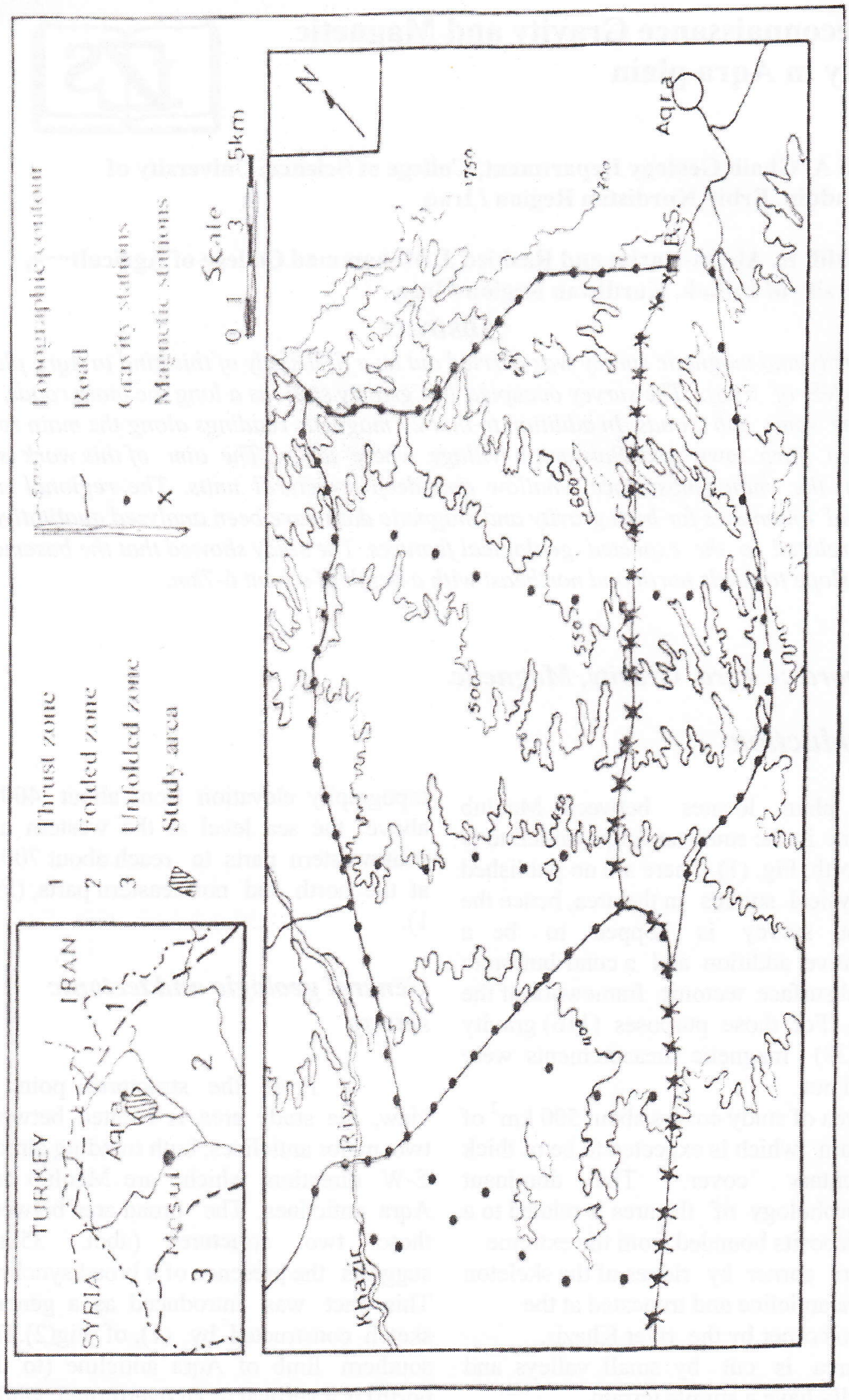


Fig (1) : Location and Topographic map of Aqra plain showing gravity and magnetic stations.

vertical the northern limb of Maqlub anticline (to the south) is of a normal dip [2].

Outcrops of Bakhtiari formation (Pliocene), Upper and Lower Fars formations (Miocene), PilaSpi formation anticline forms the northern boundary of foothill zone and it is suggested that it was formed by the basement uplifts in the Pre-Lower Miocene stages as a horst combined by a reverse fault on its southern flank [5].

