Facies and Reservoir Evaluation of Mishrif Formation in Tuba Oil Field

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Abstract
The Mishrif Formation is one of the most important formation in oil fields, which is located in southern part of Iraq, and it is of Upper Cretaceous age. Tuba field is located nearly 40 km SW – Basrah city. It is bounded from east by Zubair oil field (5 km distance) and from west by Rumaila (2 km distance). The Tuba oil field is situated between Zubair oil field in the east and Rumaila in the west, and is separated by two depressions.
The rock (core and chips) samples have been collected systematically from cores of Mishrif Formation that are available from stores of southern oil company to prepare thin sections and slides—these slides have been examined by using microscope. These samples have been taken from all parts of the reservoir units of Mishrif, namely, mA, mB1, mB2 units. Twenty-four samples have been applied to the petrophysical tests to measure the porosity and permeability. The water and oil saturations have been identified by consulting the log documents for studied wells (7 wells). Besides, four hundred ten rockslides have been made for identifying the facies and diagenices processes.
Four main facies have been diagnosed at Mishrif Formation (Grainstone, packstone, wackstone and mudstone) which are spread all over the reservoir units. Moreover, the diagentic processes have been identified by using microscope to check the rockslides, which have greatly framed the petrophysical characteristics for Mishrif Formation. These processes include dissolution, all categories of porosity, compaction, cementation, new morphisim and dolomitization.
The results of the reservoir geological model show that Tuba field is an anticline fold which its extension is in (north – northwest), (south- southeast) direction. The results have proved that facies model distribution completely match the facies description in the study. This model contains Grainstone, Packstone, Wackstone and Mudstone.

Keywords: Reservoir, Mishrif, Tuba oil field.

تقييم سحني ومكمني لتكوين المشرف في حقل طوبة النفطي

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الخلاصة

يعد تكوين المشرف (الطباشيري الأعلى) أحد المكامن المهمة في الحقول النفطية جنوب العراق ولاسيما في حقل طوبة النفطي يقع حقل طوبة بمسافة 40 كم جنوب غرب مدينة البصرة ويحد الحقل من جهة الشرق حقل الزبير بمسافة 5 كم ومن جهة الغرب حقل الرميلة بمسافة 2 كم ويفصل بينهما مع حقل طوبة منخفضان.

تم جمع نماذج صخرية (لباب + قطع صخرية) من مكمن المشرف المتوفرة في مخازن شركة نفط الجنوب وتم اعدادها لغرض عمل الشرائح الصخرية وفحصها في المجهر وغطت كافة الوحدات المكمنية لتكوين المشرف وهي mA و mB1 و mB2ثم فحص (24) نموذجا صخريا لغرض التحاليل البتروفيزيائية والتي شملت قياس المسامية والنفاذية ثم تحديد مناطق التشبعات المائية والنفطية بالاعتماد على سجلات الجس للآبار قيد الدراسة. وكذلك عملت (410) شريحة صخرية لغرض تشخيص السحنات والعمليات التحويرية.

تم تشخيص أربع سحنات رئيسية في صخور مكمن المشرف Packstone Wackstone،Grainstone ، Mudstoneموزعة على الوحدات المكمنية وكذلك من خلال الفحص المجهري للشرائح الصخرية تم تحديد العمليات التحويرية والتي كان لها الدور الاكبر في تشكيل المواصفات البتروفيزيائية لصخور تكوين المشرف وهي الاذابة، المسامية بكل انواعها، الانضغاط التسميت، اعادة التشكل، الدلمتة.

بينت نتائج الموديل الجيولوجي المكمني بان حقل طوبة عبارة عن طية محدبة تمتد باتجاه الشمال –شمال غرب، جنوب – جنوب شرق.

اما بالنسبة الى توزيع الموديل السحني فقد اكدت النتائج بانه متطابق تماما مع الوصف السحني في الدراسة والذي يحتوي على السحنات التالية (Mudstone، Wackstone، Packstone،Grainstone).

Introduction

Studying depositional and stratigraphic facies sequence is a fundamental factor, which explains oil saturation areas and its extensions in fields. The early knowledge of facies types and their geographic extensions are important to evaluate oil reservoirs.

The current study focuses on one of the most important reservoir units in south of Iraq, which is Mishrif Reservoir. It is consisted of limestones of variant and different facies from field to south Iraq. To obtain more accurate information's concerning facies and sediment aspects it is possible to compare the required results which are supported by logs behavior. Because of the lack of core, which covers all the depths of Mishrif Formation in all wells of the study we depended on log recorder to, complete the facies picture for all the depths of the reservoir unites mB1 and mB2.

Sitratigraphical and Reservoir Classification

The Mishrif Formation is subdivided into lower and upper cycle, where specific succession of beds constitute litho-sequence: the cycle the litho sequence represented in (table -2).

Are to be understand on model cycle, that means that locally the actual rock sequence show minor differ in the studied wells. Thickness, (table -4) and facies at the cycle are changing according to the environmental trend within the cyclothem.

Which shows the regressive facies trend Furthermore the Mishrif Formation is subdivided in Tuba oil field due to the reservoirs in five main lithological units. (table -1).

Table 1- The Unit Subdivisions of Mishrif Formation in Southern Iraqi Oil Fields.

(Mishrif B2) ***** mB2 units)
(Mishrif B1) ***** (mB1 unit)
(Cup Rock 2) ***** (CR2 units)
(Mishrif A) ***** (mA units)
(Cup Rock 1) ***** (CR1 unit)

The authors suggest a binary concept for the upper part of the sequence Figure -1.
The lower cycle constitutes the units, mB1, mB2 exclusively without the upper part or the upper sequence, while the upper units contain the following the most upper part (mB1, CR1, mA, CR2). (table- 2).

Table 2- Sedimentary Cycle of Mishrif Formation.

sedimentary cycle	Unit
Lower Mishrif (Lower sediment cycle)	mB2 Unit
	mB1(Except upper part)
Upper Mishrif (Upper sediment cycle)	Lower part from mB1
	CR2 Unit
	mA Unit
	CR1 Unit

Lithology
The sedimentation is revealed by the kind of lithological diversification, which is connected, with gradual leveling of the (decrease of basin slope) in an expanding basin. The litho-sequence comprises different facies and rock-types and consequently different units in all the studied wells {(Tu-1), (Tu-2), (Tu-3), (Tu-4), (Tu-5), (Tu-6), (Tu-7), (Tu-8), (Tu-9), (Tu-10), (Tu-12), (Tu-13), (Tu-14), (Tu-16), (Tu-17), (Tu-18),(Tu-22) and (Tu-24)}, (figure- 1),(table -3) and the thickness deferent in these wells (table -4). They are as follows:

