في وسائل الدفع الالكترونية سببه الإشراف والرقابة ما لم يؤثر مؤثر آخر، ويرى الباحثان إن ذلك عائد إلى توفر السلطات الإشراقية والرقابية الكافية لحماية حسابات العملاء ولاستخدام نظام التشفير في التعاملات، إضافة إلى الإشراف الجيد والرقابة على إجراءات الصيانة وكذلك الاشراف والمراقبة على فحص مكونات أمن النظام والتأكد من سلامة البيانات.

2. عدم استخدام التوقيعات الإلكترونية المشفرة وتوفر نظام اشراف والرقابة عليها.
3. وجود نظام الاشراف والرقابية على اختراقات لموقع المصرف على الشبكة.
4. عدم توفر نظام الاشراف والرقابة على اوضاع عدم التيقن التي تكتنف الجوانب القانونية.

التوصيات: –

1. العمل على الفصل بين المهام والمسؤوليات بين إدارات النظام المصرفي التجاري.
2. العمل على تفعيل استخدام التوقيعات الالكترونية المشفرة في المعاملات المصرفية التجارية.
3. ضرورة الاحتفاظ بنسخ احتياطية من الأنظمة والبرامج والملفات الإلكترونية ضمن خطة للطوارئ خارج مراكز العمل.
4. العمل على توفير الضوابط اللازمة للرقابة والاشراف على المعلومات وذلك لتجنب المخاطر التي قد تنجم عن الدخول الى شبكة المعلومات من قبل الغير المرخصين بذلك.
5. تفعيل نظام الاشراف والرقابة على أوضاع عدم التيقن التي تكتنف الجوانب القانونية.

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Petrophysical properties of the Mamuniyat Reservoir Sandstone in I-Oil Field -NC186, Murzuq Basin-Libya

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Abstract

This study is attentive on of Petrophysical properties of the Mamuniyat reservoir sandstone in I-Oil Field -NC186 which located in Murzuq Basin which is containing mainly sandstone with litter shale layer using well logging data as (Gamma Ray Log ,Resistivity Log , Neutron Log and Density Log). and using new software Techlog software and surfer software .the Mamuniyat reservoir sandstone which represents the target reservoir producing oil from wells in I Oil Field located in the Concession 186 . the petrophysical analysis of the reservoir properties is an important to evaluate the reservoir reserve assessment using well logs data recorded of select six wells (I1-186,I2-NC186 ,I3-NC186,I4-NC186,I5-NC186 and I6-NC186) over studied reservoir for by using well log data only such as and using new software techlog software 2015 and surfer software for mapping , the logs were using in this study the results show Mamuniyat reservoir sand stone has good quality reservoir ,where the porosity is about15 % , the net pay thickness is about 43.5 feet and ,water saturation is up to 39.3 %. the initial oil in place was calculated using the volumetric method equal to 949,29 MMSTB, where the recoverable reserve is 30377.1MMSTB .

Introduction

The I oil field - NC186 located in the south part of Concession 186 , in Northeast part of the Murzuq Basin ,the north east of Concession (NC 115),. The concession (NC 186) consists of main oil fields as (A, B, C , I ,H, M) have been discovery, The first well discovery I1-NC186 in 2005 in the Mamuniyat Formation in the structural I-oil field.

The objective of study is investigating the petrophysical characteristics of the Mamuniyat main reservoir in the I-oil Field in Concession NC186 and Estimation of hydrocarbon reserves of the study area. The source rock in this study is The Tanzzuft shale (Hot shale) , Tanzzuft shale is the cap rock of Mamuniyat Reservoir.

The method used in this study were applied Petrophysical analysis Using Techlog 2015 software for Six wells selected (I1, I2. I3, I4, I5 and I6) content well logs, include Gamma-ray, Neutron, Resistivity log and Sonic log and Formation tops., in order to determine the quantity of Petrophysical properties for the Mamuniyat reservoir such as Porosity, Permeability, water saturation and net pay, and combined them with the geological information to help us to evaluate the reservoir quality in study area.

surfer 13 software has been using for generated by Maps of Porosity, Permeability and Water saturation.

