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Seismic Data Processing of Subba Oil Field in South Iraq

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Abstract

Evaluation study was conducted for seismic interpretation using two-dimensional seismic data for Subba oil field, which is located in the southern Iraq. The Subba oil field was discovered in 1973 through the results of the seismic surveys and the digging of the first exploratory well SU-1 in 1975 to the south of the Subba oil field. The entire length of the field is 35 km and its width is about 10 km. The Subba oil field contains 15 wells most of them distributed in the central of the field.

This study is dealing with the field data and how to process it for the purpose of interpretation; the processes included conversion of field data format, compensation of lost data and noise disposal, as well as the application of normal moveout correction for the purpose of improving the quality of seismic sections, using Omiga software at the processing department/ Petroleum Exploration Company.

After processing RMS velocity map was done also constructed from the processing data and showed a low velocity compatibility north of the study area and an increase in velocity to the south of the oil field.

Keywords: Data processing, Gain Applications, Noise Attenuation, NMO correction, RMS velocity at Subba oil field

معالجة البيانات لحقل صبة النفطي جنوب العراق

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الخلاصة

تم إجراء دراسة تقيمية في التفاسير الزلزالية بأستخدام بيانات ثنائية الابعاد لحقل صبة النفطي الذي يقع في جنوب العراق. تم أكتشاف حقل صبة سنة ١٩٧٣م من خلال نتائج تفاسير المسوحات الزلزالية وتم حفر البئر الأستكشافي الأول SU–1 سنة ١٩٧٥م الى الجنوب من الحقل. يبلغ طول حقل صبة النفطي ٣٥كم أما عرضه حوالي ١٠كم، ويحتوي على ١٥ بئراً منتشراً وسط الحقل.

في هذه الدراسة اشرت الى طريقة التعامل مع البيانات الحقليه وكيفية معالجتها لغرض العمل عليها ، حيث شملت عمليات المعالجة تحويل الصيغه الحقليه للبيانات وتعويض البيانات المفقودة والتخلص من الضوضاء وكذلك تطبيق التصحيح الحركي لغرض تحسين نوعية المقاطع الزلزالية وتم العمل على برنامج الاوميكا في قسم المعالجة / شركة الاستكشافات النفطية .

و بعد المعالجة تم بناء خريطة السرعة الجذرية من بيانات المعالجة واظهرت نقصان السرعة الى الشمال من منطقة الدراسة وزيادة السرعة الى الجنوب من الحقل النفطي .

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Introduction

Geophysical data processing is the use of computers for the analysis of geophysical data, a major task in geophysics is to determine as much as possible about the constitution of the interior of the earth. The direct penetration is impractical, seismic, electric, gravity, and magnetic measurements are made and the task of making construct from these measurements is begun [1].

The processing of the data obtained from a seismic survey consists of the following operations: initial processing of the seismograms and correlation of the waves on them, the calculation of corrections, the plotting of time-distance curves for the useful waves, the calculation of the average, effective and boundary velocities, the construction of a composite velocity column, the construction of seismic section along the profiles and of structure contour maps [2].

Two stages of seismic processed data are:

1. A preliminary or field processing during field operations.
2. The final or central-office processing which is done after field operations are completed when all the materials required for interpretation have been obtained.

The study area is located in southern Iraq within the provinces of Basra, Dhi Qar and Almuthanna (Figure-1). The aim of this research is using data to done RMS velocity and showing the variation of velocity in Nahr Umr Formation at Subba oil field.