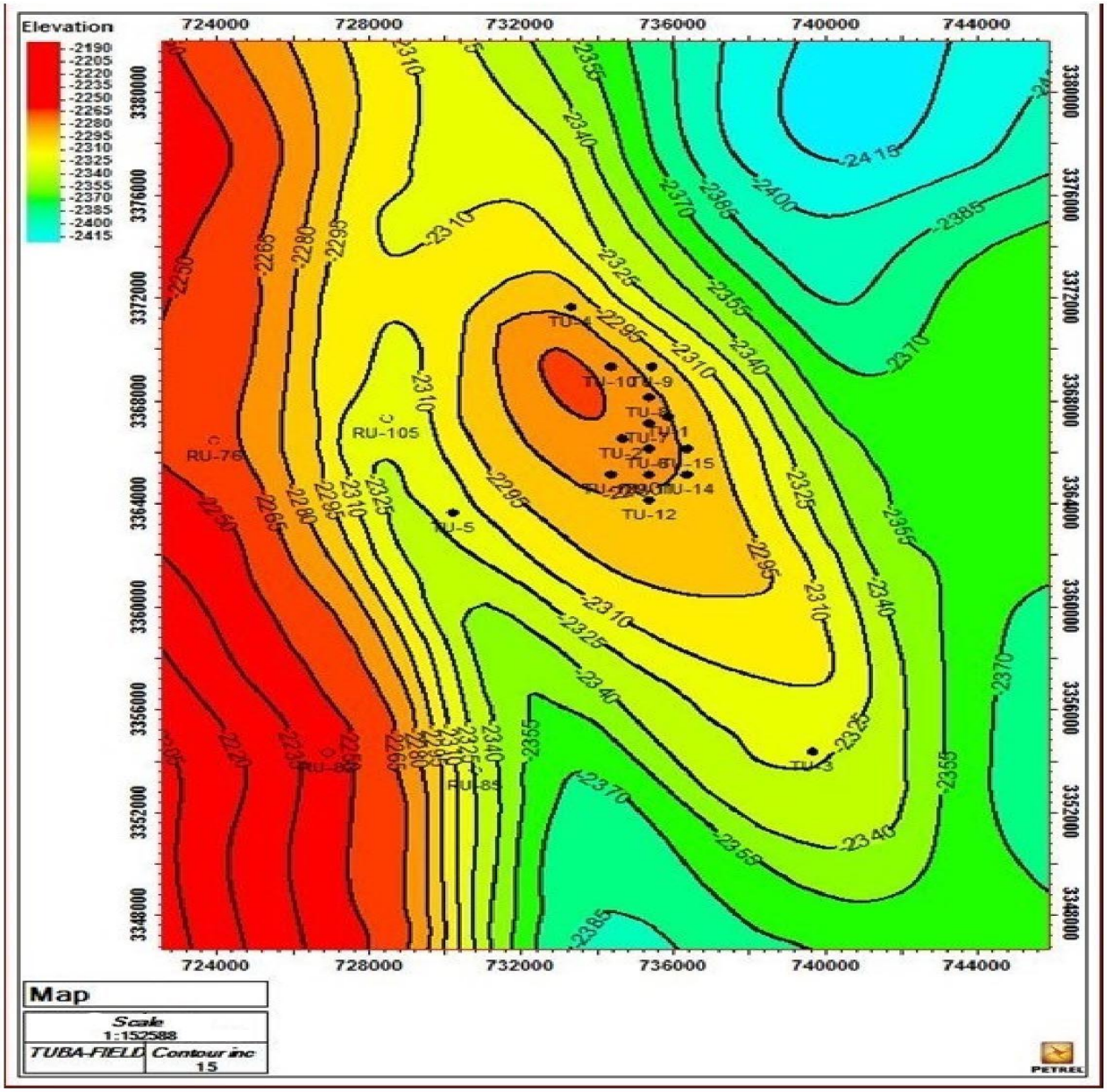

Figure 1- Wells Distribution in Tuba Oil Field

Table 3- Tops of Mishrif Formation

Well	Surface	X	Y	Top(S.L)	Top(R.T.K.B)
Tu-1	Mishrif/ CR	735500	3367250	-2279.8	2306
Tu-2	Mishrif/ CR	734300	3366400	-2259	2291
Tu-3	Mishrif/ CR	739800	3353900	-2324.7	2364
Tu-4	Mishrif/ CR	733300	3371700	-2294.8	2322
Tu-5	Mishrif/ CR	730200	3363700	-2318.7	2354
Tu-6	Mishrif/ CR	735355.8	3366183.8	-2259	2293
Tu-7	Mishrif/ CR	735355.8	3367183.8	-2265	2299
Tu-8	Mishrif/ CR	735355.8	3368183.8	-2272.3	2304.5
Tu-9	Mishrif/ CR	735435	3369377	-2283	2315
Tu-10	Mishrif/ CR	734355.8	3369138.8	-2272	2306
Tu-12	Mishrif/ CR	735355.8	3364183.8	-2289.4	2322
Tu-13	Mishrif/ CR	734355.8	3365183.8	-2264.5	2299.5
Tu-14	Mishrif/ CR	736356	3365184	-2286.6	2320
Tu-16	Mishrif/ CR	733355.8	3368183.8	-2263.6	2297
Tu-17	Mishrif/ CR	733355.8	3369183.8	-2264.6	2298
Tu-18	Mishrif/ CR	736335.8	3364183.8	-2299.3	2330
Tu-22	Mishrif/ CR	734355.8	3368183.8	-2264.5	2297.5
Tu-24	Mishrif/ CR	736335.8	3362183.8	-2301.04	2334
Tu-25	Mishrif/ CR	735355.8	3362183.8	-2297.2	2333
Tu-29	Mishrif/ CR	733675	3366470	-2255.7	2290

Table 4- Thickness Evaluation at Mishrif Formation Units

Well No.	Unit	Thick.	Well No.	Unit	Thick.	Well No.	Unit	Thick.
Tu-1	Mishrif/ CR	23.98	Tu-7	Mishrif/ CR	31	Tu-14	Mishrif/ CR	29.2
Tu-1	mA	15.02	Tu-7	mA	13.5	Tu-14	mA	16.55
Tu-1	CRll	4	Tu-7	CRll	3.5	Tu-14	CRll	2
Tu-1	mB1	55.28	Tu-7	mB1	53	Tu-14	mB1	44.35
Tu-1	mB2	45.72	Tu-7	mB2	43	Tu-14	mB2	51.7
Tu-2	Mishrif/ CR	22.9	Tu-8	Mishrif/ CR	29.3	Tu-16	Mishrif/ CR	24
Tu-2	mA	14.75	Tu-8	mA	14.1	Tu-16	mA	11.5
Tu-2	CRll	2	Tu-8	CRll	1	Tu-16	CRll	4.5
Tu-2	mB1	43.87	Tu-8	mB1	55.7	Tu-16	mB1	35
Tu-2	mB2	52.13	Tu-8	mB2	45.4	Tu-16	mB2	35
Tu-3	Mishrif/ CR	24.88	Tu-9	Mishrif/ CR	25.1	Tu-17	Mishrif/ CR	25.2
Tu-3	mA	19	Tu-9	mA	16.1	Tu-17	mA	19
Tu-3	CRll	0.75	Tu-9	CRll	0.6	Tu-17	CRll	0.8
Tu-3	mB1	36.87	Tu-9	mB1	53.7	Tu-17	mB1	48.4
Tu-3	mB2	49.75	Tu-9	mB2	41.9	Tu-17	MB2	48.4
Tu-4	Mishrif/ CR	21	Tu-10	Mishrif/ CR	25	Tu-18	Mishrif/ CR	30
Tu-4	mA	34.875	Tu-10	mA	13.7	Tu-18	mA	17
Tu-4	CRll	2.25	Tu-10	CRll	4	Tu-18	CRll	3.5
Tu-4	mB1	26.375	Tu-10	mB1	38.5	Tu-18	mB1	52.5
Tu-4	mB2	58.5	Tu-10	mB2	50	Tu-18	mB2	39
Tu-5	Mishrif/ CR	24.125	Tu-12	Mishrif/ CR	19.67	Tu-22	Mishrif/ CR	25.7
Tu-5	mA	22.125	Tu-12	mA	20.23	Tu-22	mA	15.8
Tu-5	CRll	1	Tu-12	CRll	1.4	Tu-22	CRll	1
Tu-5	mB1	41.125	Tu-12	mB1	37.5	Tu-22	mB1	48.2
Tu-5	mB2	49.625	Tu-12	mB2	47.4	Tu-22	mB2	44.8
Tu-6	Mishrif/ CR	29.89	Tu-13	Mishrif/ CR	30.25	Tu-24	Mishrif/ CR	35.5
Tu-6	mA	12.51	Tu-13	mA	17.25	Tu-24	mA	21
Tu-6	CRll	1.8	Tu-13	CRll	1.625	Tu-24	CRll	4
Tu-6	mB1	40	Tu-13	mB1	39.625	Tu-24	mB1	51
Tu-6	mB2	59.7	Tu-13	mB2	49.75	Tu-24	mB2	36.5

mB2 Unit

This units is considered to be the main reservoir, characterized by the various facies - types and features of various depositional environment and controlled from outside by ecstatic changes of sea level. Significance facies is the wackstone which are consisting from biocalsts (Algae), (plate 1) and plankton (plate 2) which reflect open sea environment and is followed by banks of rudest or reefs , this unit is represented the main reservoir unit with a suitable pores – pattern . Particulary the primary pattern, followed by back reef facies of wackstone type, which include benthonic Foraminifera (plate 3) and Melliolids (plate 4).

This units represent the upper terminations coincide frequently with the top of the banks (shoals), which built up by grainstone facies with peloid feature (plate 5) and bioclasts (plate 6), which is criterions water shallowness as well as a high-energy environment [1].

mB1 Unit

The begin of the unit is formed by compacted massive rocks separated the two units reservoir mB1 mB2, where the thickness is of (m - dimension). These units do not present barrier by hydrocarbon migration from lower to upper part of the lithosquence carbonate sequence of mud - wackstone facies.

The depositional environment is of lagoon type followed by open marine circulation followed by shallowness of grainstone facies which is altered with wackstone including benothic forms particullary (plate 7) and small reef builder with banks of rudest – clastics (plate 8). Patch reef is trending to be more packstone with grainstone facies, which is composed of carbonate detrital rudest. In addition to benthonic bioclasts (plate 9) and algae. This facies complex representing important part of the reservoir, which is termination by lagoonal or swamps environment, fossil index particularly Milliolids are predominant (plate 10). The fossil assemblage significant a lagoonal environment Milliolids, which represent wackstone and the end of the lower part of Mishrif Formation.

The upper cycle start with the last part of mB1 – units, Sponges (plate 11) and planktons (plate 12) are remarkable, and they represent open sea environment. .

CR2 Unit

It is that unit, located between mB1 and mA unit with a thickness of m- dimension. It may consider a geological index, and it is found in the whole borehole except (Tu-4) well in the northern part of the studied oil field. The shale layers characterized by plankton's occurrences and represent by a barrier, preventing the hydrocarbon migration upward.The rock package (shale) is of wide extension, particulary in southern part of Iraq and Arabian shield (Sharland, 2001). The studied rocks package (shale- complex) is wedging out to wards north at bore hole (Tu-4) and be replaced by argillaceous limestone. Because of this replacement, the hydrocarbon can migrate over great distance vertically.

mA Unit

The litho sequence of this unit start open sea deposits and bioclasts overlain by mudstone facies. It is regarded to be open- sea environment (Wilson, 1975) and followed by Costal environment where the wackstone is occurred.

CR1 Unit

This unit is composed from solid and massive limestone characterized by mudstone and wacktone, where the cement is of blocky type, which lead to fill pores and convert the rocks to be a seal one.

Early diagenetic dolomitization occur in the upper part and can be checked by (HCL) concept. The pattern of the facias and features point a primary dolomite Particulary in the upper part, where the most upper part Mishrif signify the existence of dolomitization Microscopic examination during the drilling operation by Hydrocarbon acid treatment of the cutting which is result of drilling such an event will be noticed during the treatment and consequently a supratidal environment, namely the Sabkha. The mudstone facies is common and the fossils are absent.

The Microfacies

In the various microfacies the term component is used for describe transported particles. It includes the organized carbonate aggregates [2] above 60 micron. Detrital non-carbonate grains above 10 micron the component were measured in term of grain size.

The term matrix implies carbonates particles below 60 micron and non-carbonate particles below 10 micron. Whether transported or not, constituting the groundmass which the components are surrounded by or floating. Matrix does not imply cement. The term silt were used, where the detrital transported nature of small particles blow 60 micron should be expressed. Many facies types have been identified by studying the thin section. The various facies types are indicators of depositional environment the components are describe and discussed in briefly. The study of thin section reveal microfacies which are reflecting in the occurrence sedimentlogical and depositional environment of different biological and texture content depending on the position of that facies in the depositional basin. The most important microfacies in the studied wells, according to Danham and Folk classification. Consolidated carbonate sediments, which get their consistency by sub aerial [3]. Vadose [4] or submarine [5].

Intraclasts are indicators of reworking. Their shape, size and distribution allow estimating the hydraulic conditions of the depositional environment. Skeletal Grains are subordinate constituents in the studied rock package. They hardly exceed two-volume parent, mostly rather well preserved specimens. Locally they are concentrated in layers and nests. Some remnants can be thinly coated. Following facies of Mishrif types are classified according to [6].

Mudstone

The microfacies is built up by microcrystalline calcite with a size maximally 4 micron. The fossil content do not exceed 10 %. The plankton occurrence and bioclasts are indicative for open sea environment. The areal distribution of this facies is restricted to the southern terrain and is poorly distributed to the two reservoir units, namely mB1, mB2, while in the western area beside mB2 reservoir unit well observable but in the northern part of the field, particulary in (Tu - 4) well, the same facies is abundant in mB1 as well as the bottom of mB2. Figure -2, 3, 4, 5 and 6.