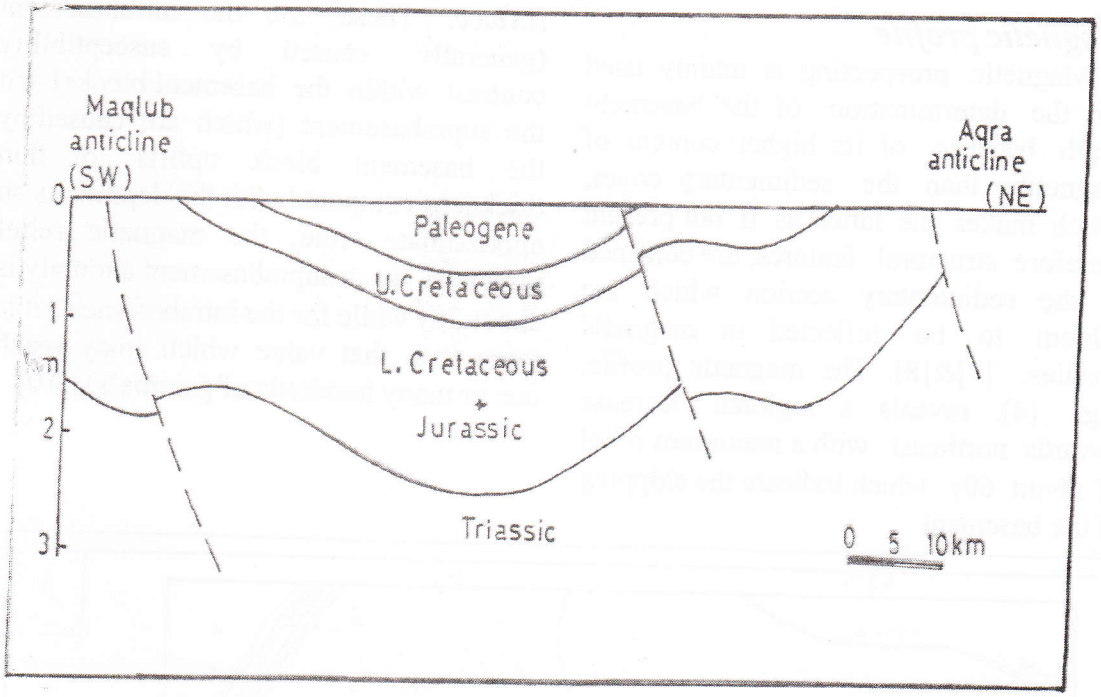


Fig (2) : A schematic cross section along Aqra plain (after Buday and Jassim. 1987).

(U. Eocene), Gercus formation (M-U. Eocene), Khormala-Kolosh formations (Paleocene–L. Eocene) and Aqra formation (Maastrichtian) are present at the northern part of the area, Fig. (3). Details about these formations are given in many literatures [3]; [2].

Tectonically the area is located within the foothill zone of Iraq [4], which is the central unit of unstable shelf of Iraq. This zone was affected by the Late Tertiary phases of the Alpine Orogeny. Aqra

Field work and data reduction

LaCoste and Romberge gravimeter-model G, Altimeter-model FA181 and a Proton precession magnetometer have been used to survey the area along the main roads Fig. (1). An arbitrary gravity base station (Fig. 1) has been established, because there is no primary base station to tie the readings to it around the area. The same point was used to be as magnetic base station. The datum of gravity data corrections was taken to be 250m above the sea level.

Free-air, Bouguer and Latitude corrections have been carried out for gravity readings while diurnal and normal corrections were applied to the magnetic readings. For the Bouguer correction, a mean surface density of 2.175gm/cm^3 was used as was the case for other Iraqi territories [6].

Magnetic profile

Magnetic prospecting is mainly used for the determination of the basement depth because of its higher content of magnetite than the sedimentary cover, which makes the latter as if not present therefore structural features, are confined to the sedimentary section which are seldom to be reflected in magnetic profiles. [7]&[8]. The magnetic profile, Fig. (4), reveals a regional decrease towards northeast with a maximum relief of about 60γ which indicate the slopping of the basement

[9] had summarized many techniques by which the depth of basement could be estimated. Using Peter's and Vacquier's methods showed that this depth ranges between 6-7km.

In general, there are two types of anomalies having their origin in magnetic contrasts at or below the basement surface. These are the intrabasement (generally caused by susceptibility contrast within the basement blocks) and the suprabasement (which are caused by the basement block uplifts of thin thickness compared with the depth). As an approximate rule, the magnetic relief produced by a suprabasement anomaly is about 20γ while for the intrabasement, it is more than that value which (may reach one or many hundreds of gamma's), [10].