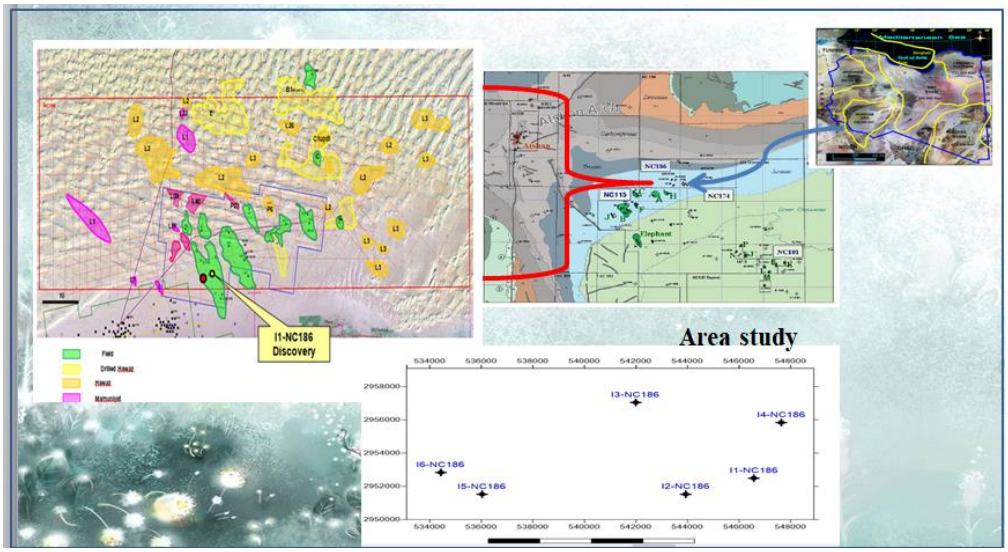

Fig (1) Location map of NC186 and well location in I Field (Akakus, 2010)

Geology Setting Of Murzuq Basin

The Murzuq Basin located on the southwest part of Libya ,it's one of a number of intracratonic basins on the Saharan Platform of North Africa, its covers area more than 350,000 km².it boundary by the Gargaf Uplift separates the Murzuq Basin from the Ghadames Basin , in the north, in the west is bounded by the Tihemboka Arch, which forms the boundary between the north western Murzuq and the eastern Illizi Basins. The eastern limit with the Sirt Basin is marked by a series of north- northeast - south-southwest faults which form a major tectonic lineation in the Paleozoic rocks Figure The south western basin limit is defined by the Hoggar Massif while, to the south, the basin extension in Niger is terminated where the Paleozoic sequences progressively rise to outcrop as they approach the African shield. (Sola, et.al 2000) and it was initiated during the Paleozoic, straddling the boundaries of Alger ,the basin is filled with sediments ranging in age from the Cambrian to Cretaceous. It has a maximum total thickness of more than 3000 meter in

the central part (Sola, et.al 2000). The present-day structure of the Murzuq Basin can only be determined by subsurface methods since the entire basin center is covered by the Murzuq Sand Sea. The structure contour map of Top Mamuniyat Formation in study area showing the East part of the area is high structure around wells I1-NC186 and I 4-NC186, and the structure turn to low in the West part Figure (2).

