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STRUCTURAL ANALYSIS OF THE SEISMIC INTERPRETATION DATA AT NORTH AMER OIL FIELD (FF/GG AREA), GULF OF SUEZ, EGYPT

Mohamed H. Abd El Aal* and Farouk I. Metwally**

*Department of Biology and Geology, Fac. of Education, Ain Shams Univ.

**General Petroleum Company (GPC).

ABSTRACT

Seismic interpretation of North Amer Oil Field has been carried out to delineate the subsurface structural elements and to unravel the tectonic history of the study area. Structural time contour maps are presented for tops Zeit, Kareem, Rudeis and Pre Miocene Formations and some geoseismic cross sections across the major stuctural element have been constructed using well derived velocities.

This study indicates that the main structural elements affecting the area is NNW -SSE elongated tilt horst block, bounded to the east and the west by two major faults of clysmic direction intersected by a unmber of NE cross faults (may be diagonal faults) and ENE faults. Some N-S and NNE minor faults are of lesser importance.

INTRODUCTION

The study area is located in the western part of the Gulf of Suez, between Latitudes 28° 42`, 28° 52 ' North and Longitudes 32° 52` and 32° 57' East some 20 Km to north of the offshore Amer Oilfield (Fig. I).

An idealised stratigraphic colum based on different wells in the study area ranges in age from Pre- Cenomanian (Nubia Formarion) to Recent (Post Zeit) as shown in figure 2.

A unmber of unconformities have been identified, including those at the base of Kareem and Rudeis Formations at which the Nukhul Formation is eroded over the western and northern parts of area, and the ragional unconformity which separates the Miocene from the underlying Pre Miocene Formations.

The seismic sections, acquired and processed by Geophysical Service Incorporated (GSI) and information derived from sonic loges of FF 83-1, 2 & 3 and GG83-1, 2 , 3 ,4 & 5 wells were used together to interpret the subsurface structural features of the study area. Four structural time map at Top Zeit, Tops Kareem, Top Rudeis and Top Pre Miocene are presented together with a number of depth converted geoseimic cross sections across the area under investigation.

DATA AND ANALYSIS

A. Seismic Data :

The seismic sections shot and processed by Geophysical Service Incorporated (GSI), are oriented at right angles to the strike of beds in the study area and pass through boreholes (Fig. 3). A number of strike lines were used to assure consistent horizon miling. The seismic source was 2000 PSI air gun and registration was done with a 2400 m streamer with 96 hydrophone groups. Processing sequences included a common depth point gather (CDP), normal move out (NMO), time variant filtering (TVF) and time variant scale (TVS).

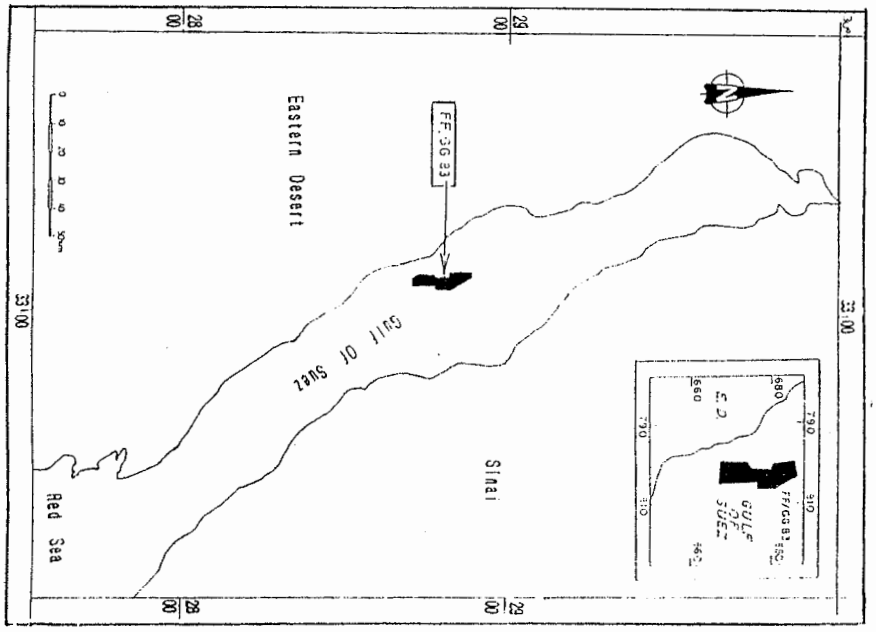

Fig. 1. Location map of the study area.

