

Structural condition analysis of Balad Field by used seismic sections

Mohammad Rashid Abbood Al-Jubori , Mhanna Metab Ahmed , Ahmed Ibrahim Saleh Al-Naemi

University of Tikrit , College of science, Applied Geology Department

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Abstract

Normal faults F1 and F2 represents the general structure of Balad Field. Which divided into three regions as: northeastern shoulder, graben and southwestern shoulder . Depending on the reflectors Khasib, Hartha and Jeribe Formations, these reflectors shows that Tertiary formations were not affected by these faults . These faults were ended at the end of the precipitation of Hartha Formation at the end of Cretaceous period. also these formations were slightly affected by the second phase of Alpine orogeny and the process of folding did not take place in the geological formations. Therefore, the area was considered as block faulting .

Introduction

Structurally, Balad Field is located within a series of structures in western bank of Tigris region, which includes: (from north to south) Baij , Tikrit, Samarra, Balad, East Baghdad. These structures are sequent to each other to form en-echelons arrangement. This was referred to in reference number 14.

Related to the subsurface data (stratigraphic, structural, geophysical data) on the study area, it can be noticed that it is affected by a group of faults which were formed through geological ages and which grow within a particular period . These faults resulted in a shape change of the succession sedimentary basin during the Jurassic up to the late Miocene age and eventually, they were reflected on the reservoir condition .

The previous study of Balad Field illustrate structural closer (fold) in this field, therefore, the current study aims to pointing the subsurface structural condition of the study area by using the seismic sections available about the area .

Geophysical surveys

Many different surveys have been performed on Balad Field for the sake of providing a structural image of the area. These surveys include different types such as :

1 - Gravity surveys

These come from the interpretation of residual gravity anomaly in Iraq (reference number 13), It shows that the general inclination of territorial gravitation from the west to the east with a positive anomaly irregularity in the shape of a structural nose.

2 - Magnetic survey results by OEC,1974

Magnetic results asserted of that the area is structurally based on the existence of two positive and negative anomaly . In addition, maps revealed the depth of the base rocks whose depth ranges from (9-13) kilometers.

3 - Seismic surveys by OEC

The first of these surveys was carried on (1958). It points to the existence of a general slope in the rocks. The region inclined towards the east, and lack of any folding phenomenon. Another survey was achieved in (1974 -1975) and repeated in (1977) . A third detailed survey was achieved in (1979-1981) .

In (1981) a deep seismic survey was undertaken on the area and in (1982) another detailed survey was done. Finally, in (1985-1986) a detailed seismic survey was achieved and then followed by a complementary seismic survey in (1987-1988) .

Location of studied area

The study area was represented by a strip of 10 kilometers width and 16 kilometers length located between the Samara Field in the north and East Baghdad Field in the south. It is located on western bank of Tigris, and it is about 9 kilometers south of Balad District and 40 kilometers north of (north stretches) of east Baghdad Field .

The study area is located between UTM Geography

N: (3766 500) (3747 000) m = 34° 02' 20.7832" , 33° 51' 43.8264"

E: (426 250) (412 250) m = 44° 12' 3.8164" , 44° 03' 4.9211"

It includes nine wells distributed in the whole area, (figure 1) .

