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3D Seismic Study to Investigate the Structural and Stratigraphy of Mishrif Formation in Kumiat Oil Field_Southern_Eastern Iraq

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Abstract— *This thesis is a reflection seismic study (structural and stratigraphic) of a (1200) km^2 area located in the eastern south of Iraq within the administrative border of the province of Maysan province .The study area was interpreted by using 3-D seismic data from Oil Exploration company. The reflector is detected Within Mishrif Formation which is deposited during the Cretaceous age .The seismic interpretation of the area approves the presence of some stratigraphic features in the studied Formation. Some distributary mound and flatspot were observed within the study area, but they are not continuous due to the tectonic effects. These activities elements give reasonable explanation for the hydrocarbon distribution in the area of study and explain why in Kt-2 is wildcat. The study of seismic facies of the picked reflectors distinction type of seismic configuration is progressive seismic facies characterized by Mishrif Formation. Using seismic attribute techniques including instantaneous frequency showed low frequency in areas of hydrocarbon accumulations. Instantaneous phase attribute was detected seismic sequence boundaries, sedimentary layer patterns and regions of onlap and top lap patterns. Amplitude attribute showed that low amplitude value which probably the area of hydrocarbon reservoir.*

Keywords—Flat spot , Dim spot , Muond , Seismic Attribute.

I. INTRODUCTION

The geophysical research history for a bout hydrocarbon accumulations returns to the beginning of the last century and a seismic reflection exploration applied to detection of that accumulations.(Berg, O.,1982). The seismic method is the most important geophysical technique in terms of expenditures and number of geophysicists involved. The predominance of the seismic method over the geophysical methods is due to various factors, the most important of which are the high accuracy, high resolution and great penetration of which the method is capable. The seismic methods are the most widely used of all geophysical methods used in petroleum exploration.(Hart, Bruce S. , 2004).The role of seismic in the petroleum studies is to provide the most accurate graphic representation of the earth's subsurface and its geological structures, where it gives a seismic section, velocity & time contour maps to determination of a structural traps, as well as, a seismic stratigraphy and seismic facieses to determination of an internal stratigraphic geometry interpretation in terms of environmental deposition pale-geography, in addition to sedimentary basin analysis.(Milson , John , 2003). Seismic reflection gives more direct and detailed picture of the subsurface geological structures. It is more suitable in areas where the oil is in structural traps, but it is also useful for locating and detailing certain types of stratigraphic features (AL-Sinawi, 1981). The seismic reflection exploration method passed through numerous development stages from mid last century to a present time included the field survey, data processing & interpretation. With reflection methods one can locate and map such features as anticlines, faults, salt domes, and reefs where many of these are associated with the accumulation of oil and gas. Major convergences caused by depositional thinning can be detected, but the resolution of the method is not as favorable as we would usually like for finding stratigraphic traps (Dobrin, 1976).

II. LOCATION OF STUDY AREA

The study area which represent Kumiat oil field is located at the eastern parts of southern Iraq as part of the administrative border of the province of Maysan, to the East of the Tigris River, near the city of Kumait (Figure1) (Al-Shuhail and Abdullatif, 2012). Kumiat oil field lies within the Universal Transversal Marketer (U.T.M) coordinates as given in Table(1)

Table.1: Coordinates of the study area.

Point	Northern	Eastern
A	356000	655000
B	354000	695000
C	3530000	680000
D	3545000	650000

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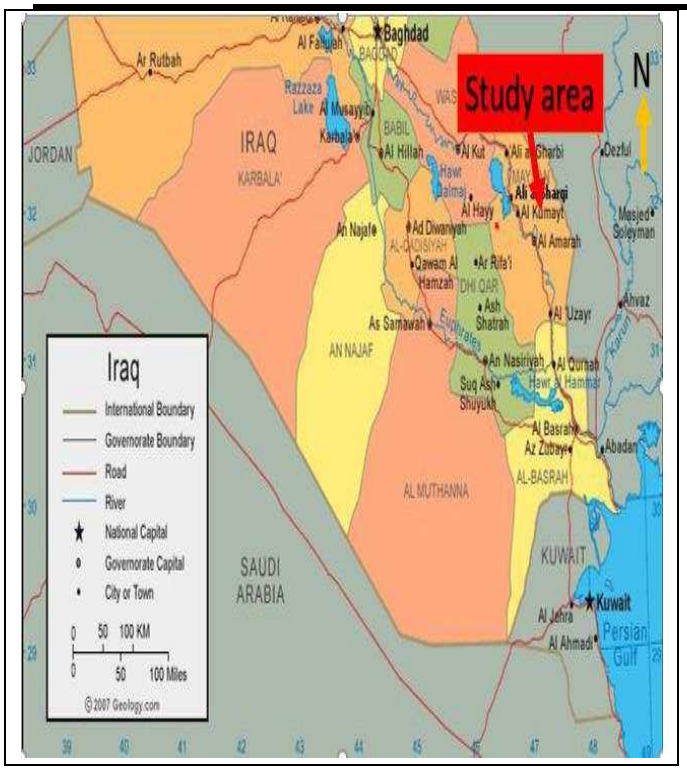