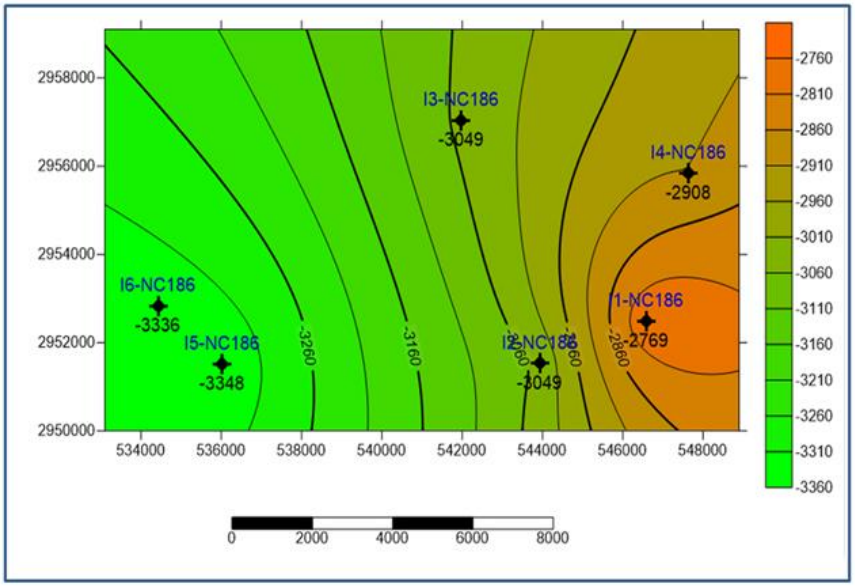

*Figure (2) Structure Contour Map of Top Mamuniyat Formation in Study Are*a

Stratigraphy Setting

The sedimentary record of the Murzuq Basin has been divided into four sedimentary sequences:

A. Cambro to Ordovician; B- Silurian; C- Devonian to carboniferous and D- Mesozoic.

a. ***The Cambrian Ordovician*** *:The sequence, which unconformably overlies the Precambrian basement, matches up with the lower Paleozoic Gargaf group, a detrital unit constituted by five formations named, from bottom to top: Hasawnah, Ash Shabiyat, Hawaz, Melaz Shuqran and Mamuniyat. All of these formations are detrital, and bounded by unconformities of different nature except for the boundary between Ash Shabiyat and Hawaz formations, which are an erosive concordant surface.*

b. ***The Silurian sequence:*** *The sediment is a fine-to medium-grained detrital sequence that overlies a complex erosive surface resulting from the late Ordovician glaciation. It constitutes a relatively continuous sequence which includes a transgressive and a high sea-level episode followed by a regressive progradation. The lower transgressive and high sea-level deposits are made by the Bir Tlacsin and Tanzzuft formations; the last one includes the hot shale member. The upper sequence is a ubiquitous one which can be recognized with similar characteristics across North Africa, from Morocco to the west to Arabia to the east.*

c. ***The Devonian-Carboniferous****: The sequence unconformably overlies the terminal Silurian Caledonian unconformity. It represents the continuous marine deposition locally punctuated by local unconformities that in some cases are responsible of major thickness variations, their deposits are both, detrital and carbonate, and include the Tadrart, Quan Kasa, Awaynat Wanin, Marar, Assedjefar, Dembaba and Tiguentourine formations. The sequence is capped by the late Carboniferous Hercynian unconformity.*

d. ***The Mesozoic sequence:*** *The sediment is absent in the uplifts bordering the Murzuq basin (Tihemboka, Tibisti, Gargaf and Atshan highs), and only a partial succession is present in the central part of the basin. The most complete Mesozoic sequence crops out southwards of the basin, in the SE and SW borders, near the Tihemboka and Tibesti highs, and it has been drilled in the subsurface only in the southern half of the basin, towards the north, the Mesozoic sequence is only represented by Cretaceous rocks, which occupy larger extensions of the basin, the Mesozoic sequence is made by continental detrital sediments and includes the Triassic Zarzaitirnt formation, the Jurassic Tourantine formation and the cretaceous Mazak formation.*