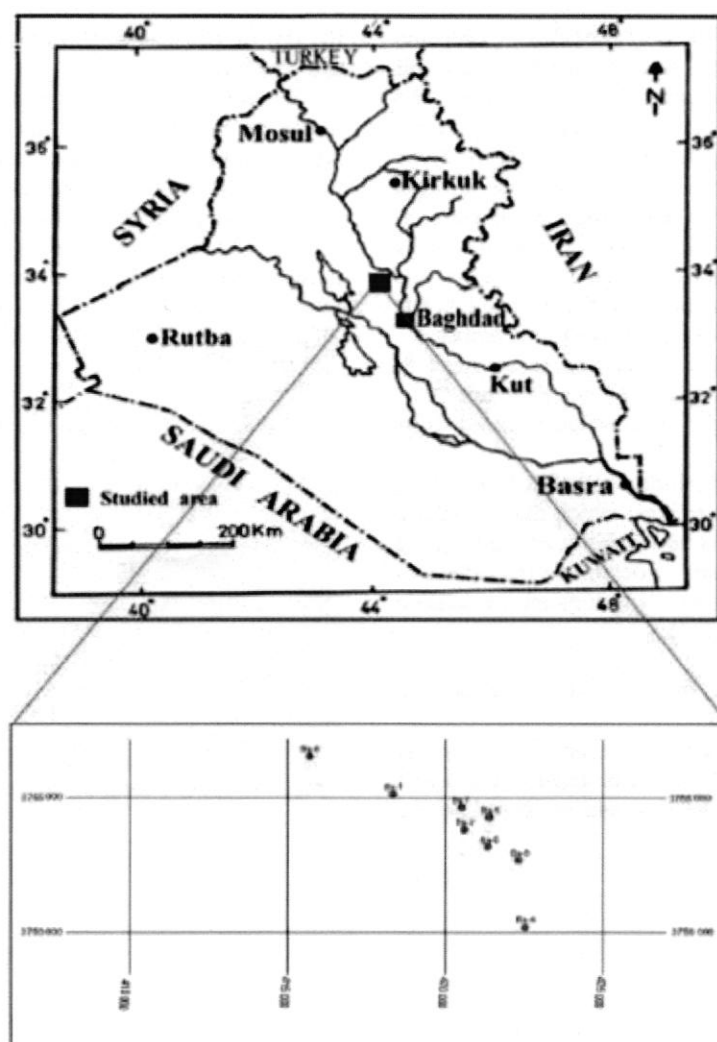


Figure (1) illustrated location map of the study area

Discussion and Structural analysis of study area

We have been depending on reflectors of Khasib, Hartha and Jeribe Formations in determining the general shape of the Balad field and the extent of influence of Alpine Orogeny and especially operations compressibility (phase II) of the Alpine Orogeny, which was on its peak at the end of the Miocene age. Faults are considered to be a feature of brittle breakage and they are formed under the effect of stresses, especially in the upper crust levels (reference number 12). Some of these faults are considered surfaces that sink in the depth through the transitional zone and when they intersect that zone their features change at their deep levels, with a gradual change in the displacement range during the flow zone. The direction of the fault movement can be suggested through the existence of the slickenside structures (references number 1 and 11).

The two major faults (F1 and F2) are considered among the faults recorded in most previous studies achieved by oil companies. It is probably that they

played a major role in determining the patterns of sedimentary basins that prevailed during geological ages, and in determining the direction of the process of oil migration from the east to the west. They might have played also a role in increasing secondary porosity.

The faults (F1 and F2) are longitudinal normal faults extending toward northwest-southeast and they represents the general structure of Balad Field within the study area with a length of more than 20 kilometers. It is believed that they are a result of deep seated faults originated from the basement rocks and extended through stratigraphic sequences till the end of the Hartha Formation deposition. Their effect in the Shiranish Formation is very little and they were not recorded in the sequences of the Tertiary age. This was clarified by structural and seismic sections and by what had been concluded from comparing the total thickness of the Tertiary sequences calculated from the top of Jeribe Formation to the top of Shiranish Formation in the wells of the study area,

The faults (F1 and F2) were decided by seismic sections and previous studies achieved by oil companies (reference number 13) . In addition, the existence of F2 fault was stressed depending on the results of wells drilling operation (Ba-1, 3, 4). Maps and structure sections show the existence of two normal parallel faults extending in northwest-southeast i.e (a strike-slip direction). The two faults are (F1 and F2) . The plane of fault F1 bends towards the northeast, while the plane of the fault F2 bends toward southwest. The two faults enclose a graben

The research area was divided into three areas in depended the two major faults (F1 and F2), namely :

- 1- Northeastern shoulder area, which includes wells Ba-2.5, 6, 7, 9.
- 2- Graben area, which includes wells Ba- 1, 3, 4, 8.
- 3- Southwestern shoulder area, which did not drill a well, where the state has been relying on the wells of northeastern shoulder area to determine the reflectors Khasib, Hartha and Jeribe, using logs on the seismic sections (figures 2. 3, 4, 5) .

CONCLUSIONS

The following points were concluded from the present study :

1. The Tertiary formations were unaffected by the normal faults (F1 and F2), and in general, the dip of formations is towards the east and northeast, while,

the dip of Cretaceous formations is toward the east and southeast .

2. The difference in thickness of Hartha Formation in the graben area is less than that in the shoulder region (northeastern and southwestern shoulders), which confirms the effectiveness of normal faults (F1 and F2) during the deposition Hartha Formation .

3. All faults that are installed in the Balad field are normal faults, which reflect the non-existence of any folding and the Balad Field is a block faulting .