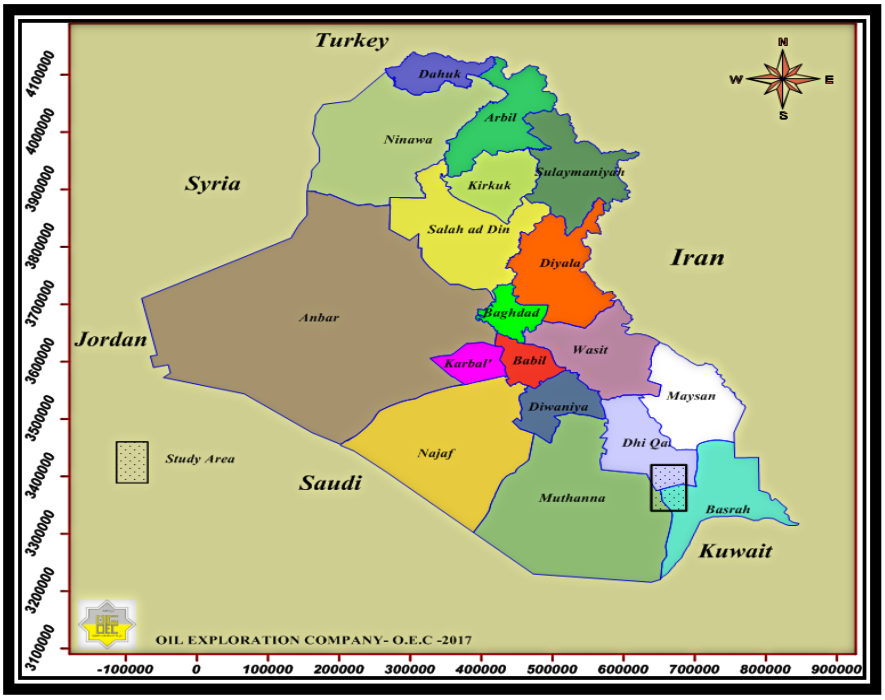


Figure 1-Location of Subba oil field [3].

Tectonic Of Study Area

The Subba oil field was located in the unstable pavement of the Mesopotamia region of Zubiar belt according to the divisions by Buday and Jassim [4], which can be considered as a passive zone .

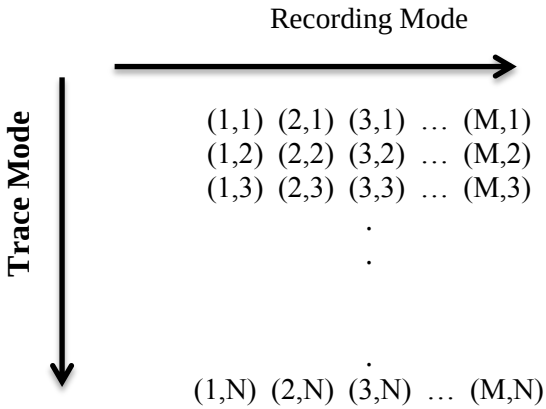
The Arabian plate has undergone many tectonic influences through the different geological ages. These effects varied between tension and pressure which led to significant developments in their tectonic status [5].

These tectonic influences formed convex folds which later became oil traps that formed most of the oil fields in the middle, east and southern Iraq, including the Subba field.

Processing Steps

1. Reformat Applications

Reformat applications was recorded in a multiplexed mode. The first data are de-multiplexed as described mathematically relationship. This process is determined by the type of processing system, a main format used in the seismic industry for data exchange is SEG-D. Exploration geophysicists is established by the society, [6].



Recorded Seismic data in rows of samples at consecutive channels at the same time, [6].

2 . Geometry Definition

The update of the field records that received from seismic teams in the field by (SPS file) consist of the information recorded in the field such as the values of (x, y, elevation and location).

3. Static Correction

The static correction of the delayed waves in the weathering zone, and eliminates effect in difference ways in earth's surface-level elevations, and velocity of weathered layer.

4. Gain Applications

The gain contains the two properties of Geo separation and exponential (Figure-2).

- Geo separation gain: is compensation for absorbed energy.
- Exponential gain: is works on the breadth of the wave front where the wave appears best.