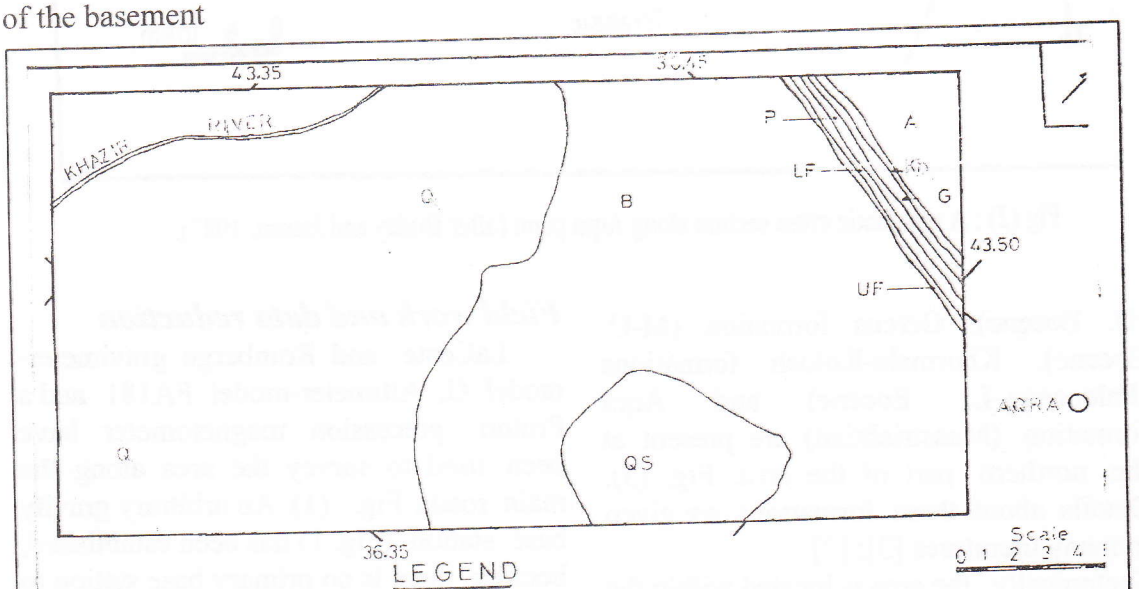


Fig (3) : Geological map of Aqra plain (in Aqrawi, 1989).

Depending on this rule, the two types of anomalies could be present in this study. The main anomaly (see the regional magnetic component), may be caused by an intrabasement condition while the undulation of amplitudes in the range of 10-20 gamma's may be attributed to a suprabasement case. The suprabasement anomalies may be caused by a local relief which may indicate the type of features for which deformation of the basement surface occurred after deposition of overlying sediments or by compaction over previously existing topography, [10].

Gravity maps

The nearest primary gravity station (of an absolute value) is located in Shaqlawa town while the nearest second order base station is located in Harir town about 50 Km. The southwestern zone is composed of a major positive anomaly of relatively steep gradient towards north and northeast with a main nose concaving towards the north Fig.(5).

The visual inspection of the Bouguer anomaly map reveals four regions of interest of positive and negative anomalies of regional and local manners.

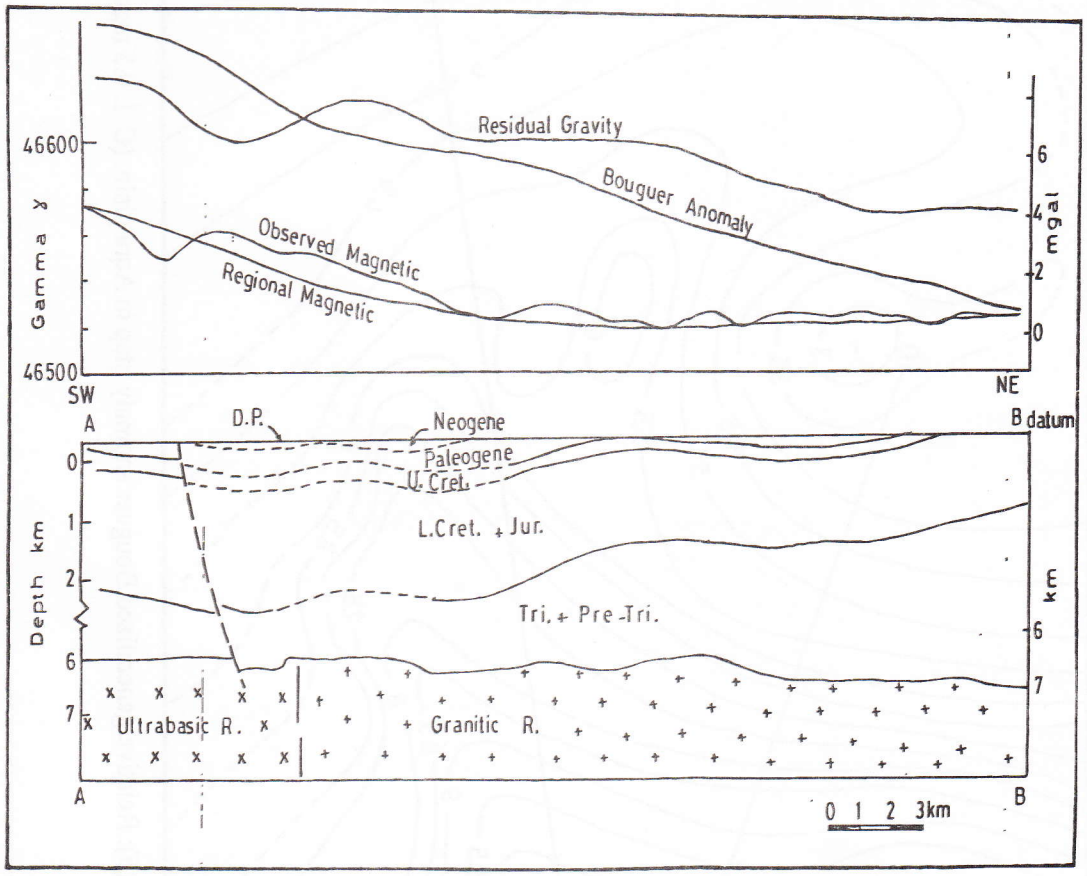


Fig (4) : Magnetic and gravity profile along Aqra plain and their expected interpretation.