Fig.1: Location of study area (Al-Shuhail and Abdullatif, 2012).

III. PROCESSING

The seismic data were processed at the Processing Center of Oil Exploration Company. The primary objective is to enhance the quality of the 3-D recorded data . Basically, this improvement is essential to facilate the structural &stratigraphic seismic interpretation.

Noise attenuation process leads to improve reflection continuity and enhance ability to compute seismic attributes. The main steps in processing are:1-Editing and muting.

2- Gain recovery static correction.

3-Deconvolution of source.

The order in which these steps are applied is variable.

IV. DATA BASE

The data base includes 3D surveywhich was carried out by the Company De General Geophysics French (CGG-05) and Iraqi seismic party no.2, there are two wells to the area have been drilled in this study, they are Kumiat_1 and Kumiat-2. Marker, check shot and sonic logs information were available for Kumiat_1 and Kumiat-2 wells.

V. REFLECTION DATA PROCESSING

To convert the field recording into a usable seismic section requires a good deal of data manipulation. The purpose of seismic processing is to manipulate the acquired data into an image that can be used to infer the sub-surface structure. Only minimal processing would be required if we had a perfect acquisition system. Processing consists of the application of a series of computer routines to the acquired data guided by the hand of the processing geophysicist. Processing routines generally fall into one of the following categories:

1- enhancing signal at the expense of noise
2- Correction CDP gather for normal move out and stack them.
3- Correction for effect of near-surface time delays (static correction).
4- Filtering processes.
5- Providing velocity information
6- Increasing resolution
7- Collapsing diffractions and placing dipping events in their true subsurface locations (migration).

This processes are achieved using Geoframe system, they include many mathematical processes depend on physical fundamentals. There are three main processes in seismic data processing: deconvolution, stacking and migration. The processing stages are divided into pre-stack and post-stack processing (Yilmaz, 1987).

VI. VELOCITY SURVEY

Figures (2) and (3)show a check-shot of well Kumiat_1 and Kumiat_2.

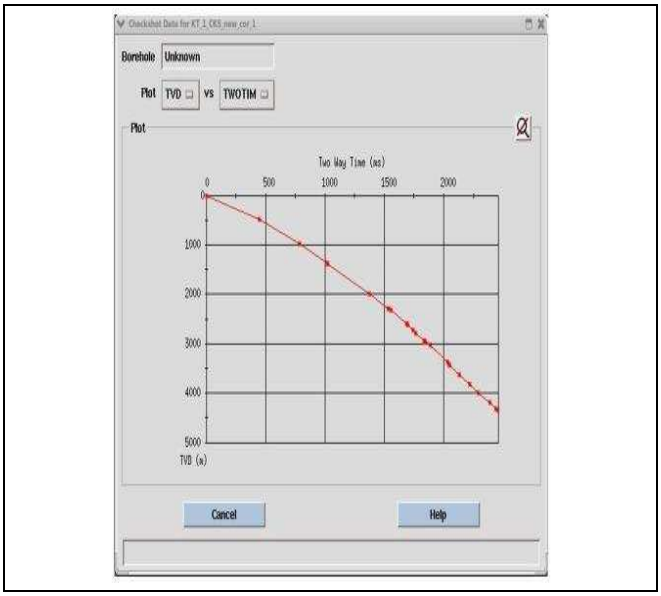

Fig.2: Illustrates the check shot curve for Kt-1 well .