Wackstone

It is consist from a micrtic matrix, mud- supported the skeletal, and non-skeletal grains formed more than 40%. The skeletal grain are-

Benthonic grain, Algae, Mollusca and Echinoderm. While the non-skeletal are:-

Pellets and biolistic.

Thin facies occur very rare in southern and western area of the oil field mB1 and well increase in mB2-unit. Although the facies above-mentioned facies have been remarked in northern and central part of the oil field in unit reservoir mB1. Figure -2, 3, 4, 5 and 6.

Packstone

It is representing by a markant fossil assemblage from rudest shells. Algae and some benthonic foraminifera with (40 - 90) % percent. This facies is considered to be of good reservoir properties in the whole area due to mold and dissolution pores. Furthermore, the facies is indicative for reef proper; fore reef and shoals, it is very common in the studied area. Figure -2, 3, 4, 5 and 6.

Grainstone

The skeletal and non-skeletal grains formed 90 % from the whole rocks. The grains are mainly rudest shells, benthonic foraminifera and bioclasts. The occurrence of this facies in the northern part of the oil field is not common. It is recorded in reservoir unit mB2 in southern field. The geological extension of this facies is covering the central and western of the reservoir units, namely mB1and mB2. Figure -2, 3, 4, 5 and 6.

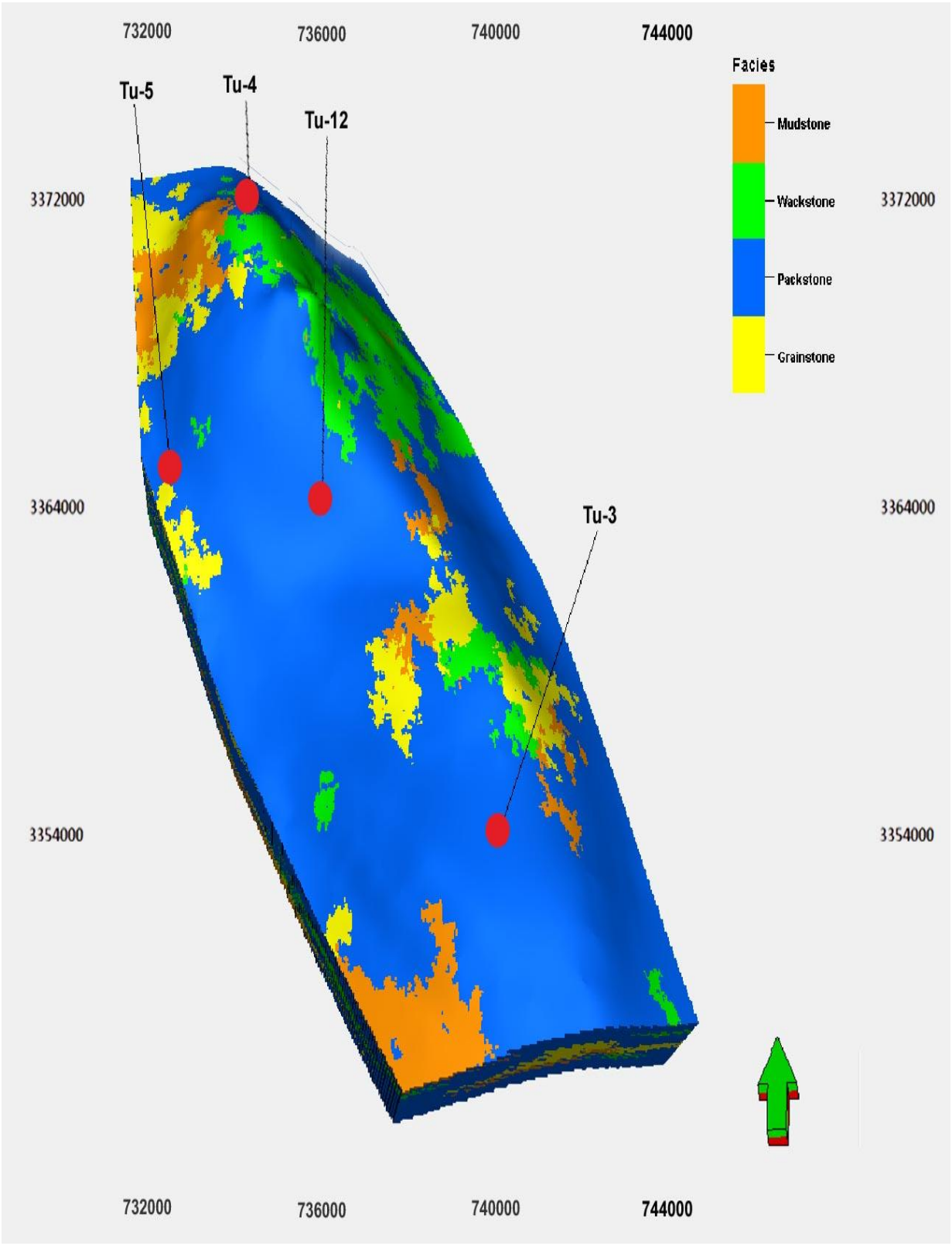

Figure 2- Facies Distribution (3D) in mB1, mB2 Units in Tuba Oil Field

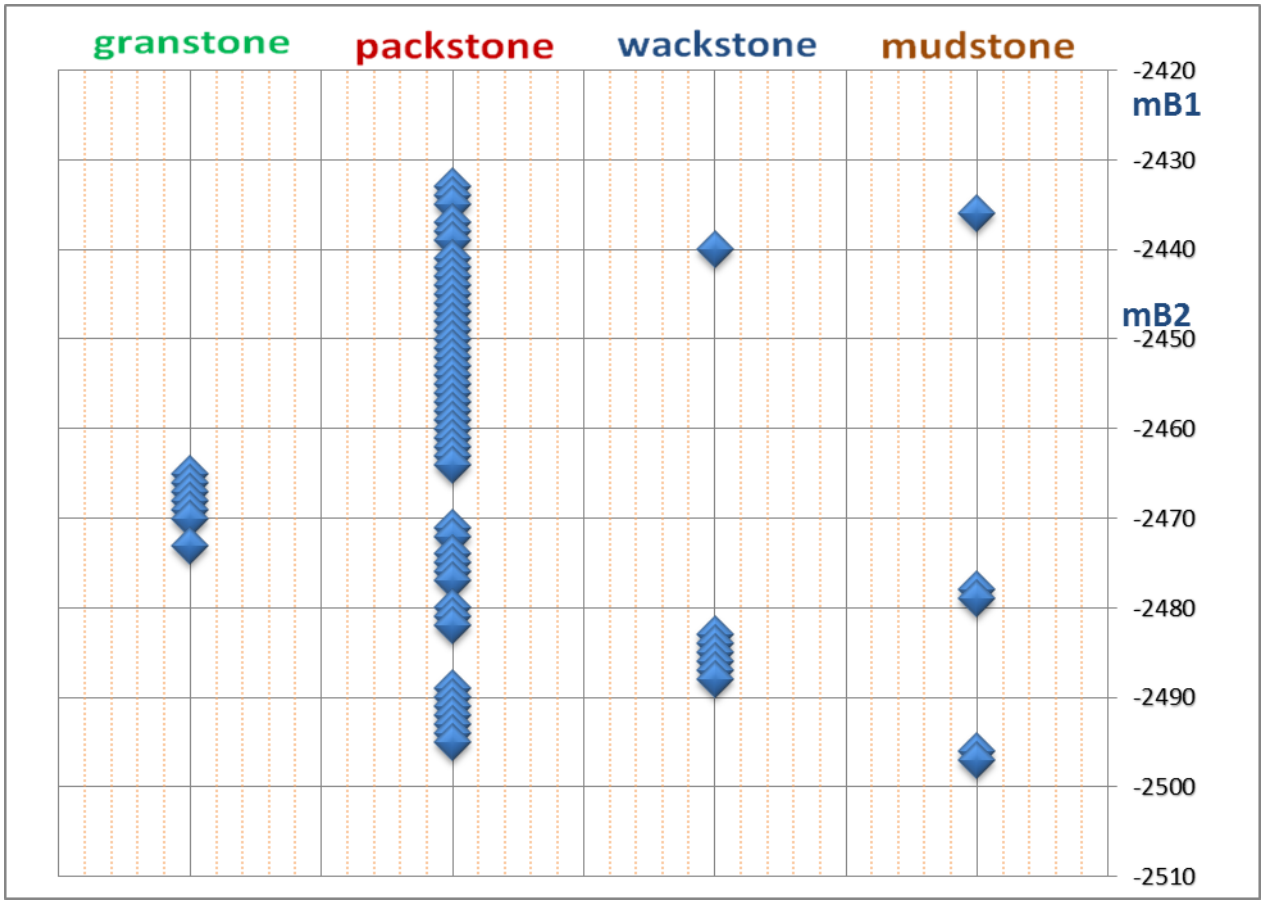

Figure 3- Facies Distribution in mB1, mB2 Units (Tu-3)