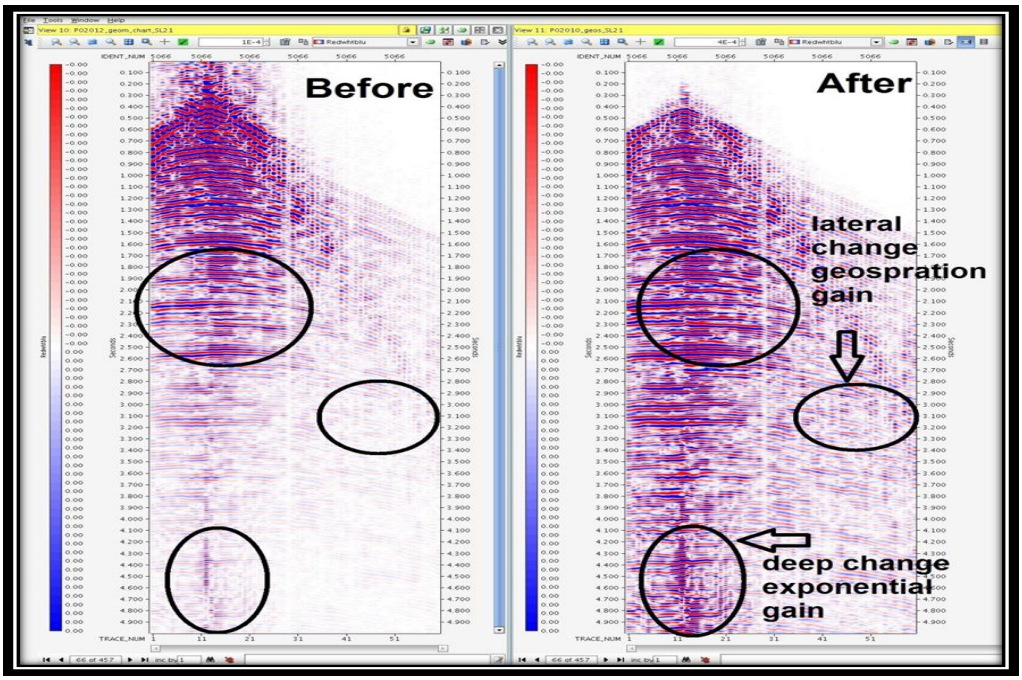


Figure 2-Shot gather before and after two types of gain (Geo separation and exponential) of seismic data at line Sl-21 of the field.

5. Noise Attenuation

Noise is classified into two types, liner noise and random noise [7], (Figure-3).

- The liner noise type includes reverberations and multiples, linear noise types include direct waves, which often are specific present in shallow.
- The random noise category includes noise in the temporal direction and spatially random noise that is uncorrelated from trace to trace, the first type of random noise usually is stronger at late times than early times in recorded data.