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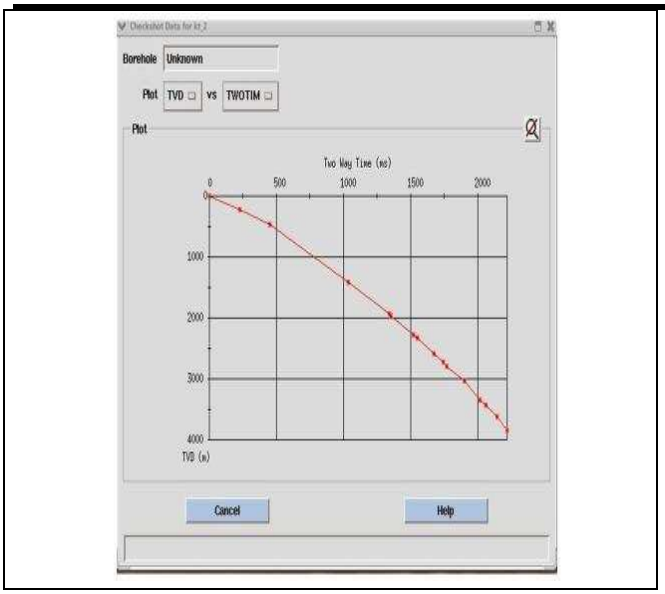

Fig.3: Illustrates the check shot curve for Kt-2 well ,

VII. GENERATING SYNTHETIC SEISMOGRAMS AND REFLECTORS DEFINITION:

The process of interpretation of seismic section requires the identification of reflectors that represent certain formations,This is done by a comparison between the times of reflection Two Way Time (TWT) on the seismic section and between the synthetic seismogrsms obtained by sonic log and velocities survey in the wells in the study area.

Convolution process between the reflection coefficient and experimentally selected wavelet is made to obtain on the synthetic seismogram. The sonic log data are compared with the well velocity survey which represents the direct method to obtain the geological velocity (average velocity) of geological strata. These have ability to extract the relation between the time and depth functions in the well location. Synthatic seismograms were generated for well (Kt-1) using geoframe software package,(Figure 4) represents the seismic sections passing through the well locations and synthetic traces of reflectors are displayed. The match between seismic traces and synthetic traces is good. The picked reflectors wavelets appeared as peaks and trough on synthetic trace (positive and negative reflection) with different intensity. The Mishrif Formation is correspond to a peak because both formations are comprised of carbonate which have positive reflection coefficient.

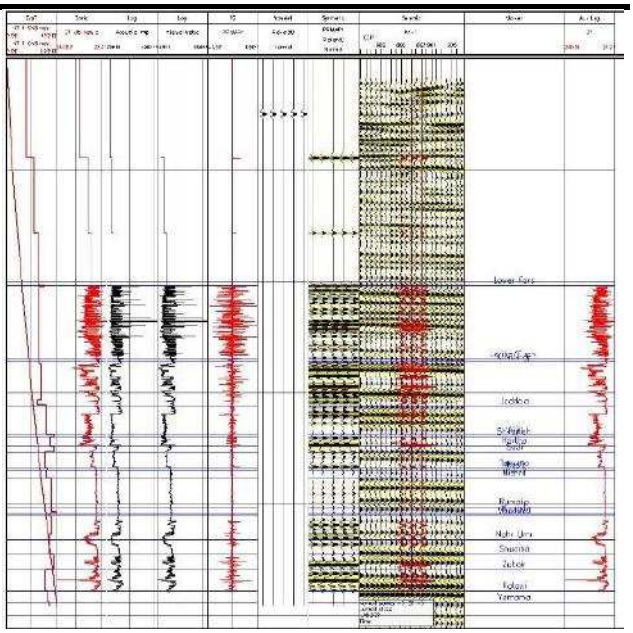

Fig.4: Illustrates the synthetic seismogram of the Kumiat_1

VIII. SEISMIC STRATIGRAPHIC INTERPRETATION

Seismic stratigraphy is a technique for interpreting stratigraphic information deduced from seismic data. Basically, changes in rock type produce changes in the reflectivity, which affect the wave shape seen in seismic data, and inferring stratigraphic changes and their occurrence. which is based on characteristics of seismic data is an objective of seismic stratigraphy (Sheriff, 1980). In many areas; seismic stratigraphy can add important geological information and enhance the understanding of the depositional environments, which may help in the understanding the origin, accumulation, and trapping mechanisms of the hydrocarbon deposits. The seismic traces are trying to tell us the details of the subsurface. (Gadallah and Fisher, 2009).