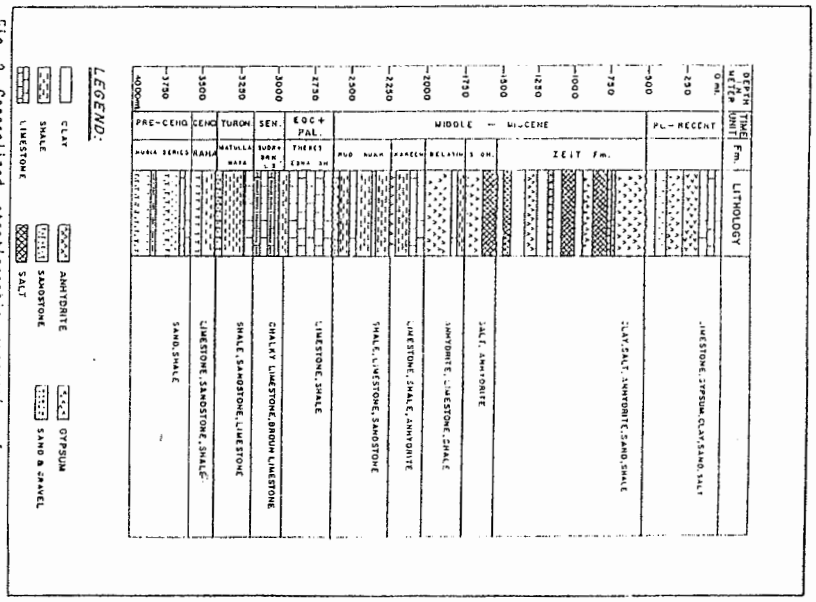

Fig. 2. Generalized stratigraphic succession of encountered in FF/GG area.

B. Borehole Data :

These include geological borehole data and sonic logs, from which the average and velocities of different formations at the wells were derived (Figs. 4 & 5). The borhole data were used to aid in the seismic interpretation. Four horizons (Top Zeit, Top Kareem, Top Rudies and Top Pre Miocene) have been correlated on the seismic sections followed, digitization and conversion of reflection time into depth. The seismic interpretation is presented on time contour maps (Figs. 6, 7, 8 and 9) and a number of depth converted geoseismic cross sections (Figs. 10, 11, 12 and 13).

SUBSURFACE STRUCTURAL FEATURES

The structural time maps of Top Pre- Miocene (Fig. 6), Top Rudies (Fig. 7), Top Kareem (Fig. 8) and Top Zeit Formations (Fig. 9) and a number of geoseismic cross sections (Figs. 10, 11, 12 and 13) allow the following structure interpretation.

I. Pre Miocene

The structural time contour map (Fig. 6) of Top Pre Miocene reflector reveals a highly structural features including major and minor faults. The structural features can be described as follow :

The main structure is NNW-SSE elongated tilted horst block with appoximately 10.5 km long and 1.7 km wide. It is bounded to the east and the west by two major faults of clysmic direction and it is dissected by minor NE faults (may be diagonal fault) and ENE faults. The FF 83-1 & 2 and GG 83-1 Wells are located near the crest of upthrown block. Along both sides of NNW-SSE trending