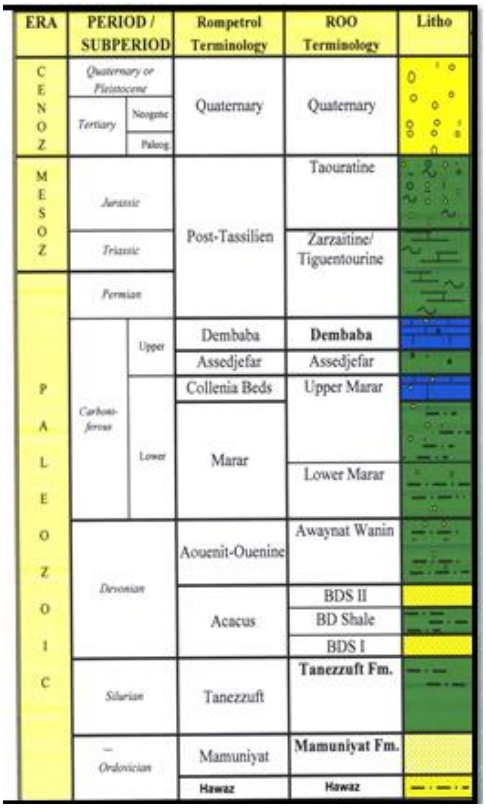

Figure (3) lithostratigraphic section of nc186 (akakus, 2016)

Reservoir in study area

Producing fields in the Murzuq Basin all have reservoirs in the sandstones of the Ordovician Mamuniyat Formation or in the underlying Hawaz Formation where the Mamuniyat is thin or absent. Devonian sandstones are regarded as a secondary target. The Ashgillian Mamuniyat Formation is the main reservoir and represents the primary target in the basin. The formation was deposited during the late Ordovician glaciation over North Africa. Its origins as a glacial-marine deposit create a degree of petrophysical uncertainty, characterized by great lateral and vertical facies change.

In Murzuq Basin the Mamuniyat Formation was divided in to three section upper Mamuniyat which consists of clean zone its indicated the lithology mainly is sandstone with gross thickness 182 feet and the thickness decrease in some other wells , the thickness decrease up to toward the west and the north east part reached to 33 feet which indicates periods of sea level change during of deposition sandstone beds with thin layers of shale , and Lower Mamuniyat section in this study is shale ,so the upper Mamuniyat formation is main reservoir only figure (3) .