IX. SEISMIC ATTRIBUTE SECTIONS

Seismic attribute technique is applied to the seismic section of the study area to diagnose extensions facies changes in order to identify indicators of direct hydrocarbon indicator (DHI) of traps, and through the interpretation of the seismic section after converting to the seismic attribute data, by application of the following:

Reflection Magnitude Section

The reflection magnitude was noted to be decreased in the KT-1 well Mishrif Formation which may be refer low amplitude and indicate hydrocarbon accumulation (Figure 5)

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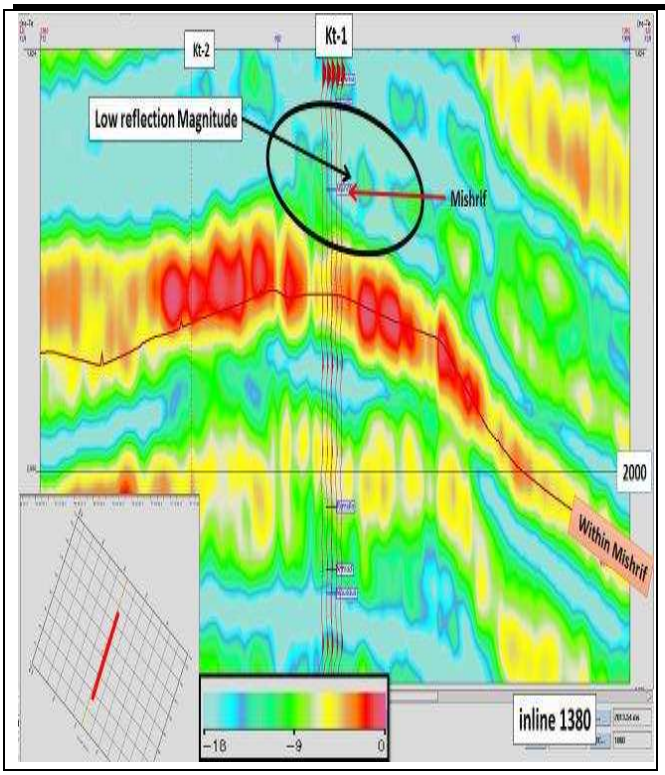


Fig.5: Seismic section display the variation in reflection magnitude of studied reflectors.

Instantaneous Phase Sections

Instantaneous Phase Section refer to a phase display the continuity of seismic event (Taner&Shariff, 1977). It is very important to study the faults, discontinuity of reflectors, angular unconformity, pinchout and onlap. The information of instantaneous phase is very important in showing and distinguishing the ends of continuity of reflective surfaces (khorshid and khadhm, 2015). The downlap in seismic section were noted by the application of Instantaneous Phase Section (Figure 6)

