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QUANTITATIVE WELL LOG INTERPRETATION OF SOME EARLY CRETACEOUS FORMATIONS IN SIDI ABDEL RAHMAN AREA

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ABSTRACT

Commercial oil and gas field have been discovered with reasonable reserves in the northern part of Western Desert. The producing horizons are widely represented throughout the Cretaceous sedimentary sections. The present work is a contribution of well logging data to evaluate Alamein, Dahab and Kharita Formations of Early Cretaceous time in the area between Sidi Abdel Rahman and Kanayis Gulf. The study area is close to one of the biggest hydrocarbon producing area in Egypt, called Alamein Field .

INTRODUCTION

The study area lies between Sidi Abdel Rahman and Kanayis Culf in the extreme north-central part of the Western Desert (fig. 1). It has an area of about 2500 Km^2 and bounded by longitudes 28° 00' and 28° 50' E and latitudes 30° 20' and 31° 00' N. The main object of the present study is to evalute Alamein, Dahab and Kharita Formations of Early Cretaceous time from well log interpretation of six wells drilled in the study area. The wells are Almaz-I, Abu Subeiha-IX, Fadda-I, Dahab-IX, Washka-IX and Ganayen-IX wells.

Well logging data used in the interpretation includes the logs of gamma rays, spontaneous potential, borehole sonic, formation density compensated, neutron (compensated neutron-CNL and sidewall neutron porosity-SNP) and resistivity, in addition to the composite logs.

Generally, Alamein Formation is a distinct unit of Aptian age and is composed of carbonate rocks. Its thickness ranges from 305 ft in Dahab-IX well to 245 ft in Abu Subeiha-IX well. The upper of Aptian sequence is Dahab Formation which consists of interbedded shale and sandstone with some carbonate streaks. It has a thickness between 545 ft in Fadda-I and 374 ft in Ganayen-IX well.

Kharita Formation is of Albian age and represents the upper part of the Lower Cretaceous section. It consists of sandstone with shale intercalations. Its thickness varies from 1267 ft in Almaz-I well to 1100 ft in Dahab-IX well.

TectonicallY, the north Western Desert belongs to the unstable shelf area which lies between the stable shelf in the south and the miogeosy nclinal basinal area in the north [1,8,14,15]. Among the tectonic movements which affected the sedimentation processes in the study area is the Alpine movement. This movement continued throughout all Mesozoic time in the form of pulses that reached its maximum at the end Cretaceous. The result of this movement was the formation of folds having an ENE-WSW (Syrian Arc) trend [4].

LOG ANALYSIS PROCEDURES

The main constituents of any sedimentary rock, in general, are shale content, porosity and matrix material. Each of these constituents affects the different well logs with a distinguished response. Hence, the quantitative analysis of these logs in a comperhensive way would lead to good results for estimating the present rock constituents and their distribution in the study formations.

Shale Content

The most critical phase of the log interpretation is probably shale content evaluation which is a key factor in the correct evaluation of porosity. Since the clay minerals are very common not only in shale beds, but also in many porous-permeable formations and they affect all log types (electrical, nuclear and acustic) to some extent, therefore, the estimation of shale content is considered as an important step in well log analysis.

The way shaliness affecting log readings depends on the proportion of shale and its physical properties. It is normally assumed in the computation that , for limited intervals the parameters of shale remain constant. In formations containing many shale beds, a slow variation of shale logging parameters with depth is generally observed, but for several hundreds of feet, the variation is usually negligible [15].

The physical parameters of shale may be selected by visual determination of different tool measurements opposite shale bed or from certain types of crossplots. However, there is no simple way for determining shale volume and usually no single approach is fully satisfactory, therefore, all the available shale indicators can be used adequately, The different types of shale indicators have been discussed in many litratures such as Poupon and Gaymard [10], Poupon et al. [9,11], Frost and Fertl [7] and Rider [13]. Each of these indicators is calibrated in such a way that it gives either a good approximation of shale content when the conditions are favourable for that particular indicator or its upper limit.

Porosity Determination

The porosity values can be obtained from, neutron, density and sonic logs which are affected by other parameters such as shaliness, lithology and nature of fluid or gases in the pores. When these parameters are known, correct porosity values can be derived . Also, it is important to realize that porosities derived from neutron, density and sonic logs may be not equal to each others or to true porosity. This is because the instruments do not read porosity directly but it is derived from some physical interaction in the borehole.

The neutron logs respond to porosity and give its value directly after making the correction for proper lithology effect since these logs are calibrated for limestone matrix. When the lithology is known as dolomite or sandstone, the neutron porosity values are then corrected using the following equations [5].

a) In the case of CNL tool

-for dolomite: $\emptyset_{N,c} = 0.0311\ \emptyset_N^2 + 0.102\ \emptyset_N - 0.1331$ when $\emptyset_N < 10\%$ (1)

$\emptyset_{N,c} = \emptyset_N - 6$ when $\emptyset_N > 10\%$ (2)

-for sandstone: $\emptyset_{N,c} = \emptyset_N - 4$ (3)

B) In the case of SNP tool

-for dolomite: $\emptyset_{N,c} = 0.0034\ \emptyset_N^2 + 0.8278\ \emptyset_N - 1.2494$ (4)

-for sandstone: $\emptyset_{N,c} = -0.0014\ \emptyset_N^2 + 1.047\ \emptyset_N + 3.0482$ (5)

where:

$\emptyset_N$ is the neutron porosity reading,

$\emptyset_{N,c}$ is the corrected neutron porosity for lithology effect.

When, the shale is present in the rock, the log reading is corrected again for shale effect as follows:

$$\emptyset_e = \emptyset_{N,c} - V_{sh} \cdot \emptyset_{sh} \qquad (6)$$

where , $\emptyset_e$ is the effective porosity, V_{sh} is the clay volume fraction and $\emptyset_{sh}$ is the log response of that shale corrected to lithology.

In the presence of ligh hydrocarbons, the neutron log, calibrated for water filled fromation gives porosites too low because the hydrogen content per unit volume is lower than that of water. Then, the porosity should be corrected.

The porosity from density log ($\emptyset_d$) can be obtained using the following equation;

$$\emptyset_d = (P_{ma} - P_b) / (P_{ma} - P_f) \qquad (7)$$

where, P_{ma} is grain density of the formation and may be determined using density-resistivity crossplot, P_b is bulk density from density log and P_f is density of fluid in the pores.

$$\emptyset_e = \emptyset_d - [V_{sh}((P_{ma} - P_{sh}) / (P_{ma} - P_f))] \qquad (8)$$

where, P_{sh} is the log response of shale beds in that formation.

The bulk density of shale increases with compaction, and in area where the sediments are relatively young, the increase of shale density with depth is apparent on the logs [13]. Therefore, the effect of shale is small to moderate as long as P_{sh} does not differ much from P_{ma}, but in shallow depth, P_{sh} is usually substantially lower and the effect on P_b is greater. The presence of hydrocarbon tends to reduce density log readings due to low hydrocarbon density. In gas bearing formations, this effect is greater and density derived porosity will be higher. So, the log readings must be corrected for gas effect.

Wyllie et al. [18] proposed a time-average equation, which is a linear relationship between time and porosity ($\emptyset_s$) as follows ;

$$\emptyset_s = (\Delta t - \Delta t_{ma}) / (\Delta t_f - \Delta t_{ma}) \qquad (9)$$

where, Δt is the log reading and Δt_{ma} and Δt_{f} are the interval transit times of rock matrix and fluid in the pores respectively.

The effect of shalliness may depends to some extent on the way the shale is distributed in the formation, but a generalized Wyllie's formula gives a good approximation of sonic derived porosity in most cases [15]. The following equation is used to determine effective porosity in shaly formations;

$$\emptyset_e = \emptyset_s - [V_{sh} ((\Delta t_{sh} - \Delta t_{ma})/(\Delta t_f - \Delta t_{ma}))] \quad (10)$$

where, Δt_{sh} is the log response of shale bed.

It is generally considered that hydrocarbons have no significant effect on sonic log readings. In the case of non uniform distribution of porosity such as the presence of vuges or fractures in a formation, the sonic tends to reflect the primary porosity.

As mentioned before, total porosity can be obtained from neutron , density or sonic log under certain conditions. In fact, each responds indepenently to the different matrix compositions and the presence of gas light oils. Therefore, combination of two porosity logs may give accurate porosity and more information about formation and its contents than that from a single log.

Multimineral Identification

Lithology interpretation with three porosity tool combination is facilitated by the use of MID plot [3].