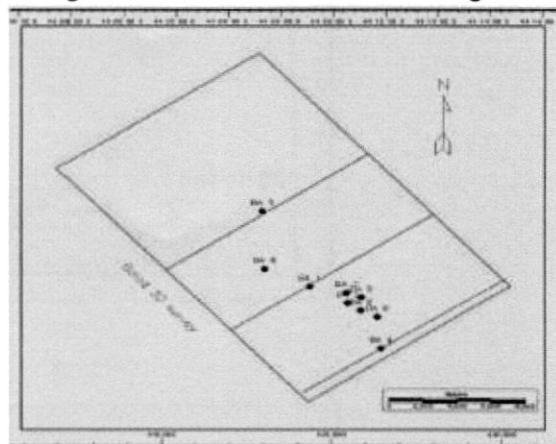


Figure (2) Base map of seismic section on Balad Field

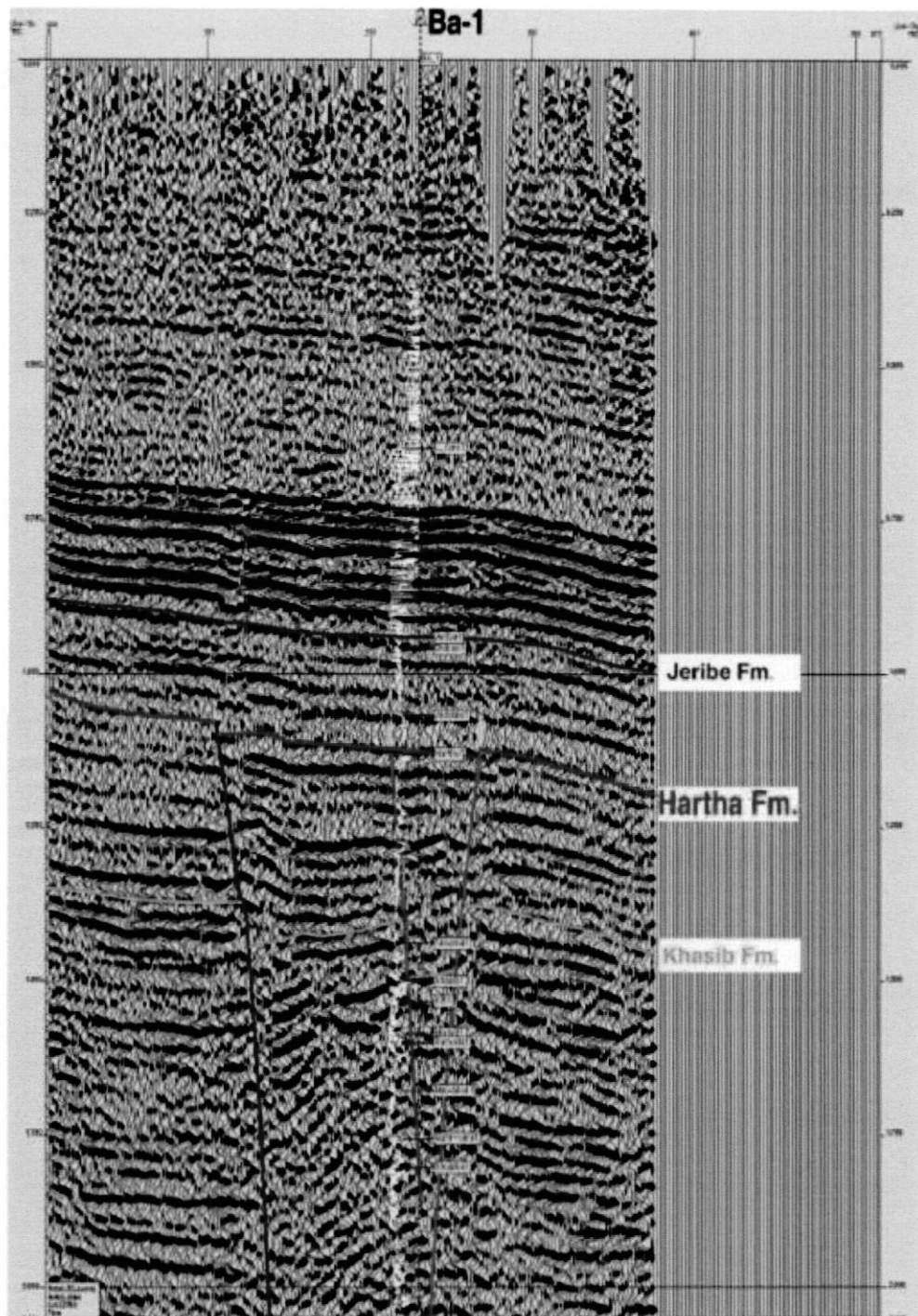