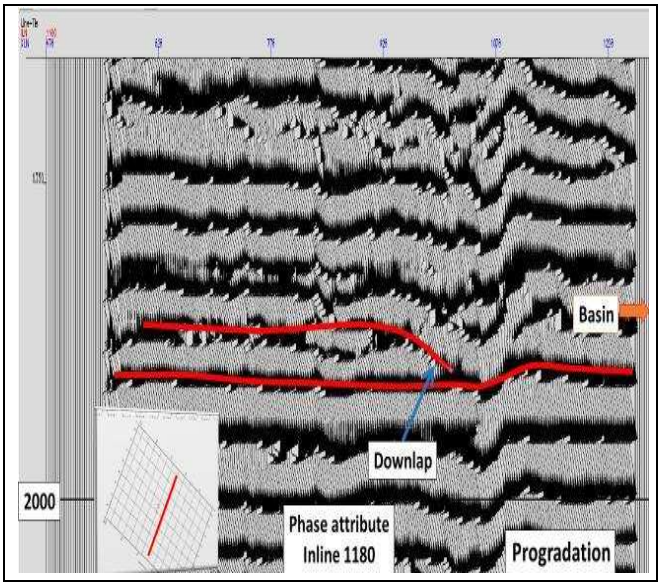


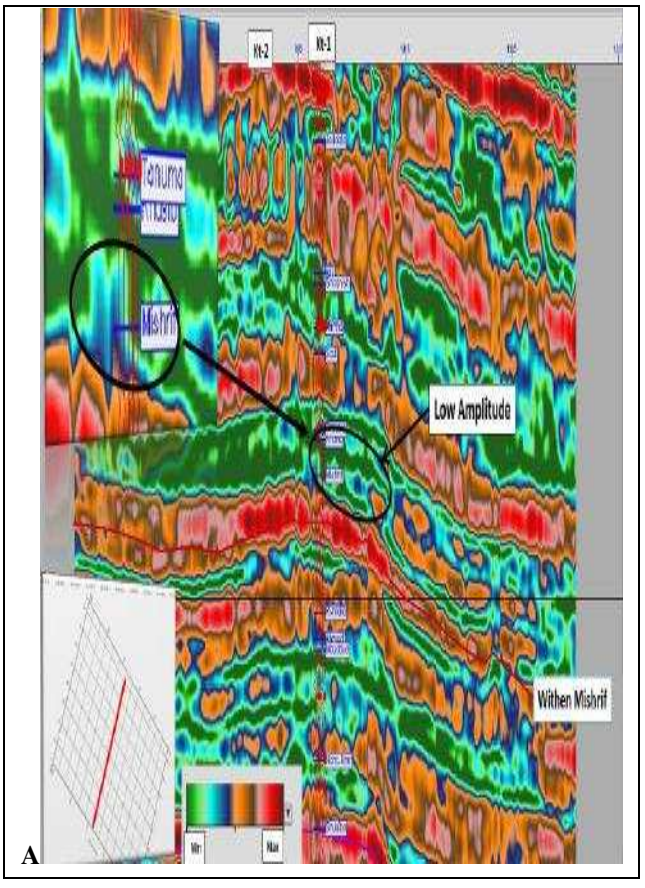
Fig.6: Seismic section display the variation in instantaneous phase of studied reflectors.

Instantaneous Amplitude Sections:

A seismic reflection is strong or weak depending on difference in velocities and densities between the rock layers above the reflection and the one below it , the greater the difference the stronger the reflection (Al-Ridha and Ali, 2015).This attribute which measured in time is primarily used to visualize regional characteristics such as structure, sequence boundaries, thickness and lithology variations. In some cases, bright and dim spots phenomena are related to gas accumulations. Low amplitude values are observed in study area, which are probablyarea of hydrocarbon reservoirs,(figure7).Region that rounded with KT-1 and KT-2 has decreases of seismic amplitude which indicate to absorption of seismic wave energy due to presence the hydrocarbon accumulation. Also low amplitude value in time slice view in the same area were noted (Mitchum and Vail, 1977). . Low amplitude in KT-1 Within Mishrif is noted which is consider as hydrocarbon accumulation.

Instantaneous Frequency Sections:

The results of the application of attribute assist to determine sites changes Instantaneous frequency and their relationship to changes in petro-physical qualities, is linked frequencies of low-lying areas to zones communities of hydrocarbon (Al-Ridha and Muhsin, 2015) .Low frequency signals were noted within this section which indicates of hydrocarbon accumulation, while high frequency which indicate weak probability of hydrocarbon accumulation (Figure 8) .



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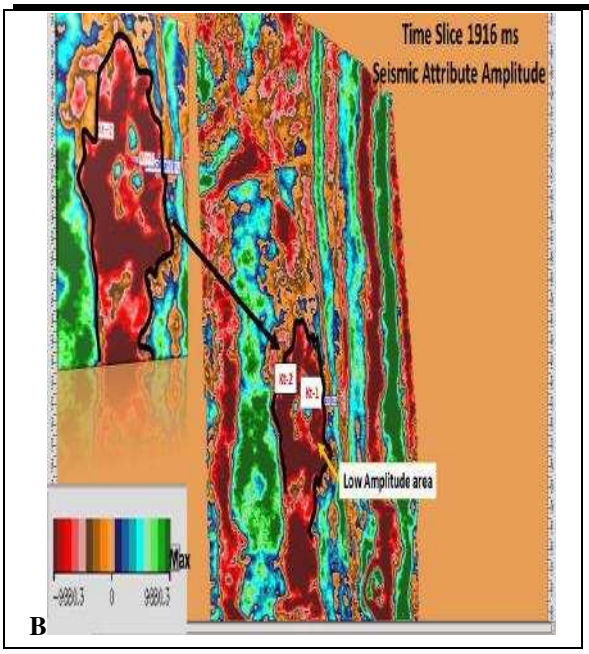