The first step in the use of MID plot is the determination of apparent matrix parameters (P_{ma}) and (Δt_{ma}) using netron - density and neutron - sonic crossplot charts respectively [17]. Values of $\emptyset_N$ and Δt are entered into the appropiate chart to determine the corresponding value of (Δt_{ma})$_a$, and the same is done using $\emptyset_N$ and P_b values to get (P_{ma})$_a$ taking in consideration the mud salinity (fresh or saline). On the MID plot, the most common matrix minerals (quartz, calcite, dolomite and anhydrite) are plotted. The lithologic trends may be seem by plotting values of (P_{ma})$_a$ and (Δt_{ma})$_a$ for many levels over a formation and observing how the points are grouped on the crossplot with reapect to the mineral points. The presence of gas shifts the plotted points to the northeast of the plot, and secondary porosity upward, while shale to southwest direction.

Hydrocarbon Saturation Estimation

In shaly formation, the formula of Poupon and Leveaux [12] is frequently applied to determine water saturation (S_w) using true resistivity (R_t) , formation resistivity factor (F) and formation water resistivity (R_w) in addition to shale resistivity (R_{sh}) and clay volume fraction (V_{sh}).

$$S_w = \{[(V_{sh})^c / (R_{sh} / R_t)]^{0.5} + (R_t / F.R_w)^{0.5}\}^{-2/n} \quad (9)$$

where:

$$c = 0.5 (1 - V_{sh})$$

Also, there is another formula which has been applied to determine water saturation taking in consideration the effect of excess conductivity of shale, [7].

$$S_w = (1/\emptyset) [[(0.81 R_w/R_t) + (B.V_{sh}/2)^2]^{0.5} - (B.V_{sh}/2)] \quad (10)$$

where :

$$B = X1 - X2$$

$$X1 = (P_{ma} - P_{sh}) / (P_{ma} - P_f)$$

$$X2 = (\Delta t_{sh} - \Delta t_{ma}) / (\Delta t_f - \Delta t_{ma})$$

In the absence of gas, oil saturation (S_o) in a reservoir, can be determined as follows;

$$S_o = 1 - S_w \quad (11)$$

But, in the presence of gas and oil in that reservoir, oil saturation is determined using the following equation;

$$S_o = 1 - (S_w + S_g) \quad (12)$$

where , S_g is gas saturation and can be estimated using Schlumberger charts [17].

WELL LOG INTERPRETATION

All the available log data obtained from the six wells drilled in the study area were used to evaluate Alamein, Dahab and Kharita Formations.

The method of interpretation requires correction of log data to borehole environment, selection of some physical parameters of shale and lithology matrix and determination of shale content and effective porosity. All these steps may lead to an accurate evaluation of hydrocarbon saturation in the studied formatons.

Selection of Shale Parameters

The physical parameters of shale which are important for excluding the effect of shale from the porosity derived from neutron, density and sonic logs to obtain the effective porosity were selected for Alamein Formation from visual inspection of different log types, because shale beds are rarely occurred in this formation in the study area. As for Dahab and Kharita Formations. these parameters were determined using some crossplots of the mathematical parameter M [2] of shale against different log measurements.

The different shale parameters in Alamein Formation were determined directly in front of shale beds. It was found that gamma ray (GR_{sh}) , resistivity (R_{sh}), travel transite time (Δt_{sh}). density (P_{sh}) and neutron ($\emptyset_{N,sh}$) , of shale in this formation are 65 APIu., 2.5 ohm. m, 80 usc/ft , 2.5 gm/cc. and 44% respectively.

The M-GR, M-R , M- Δt, M P and M-$\emptyset$ crossplots were used to determine the physical parameters of shale in Dahab and Kharita Formations. Figs 2 and 3 are two examples from Dahab-IX and Fadda-1 wells to show shale parameter selection in Dahab and Kharita respectively. In M-GR crossplot, the low gamma ray points of clean formation lie in the upper right side of the plot, while those representing shale lie in the lower left side. In M-GR, the right-most points represent the highest resistivities in the interval, the displacements of plotted points to the left indicate the development of water-filled porosity. The shale trend is in the direction of points displaced downward. In other cross-plots (M-porosity log measurements), the zero porosity; pure mineral points are present at the right edge of the distribution and porosity increases to the left side from any mineral point. All these crossplots show the shaliness tendency in the direction of decreasing M values.

More details about the shale parameters selected from different crossplots for Dahab and Kharita Formations in the studied wells are listed in table (1).

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Well	Dahab Fm.					Kharita Fm.				
	GR_{sh}	R_{sh}	Δt_{sh}	ρ_{sh}	$\Phi_{N,sh}$	GR_{sh}	R_{sh}	Δt_{sh}	ρ_{sh}	$\Phi_{N,sh}$
Almaz-I	88	2.2	84	2.4	38	84	2.5	84.5	2.37	39
Abu Subeiha-IX	77	2.0	98	2.26	48	77	2.8	91	2.36	40
Fadda-I	80	2.5	84	2.35	38	82	2.5	80	2.37	39
Dahab-IX	70	2.0	95	2.43	45	75	3.0	78	2.49	39
Washka-Ix	79	2.3	100	2.38	—	78	2.6	86	—	—
Ganayen-IX	78	2.0	98	2.28	—	78	3.5	86	2.37	—

Table (1): Shale parameter values of the studied wells in Dahab and Kharita Formations.
(GR_{sh}=API u., R_{sh}=ohm.m, Δt_{sh}=μsc/ft, ρ_{sh}=gm/cc, $\Phi_{N,sh}$=%)

In table (1), some shale parameters are absent in some wells because of the lack of neutron log data of Ganayen-IX and Washka-IX wells in both Dahab and Kharita Formations and density log data of Washka-IX well in Kharita Formation.

Matrix Parameter Selection

The matrix parameters of the studied formations have been selected from the crossplots of Δt-R_t and ρ_b-R_t for each studied well.

Three examples were taken from some wells in the area named Ganayen-IX, Dahab-IX and Fadda-1 to show matrix parameter selection in Alamein, Dahab and Kharita Formations respectively as shown in fig.4 to determine Δt and fig.5

to determine P_{ma} . More details about the selected matrix parameters of the studied formations in the different wells are listed in table (2).

Wells	Alamein Fm.		Dahab Fm.		Kharita Fm.	
	Δt_{ma} µsc/ft	ρ_{ma} gm/cc.	Δt_{ma} µsc/ft	ρ_{ma} gm/cc.	Δt_{ma} µsc/ft	ρ_{ma} gm/cc.
Almaz-1	46	2.77	51	2.66	52	2.57
Abu Subeiha-1X	46	2.82	48	2.80	52	2.56
Fadda-1	48	2.81	52	2.57	52	2.57
Dahab-1X	45	2.85	48	2.74	52	2.63
Washka-1X	45	2.83	49	2.70	52	---
Ganayen-1X	45	2.75	53	2.54	52	2.53

Table (2): Matrix parameter values of the studied wells in Alamein, Dahab and Kharita Formations.

Matrix Identification

Some crossplots have been applied to identify lithology matrix of the studied formations in each well and to study lithology composition variation laterally and vertically as well as to estimate volume fraction of each mineral at each level .

Some litho-porosity crossplots have been applied to identify the lithology matrix of the studied formations in each well and to study the lithology composition variation laterally and vertically as well as to estimate the volume fraction of each mineral at each level depth .

The application of such crossplots requires the presence of the porosity logs; neutron, density and sonic. In the absence of one or two of them, the composite logs can be used to obtain information about the lithology.

Figs 6,7 and 8 are the MID-plots of Alamein, Dahab and Kharita Formations respectively in the studied wells (except those of Ganayen-IX and Washka-IX which have no MID crossplots due to the lack of neutron or density logs).

The available crossplots of Alamein Formation (fig.6) reveal the absolute predominance of carbonates having a majority of dolomite lithology except that of Fadda-1 well where the percentage of limestone increases. Also, the crossplots show displacement of many points in the direction of gas with different proportions. The Data points of crossplots of Dahab Formation (fig.7) reflect the occurence of shale, carbonate and sandstone with relative abundance of shale. Most of the data points of Kharita Formation are clustered around the quartz points with some shifts toward secondary porosity direction indicating occurence of fractured sandstone, also of these points indicate occurence of calcareous material and shale, (fig.8).

Continous Graphic Presentation of Well Log Evalution

The different petrophysical parameters calculated at every two feet depth in the studied well are presented graphically to study formation characteristics of Alamein, Dahab and Kharita Formations as shown in figs.9 and 10.

The graphic presentation of well log analysis reseults (analog) consists of two tracks; one represents the bulk volume analysis of the studied formations which includes the percentages of clay , sandstone , limestone , dolomite and total reservoir porosity corrected for shale effect, and the second track represents bulk volume analysis water, oil and gas filling the porosity. The analog of each studied well is represented in fig.9 for Alamein and Dahab formations and in fig. 10 for Kharita Formations.

Almaz-1 well analog(figs 9,a and 10,a)

In this well, the dolomitization of Alamin carbonates led to abundance of dolomitic lithology over limestone. Dahab Formation is composed of shale, carbonate and sand-stone intercalation indicating sea osciliation during deposition. some calcareous materials were introduced to the prevailing sandstone of Kharita Formation. The abun-dance of shale and limestone intercations in the lower and upper parts of latter unit is interpreted as transitional zones to Dahab and Bahariya Formations respectively.