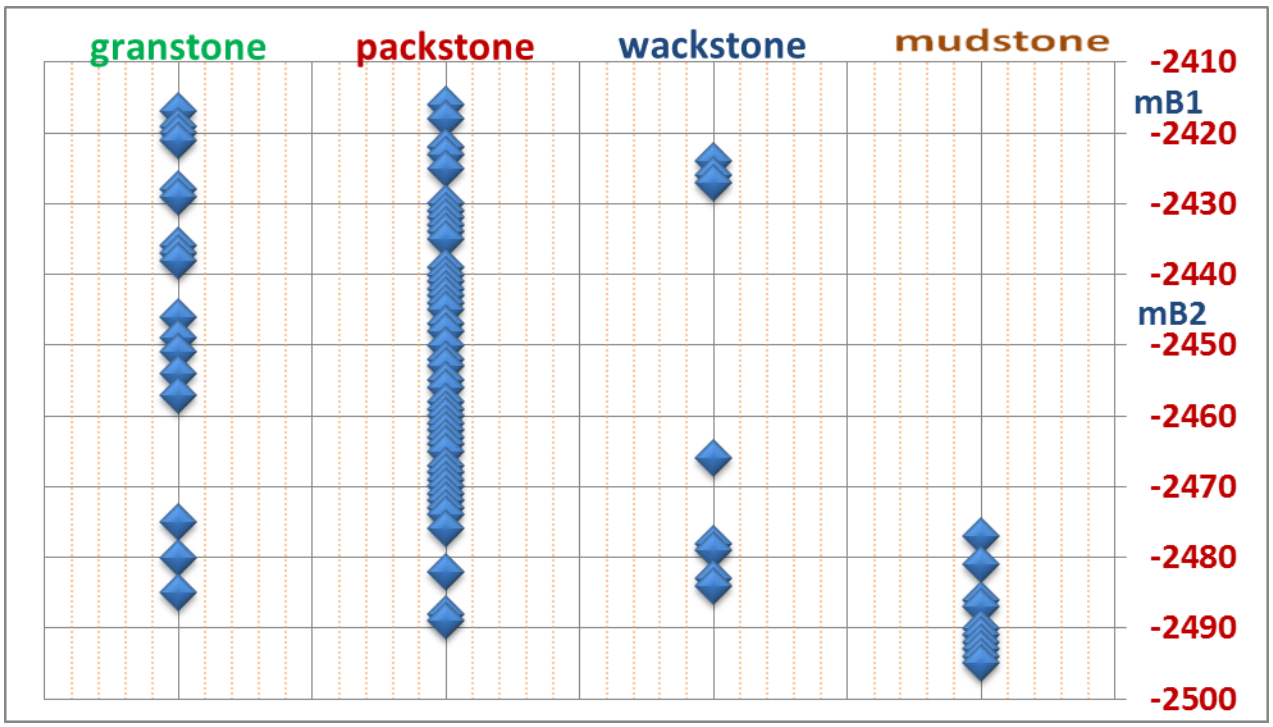

Figure 4- Facies Distribution in mB1, mB2 Units (Tu-5)

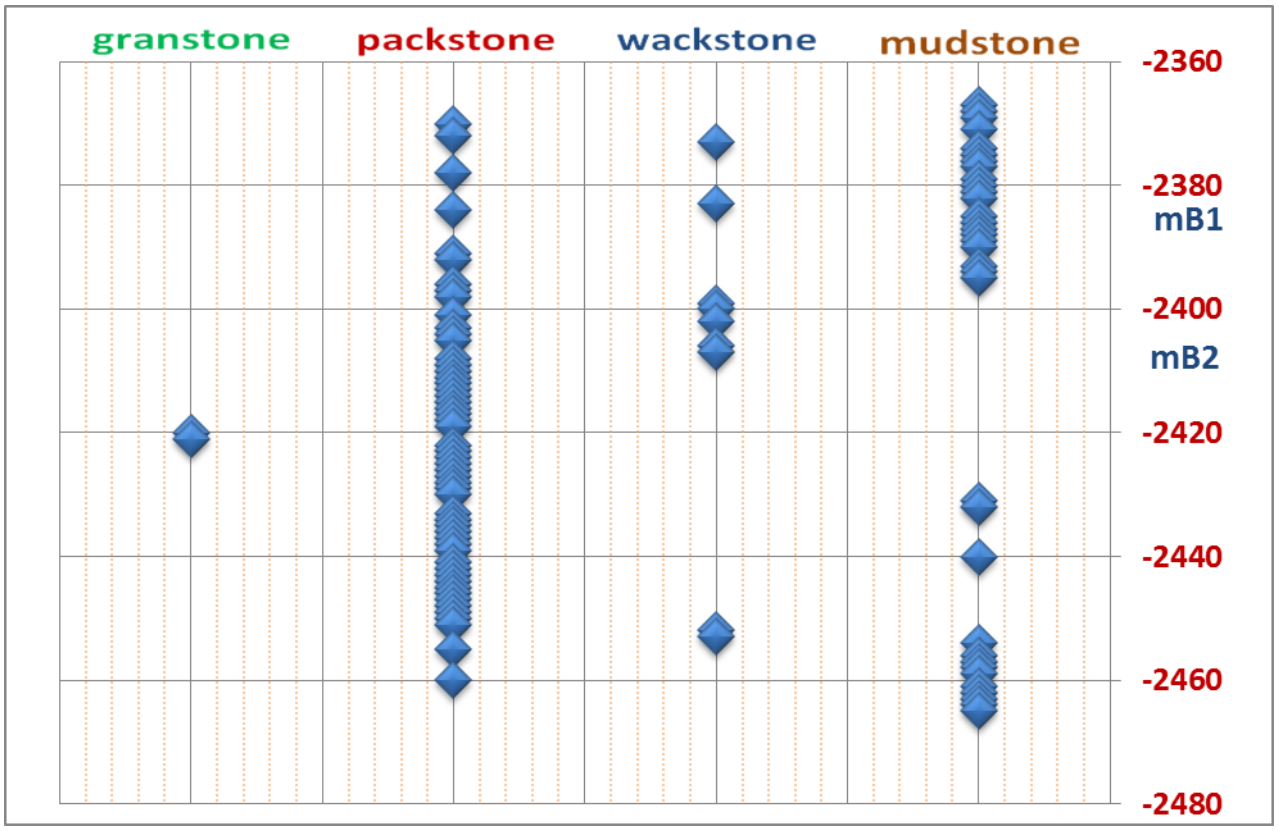

Figure 5- Facies Distribution in mB1, mB2 Units (Tu-4)

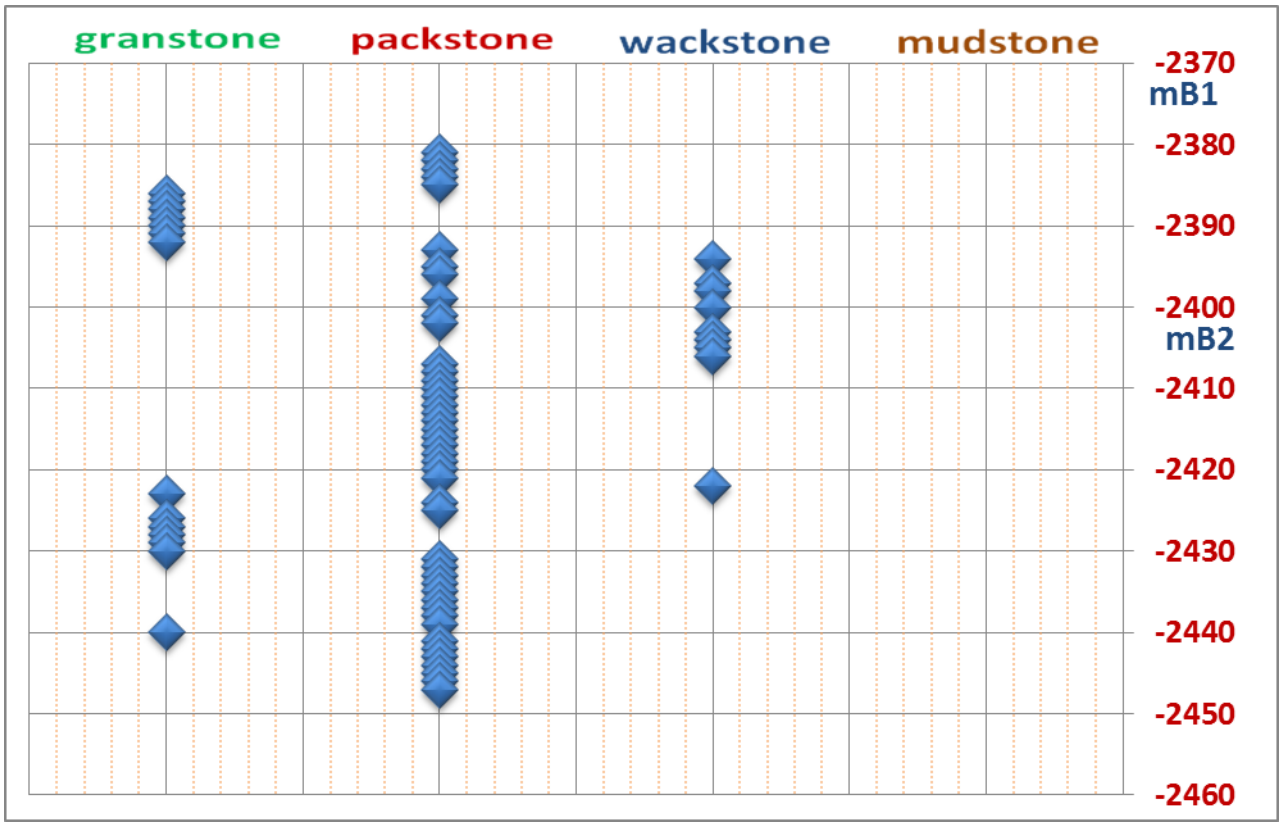

Figure 6- Facies Distribution in Units (Tu-12)