Fig.7: Shows the low amplitude in KT-1

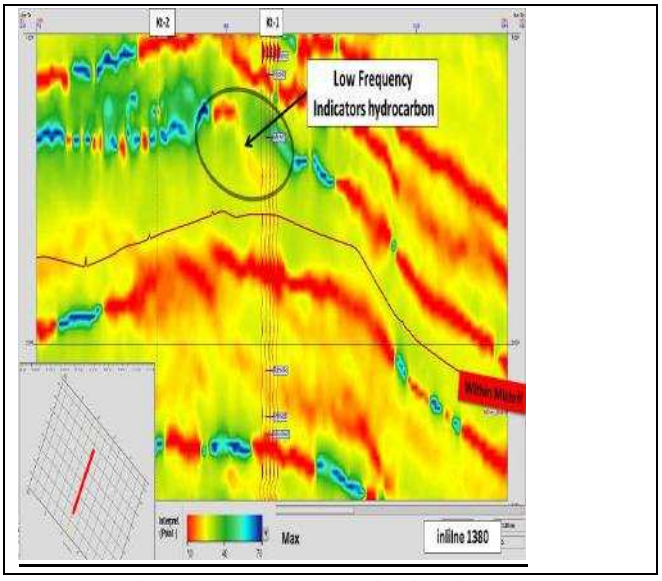

Fig.8: Shows seismic section display the variation in instantaneous frequency of studied reflectors.

It is noted that Frequency decreases in shelf margin (Figure 9) and that is indicator to presence of hydrocarbon accumulation.

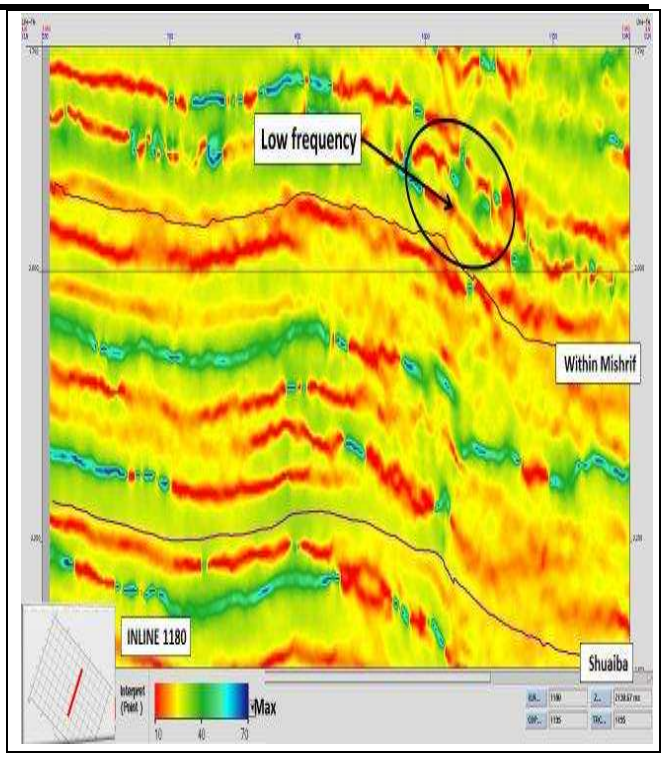

Fig.9: Seismic section for seismic attributes (Instantaneous Frequency)

X. CONCLUSIONS

1. The reflector which is picked in this study (Within Mishrif) show that Within Mishrif wavelet appeared on synthetic seismogram as peak , with different intensity. This is because they have higher density than the densities of the above and under reflector.
2. The seismic interpretation of the area approves the presence of some stratigraphic features in the studied formations. Some distributary mound and flat spot were observed within the study area, but they are not continuous due to the tectonic effects. These activities elements give reasonable explanation for the hydrocarbon distribution in the area of study and explain why in Kt-2 is wildcat.
3. The study of seismic facies of the picked reflector distinction type of seismic configuration is progressive seismic facies characterized by Mishrif Formation.
4. Using seismic attribute techniques showed stratigraphic feature such as mound and flat spot which indicate hydrocarbon accumulations. Instantaneous Amplitude attribute showed that the low amplitude values are observed in study area, which are probably the area of hydrocarbon reservoir.

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