The porosity is about 22% in the sandstone zones of Kharita Formation, whereas in Dahab Formation, the presence of shaly material led to a decrease in the volume of pore spaces, while the carbonates of Alamein Formation attain relatively low porosities. Most of the studied succession is water bearing with slight contamination of oil. Gas shows are also, present in the shales and has appreciable amounts in Alamein Formation.

Abu Subeiha analog (fig. 9,b and 10,b)

This well exhibits the same facies as in Almaz-1 well, where the carbonate sediments of Alamein Formation change upward into the shaly fasies of Dahab Formation. The shales are interclated with carbonates, at the lower part of latter formation and sandstones at its upper part indicating shallower marine environment. The sandy facies of kharita Formation was, then, predominated .

The porosity values are low in Alamein Formation and relatively increase in Dahab Formation to reach its maximum in Kharita Formation. The three formations have high water saturation with minor quantities of oil. Gas occurs in Alamein Formation and in the intercalated shales of the succession.

Fadda-1 well analog (figs 9,c and 10,c)

The Alamein Formation in the studied well is mainly calcareous with increment of dolomitization in the upper part of the formation. The shaly Dahab Formation has more frequent sands at the expense of carbonates especially at the upper part .

The porosity distribution in the different formation does not differ from that of the other well except in Dahab Formation, where porosity is higher due to the abundance of sandstone beds. Most of the pore spaces are occupied by water in both Dahab and Kharita Formations with minor quantities of oil, while the shales have large quantities of gas. Considerable amounts of gas are filling the pore spaces of Alamein Formation.

Dahab-IX well analog (figs 9,d and 10,d)

The complete dolomitization of the Alamein carbonates resulted in the presence of secondary porosity. Dahab and Kharita Formations, in this well , are not as similar in thickness and lithology as those in the other wells. While Dahab Formation is thick (except in Fadda-1 well) and composed only of shale and carbonates (sandy facies disappeared), Kharita Formation has a relatively reduced thickness with increment of shales and carbonates at the lower part at the expense of sandstones.

The porosity values of Kharita and Dahab Formations are lower than those of the other wells, while Alamein Formation has the same lower porosity values. This may be due to change of the nature of lithologies or change in the degree of compaction resulted from the huge load of sedimentary sequence where Dahab-IX well lies at the downthrown side of a fault. Small quantities of oil is present in

Dahab and Kharita Formations. Gas shows are restricted to shale beds in Alamein Formation.

Washka-IX analog (figs 9,e and 10,e)

The matrix fractions, represented in this well and Ganayen-IX well, were obtained from the composite logs. The studied subsurface section in this well is similar to those of the other wells with complete predominance of dolomite in Alamein Formation and sandstone in Kharita Formation. Dahab Formation consists of sandstone and carbonate with intercalation of shale beds. The pore spaces are generally highly water saturated, in addition to minor oil. An observal amounts of gas associated to the shale beds in Dahab Formation and minor gas shows are present in Alamein Formation.

Ganayen- IX well analog (figs 9.f and 10,f)

The well is located at southwest of the study area, on the anticlinal crest during the deposition of Dahab and Kharita Formations. These two formations , therefore, represent more shallower facies in this well than in other wells . Dahab Formation consists only of alternative shale and sandstone sequence, while Kharita Formation almost consists of sandstone with minor shale beds.

The porosity values of Dahab and Kharita Formations are steady without diagonestic variations and obviously are greater than those of Alamein Formation. In Kharita Formation, the pore spaces are fully saturated with water in addition to slight occurence of oil. In Dahab Formation, minor gas shows are shown in some sandstone beds, while this shales have higher gas saturation. Considerable amounts of gas are filling the pore spaces of Alamein Formation.

SUMMARY AND CONCLUSIONS

The aim of this work is to evaluate Alamein, Dahab and Kharita Formations of Early Cretaceous time in the area between Sidi Abdel Rahman and Kanayis area in the nortern Western Desert. The evaluation included quantitative analysis of all available logs obtained from six wells drilled in the study area and named Almaz-1, Abu Subeiha-IX, Fadda-1 Dahab-IX, Washka-IX and Ganayen-IX.

The quantitative well log interpretation has been carried out using IBM-PC computer to determine the different petrophysical parameters such as shale content, matrix fractions, porosity and fluid saturation.

The shale parameters of Alamein Formation were determined directly in the front of shale beds which are rarely occured in this formation. It was found that GR_{sh}, R_{sh}, Δt_{sh}, P_{sh}, and $\emptyset_{N,sh}$ are 65 APIu ., 2.5 ohm.m, 80 μsc/ft, 2.5 gm/cc and 44% respectively. In Dahab and Kharita Formations, these shale parameters were determined statistically using some crossplots of mathematical parameter M against the different log data (M-GR, M- Δt , M-P_b and M-$\emptyset_N$). The crossplots of different wells in Dahab Formation show that GR_{sh} ranges from 70-88 APIu., R_{sh} from 2.0-2.5 ohm.m, Δt_{sh} from 84-100 usc/ft, from 2.27-2.43 gm/cc. and $\emptyset_{N,sh}$ from 38-48%, while those of Kharita Formation show that GR_{sh} ranges from 75-84 APIu., R_{sh} ranges from 2.5-3.5 ohm.m, Δt_{sh} from 85-90 usc/ft, P_{sh} from 2.36-2.49 gm/cc. and $\emptyset_{N,sh}$ from 39-40%.

The matrix parameters of the three fromations required to determine the porosity from sonic and density logs were estimated from Δt-R_t and P_b-R_t . In Alamein Formation, the crossplots of different well show that Δt_{ma} ranges from 45-48 usc/ft and P_{ma} from 2.75- 2.85 gm/cc In Dahab Formation, Δt_{ma} ranges from 48-53 usc/ft and P_{ma} from 2.45-2.8 gm/cc. indicating variable matrix lithology from one well to another. In Kharita Formation, t_{ma} is 52 usc/ft in all the studied wells, while P_{ma} ranges from 2.54- 2.63 gm/cc .

Some litho-porsity crossplots were applied to identify lithology matrix in each formation and to determine the volume fraction of each mineral in the lithology at each level depth. In the absence of one of the three porosity log, the composite logs are helpful to obtain information about lithology. The MID-plots of Alamein Formation show that the majority of lithology is dolomite. Also, they show displacement of numerous points in direction of gas. The data points of Dahab Formation reflect the occurence of shale, carbonate and sandstone. Most of the data Points of Kharita Formation are grouped around quartz ponit with some shift in the direction of secondary porosity indicating the predominance of fractured sandstone.

All the petrophysical parameters (shale content, volume fraction of each mineral in the matrix, effective porosity and saturation of water, oil and gas) were calculated continously at every two feet and presented graphically in the form of analog for each well.

The petrophysical studies, showed that , Alamein Formation has the lowest porosity among the studied formations and the average porosity values in the different wells range between 6-10%. Although, this formation has low porosity values, its pore spaces have considerable amounts of gas , particulary, those of Ganayen-IX well.

The porosity in Dahab Formation is much higher where its avarage values range from 11-22%. The occurence in this formation is confined to the impervious shale which does not yield any production but it may be considered as a good source rock. Kharita Formation has the higest porosity where its avarage porosity values range from 13-22%. Most of its pore spaces are water wet with some minor oil shows.