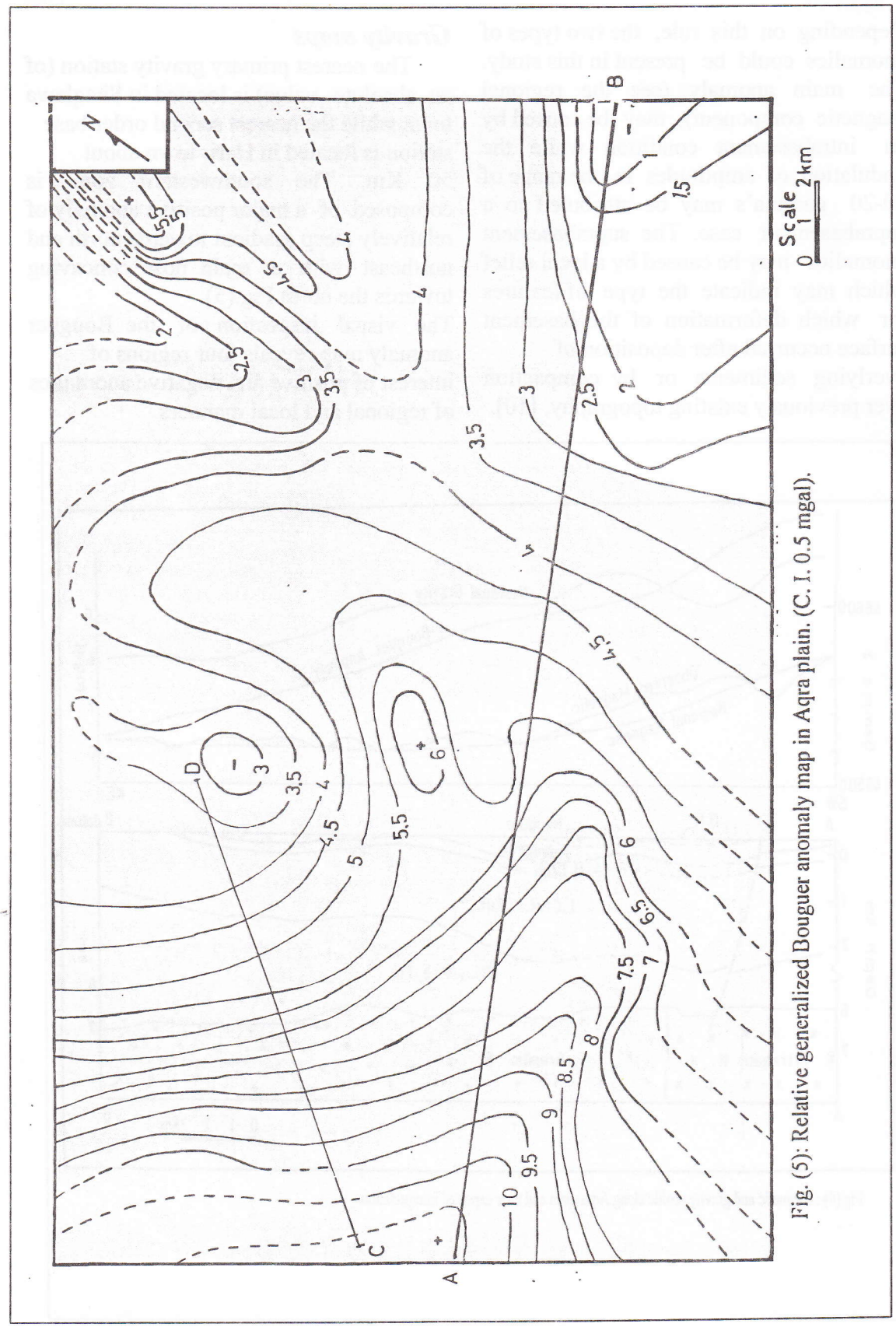


Fig. (5): Relative generalized Bouguer anomaly map in Aqra plain. (C. I. 0.5 mgal).

to be connected to another positive anomaly at the extreme northern corner of the study area. The latter one is trending N-S, may be along a major fault (F1, Fig. 6). The first mentioned anomaly is bounded from the north by a major fault (F2) which has its surface indications as gas-seeps. It is also bounded from the south by a fault trace trending E-W (F 3). The combination of these two faults form the main nose of the southwestern anomaly.

Along the E-W line, two separated negative anomalies are present. The first at the western part of the study area which is almost a closed anomaly reaching a minimum of about 3mgls, while the second is occupies the eastern corner of the area reaching a minimum value of about 1mgl. All the anomalies are extend outside the scope of the area of this study.