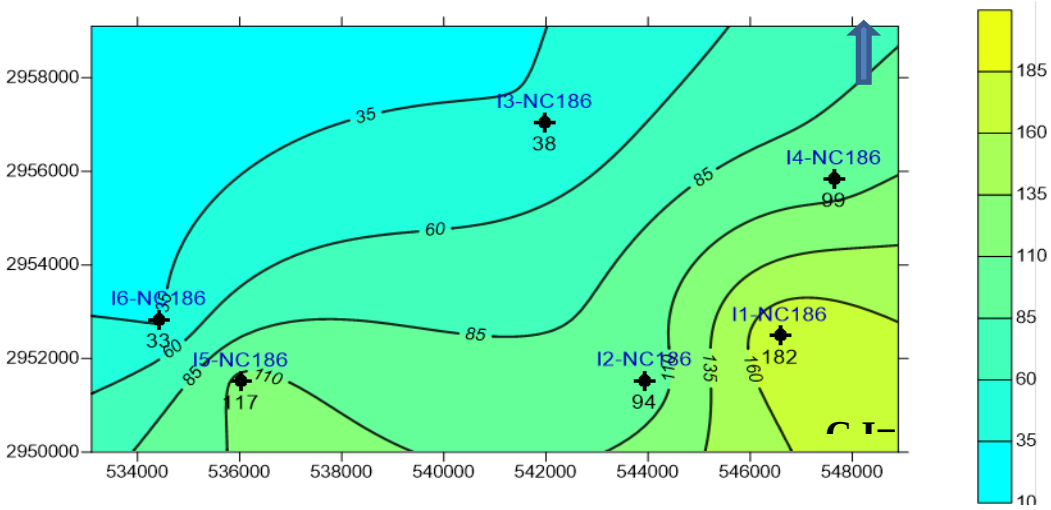

Fig (3) thickness map of Upper Mamuniyat Formation

Petrophysics Study

Petrophysics mean the study of the rock properties; porosity, permeability and fluid distribution, etc. In this study a complete package of porosity and resistivity logs, records including neutron, density, sonic and induction Logs, have been recorded across the reservoirs. Interval of each log was read every 0.5 feet and analyzed in detail for porosity, volume of shale, water saturation, and net pay thickness and hydrocarbon pore volume. Petrophysical analysis of the Mamuniyat Formation in I oil field Concession NC-186 were carried out with the aim of acquiring the variables needed to perform a volumetric calculations of the field a number of six wells were used in this study which are. The available well logs are (GR, Density, Neutron, Sonic and Resistivity), these logs were used to determine the characteristics of the reservoir, also to calculate the thickness of the reservoir interval, water saturation and the thickness of the Net-pay zone.

Wells correlation:

The main objective of the well correlation is to determine the extension of the Mamuniyat Formation within the Concession NC-186. Other objectives include measuring the thickness variation between the wells and determining whether or not facies changes are present within the formation ,Well correlation was done using the GR log ,the Mamuniyat formation layers in study area, where in figure (4) show varies of thickness for both upper and lower Mamuniyat Formation in study area ,which show in the west part, the upper Mamuniyat present with varies thickness about 33 feet in well I6-NC186 and the thickness increasing toward the east part in well I1-NC186

and the lower Mamuniyat shale is absent in well I5-NC186 to thick shale in well I6-NC186 due to change of sedimentary environment . ,

Determination Volume of Shale

the shale volume is the average of the value obtained from the following calculation methods:

$$VGR= (GRlog - GRclean)/(GRsh - GRclean)$$

Where:

IGR= the Gamma ray index (API).
GRlog:= the Gamma ray reading.
GRclean= the minimum Gamma ray reading.
GRsh = the maximum Gamma ray reading .

Porosity Determination

Total porosity was calculated from density log as shown in the following relationship

$$\Phi= (\rho ma - \rho b)/ (\rho ma - \rho f)$$

Where:
Φ = the porosity of the rock, fraction.
ρb = the bulk density of the formation, g/cm3.
ρma = the density of the rock matrix, g/cm3.
ρf = the density of the fluids occupying the porosity, g/cm3.

Effective porosity was estimated according to equation

$$\Phi e = \Phi *(1- VCL) 2$$

Where:

Φe = Effective porosity

(ρma = 2.65g/cc, ρf = 1.0g/cc)

Water Saturation

Archie Equation was used to calculate the water saturation as shown below

$$Sw = (a.Rw/ \Phi m.Rt)(1/n)$$

Where:
Sw = water saturation, fraction.
Rw = water resistivity (= 0.3 ohm.m) from lab.
Rt = true resistivity of formation containing hydrocarbons and formation water, ohm.m.
n = saturation exponent, (= 2).
F = formation resistivity factor, ohm.m

Net Pay
A porosity cut-off of 9% was used along with a shale volume cut-off of 30% to define the quality of the reservoir rock. Water saturation, Sw, cut-off value of 50% was used to define pay. The

reservoirs were defined by the porosity greater than 9% and shale volume less than 30%. For the net pay, if the water saturation within the reservoir is less than 50%, it is considered to contain

Petrophysical Analysis Results

the detailed results of the petrophysical analysis of the Upper Mamuniyat Reservoir in I- oil field will be presented and summaries in table 1 .Based on the available well data and petrophysical results of well log data show the petrophysical result as porosity in study area is excellent porosity and varies in values of porosity is varies from 14 % in the east to 22 % in the west part due to closed to fault in the western part result the secondary porosity (fracture porosity) water saturation show varies result in studies wells due to varies in parameters of reservoir and the reservoir is not homogenies missing of data information such as core data , sedimentation analysis report , to understand the area , reservoir properties, the structure could be effect on the result ,absent of seismic data is effect on structure shape.