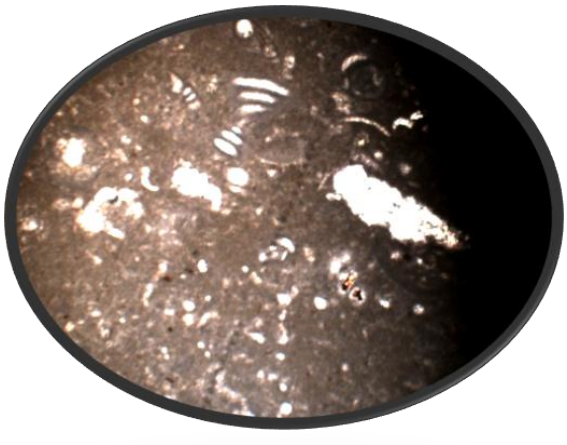

Plate 1 -Algae Fragment

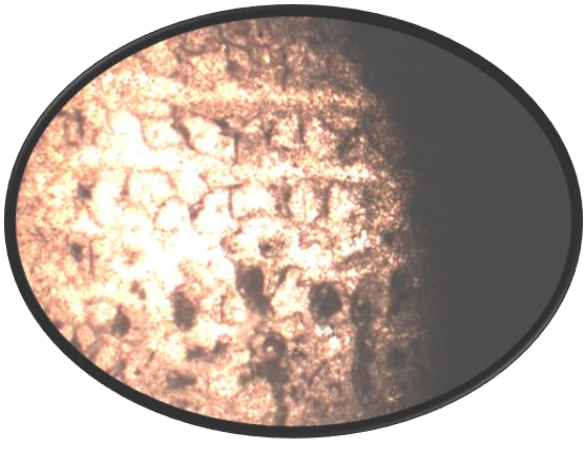

Plate 2 - Planktonic

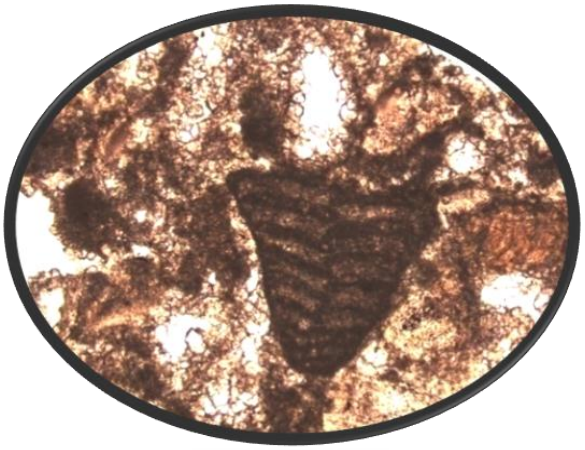

Plate 3-Benthonic Foraminifera

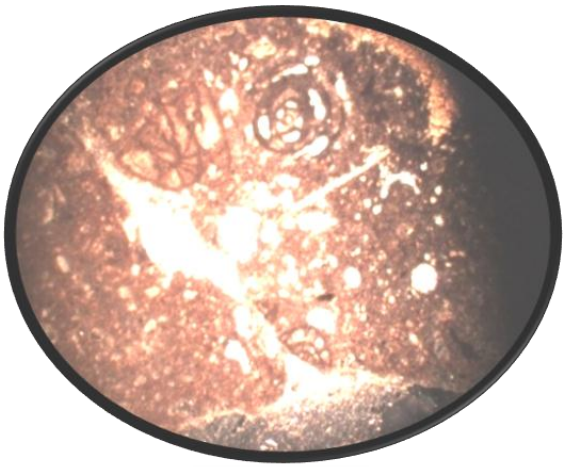

Plate 4- Milliolid

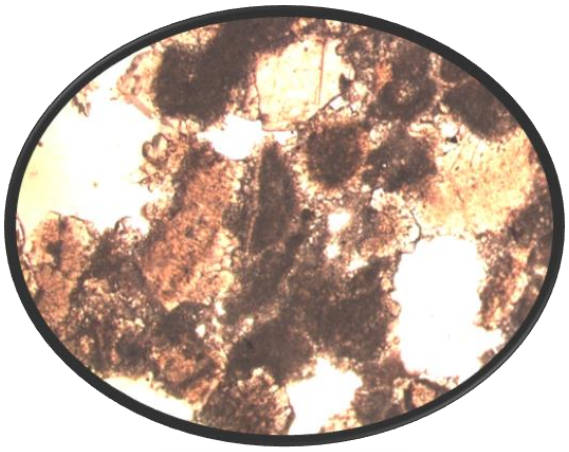

Plate 5 - Peloids

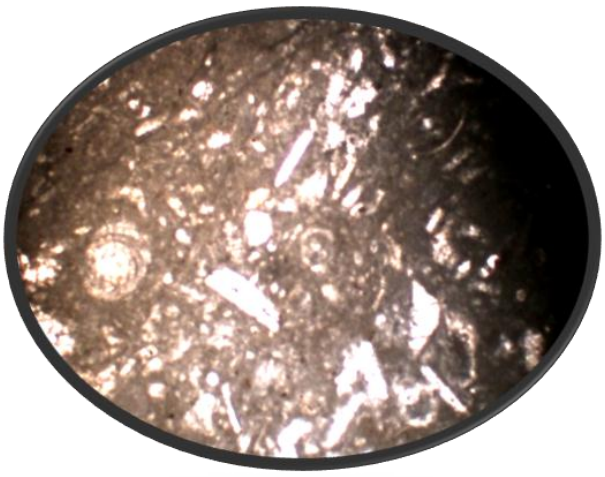

Plate 6 -Bioclastic

Plate 7 -Benthonic – Tu-4

Plate 8 - Rudest – Tu-4

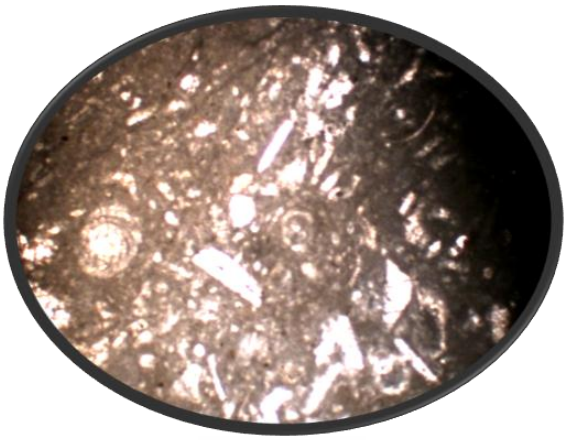

Plate 9 -Bioclastic – Tu-4

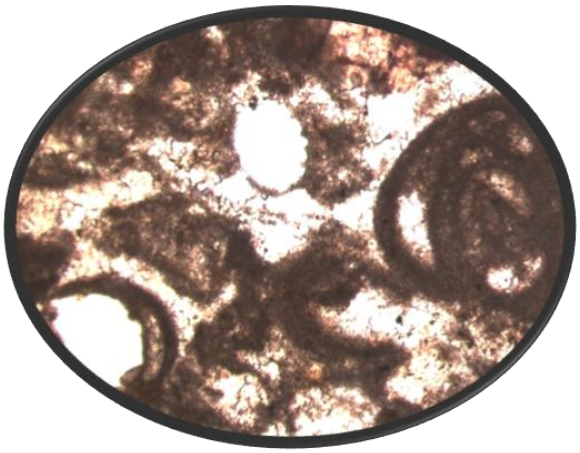

Plate10 - Milliolid – Tu-12

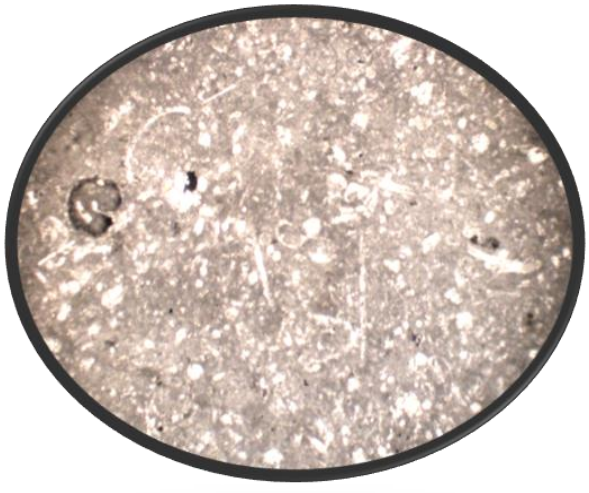

Plate 11 – Sponge Tu-5

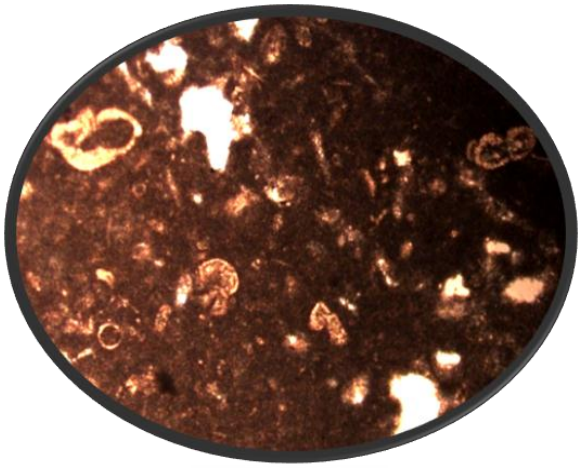

Plate 12- Planktonic

Diagenetic processes

The diagenetic alternation in the facies of Mishrif Formation varies within a wide range and are generally strong , particulary in the central part of the oil field and more uniform and less important in the lower cycle .

The significance of diagenetic are change of mineral and chemical compositions and primary textures according to circumstances [7]. The carbonate diagenesis is a marked one and present most important features e.g. porosity / permeability the most important carbonate diagenesis in two reservoir units mB1 , mB2 are :- Dissolution, Compaction, Cementation, Micritization, Neomorphism, Dolomitization. Figure -10.

1-Dissolution

Impure dolostone were submitted to avoid creating dissolution process. The dissolution was mostly incomplete; relicts refer to the original material. The timing of dolomotization and forming voids can be concluded from the void fabric. Empty voids with more or less smooth wall postdate dolomitization, while others a polyphase process:

The first generation, wall-lining dolomite crystals, in some samples the voids can be widened to large vugs, many basic porosity types recognized [8-9]. Figures -7, 8 and 9.

-Interpartical porosity / (primary porosity)

It is a sort of primary porosity will occurred between the particles during the rocks-genesis. The effected of cementation on this sort of porosity is well observable. It is common in the oil field, particulary in the northern part of the oil field in the reservoir unit mB2, and this type not widely spreads in middle and west the oil field. (plate 13).

-Intrapartical Porosity / (Primary Porosity)

Both types are fabric selective. Such a pores are resulted due to barrier fabric selective on dissolution process. It is well know that some biota skeletal of algae, foraminifera are effective on dissolution action. This type is present namely reservoir unit mB1, exactly in the central part of oil field. Occurrence in mB2 in well established in the west of the oil field. While in the north, it is found in both reservoir units mB1 and mB2. (plate 14).

-Vugy /Secondary Porosity

It is pores irregular shape objects and distributed widely, it show an improvement of reservoir properties and an increase in the permeability ratio due to the continuous connection of the subjected area. It is present in north and west area of the oil field at the reservoir unit mB2. It is less the at the center of the field at the reservoir unit mB1. (Plate 15).

-Moldic Porosity / Secondary Porosity

The Pores are the result of shell-dissolution and get shell-shape. The algae are very sensitive to dissolution, Foraminifera (plate 16) and Mullusca. (plate 17). It is significant by geographically wide extend , particular in reservoir unit (mB1 , mB2) in the central area of the studied field , as well as in mB2 in the north of studied area. It is found in the north and west of the reservoir unit mB2, and it is found in the west of the field. (plate 15).

-Fractured Porosity / Secondary Porosity

Porosity formed by diagenesis and tectonic movement or collapse a result of solution destruction. It will be found in the north and central area of the studied area, where this type is lacking in the west. (Plate18).