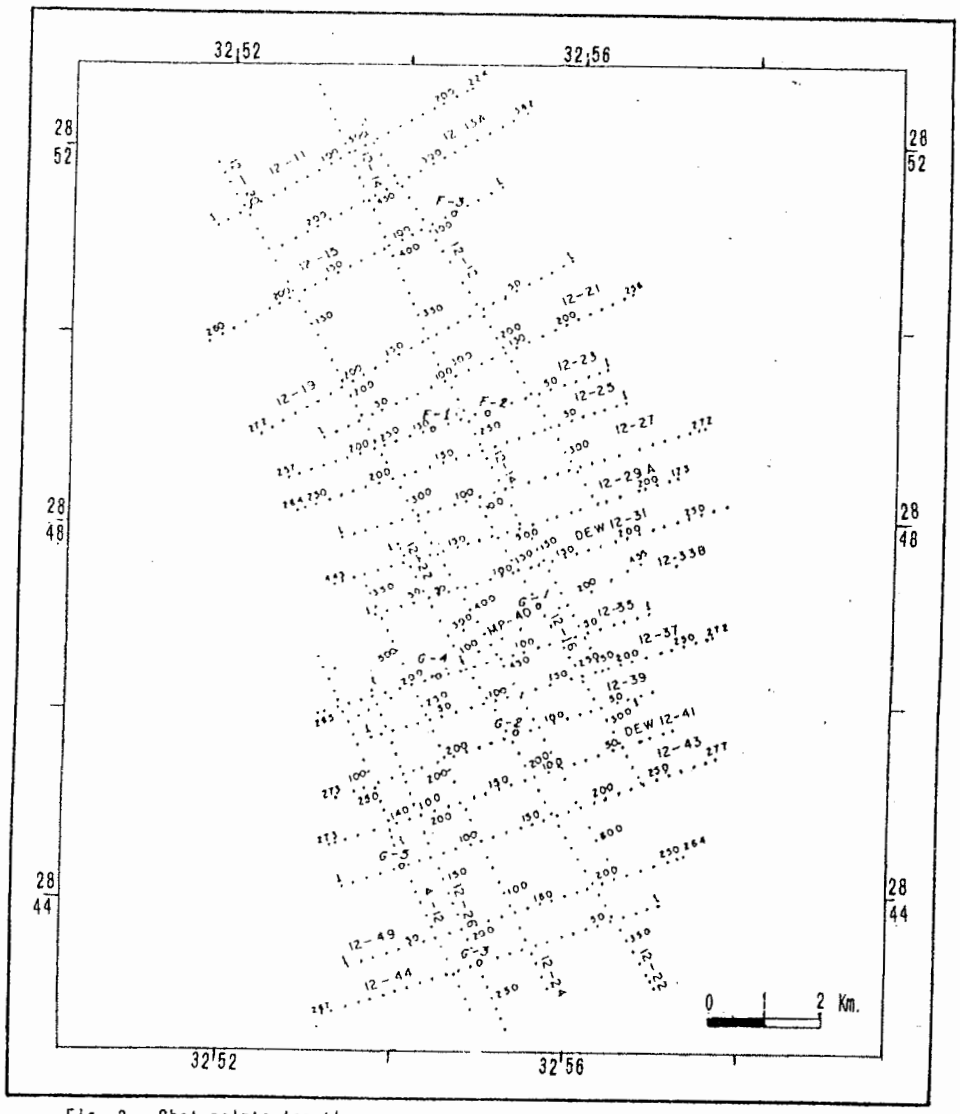

Fig. 3 . Shot points location map.