An attempt has been done to infer the major fault trends from the Bouguer anomaly map, Fig. (6). The figure shows a simple pattern of horst and graben structures which may have an important role in forming oil traps.

Bouguer anomalies are usually the reflection of two types of causative bodies. Shallow structures are reflected as the so-called residual anomalies superimposed on the regional anomalies having their sources deeper in the sedimentary cover and the basement complex rocks.

Many techniques have been stated for the separation of these two combined anomalies [12];[13]&[14]. The simplest method in doing this may be the contour smoothing which has a disadvantage of the personal bias. However this personal bias may has it's advantage when the interpreter has some knowledge about the geology of the study area. In our case the main constraints are the presence of clear outcrops and strata attitudes north and south of the area.

The residual anomaly of the separated area using the contour smoothing method is shown in Fig. (7). This map reveals clearly the fourpartite anomaly distribution which are present in Bouguer map. An approximately northsouth trending, two positive anomalies occupying both the northern and southern corners of the area. These two anomalies are separated by the extension between the two negative anomalies lying on the E-W line occupying the eastern and western corners. This interaction between the southern positive anomaly and the western negative anomaly as well as the approximately E-W fault which separates them may have some interest from the petroleum-geological point of view.

By correlating the residual anomalies with a flow-net map prepared by [15], Fig. (8), however, this map is a reflection of the influence of very shallow structures (even above the gravity datum level), there are some important indicative features. The most conspicuous is that the area of accumulation of under ground water which is in coincidence with the negative anomaly near the eastern corner of the area.

On the other hand, the regional anomaly map, Fig. (9) reflects the effect of deep-seated structures. It is obvious that the faults trending N-S and E-W are of shallow and deep origin specially there appearance at both the northern and eastern corners of the study area. The general gradient of the gravity regional field is towards the north and has a value of about 0.7mgl/km which indicates again that the basement complex is deepening towards north and northeast.