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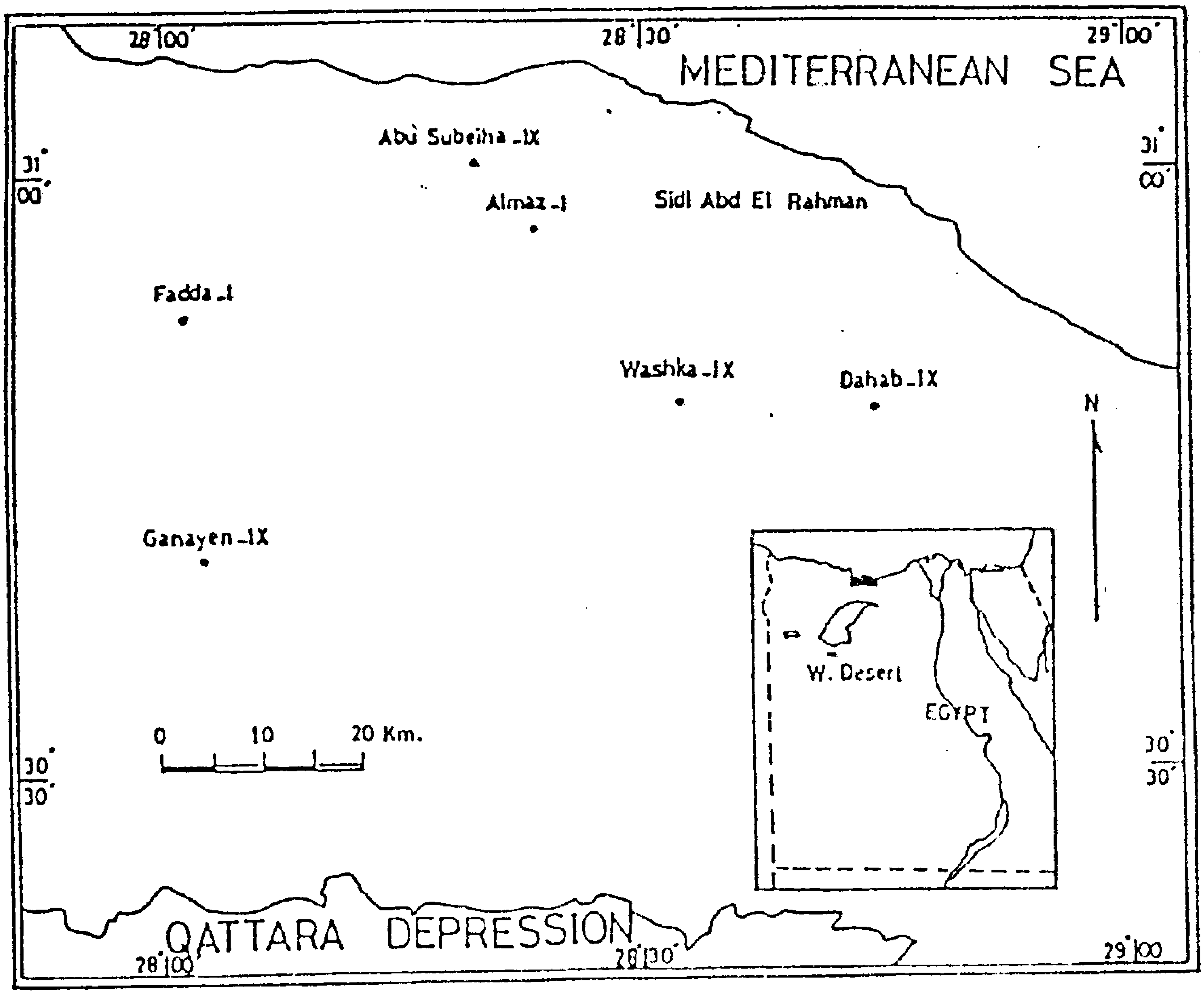

Fig.1 Location map of the study area showing distiibution of the study wells.

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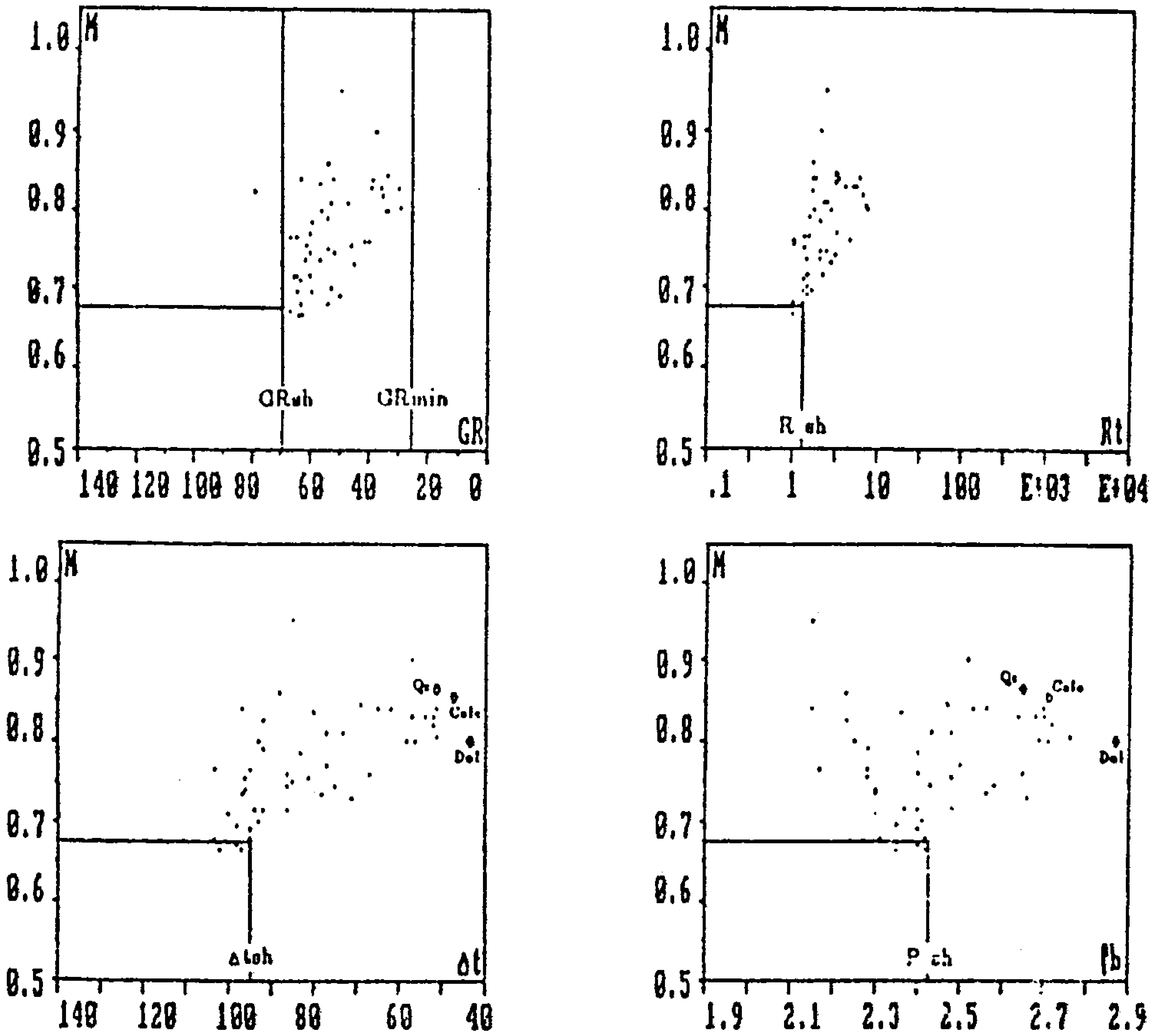