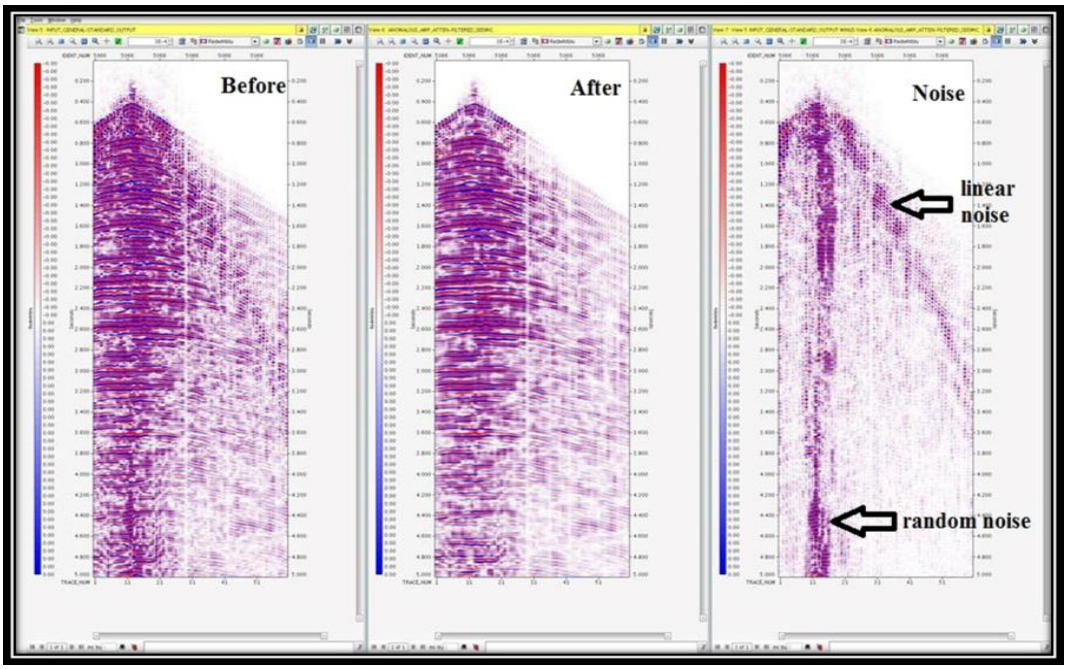


Figure 3-Shot gather before and after processing to remove the different types of noise attenuation (Linear noise and Random noise) of seismic data at line Sl-21 of the field

6. Deconvolution

The purpose of deconvolution is to improve temporal resolution by compressing the effective source wavelet contained in the seismic section. Deconvolution compresses the basic wavelet in the recorded seismogram [6].

(Figure-4) shows how to restore the real shape of the signal, This change in signal is caused by the impact of the earth, where the ground absorbs high frequencies.

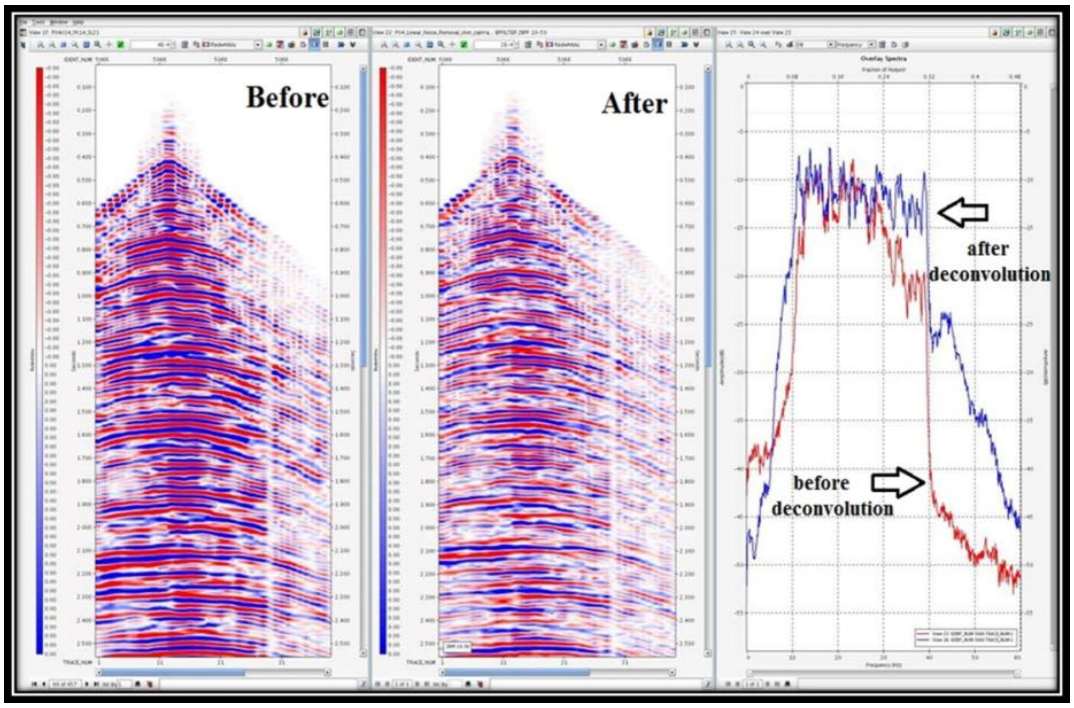


Figure 4-Shot before and after Deconvolution of seismic data at line Sl-21 of the field

7. Common - Mid point (CMP)

Common-midpoint stacking is the important application of processing data improving data quality. The principals have already been discussed along with the field procedures used to get the data, [8].