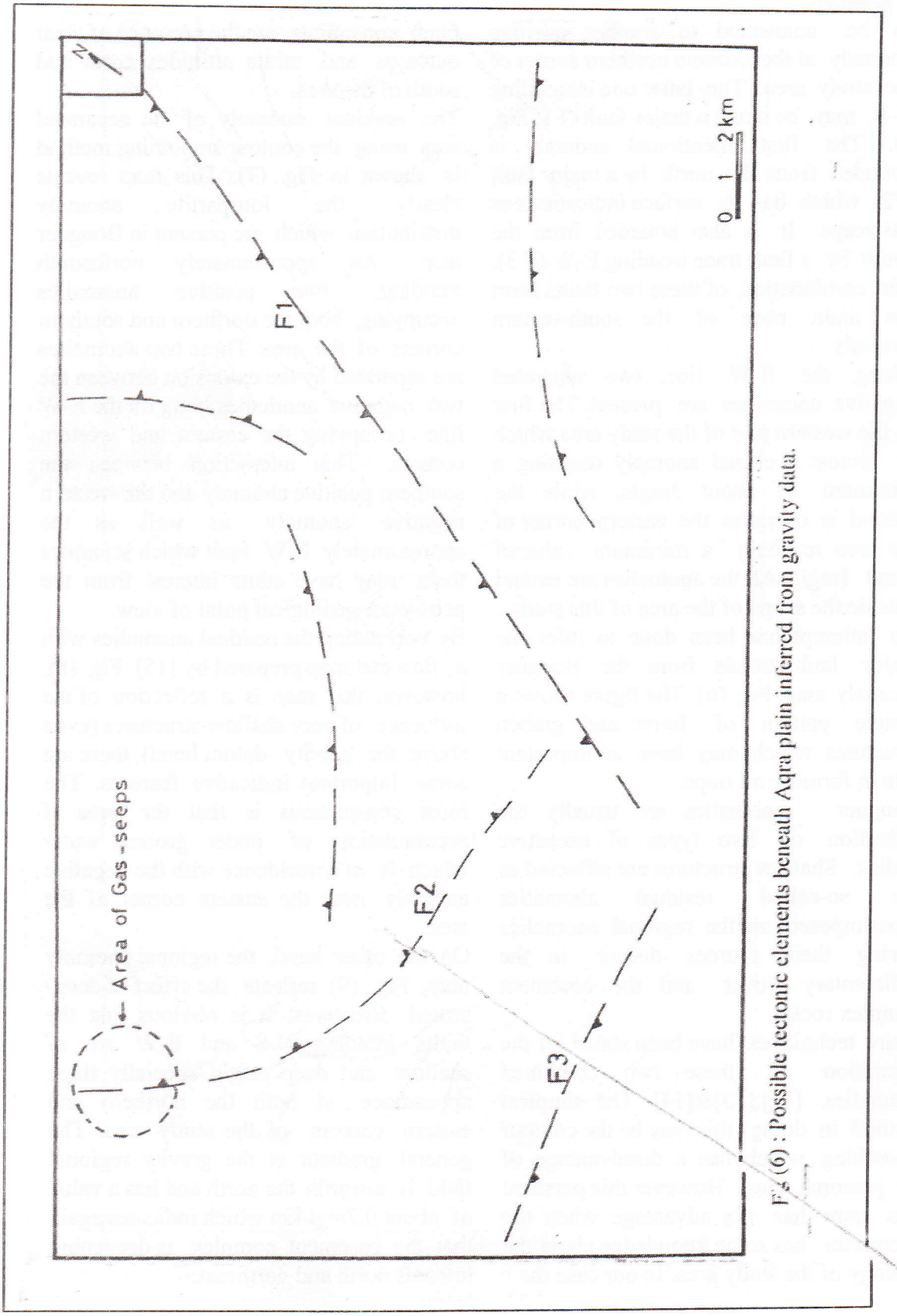


Fig.(6) : Possible tectonic elements beneath Aqra plain inferred from gravity data.

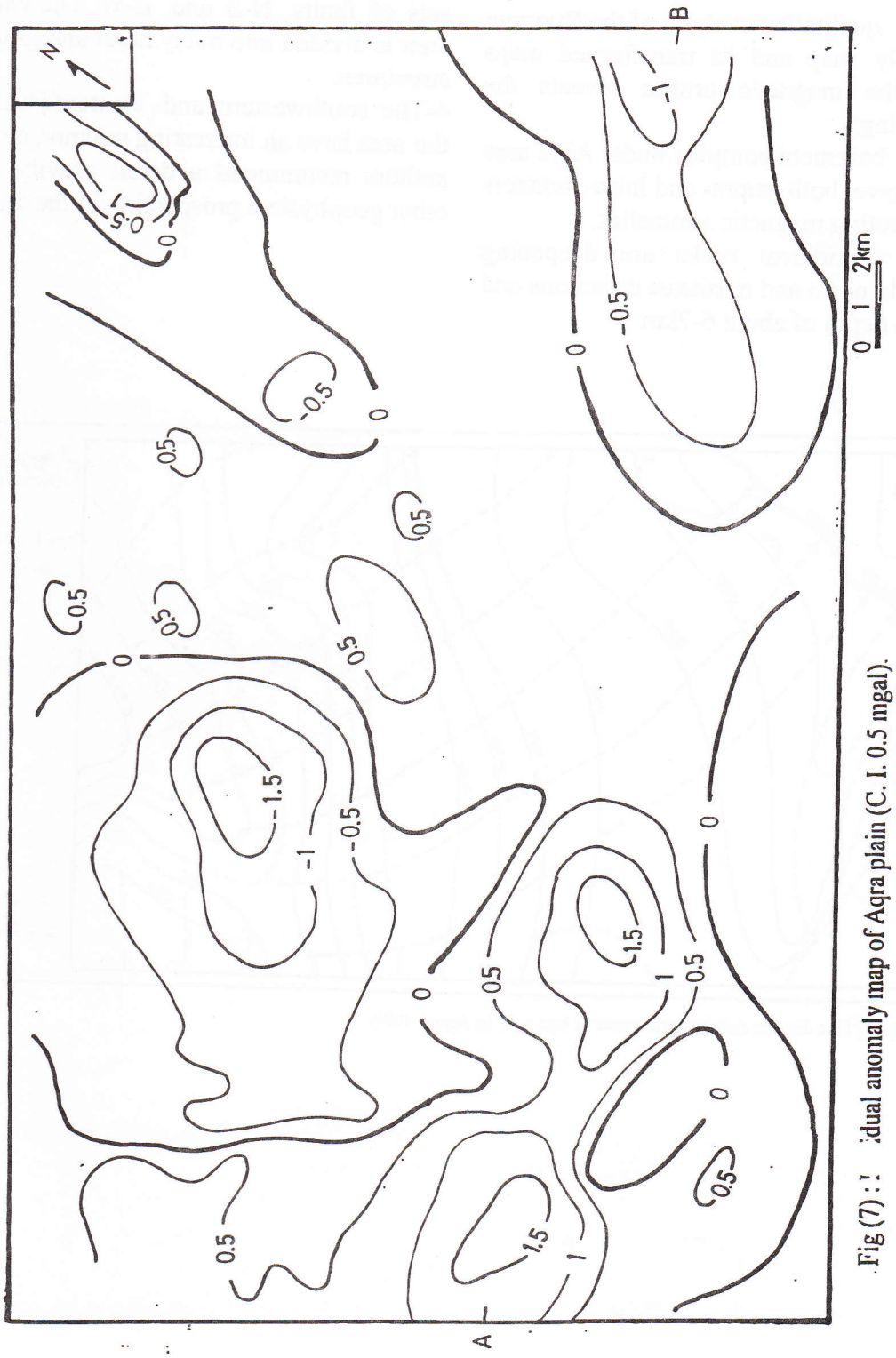


Fig (7) : : :dual anomaly map of Aqra plain (C. I. 0.5 mgal).