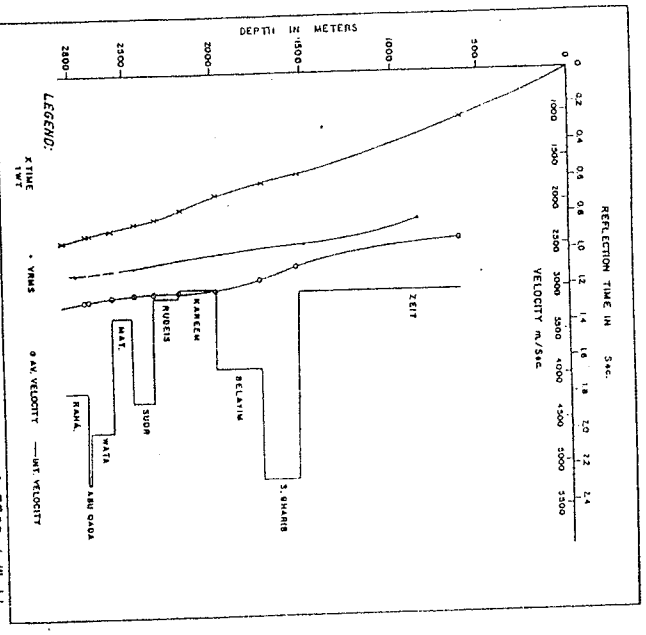

Fig. 4 . Time and velocities versus depth of FF83-1 Well as an example of velocity analysis for FF Area.

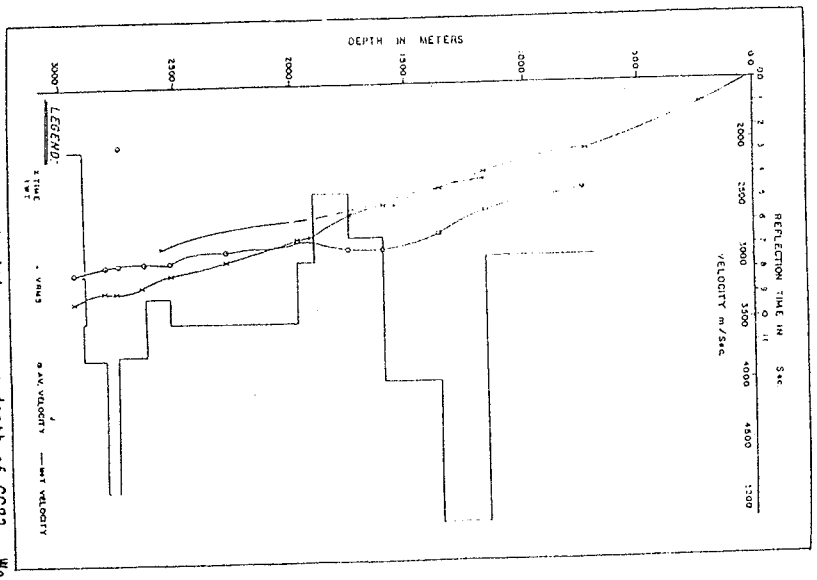

Fig. 5 . Time and velocities versus depth of GG83- Well as an example of velocity analysis for GG Area.

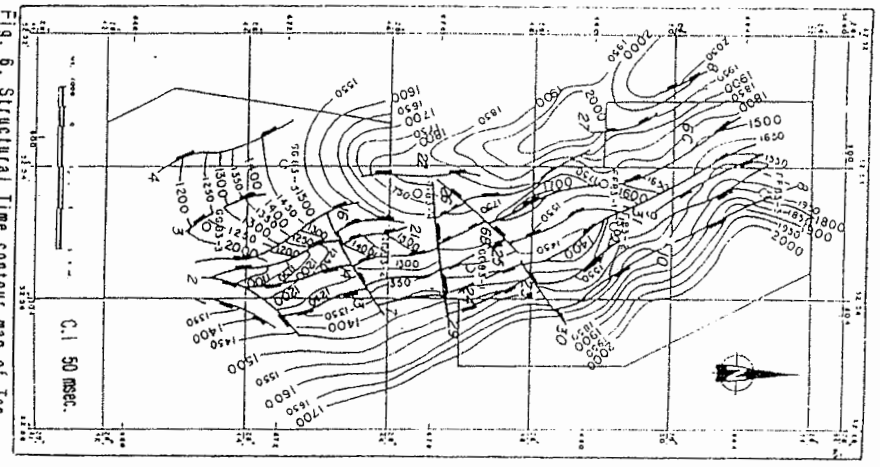

Fig. 6. Structural Time contour map of Top Pre-Miocene Formation.

