



COMPARISON BETWEEN BASEMENT DEPTHS ESTIMATED FROM LAND MAGNETIC AND AEROMAGNETIC SURVEYS, WEST IRAQ

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Abstract

Basement depth is determined from land magnetic survey along a traverse with a length of 190 Km in the western desert of Iraq. The traverse was extended from Akkashat to Um Rthuma area. The shape and depth of the basement surface is obtained through using Geomodel program. The outcome is compared with the basement depth determined by Compagine Generale de Geophysique (CGG), through using aeromagnetic data. There are certain variations between the two results concerning the depth values along the traverse profile. The CGG basement depth map provided a general picture and the present results indicate the importance of re-determination of basement depth from field data and use the developed and sophisticated analysis procedures to get a new look to such important topic.

Keywords:-Basement depth Geomodel, land magnetic survey, Aeromagnetic survey

مقارنة بين أعماق صخور القاعدة محسوبة من المسح المغناطيسي الأرضي والمسح الجوي غرب العراق

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الخلاصة

تم حساب عمق صخور القاعدة من المسح المغناطيسي الأرضي بمحاذاة مسار طوليه (١٩٠ كم) في الصحراء الغربية من العراق امتد المسار من منطقة عكاشات إلى أم ارضمة . لقد وجد شكل وعمق سطح صخور القاعدة من خلال استخدام برنامج Geomodel، وقد فورنت النتائج مع عمق صخور القاعدة المحسوب من قبل شركة CGG . هنالك بعض الفروقات بين نتائج المسوحات المتعلقة بالعمق ، فخارطة عمق صخور القاعدة المعدة من قبل شركة (CGG) أعطت صورة عامة بينما النتائج من المسح الحالي تشير إلى أهمية إعادة احتساب العمق من معلومات المسح الحقلية الأرضي ، ومن ثم استخدام أساليب التحليل المتطورة للحصول على معلومة جديدة بخصوص هذا الموضوع .

الكلمات المفتاحية:- صخور القاعدة، المسح المغناطيسي الأرضي، المسح الحقلية الأرضي.

Introduction

The determination of the basement depth is an important aspect since it reflects structural features that have an influence on the overlying sedimentary cover. Magnetic method is suitable for mapping basement features which may be hidden by overlying sedimentary cover. The estimation of basement depths are targets for oil exploration. Contour maps of basement depth for the western desert of Iraq have been established by [1,2]. Ditmar et. al. used the statistical correlation method using geological and geophysical data while CGG interpreted the aeromagnetic map through the application of the inflection tangent intersection (ITI) method. The two maps show great differences in the basement depth estimation of the order of few kilometers. Such differences have great deal with the thickness of the overlying sedimentary cover and in turn have a great influence in the estimation of oil potential of the area. The depth of the crystalline basement around Rutba area ranges between 2-5km and its highest part occurs in the Ga'ara area (Buday and Hak, 1980). The depth values estimated from aeromagnetic interpretation by [1] in this area is about 8Km. This value differs from the depth of 1-4Km given by [2,3,4]. The result of seismic reflection studies in the western desert of Iraq shows that the basement depth is around 7Km [5]. In Akkas area, [6] interpreted top basement to be about 6.5Km subsea. Depending on the discovery of natural gas in the Paleozoic sediments (Akkas field), [7] believed that the area may have good hydrocarbon accumulations. The purpose of paper is to get information about basement depth determination from land magnetic survey along a traverse extends from Akkashat area to Um Rthuma area, near Rutba (Fig. 1). Then this result is compared with the published depth values estimated by CGG along the same traverse.

Geology of the Area

The area, under which the basement depth estimation was carried out, represents part of Iraqi western desert which belongs to the stable shelf of African-Arabian platform. The sedimentary cover extends from the Paleozoic to the Tertiary and is characterized by mostly shallow deposits and by numerous breaks in sedimentation [8]. From structural point of view, the area is relatively

simple; the dip of the strata is generally below one degree and cannot be measured directly. The basic structural feature is the Rutba –Khelissia subzone of the stable shelf [8] which represents part of huge regional N-S trending uplift structure. The dominant feature of this area is Rutba uplift which has been observed on the gravity measurements carried out on the western desert [9]. A good description of the geology of the western desert of Iraq and its hydrocarbon potential is given by [10].