Conclusion and Recommendation

The qualitative analysis of the Buoguer anomaly map and its transformed maps with the magnetic profile reveals the following:

1-The basement complex under Aqra area may have both supra- and intra- manners in reflecting magnetic anomalies.

2-The basement rocks are deepening towards north and northeast directions and have a depth of about 6-7km.

3-The area is complicated mainly by two sets of faults, N-S and E-W. The whole area is divided into many horst and graben structures.

4-The southwestern and western parts of the area have an interesting manner, so the authors recommend a detail gravity and other geophysical prospecting in the area.

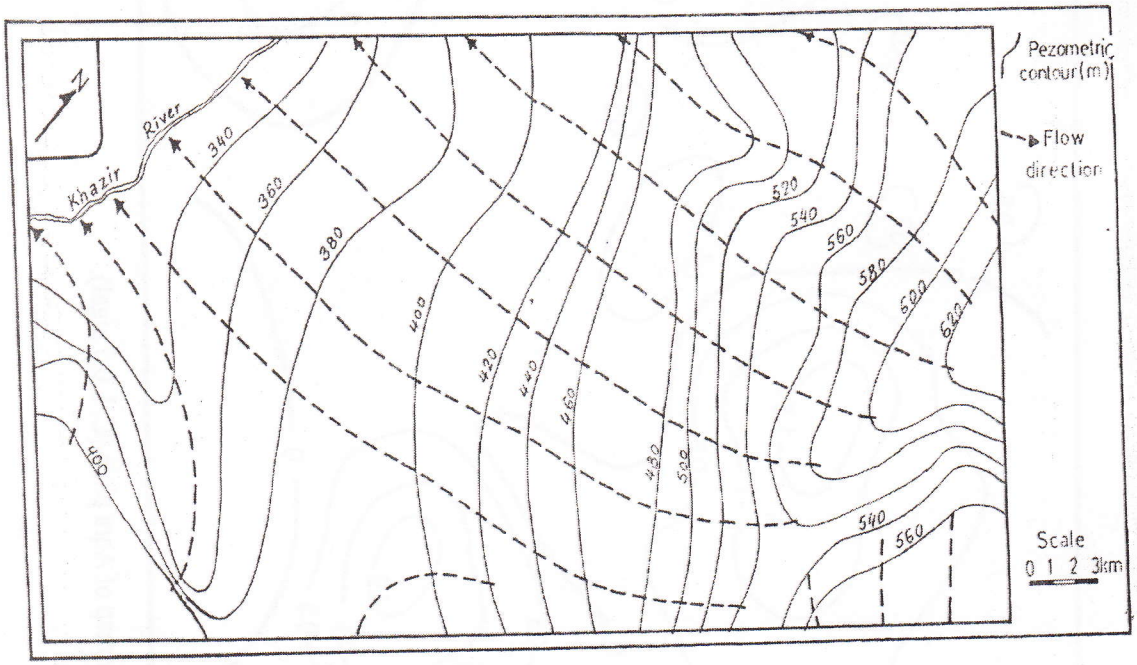
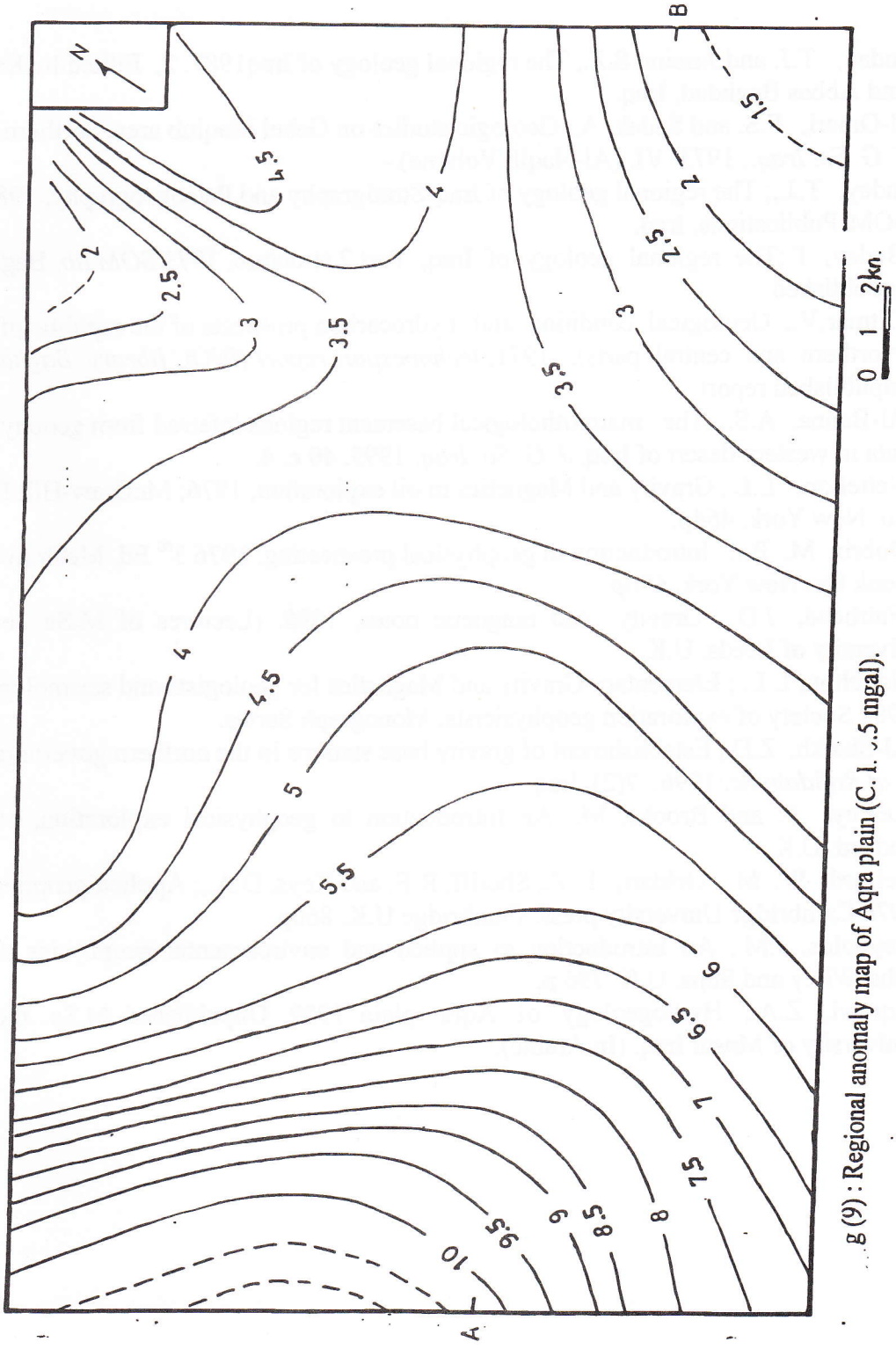