8. Normal - Moveout Correction (NMO)

Normal moveout (NMO) correction of CMP gathers using the velocity field, the NMO correction removes the moveout effect on travel times, the stacked section comprises the stacked traces at all midpoint locations along the line traverse, [9].

NMO is the basis for specifying velocities from seismic data. In turn computed velocities can be used to correct for NMO.

To make flat of the field wave used NMO correct with picking RMS velocity in semblance panel, (Figure-5). The velocity is derived from the velocity functions picked from the velocity spectra after NMO correction.

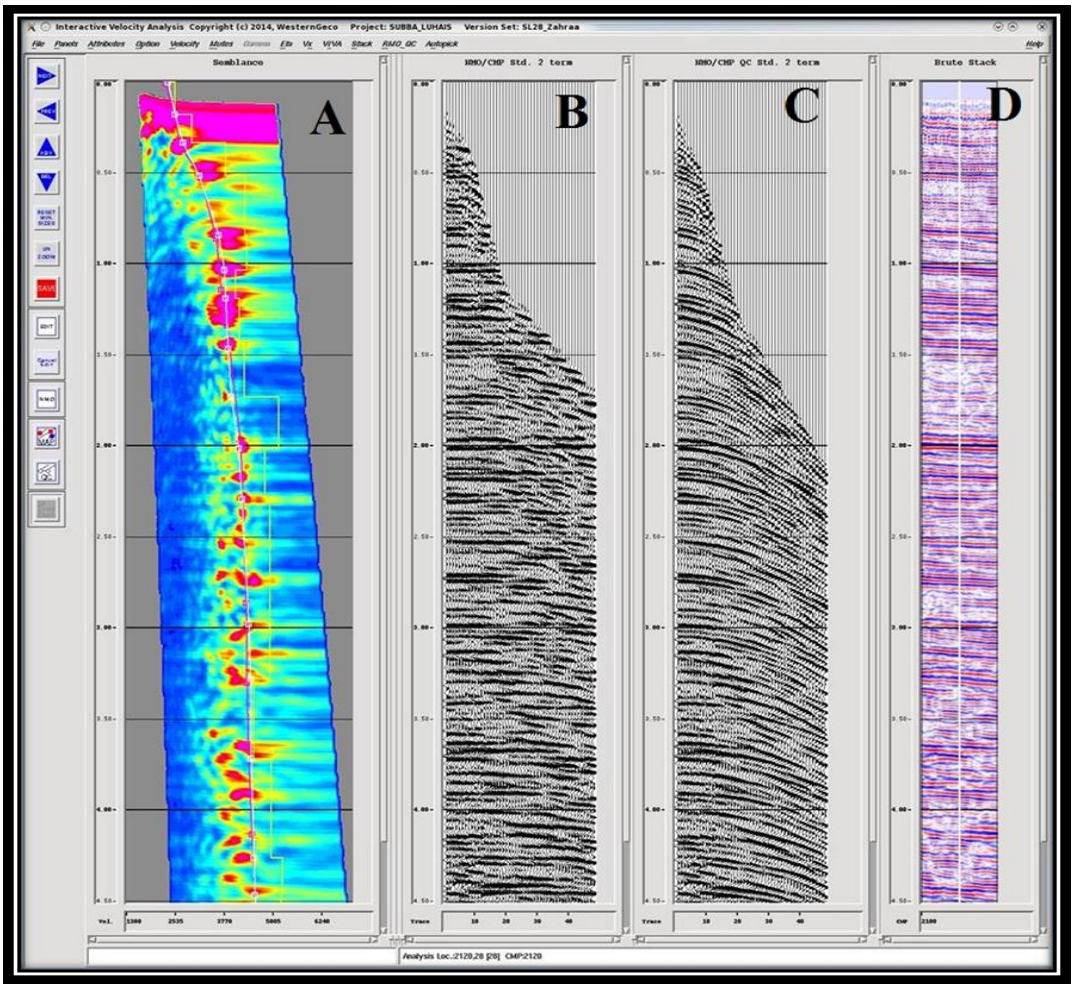


Figure 5-A) RMS velocity picking, B) NMO-Corrected, C) Un-corrected, D) The area of stack

9. Stacking

Stacking is the most advanced stages in the treatment of seismic data. It aims to improve the quality of data, stacking depends on velocity analysis, for best seismic sections it is applied after the procedures of the Normal moveout (NMO) corrections.