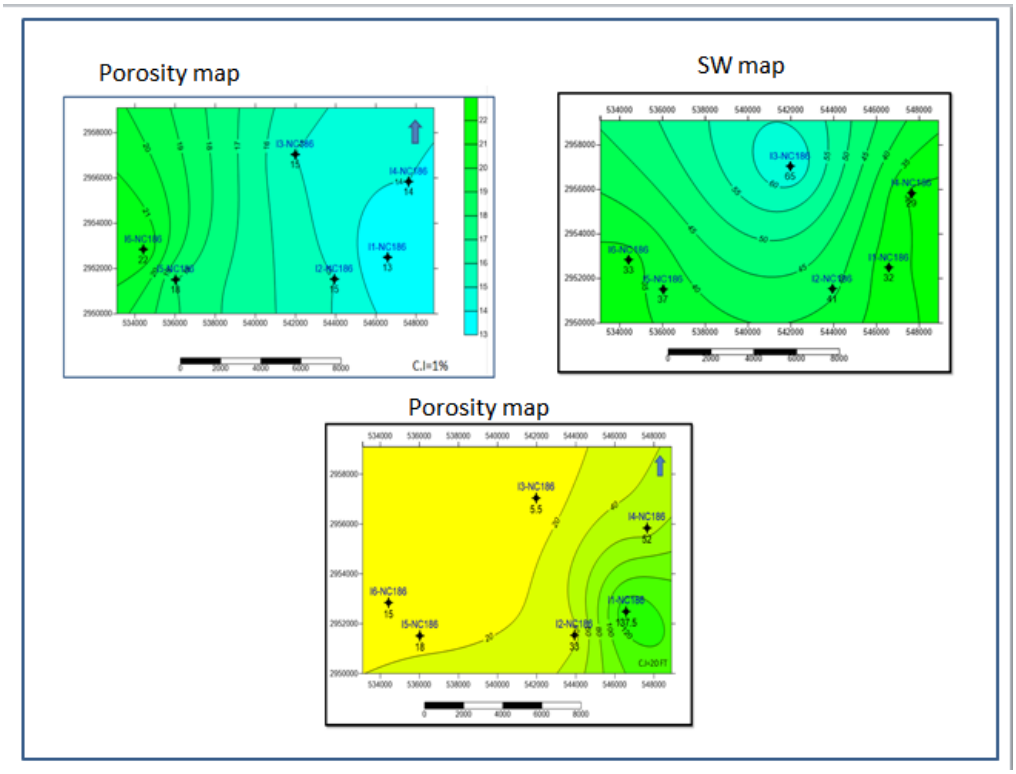

Figure (4) show petrophysics Result (porosity ,Sw and Net pay) in study area

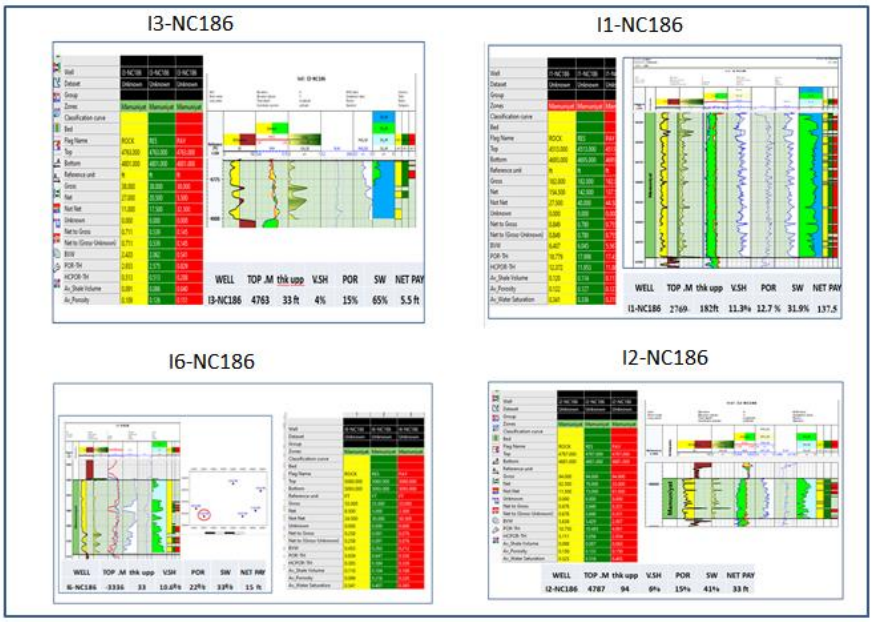

Figure (5) show petrophysics Result in study area

Table (1) petrophysics results for studied wells

WELL NAME	I1-NC186	I2-NC186	I3-NC186	I4-NC186	I5-NC186	I6-NC186
TOP Mamuniyat, (FT)	4513	4787	4763	4620	5070	5060
THK, (FT)	181	94	38	99	117	33
Volume of shale(%)	11.3	6.3	4	6.9	6.9	10.4
Net pay(FT)	137.5	33	5.5	52	18	15
Porosity(%)	12.7	15	15.1	13.8	11.8	22.3
SW(%)	31.9	40.5	65.3	28.6	37.2	32.8

The Initial Oil Reserves:

To calculate the hydrocarbon pore volume of I –NC186 oil field, the calculating the all of the required variables by the HPV equation are now obtained, and the reserves can now be calculated. The porosity Ø and water saturation Sw , A net pay thickness were represented by their average values, we collected all values of HPV of the Upper Mamuniyat Reservoir in each wells and entered them in the equation

$$HPV = h \times Øavg \times (1-Sw)$$

Where:

HPV= Net hydrocarbon pore volume (ft/acre).
h = Net pay thickness (ft). = 43.5 Feet
Ø = Net pay porosity (%). = 15%
Sw = Net pay water saturation (%).= 39.3 %

HPV = 43.5 × 0.15×0.607= 3.960

OOIP = HPV× 7758× A

OOIP=3.960 × 7758 × 35528.8 = 1,091 MM, STB

IOIP =OOIP/FVF

Where:

OOIP: is the Original Oil in Place.
A: is the Area in acres (35528.8Acre).
7758: is the number of barrels per feet.
IOIP: is the Initial oil in place (STB).