Figure (3) Seismic section on Balad-1 well

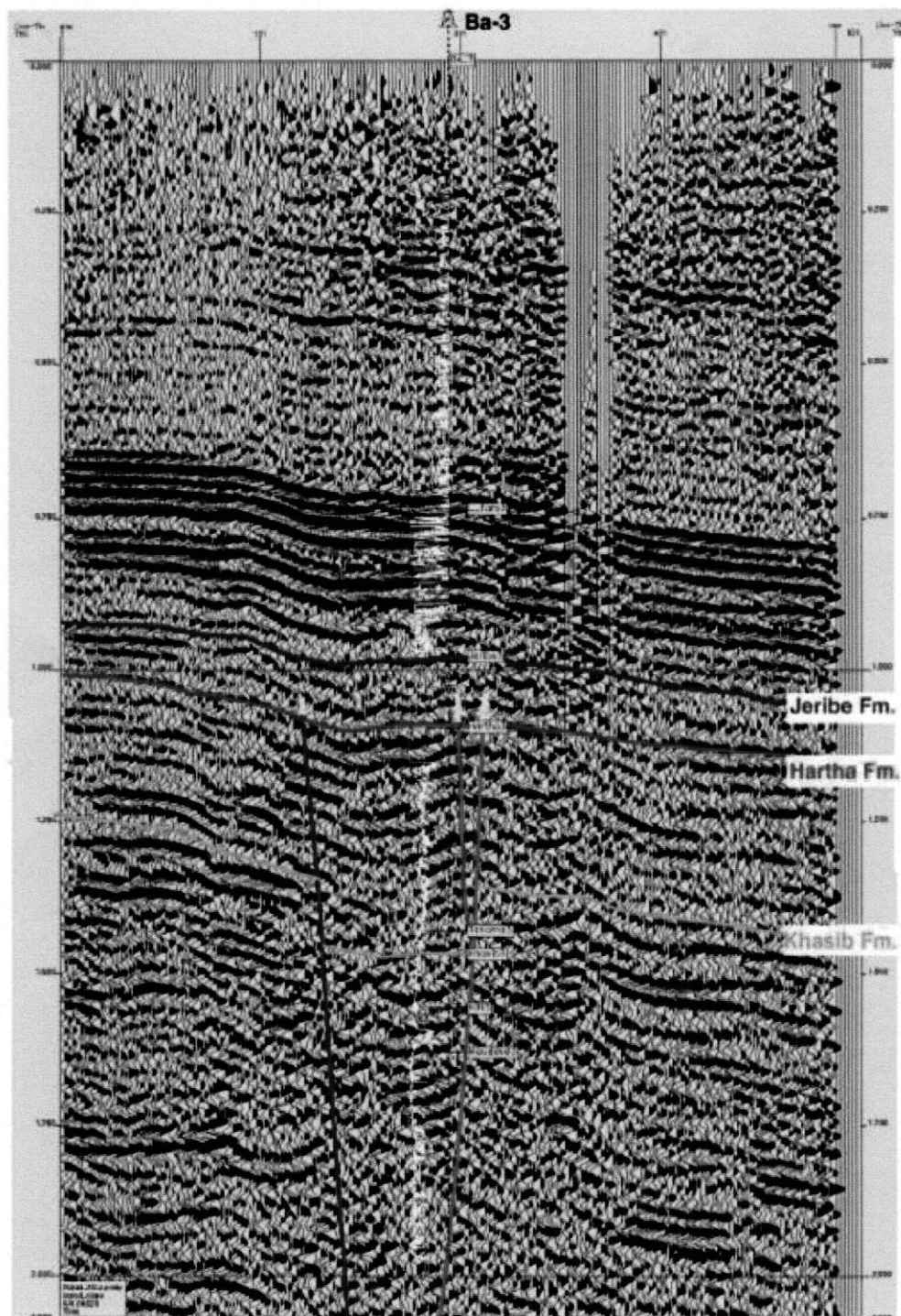


Figure (4) Seismic section on Balad-3 well.