The results stack showing a significant change in the shape of the seismic section as illustrated in (Figure-6). The red circles in B section indicate to places of signal enhancement of the seismic section between two stacks in same location.

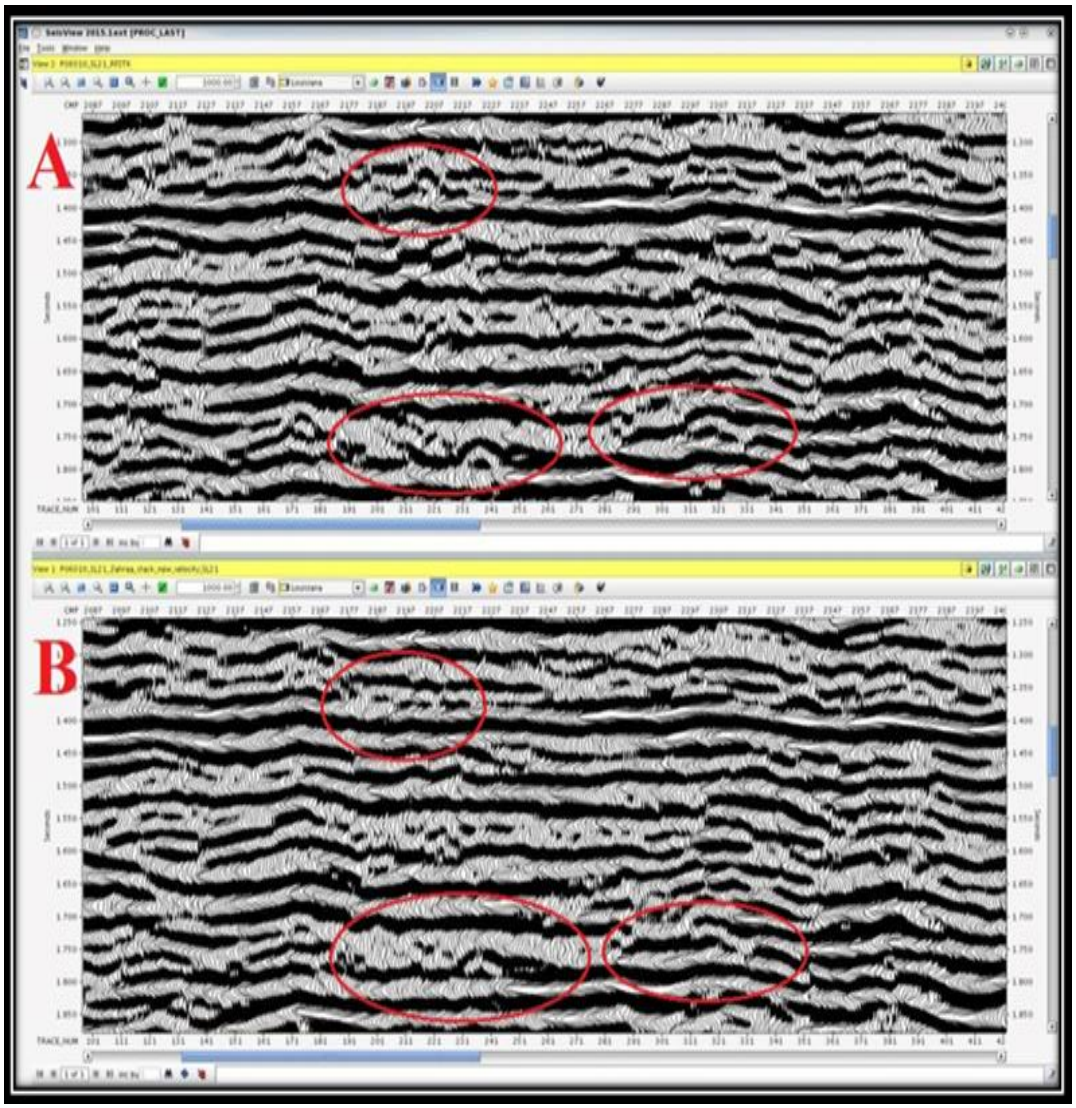


Figure 6-Showing the changes of seismic section in many places at line Sl-21 of the field

The Picked Reflector

Generally the seismic sections of the studied area gives us an indication on the important reflectors to be studied, their