FVF: Is the Formation Volume Factor equal to (1.15 RB/STB), obtained from the reservoir data summary of (Akakus, 2017).

IOIP = 1,091,690,476 ÷ 1.15 =949,29STB

The original oil in place was estimated to be 1,091, MM stack tank Barrel using equation This is equation to initial oil in place at formation volume factor (F.V.F) of (1.15 RB/STB) calculated using equation . The recovery factor (R) in I –NC186 Oil field is (32 %) in I –NC186 field The Recoverable oil is using equation

*Oil recoverable = IOIP * RF*

Where:

IOIP: Is initial oil in place (STB).

RF: Is recovery factor, considered as (32 %).

Oil recoverable = 949296066.3* 0.32 = 303.77MM STB

Summary and Conclusions

- *Thickness the Upper Mamuniyat in study area about from 33 to 182 feet.*
- *The Mamuniyat reservoir is main target and has the best reservoir characteristics with an average porosity ranging between (13%) and (22%) .*
- *The Net-pay thickness ranges between 5.5 feet and 137 feet .*
- *The water saturation values were fair to good hydrocarbon saturation as good reservoir in I –NC186 Oil field in all of studied wells with average water saturation 39.3%.*
- *The oil in place about 1,091,69MMSTB and OIL recovery about 303, 77 STB.*
- *No more well will be to drill in the north or to Eastern part in area due to thickness could be very thin or absent also the reservoir quality is very bad quality reservoir (shaly bed).*

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