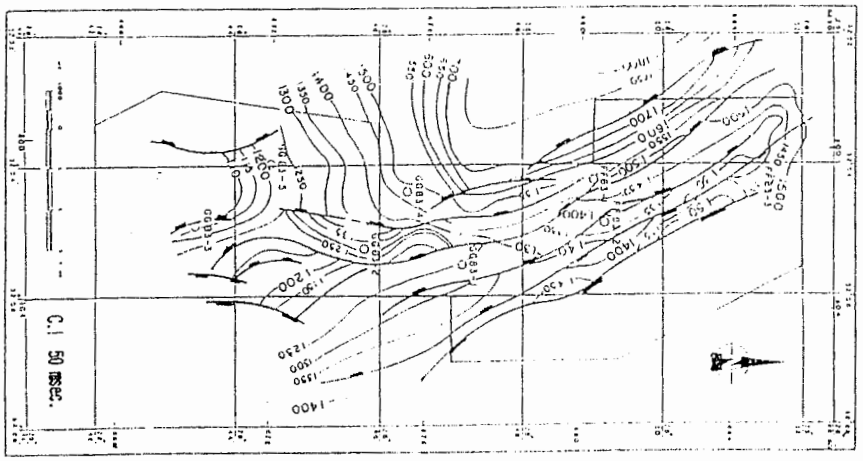

Fig. 7. Structural Time contour map of Top Rudeis Formation.

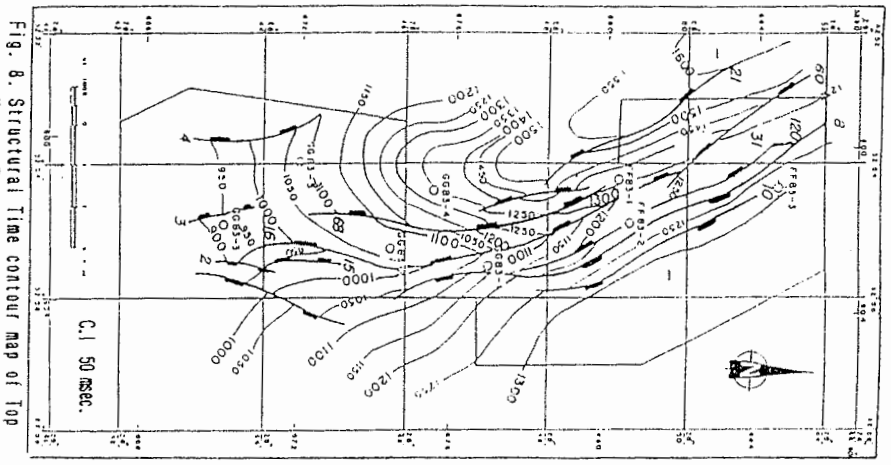

Fig. 8. Structural Time contour map of Top Kareem Formation.

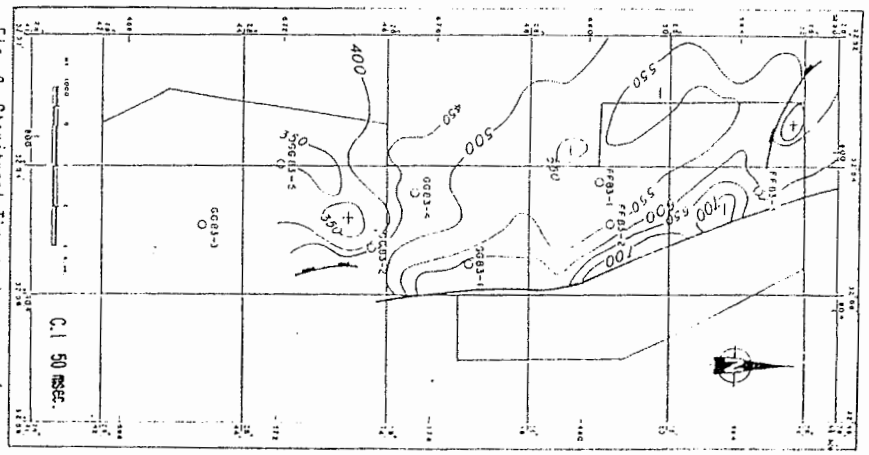

Fig. 9. Structural Time contour map of Top Zeit Formation.