continuities overall the area, the match between the same reflector at the intersection points, and observing the quality of the reflector.

After picking the reflector of (Nahr Umr Formation), and the concordances of these reflector are good (Figure-7).

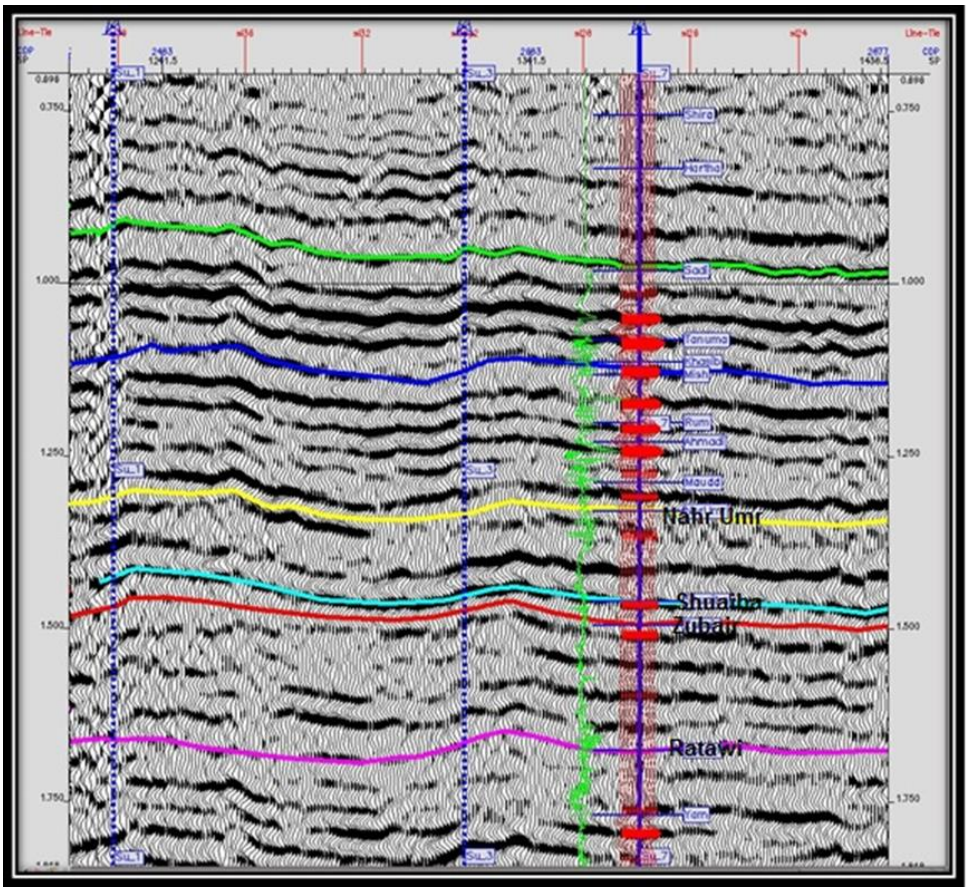


Figure 7-The concordance of reflector of Nahr Umr Formation

RMS Velocity map

In this part interpreting of RMS velocity variations were to detect the existence of oil reservoir of Nahr Umr Formation in Subba oil field.