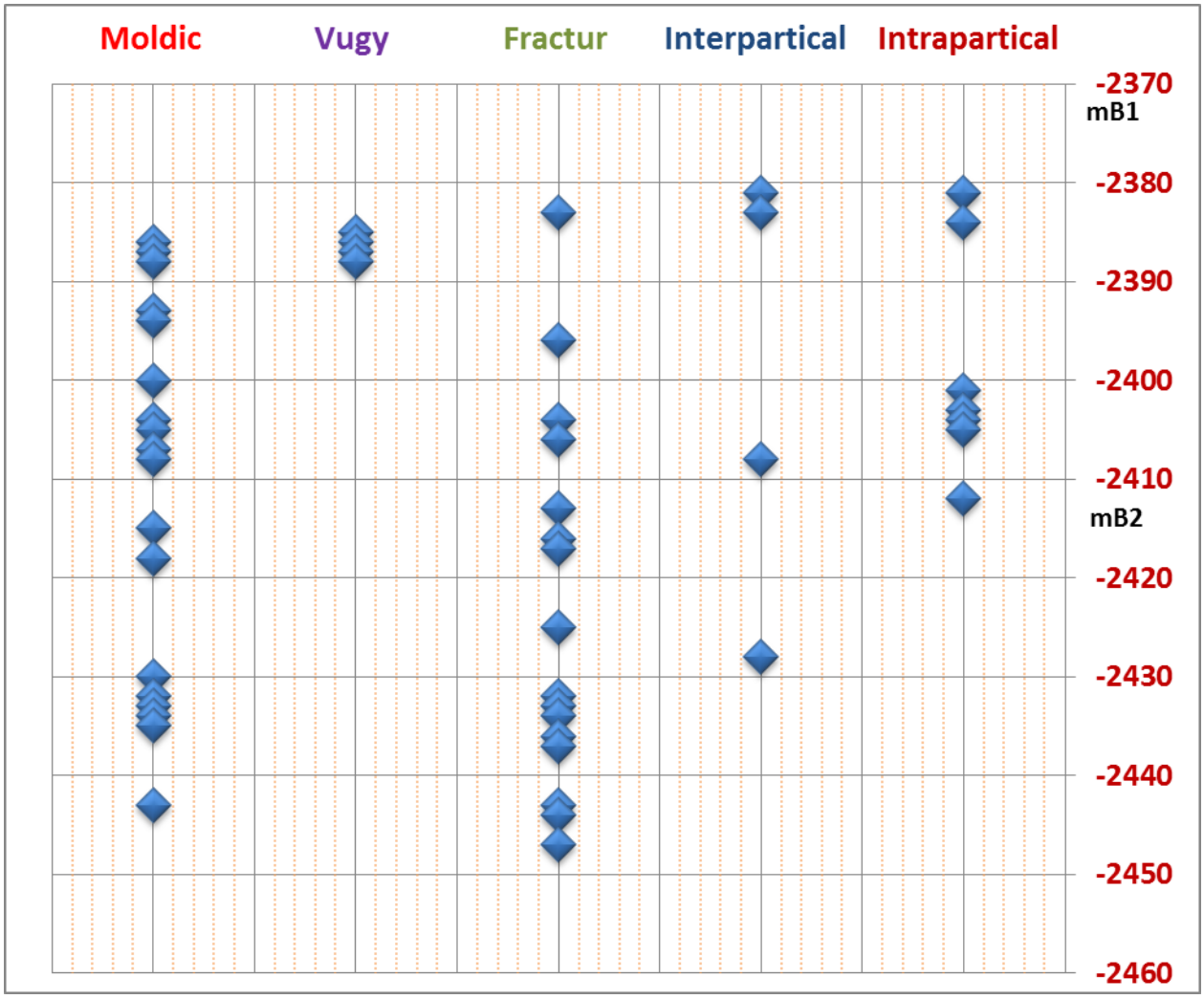

Figure 7- Porosity Distribution in mB1, mB2 Units (Tu-12)

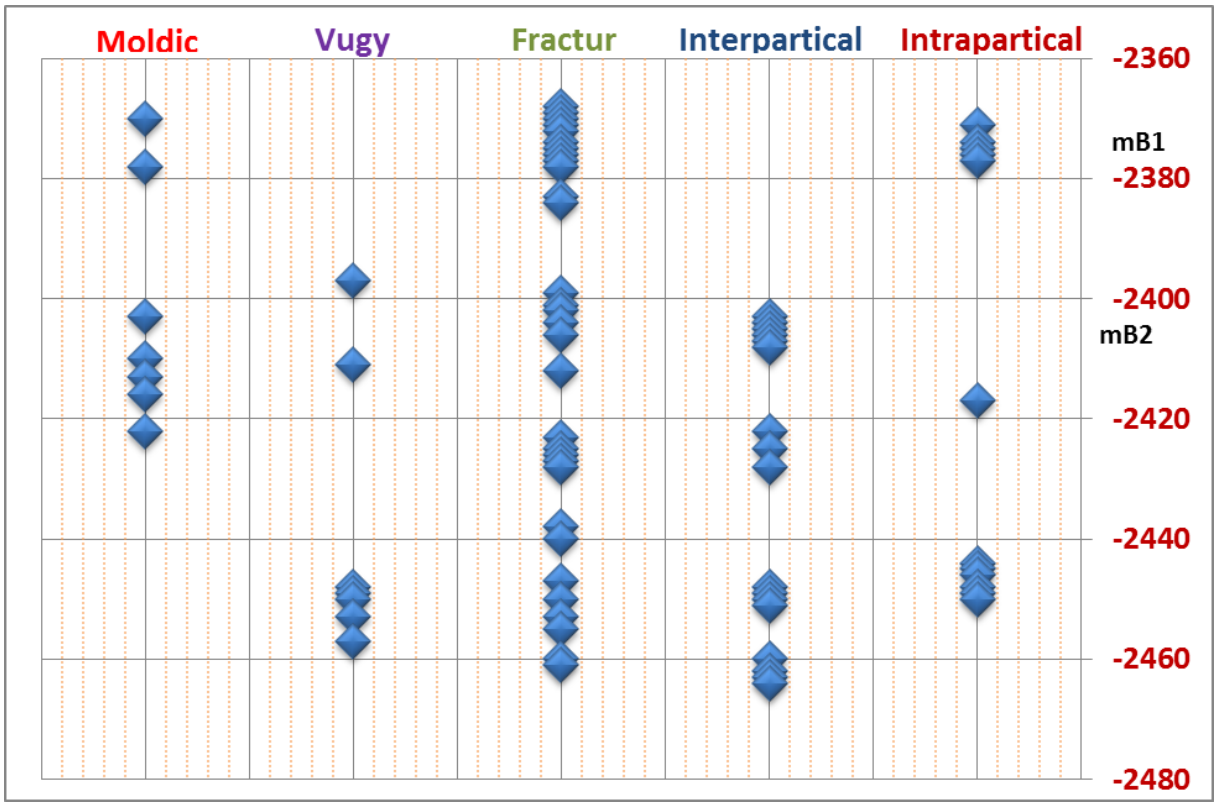

Figure 8- porosity Distribution in mB1, mB2 Units (Tu-4)

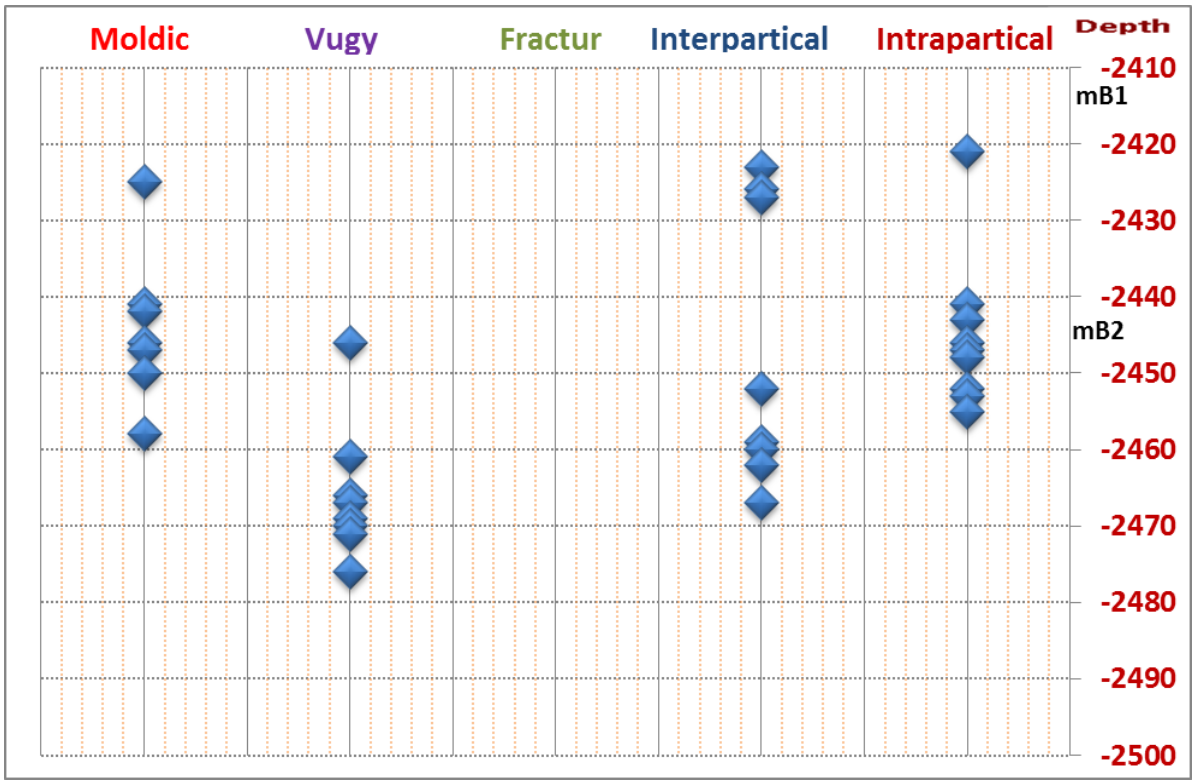

Figure 9- Porosity Distribution in mB1, mB2 Units (Tu-5)