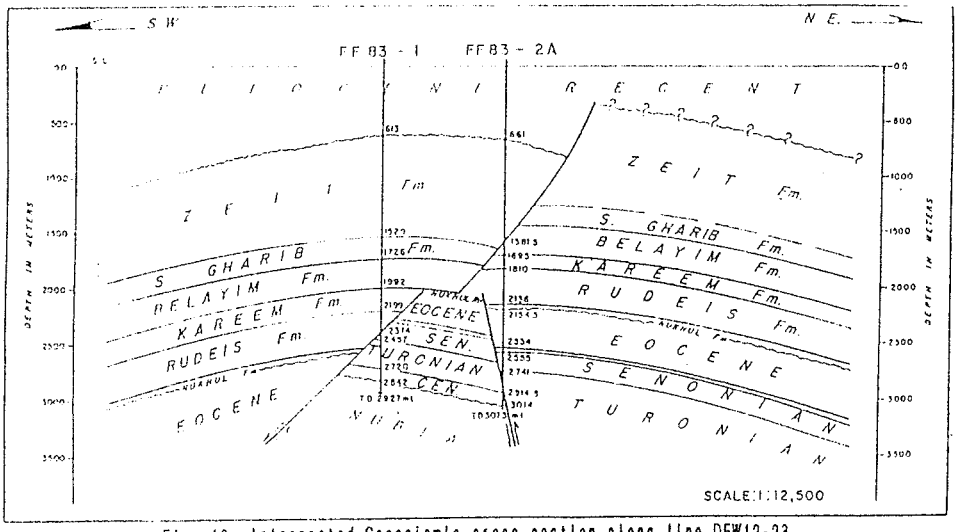

Fig. 10. Interpreted Geoseismic cross section along line DEW12-23 including FF83-1 and FF83-2A Wells.

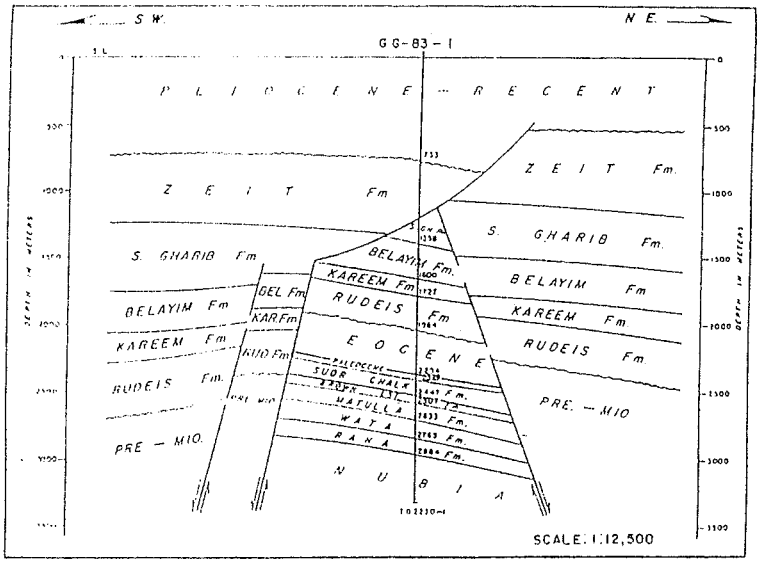

Fig.11. Interpreted Geoseismic cross section along line DEW12-33B including GG83-1 Well.