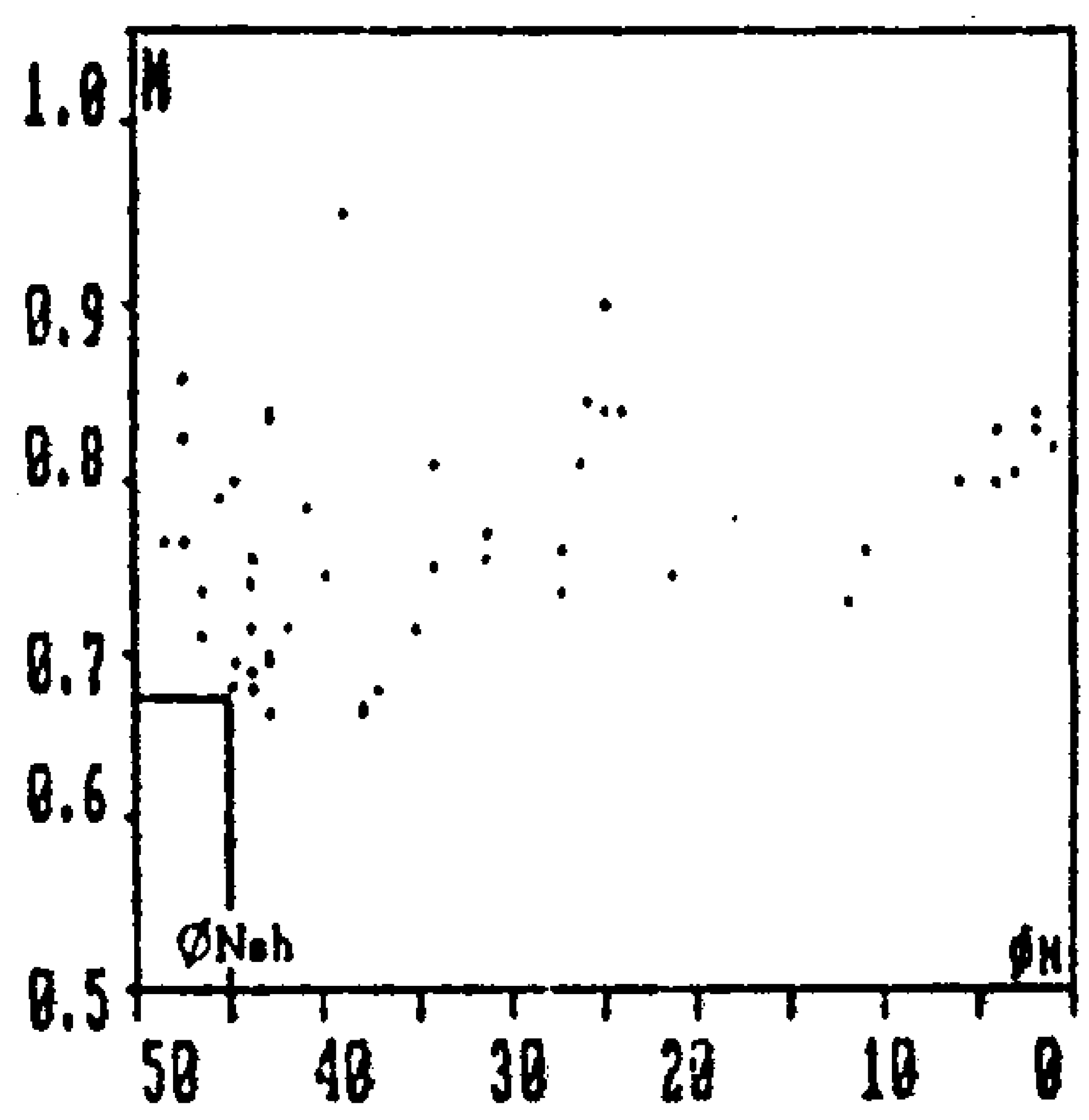
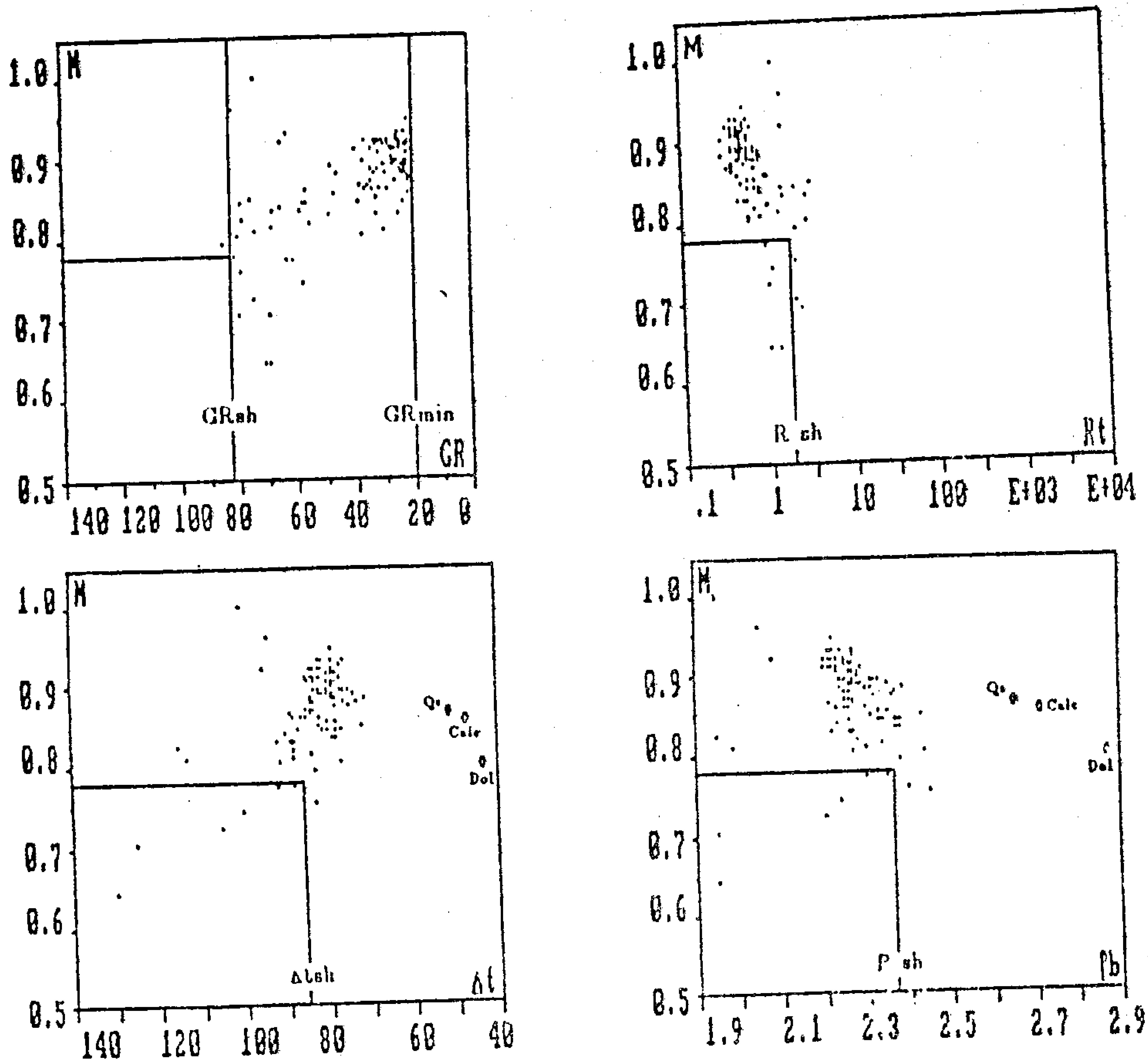


Fig.2 An example from Dahab-1X well to show shale parameter selection in Dahab Fm.



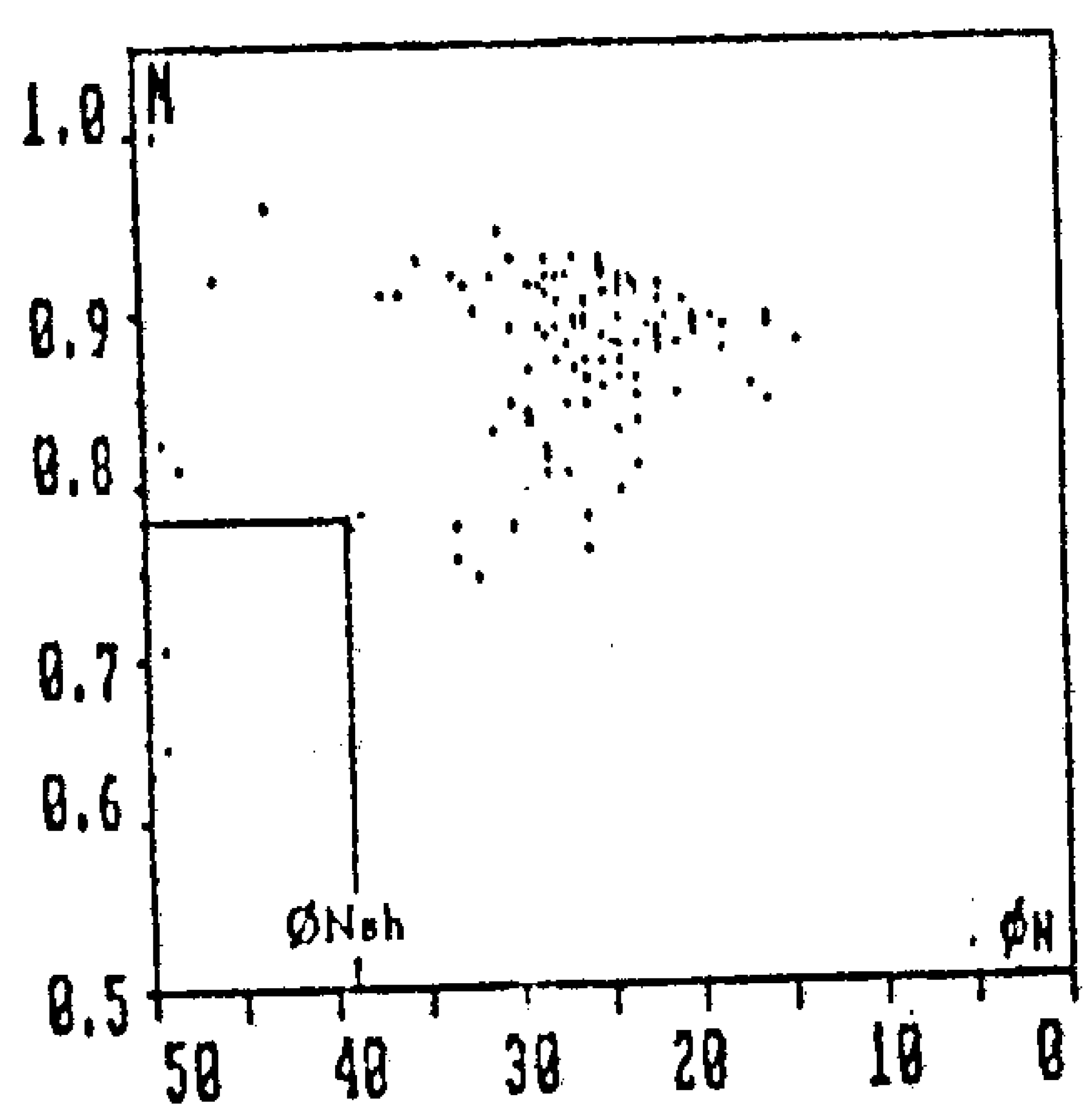


Fig.3 An example from Fadda-1 well to show shale parameter selection in Kharita Fm.