Fig. (8): Flow direction and pizometric contour of Aqra plain. (in Aqrawi, 1989).



g (9) : Regional anomaly map of Aqra plain (C. I. ..5 mgal).

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فەکولینە کاراکیشانی وموگناتیسی یالینیرینی بودە شتا ئاکری

فازل علی غائب
کۆلیجی زانست / زانکۆی سەلاحەددین / هەریمی کوردستان - عیراق
و سالیح خەلیل عەبدو الکریم و رەشید جەعفەرمحمد
کۆلیجی کشتوکال/ زانکۆی دهۆك / هەریمی کوردستان - عیراق

پوختە

لەناوچەی دەشتی ئاکری کە دەکەویت رۆژهەلاتی باکوری عیراق مەسحیکی کیش کردن و موگناتیسی ئەزموونیکرا، ئەمە بو یەکەمین جارە لەم جۆرە تویژینەوەیە بکریت، ١١٦ ئیستگەی کیش کردن تومارکرا و لەسەر ریگای سەرەکی وپیوران وهەروەها ٢٩ ئیستگەی موگناتیسی لەسەر ریگای سەرەکی نیوان ئاکری وبەردەرەش پیوران. ئامانجی ئەم تویژینەوەیە وەرگرتنی زانیاری بوو لەسەر چۆنیەتی پیکهاتووی نزم وقوك لەم ناوچەیەو شیکردنەوەی دەرئەنجامی کیش کردن و موگناتیسی ونەخشەو جۆرەکانی برگە بواری هەریمی و ناوچەی وگریدانیان بە باری جیولوجی پیشبین کراوی ژیر رووی زەوی، لە ئەنجامدا دەرکەوت کەقولای بنکەی ئالوز (القاعدە المعقدە) دەکەویتە نیوان ٦-٧کم ولاریەکەی بە ئاراستەی باکور و رۆژهەلاتی باکورە.

دراسة جذبية ومغناطيسية استطلاعية لسهل عقرة

فاضل علي غائب كليةالعلوم /جامعة صلاح الدين / اقليم كردستان - العراق
و صالح خليل عبد الكريم و رشيد جعفر محمد
كلية الزراعة / جامعة دهوك / اقليم كردستان - العراق

الخلاصة

أجري مسح جذبي ومغناطيسي لمنطقة سهل عقرة الواقع في الجزء الشمال الشرقي من العراق ولأول مرة تجرى دراسة من هذا النوع في هذه المنطقة حيث سجلت (١١٦) محطة جذبية قيست على شبكة الطرق الرئيسية و (٢٩) محطة مغناطيسية قيست على الطريق الرئيسي الرابط بين قضاء عقرة وقرية بردرش. استهدفت هذه الدراسة الحصول على معلومات عن الوضع التركيبي الضحل والعميق في المنطقة. تم تحليل المعطيات الجذبية والمغناطيسية وخرائط ومقاطع المجالين الإقليمي والمحلي نوعيا وربطها بالوضع الجيولوجي المتوقع تحت السطح وجد بأن عمق القاعدة المعقدة يتراوح بين (٦-٧) كم وينحدر باتجاه الشمال والشمال الشرقي.

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