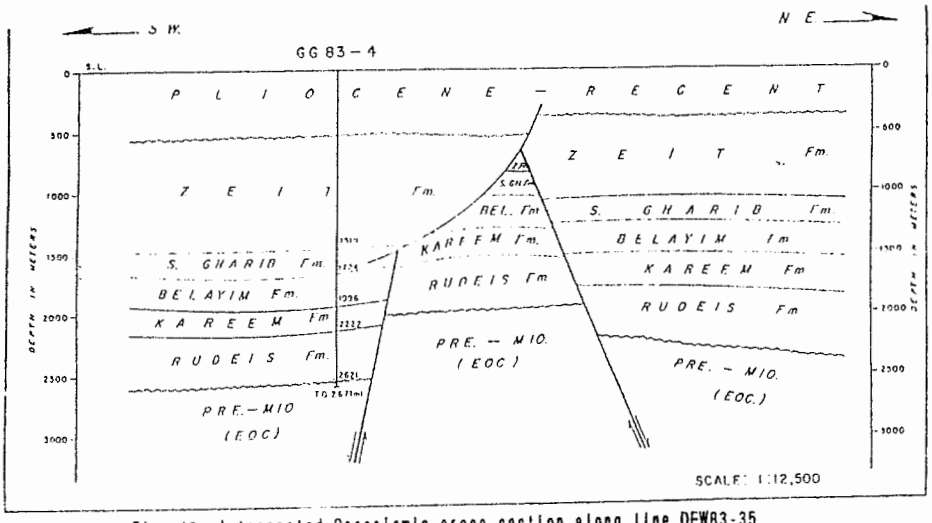

Fig. 12. Interpreted Geoseismic cross section along line DEW83-35 including GG83-4 Well.

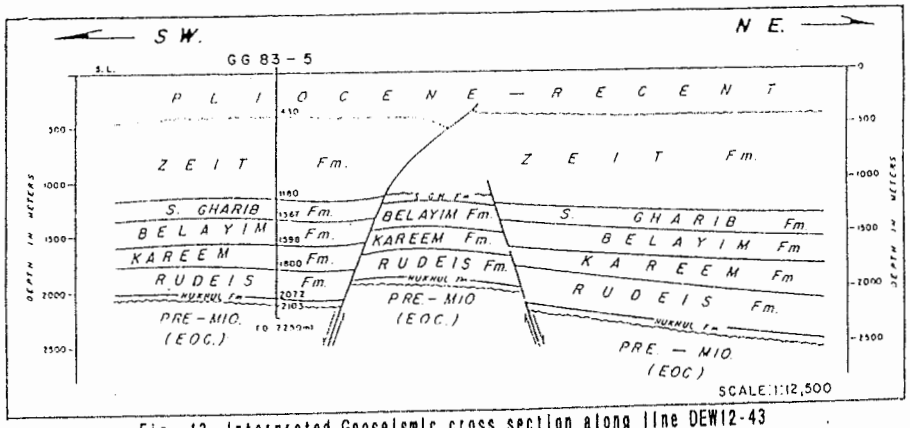

Fig. 13. Interpreted Geoseismic cross section along line DEW12-43 including GG83-5 Well.

horst block two deep basins occur . The geoseismic cross sections through FF 83-1, & 2 and GG 83-4 & 5Wells (Figs. 10-12) further illustrate the structure configuration. The fault trends affecting the Pre-Miocene surface have been classified according to their trends and magnitudes as follows :

1. NNW SSE Faults :

Faults of this class form the main structure trend of the study area (Fig. 6). They are of regional extent and their dip angles range between approximately 60 and 70 degrees. Their throw reaches about 550 meters. Parallel to the main bounding fault a number of minor faults occur, with throws ranging between 30 to 90 meters.

2. NE Faults

Faults of this trend occur over in the central and southern parts of the study area offestting the NNW/SSE trending main horst with dip throws may reach 90 meters and left hand strike throws of few meters.

3. ENE Fault

These faults also dissect the main horst bolck in the central part of the area (Fig. 6). Their dips are about 65 degrees in NNW direction with throws up to 90 meters.

4. N-S-Faults

In place small N-S trending faults occur dips of about 60 degrees to the west with throws up to 160 meters.