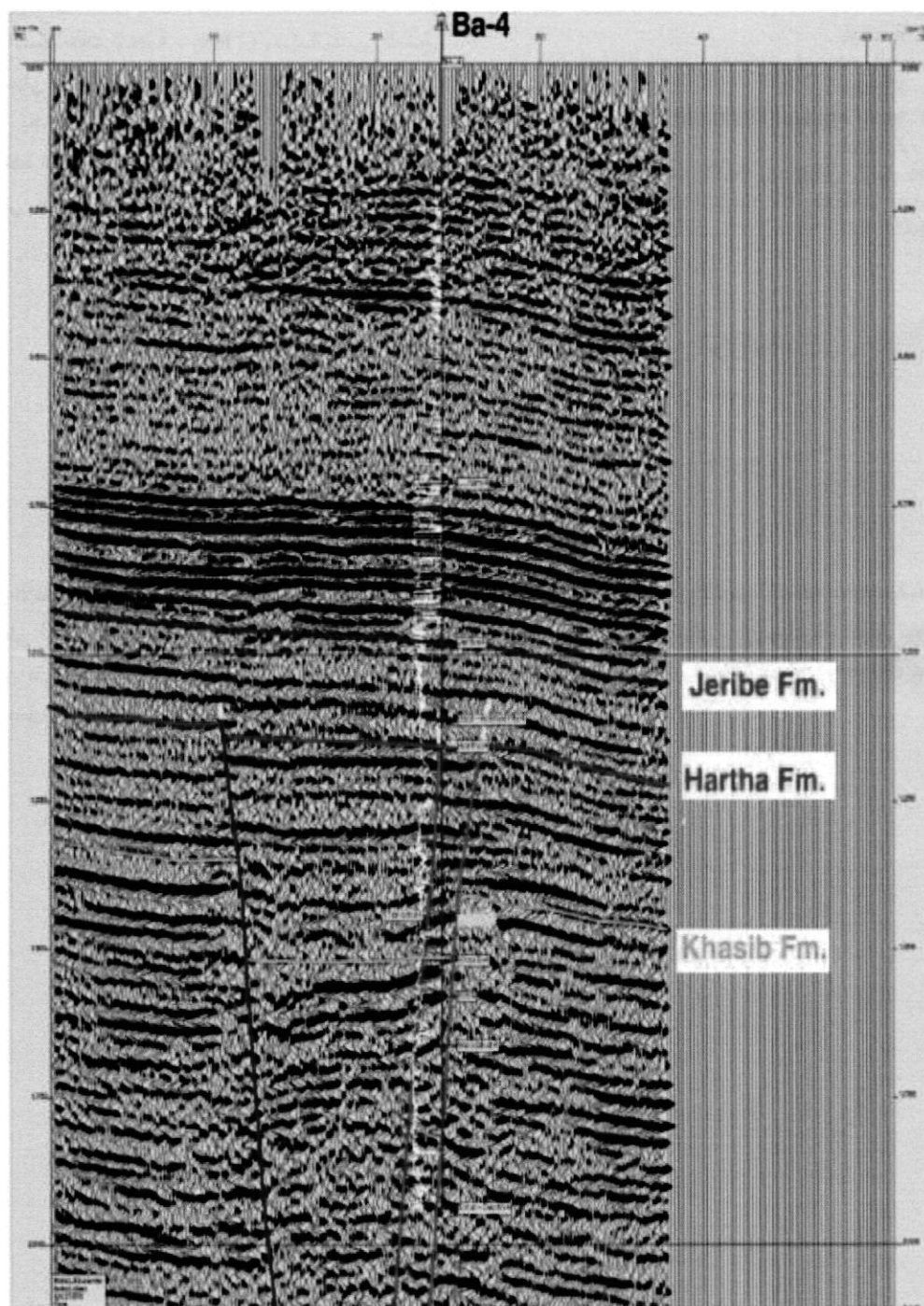


Figure (5) Seismic section on Balad-4 well

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تحليل الوضع التركيبي لحقل بلد باستخدام المقاطع الزلزالية

محمد راشد عبود الجبوري ، مهنا متعب أحمد ، أحمد ابراهيم صالح النعيمي

قسم علوم الارض التطبيقية ، كلية العلوم ، جامعة تكريت، تكريت ، العراق

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الملخص

يمثل الفالقان الاعتياديان (F1, F2) الهيكل العام لحقل بلد والذي يقسمه الى ثلاثة مناطق الكتف الشمالي الشرقي، الخسف ، الكتف الجنوبي الغربي وبالاتماد على عواكس تكوينات خصيب ، هارثه ، جريبي فان تكوينات العصر الثلاثي لم تتأثر بهذه الفوالق ، وان حركة هذه الفوالق انتهت مع نهاية ترسيب تكوين هارثه في نهاية العصر الطباشيري ، كما وان تأثر ها قليل جدا بالطور الثاني للحركة الابنية البانية للجبال (Alpine orogeny) ولم يحصل فيها عملية طي للتكوينات الجيولوجية وان المنطقة هي عبارة عن كتل متقلقة (block faulting) .