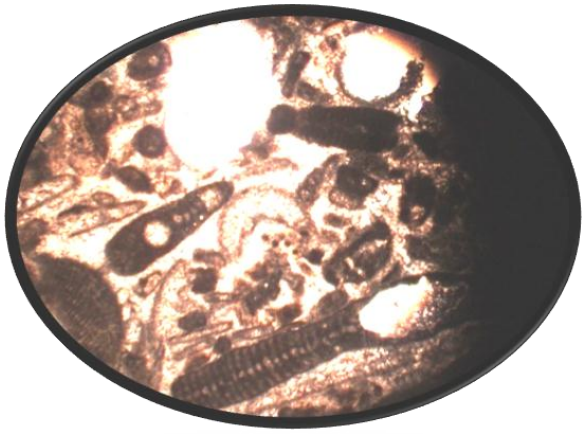

Plate 13 - Interpartical

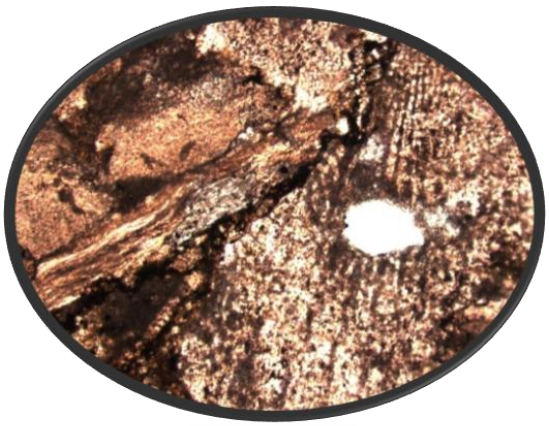

Plate14 - Intrapartical

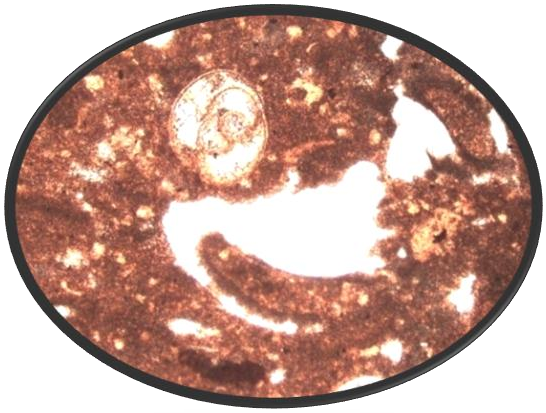

Plate 15- Vugy, Moldic

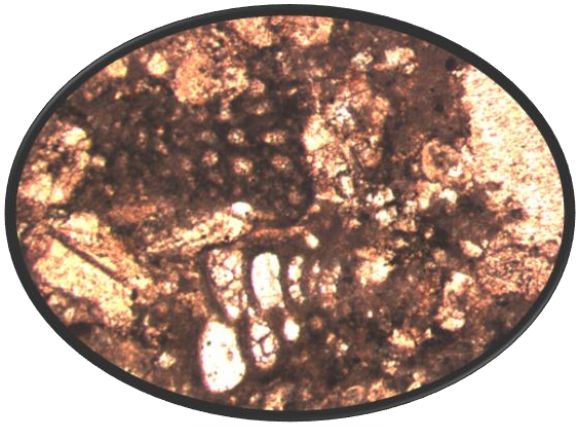

Plate 16- Foraminifera

Plate 17 - Mulusca

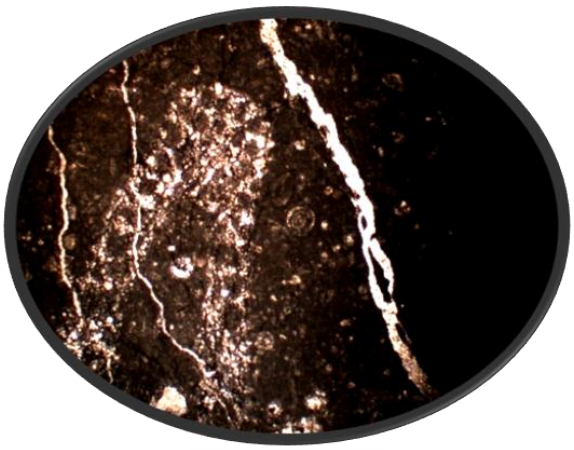

Plate 18 –Fracture

Cementation / Early Stag Consolidation

The pore space developing during early diagenetic process was quite likely cemented contemporaneously, because the mud clots do not show any sign of compaction an early stage of cementation is also revealed by intraclasts consisting of a reworked limemud. The cementation is the

filling in at primary voids in or of solution cavities by chemically precipitated cements, following types can be observed in thin section.

Granular Cement

Cement formation resulted by precipitation from water saturated caco3 and nearly from the surface [10]. It is common in wackstone and packstone. This highly exists in the northern part of the end unit mB1, the begin of mB2 and in very low quantity in the middle part of the field. It does not exist in the western part.

Mosaic Cement

It is characterized by a volume increase from pore wall to the center of the cavities [11]. This type of cement is indicative for continental environment and shallow water. It is presence in packstone facies and is very common in mB1 and mB2 and rare in central and western area of the oil field.

Blocky Cement

It is composed from anhedral to subhedral calcite-crystal also; it is precipitated in late diagenesis. It is not common in the studied area.

Spary Cement

It is consisted of small equidistance crystals and originated by pore filling and veins. It is extension is rare and scattered.

Compaction

It is any process of decreasing the bulk volume of sediments in forcing the relief during first stages of diagenesis or that cause packing of grains (reorientation). The compaction is a destructive late reform operation [12]. Common criteria for the reorganization of compaction are breakage of grains microcrystalline, over packing). There are two types of compaction, namely mechanically and chemically, which is result from the weight of the sediments. Types and characterized of pressure solution in the subsurface have been illustrated by [13] and they are namely: - Microstylolite, Stylolite, Wispy seam, Solution seam. Generally, they consists of conical to columnar projection with intervening depressions and could the result of pressure solution. Compaction is found in the northern and western part of the reservoir units mB2 and little appearance in reservoir unit mB1 and very little existence in the middle of the field.

Micritization

It present the boring into the surface of biocalsts by microorganism, which result little voids filled by micrite. The bacteria will be one of the bores, the micritization process in rounding off the particles and subsequently the formation of micritic Pelloid. This is widely spread in northern part of the field mB1 and mB2; it is rarely in the western part mb1 and totally absent in mB2. It does not exist in the middle field.

Neomorphisim

The term has been applied and I dealing for mineral transformation, where the minerals remain convert in to polymorph - series minerals. The larger crystal grow at the expense of smaller crystals. It is isochemical diagram without changing the chemical composition of the sediments and will occur in the northern part of the oil field in mB2 and absent in the western and central part of the oil field.

Dolomitization

It is a process of substituting (Mg) instead of ion Ca in the lime stone sediment forming Dolomite mineral CaMg (Co3)2. Dolomitization improves the petrophysical characteristics. This process occurs little in western part of the field and widely in mB1 and mB2 units in the north and middle.

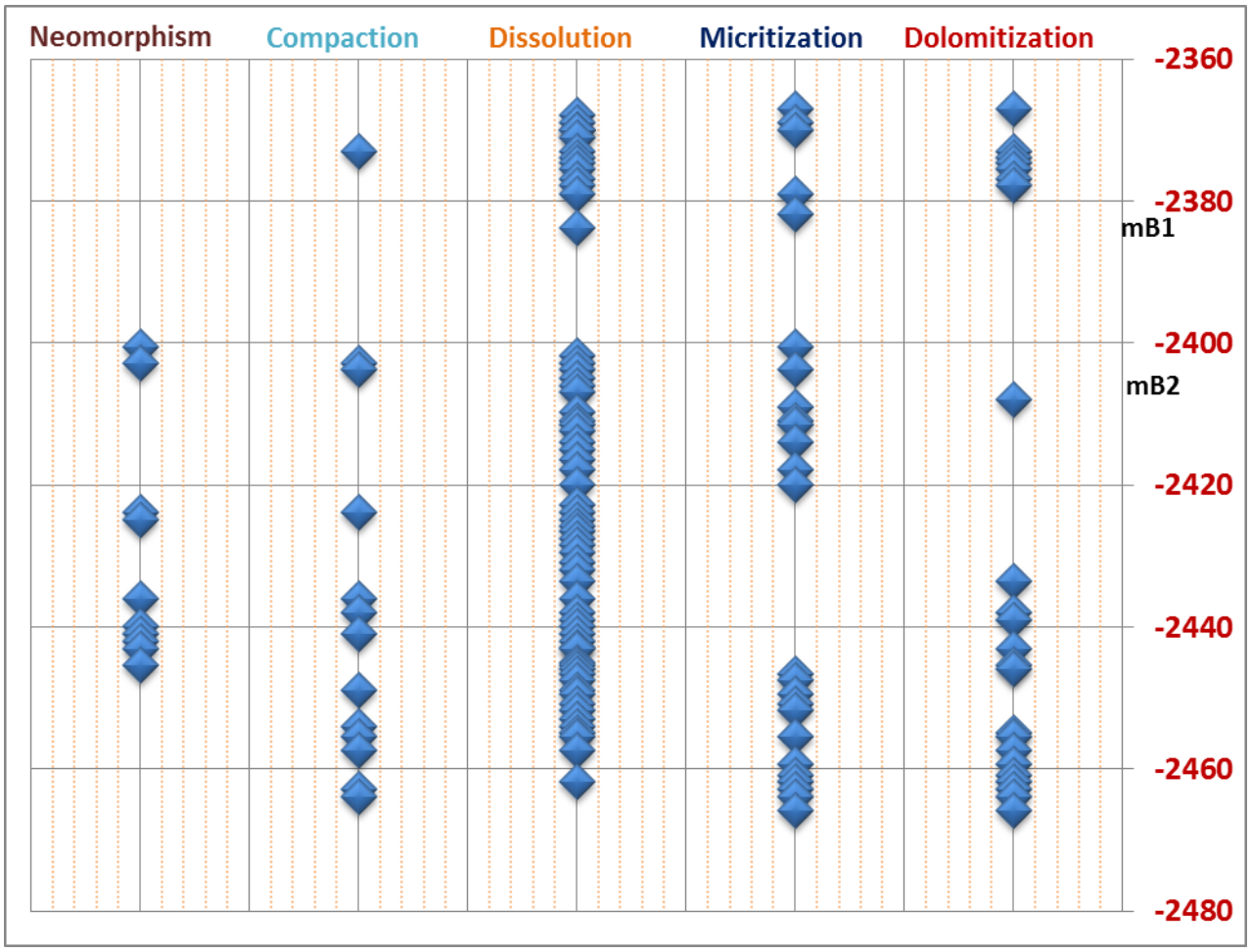

Figure 10- Daigenises Type Distribution in mB1, mB2 Units (Tu-4)

The Longitudinal and Cross - Sections

We prepared the stratigraphical sections (longitudinal and cross sections) by using the" petrel program" figure -11 and 12 also a longitudinal stratigraphical sections for wells {Tu-4), (Tu-10), (Tu-2) and (Tu-13)} also cross sections for wells {(Tu-5) and (Tu-12)}, through using the well logging {resistivity, S.P., G.R, Porosity, ROBI}, this study shows the water saturation, oil saturation, effective Porosity and the vertical arrangement of facies.