RMS velocity is the square root of the average time, it's calculated from the interval velocity data, [10].

The calculation of RMS velocity values of the Nahr Umr reflector using the following equation:

$$V_{pik}= \left(\frac{V_2-V_1}{T_2-T_1} * \left(T_{pik} - T_1\right)\right) + V_1$$

This equation is approved by the Oil exploration company

Where:

V_{pik}: Velocity picking .

V_1, V_2: First and second velocity.

T_{pik}: Time picking.

T_1, T_2: First and second time.

Top Nahr Umr RMS Velocity Map

RMS velocity map for Nahr Umr was plotted using a contour interval of 50 m/s. The RMS velocity values range from 3450 to 4300 m/s (Figure-8). Structural closure are seen in the northern part with contour values (3450-4250 m/s) where most of wells were drilled. Another small closure can be seen to the south of the oil field near wells SU-1 and SU-3. The velocity values decrease toward northern part and increase toward southern part.

The structural closure at contour values 3750 m/s shows low velocity where most wells drilled, and The structural closure at contour values 4000 m/s shows increase of velocity, and in this area there is no drilling wells.

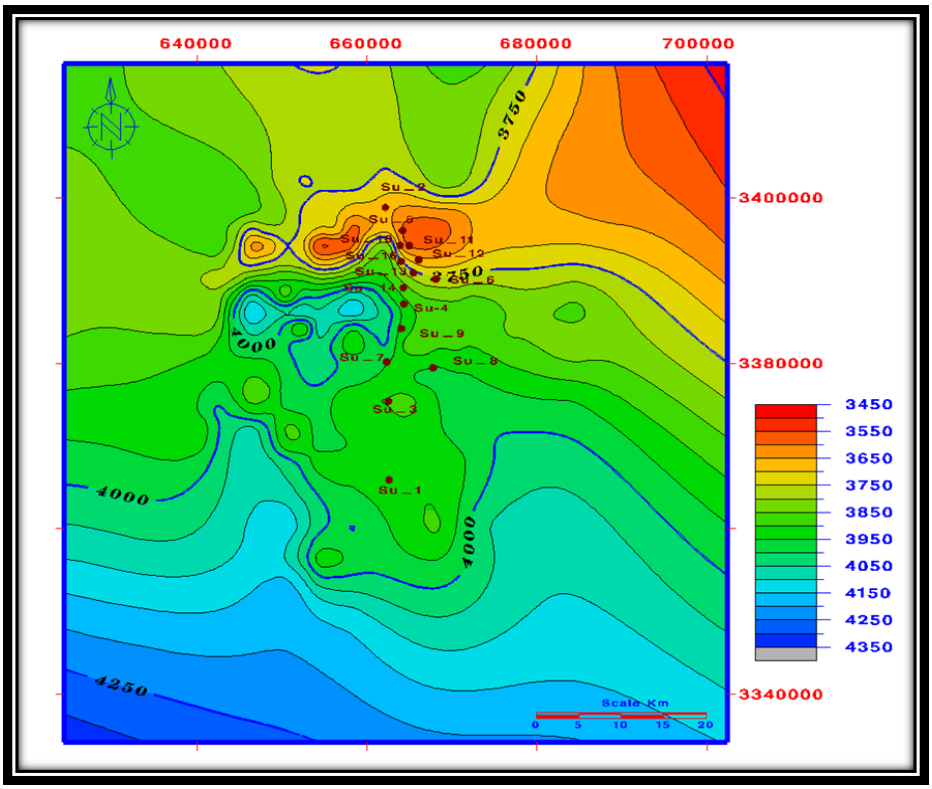


Figure 8-RMS velocity map of the Top of Nahr Umr Formation

Conclusions

1. Deconvolution result the wavelet compression at the multiple energy from the Section
2. The area is not affected by the fault system as shown on seismic sections information and the data of the three wells (SU-1, SU-3, and SU-7) in the field.
3. RMS velocity of Nahr Umr Formation explain many closures in the central part of the field, this anomaly indicate that this area is structurally closure oil field.

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