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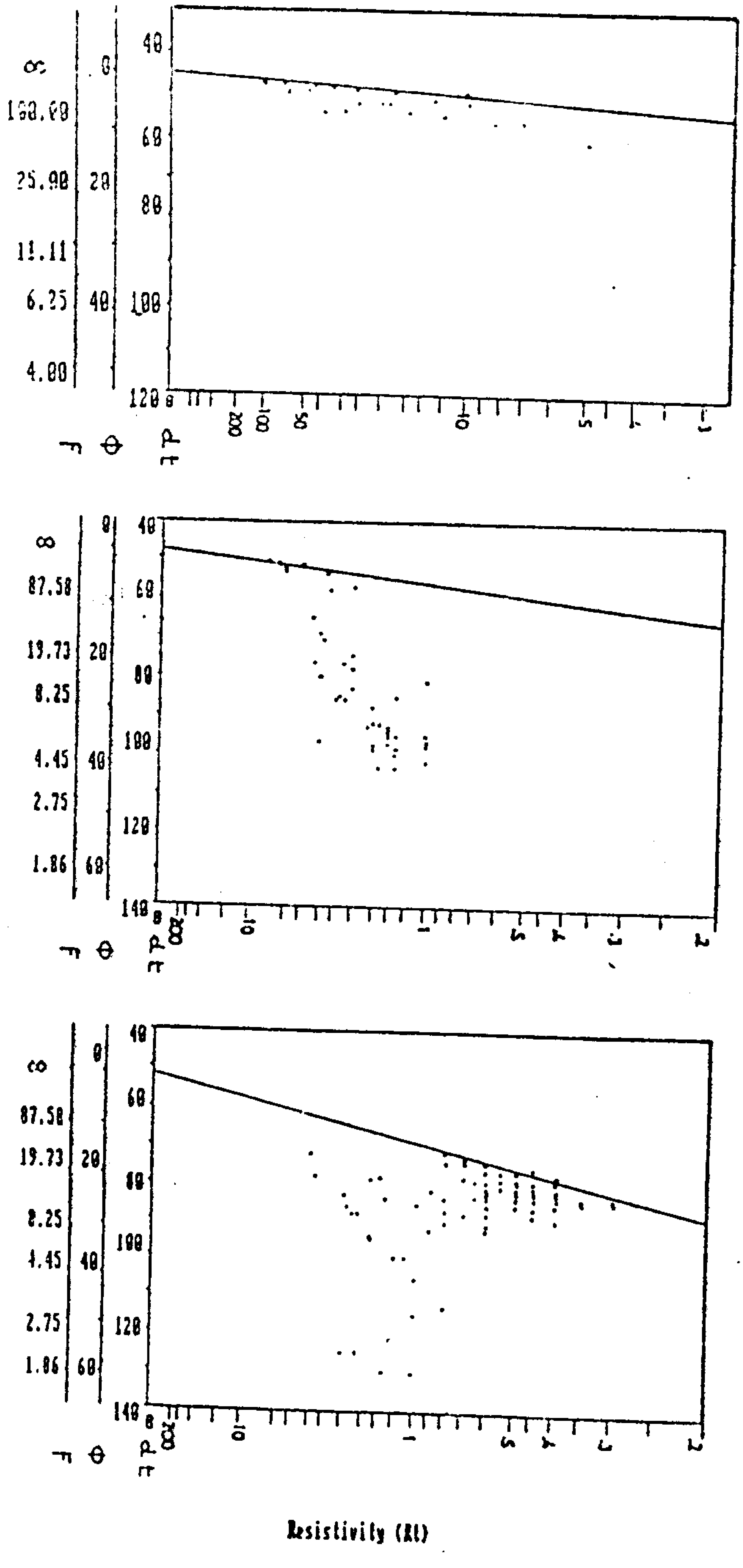

Fig.4 Examples from Ganayen-IX, Dahab-IX and Fadda-I wells to show Δt_{ma} determination in Alamein, Dahab, Kharita Formations respecively from left to right.

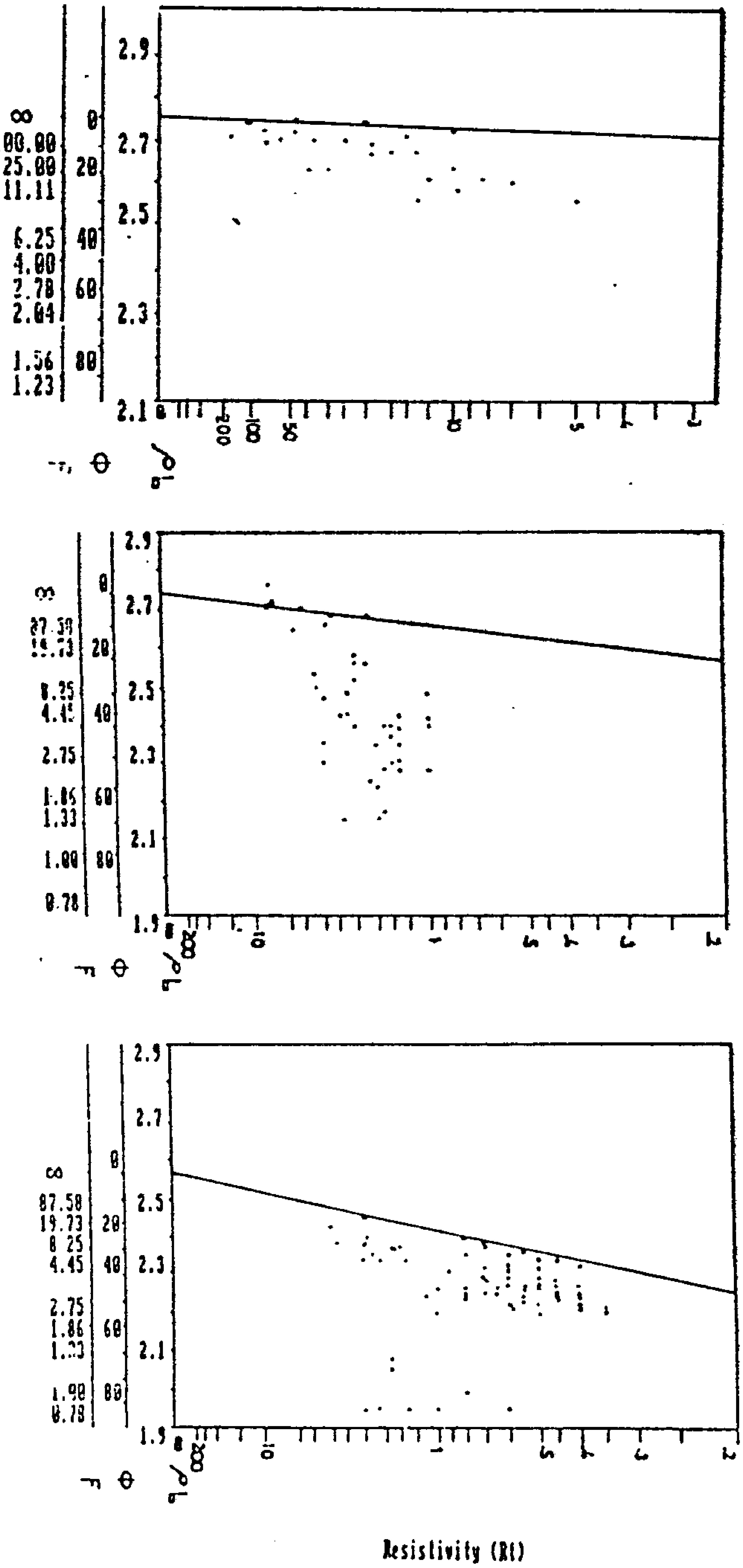

Fig.5 Examples from Ganayen-IX, Dahab-IX and Fadda-I wells to show P_{ma} determination in Alamein, Dahab and Kharita Formations respectively from left to right.