5. NNE Faults

These faults are of small length in the southern part of the area average throw of about 145 meters.

11. Lower Miocene

The sediments of this age comprise Kareem, Rudeis and Nukhul Formations. These formations unconfortmably overlay the Late Cretaceous Suder Chalk Formation in well FF 83-1 whereas they overlay the Eocene rocks in the area of wells FF83-2 GG83-2 and Nukhul Formation in FF 83-2 and GG 83-2, 3 ,4 & 5 Wells.

The structure time contour maps of the Top Rudeis and Kareem Formations (Figs. 7 and 8) reveal that the main structural trending of the Pre- Miocene sequence affects the Rudeis and Kareem Formations as well. The main horst, although narrower, trends in NNW-SSE indicating a continued rifting of the Gulf of Suez area. The main fault trends existed in Lower Miocene sediments represented in figures and are summarized below. Importantly, however, the cross faulting observed in the Pre-Miocene sequence is completely absent.

1. NNW-SSE Faults

As for the deeper horizons extend over a great length, especially in the northern part of the area. The throws reach about 387 meters which is less than at deeper levels indicating synsedimentary activity during Lower Miocene.

2. N-S Faults :

These faults are observed over the southern part of area with different throws ranging between 80 and 120 meters .

111. Middle Miocene

The structural time contour map of Top Zeit Formation (Fig. 9) indicates that the most tectonic activities which took place during Lower Miocene are ceased, apart from some reactivation along the main NNW/SSE trending clysmic trend (Figs. 10-12). The most interesting feature of the Top Zeit and Zeit sequence is the decrease in dip of the fault planes. Part of the throw across the Zeit sequence seems to sole out in the South Gharib evaporities. The decrease in dip may point to synsedimentary movement during a period of fast infill of the basin.

CONCLUSION

The seismic as well as borehole data used to construct geoseismic cross sections and structural time map for Tops Zeit, Top Rudeis, Top Kareem and Top Pre- Miocene reflections. These maps exhibit the subsurface structural setting of North Amer area as the follows :

1. The area is characterised by highly structural features along a main structural trend of NNW-SSE elongated tilted horst bolck.

2. Faults of NNW trend are predominant and they have great lengths. Their dip angles are ranging approximately from 60 to 70 degress.

3. NE cross faults (may be diagonal faults) and ENE faults dissected the main horst structure in the centeral and southern parts of the area.

4. N-S and NNE minor faults are also exists in Pre- Miocene and Lower Miocene Formations with a small lengths.

5. During the Middle Miocene , the most tectonic activities which affected during Lower Miocene were stopped where the most fault trends (NW, NE and ENE) are not represented in Middle Miocene Zeit formation, but it was affected by NNW growth fault extending from the north to the southwestern part of the area, dipping towards the southwest.

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تحليل تركيبى للمدلولات الهزية المنصرة لمنطقة حقول شمال عامر

(منطقة FF / GG) خليج السويس - مصر

محمد حامد عبد العال* ، فاروق ابراهيم على متولى**
* قسم العلوم البيولوجية والجيولوجيا - كلية التربية - جامعة عين شمس
** الشركة العامة للبترول

أجريت التفسيرات الهزية لحقول شمال عامر لتحديد التراكيب التحت سطحية واستنباط التاريخ التكتونى لمنطقة الدراسة ولذلك تم عمل خرائط تراكيب زمن لقمم تكوينات زيت ، كريم ، روديس وتكوينات ماقبل الميوسين وكذلك تم تصميم قطاعات جيولوجية سيزمية عبر العناصر التركيبية .

وهذه الدراسة تدل على أن العناصر التركيبية الرئيسية التى تؤثر على المنطقة هى نتؤ مطول فى اتجاه شمال شمال غرب - جنوب جنوب شرق يحد من الشرق والغرب بصدعين رئيسيين فى اتجاه خليج السويس ويقطع بعدد من الصدوع فى اتجاه شرق شمال شرق . أما الصدوع فى اتجاه شمال جنوب فهى أقل أهمية .