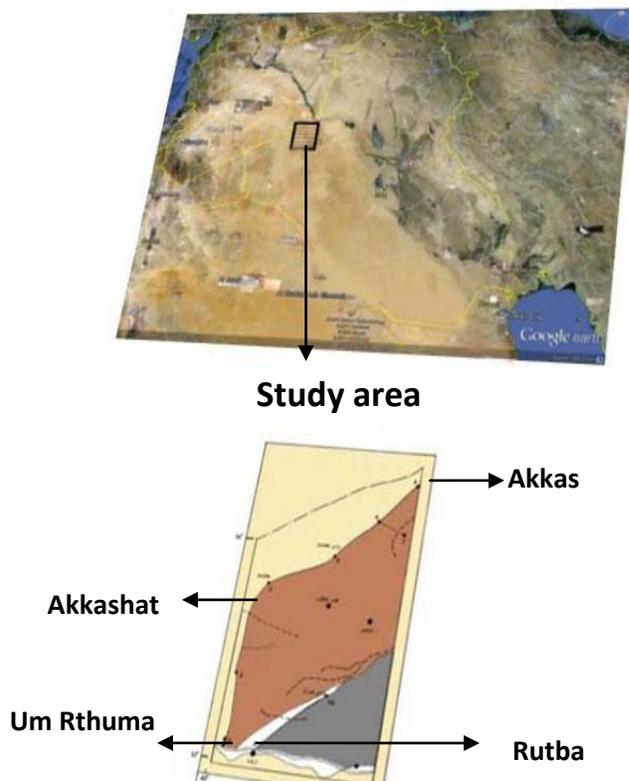


Fig.1: Location map of the land magnetic survey.

The Aeromagnetic Map of the Area

The aeromagnetic map of the area (Fig.2) is a part of the total magnetic intensity map performed by CGG from the aeromagnetic and aerospectrometric survey conducted in Iraq (1973-1974). The flight altitude was at a constant ground clearance of (135-140) m. The orientation of the line directions are $N30^{\circ} E$ and the line spacing is 2Km. The directions of magnetic anomalies are quite variables in the area where one can hardly see a dominant direction.

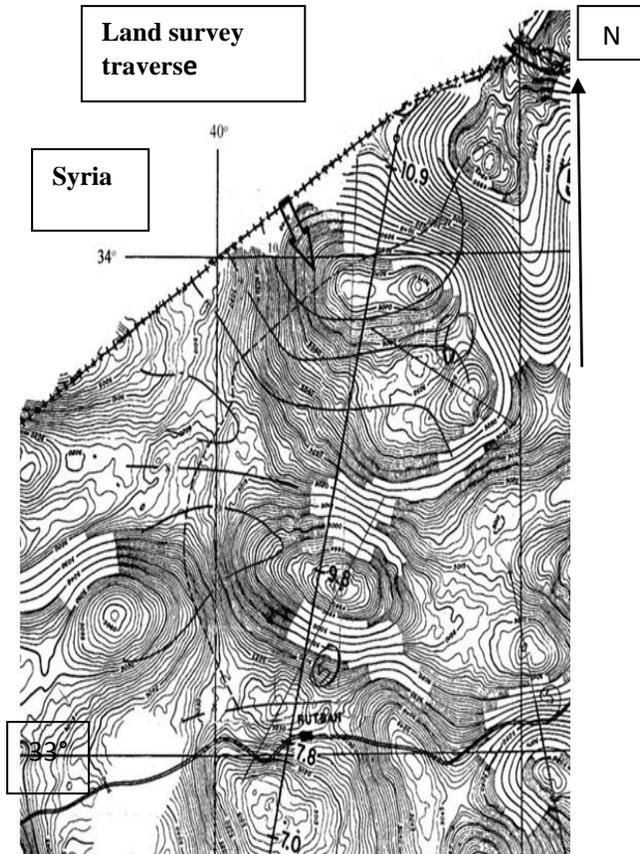
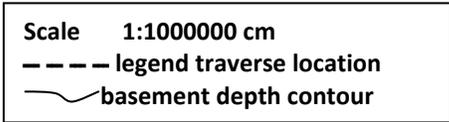


Fig. 2 :: Aeromagnetic contour map showing the location of the land magnetic survey traverse (- -) and depth of basement () determined by CGG 1973.



Magnetic Field Survey

Land magnetic survey was executed along a traverse with total length of 190Km that follows the main road from Al-Qaim-Akashat towards Tribeel area (Fig. 1). The distance between measuring stations is ranging between (1-2) Km. Two magnetometers have been used. A proton magnetometer is used to measure the total magnetic field at the measuring stations and the other one is placed at a selected site for base station where readings are used for diurnal correction. The final total magnetic values were calculated and presented as magnetic profile (Fig.3). The general shape of the obtained

magnetic profile is in good agreement with the shape of the aeromagnetic profile of CGG (Fig.4).

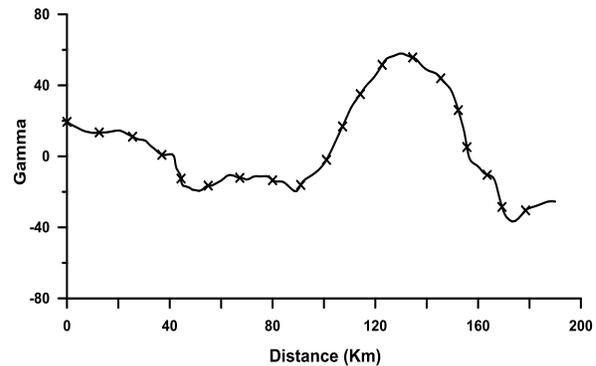


Fig. 3 : Total magnetic field intensity profile along the land survey traverse

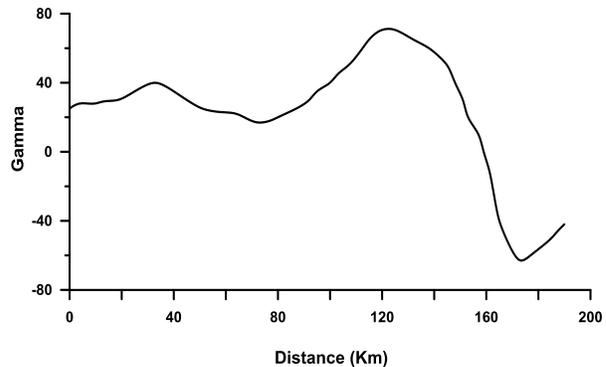


Fig. 4 : Total magnetic intensity profile along the traverse from aero magnetic map, where land magnetic survey was carried out. (Drawn from CGG map, 1973-1974)