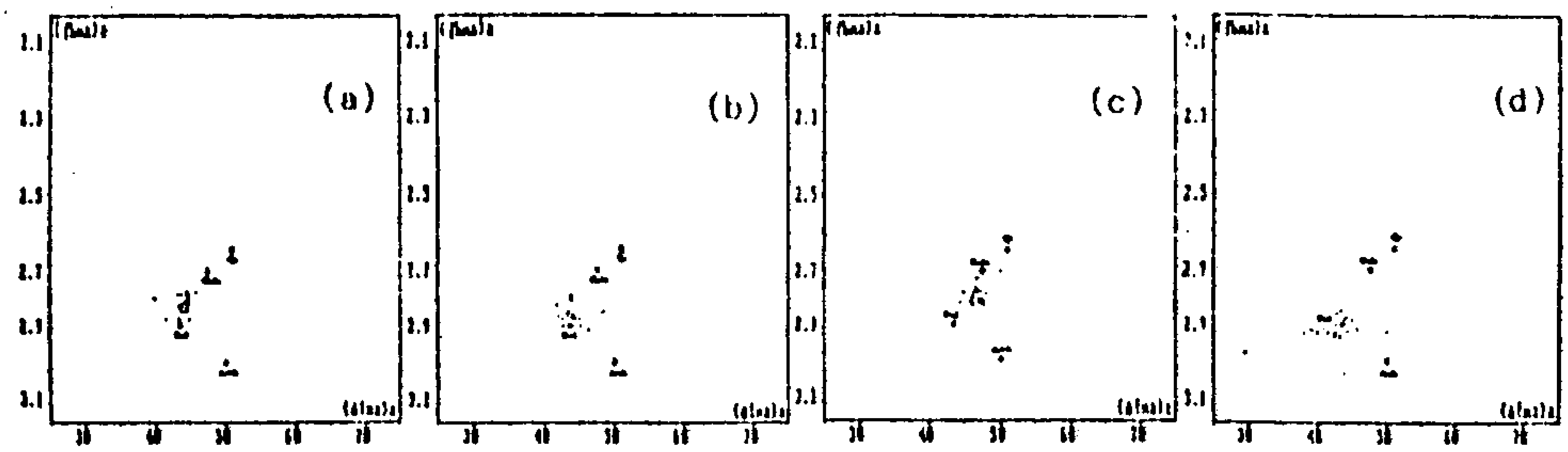

Fig.6 Some MID-plots of the studied wells in Alamein Formation.

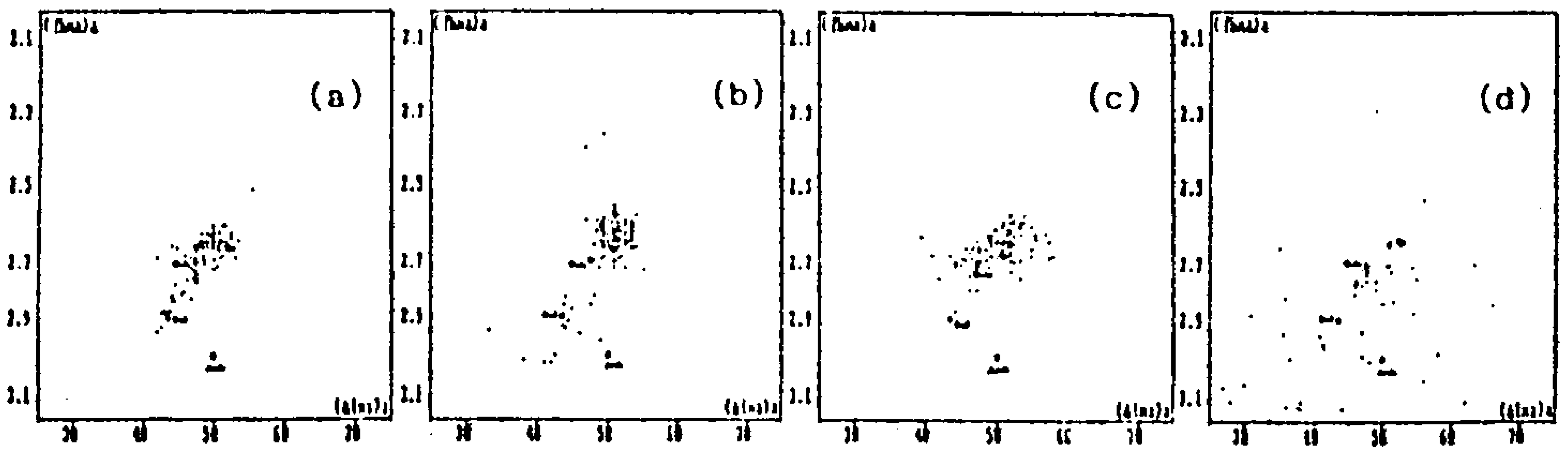

Fig.7 Some MID-plots of the studied wells in Dahab Formation.

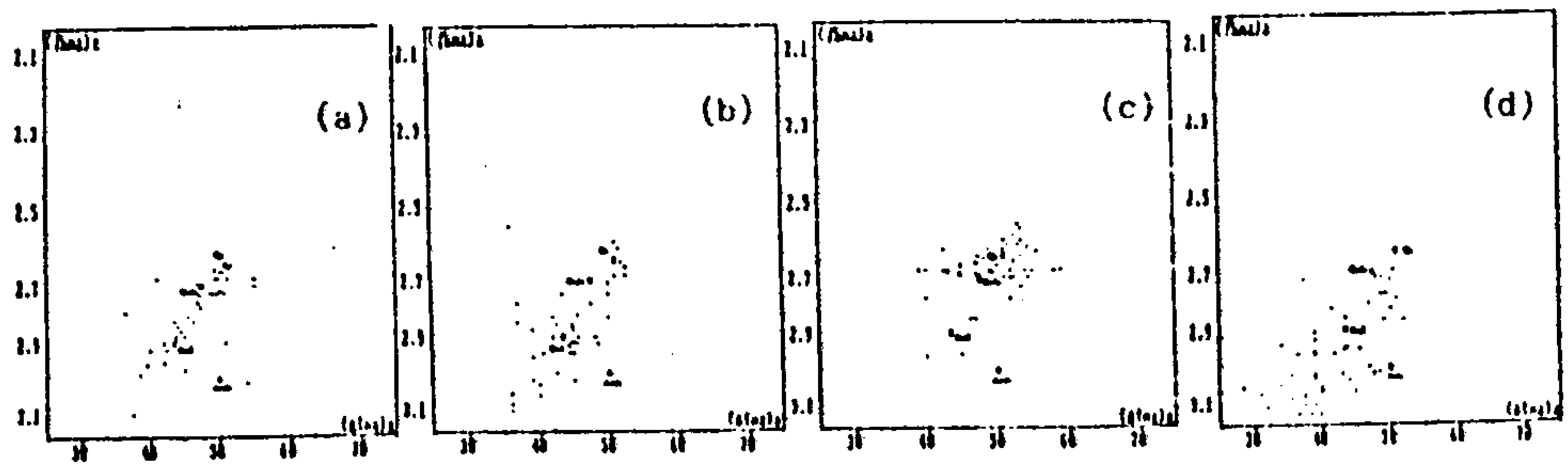

Fig.8 Some MID-plots of the studied wells in Kharita Formation.

a) Almaz-I b) Abu Subeiha-IX c) Fadda-I d) Dahab-IX

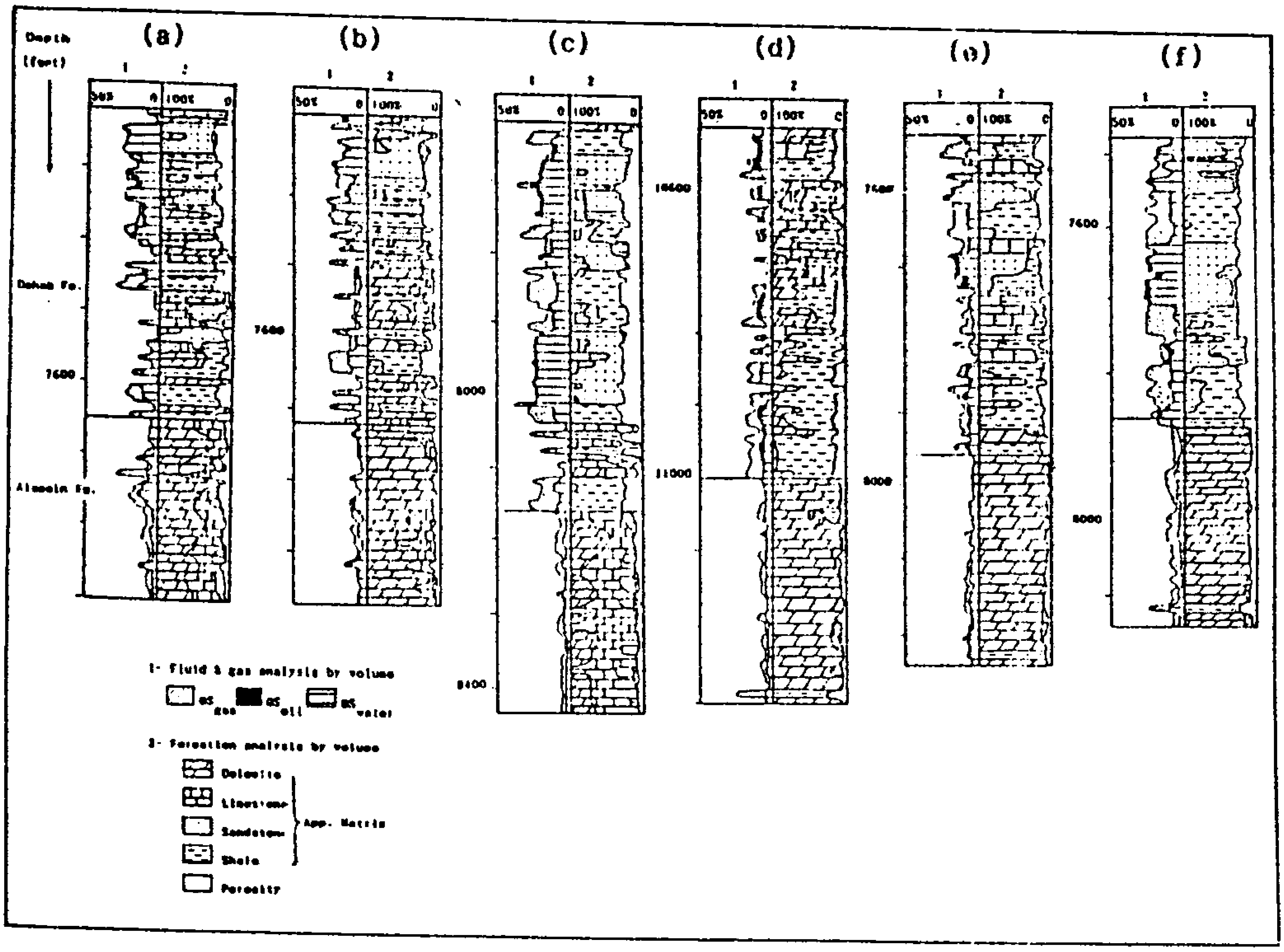

Fig.9 Graphic presentations of well log analysis results (analogs) of the studied wells in Alamein and Dahab Formations.

a) Almaz-I   b) Abu Subeiha-IX   c) Fadda-I
d) Dahab IX   e) Washka IX   f) Ganayen IX

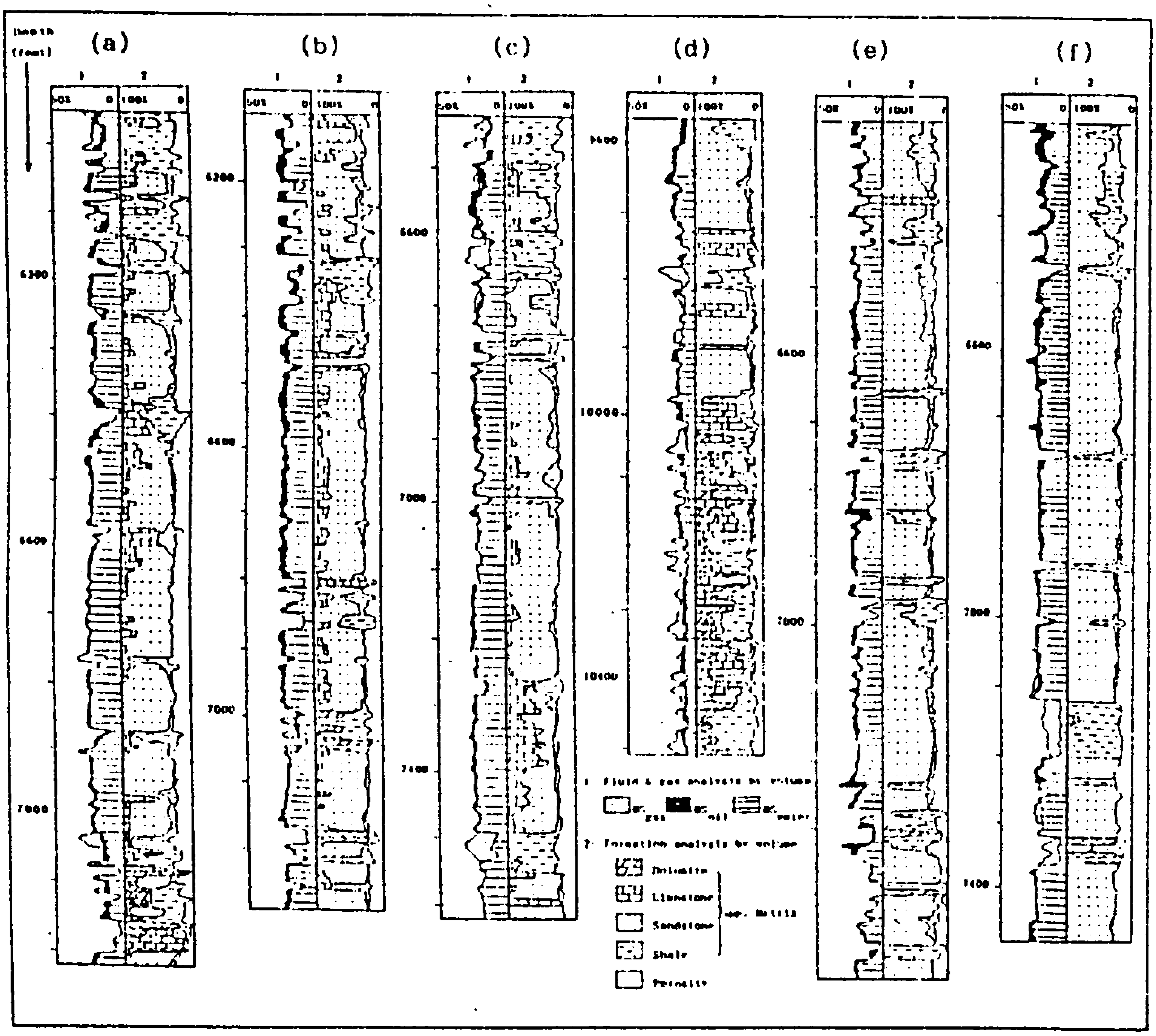

Fig.10 Graphic presentations of well log analysis results (analogs) of the studied wells in Kharita Formation.

a) Almaz-1 b) Abu Subeiha-1X c) Fadda-1

d) Dahab 1X e) Washka-1X f) Ganayen 1

تفسير كمى لتسجلات الآبار لبعض تكاوين العصر الطباشيرى السفلى فى منطقه سيدى عبد الرحمن

للدكتور / نادر حسنى الجندى والسيد / عزالدين على صالح
كليه العلوم ـ جامعه طنطا

يهتم هذا البحث بتفسير تسجلات الآبار تفسيرا كميا لثلاث تكاوين جيولوجيه هى العلمين ودهب وخريطه من العصر الطباشيرى السفلى وتقع منطقة الدراسه بين سيدى عبد الرحمن وخليج كنايس فى شمال الصحراء الغربيه.

وقد شملت هذه الدراسه تعيين المحتوى الطفلى والمكونات المعدنيه للصخر وكذلك تعيين المساميه الفعاله وأخيرا درجه تشبع هذه المساميه بكلا من الماء وزيت البترول والغازات ولما كان تحديد المعاملات الفيزيقيه لكلا من طبقه الطفله وأرضيه الصخر من العوامل الهامه فى تحديد دقه المساميه الفعاله المحسوبه فقد استعان ببعض الطرق الاحصائيه فى تعينها كلما أمكن ذلك .

ولتحديد الصفات البتروفيزيقيه بطريقه متتابعه كل قدمين عمق وبدقه فى الآبار المختلفه تم الاستعانه بالكمبيوتر الشخصى (أى ـ بى ـ ام) من خلال بعض البرامج التى شملت كل العمليات الحسابيه والعلاقات الرياضيه المستخدمه فى هذا البحث وقد مثلت هذه النتائج بيانيا لكل من تلك التكاوين الجيولوجيه فى الآبار المدروسه لدراسه التغير الرأسى والافقى لهذه الصفات .

ومن هذه الدراسه وجد أن تكوين العلمين مكون معظمه من صخور الدولوميت مع احتوائه على نسب قليله من الطين ويحتوى هذا الصخر على أقل مساميه حيث يتراوح متوسط هذه المساميه فى الابار المختلفه من ٦ ـ ١٠٪ ويحتوى بعض طبقات هذا التكاوين على غازات

بنسب معقوله تبلغ أقصاها في بئر جناين ـ ٩ أما تكوين دهب فيتكون من مجموعه من طبقات الصخور الجيريه والطينيه والرمليه ويبلغ متوسط المساميه الفعاله في هذا التكوين من ١١ ـ ٢٢٪ وقد لوحظ أن طبقات الطفله تحتوى على غازات مما يمكن اعتبار هذه الصخور مصدرا لتكوين الهيدروكربونات ويتكون تكوين خريطه معظمه من الصخور الرمليه المختلفه بقليل من المكونات الجيريه وتبلغ المساميه هنا أقصاها حيث يتراوح متوسطها من ١٣ـ ٢٢٪ علما بأن هذه المساميه غالبا تكون مشبعه بالماء مع كميات قليله من البترول أن وجد .