Basement Depth Model

Basement surface shape and depth are determined from magnetic profile along the traverse through using Geomodel program [11] where the observed profile is compared with calculated data. A good fit is achieved after many trials of computations (Fig.5), but there is discrepancy in the certain part since the traverse is divided into two parts for the purpose of fitting the data. The first part has a length of 120Km and the other has length of 70Km. The two models are gathered in one plot for the purpose of comparison with the aeromagnetic data profile. Basement depths are ranging between (7-13Km) (Fig. 6) Two uplifts on the basement surface are noticed in the southern and northern parts of the traverse. The southern part has been divided into many uplifted blocks, indicating a possible faulted block

system as suprabasement structures. The northern part is smoother but it also shows uplifted blocks with low relief surface differences. The area between the two uplifted parts shows the deepest part of the basement along this traverse, indicating the possible great thickness of the sedimentary cover. In contrary, the basement surface shape and depth along the same profile drawn from the CGG basement depth map shows an opposite picture (Fig.7). The depths range along the traverse between (7-10)Km with an uplifted area in the middle part of the traverse while the southern and northern parts reflect a smooth basement surface. It worth mentioning that there is certain difference between the observed and calculated magnetic anomalies at a distance of 80Km. This difference is due to the procedure used in applying the Geomodel where two segments are treated and then put together to be compared with CGG model.

Conclusion and Discussion

It is well known that surface measurements of magnetic field give a detailed data compared to aeromagnetic survey. The aeromagnetic survey will reflect deep, large extent structural features. The present paper highlight the importance of carrying out land survey in area where interested anomalies are reflected in aeromagnetic survey. However, the present depth model is also depend upon the chosen susceptibility in the calculation where no outcrop of basement rocks are available and these values will effect in certain extent the final results.

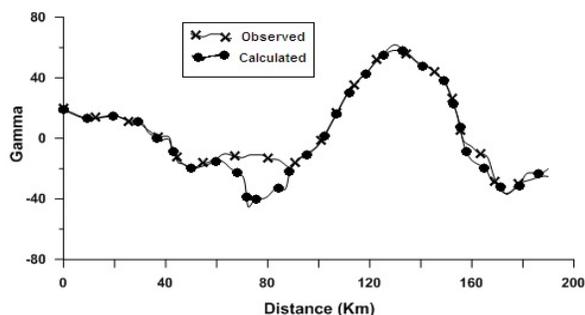


Fig. 5 : Observed magnetic profile of the land magnetic measurements carried out along the traverse with the calculated one deduced from basement surface using GEOMODEL program.

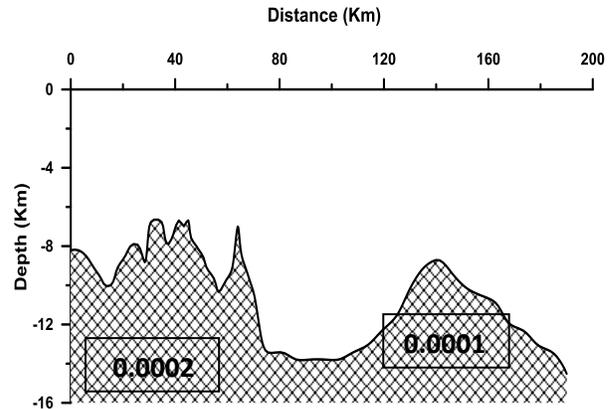


Fig. 6 : Basement surface features along the traverse where land magnetic survey was carried out. The basement depth was calculated by GEOMODEL program.

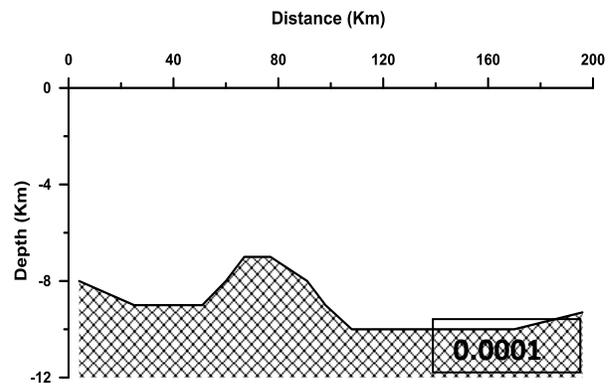


Fig. 7 : Basement surface along the magnetic profile produced from basement depth map prepared by CGG (1973-1974).

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