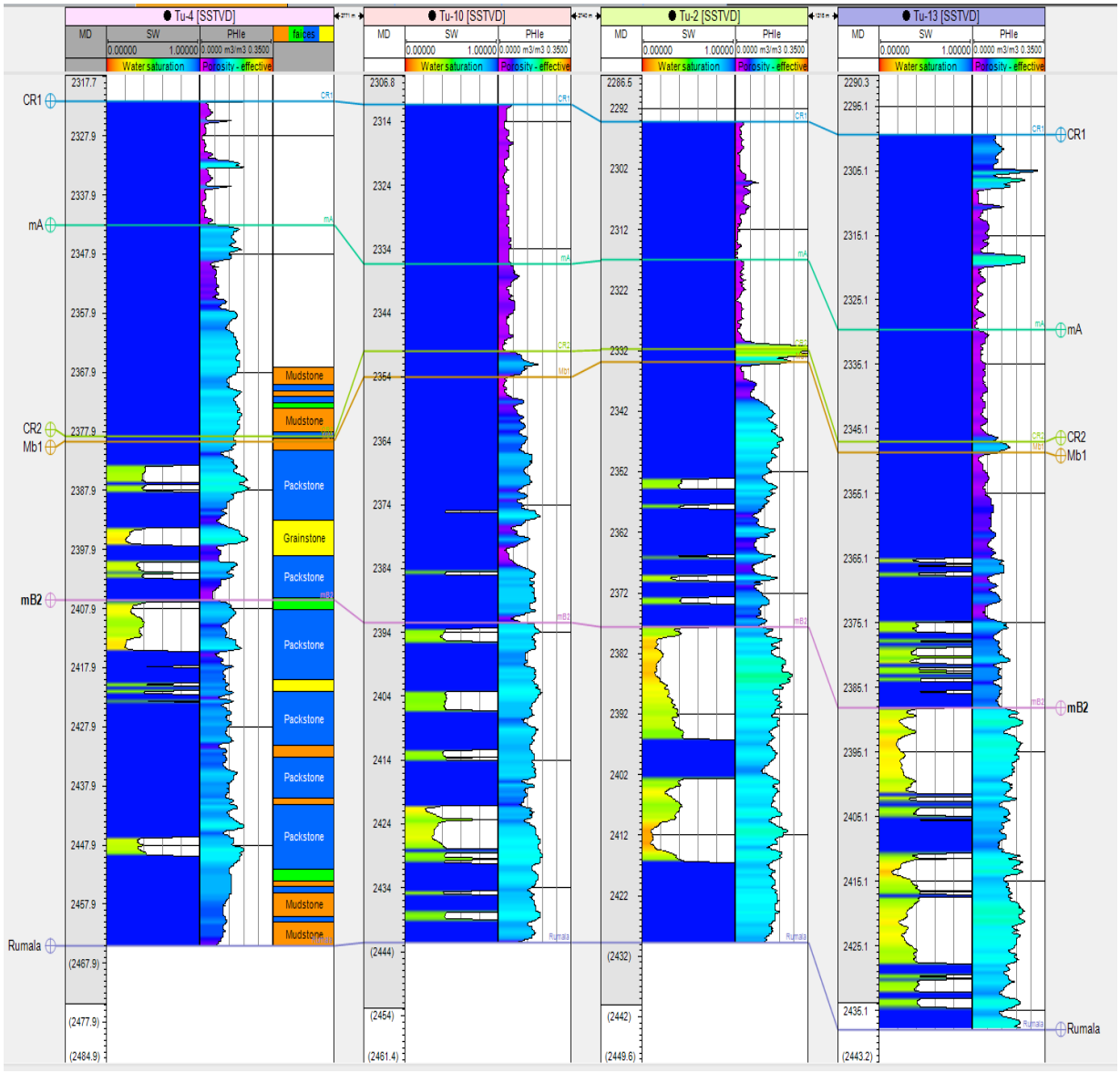

Figure: 11-Longitudinal Section in Tuba Oil Field

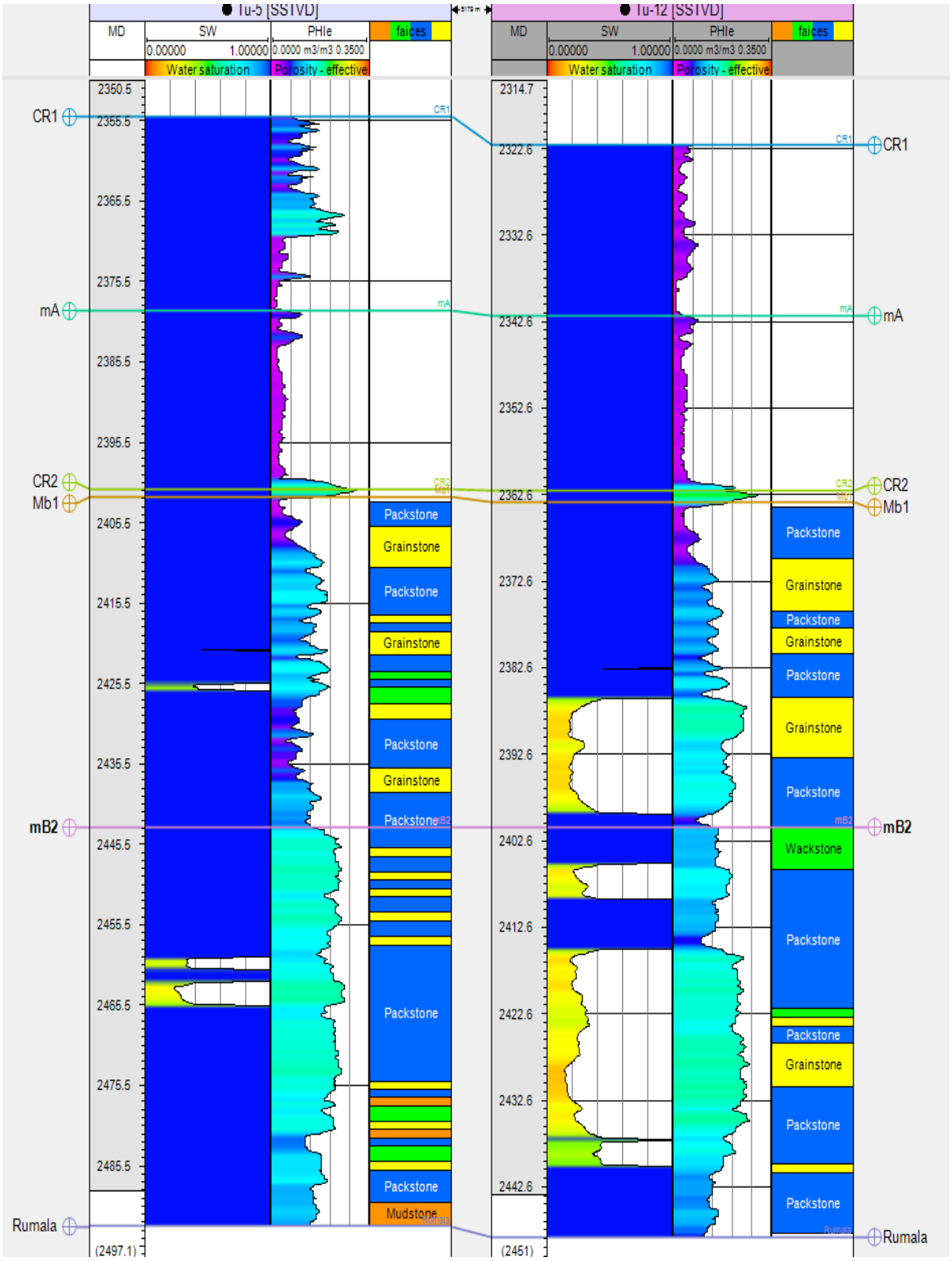

Figure 12- Cross – Section in Tuba Oil Field

Conclusions:

1- Tuba field is a structure lies in the middle of two structures Rumaila at the west and Zubair at the east.

Two troughs separate it from them, Tuba strictures is one main dome paralleling Rumaila and Zubair field.

2- Mishrif Formation is sedimentary and it is divided into two cycles:
-Lower sedimentary cycle (Lower Mishrif).
-Upper sedimentary cycle (Upper Mishrif).
Mishrif Formation is divided at Tuba field into five units: (CR1, mA, CR2, mB1, mB2).
3- Four main facies have been diagnosed at Mishrif Formation which are (grainstone , packstone , wackstone , mudstone) . Granstone and packstone are centered at the reservoir unit mB1 and mB2. Other facies were with the remaining units. Horizontal distribution of these facies includes all parts of the field.
4- Carbonate rocks are considered highly effected by the diagensis process because most carbonate minerals are overlapped.
Many diagensis process have been diagnosed and as follows :- (desolution, porosity, with its types, compaction, cementation, new morphism, dolomitezation).
These processes had influential role in multiplying and type increasing facies especially at the reservoir units' mB1 and mB2.
5- The study shows thickness of Mishrif Formation reservoir units and isolating units, which differs from one place to another at Tuba field. The biggest thickness for their units was in the middle of this field at the top of the stricture. It is thickness decreases at the flanks of the field.
6- The study shows, depending on log records especially resistivity logs, that Mishrif Formation contains different liquids, which include oil and water in different levels with depth.
7- Depending on the petrophysic interpretation and prepared diagrams, which were prepared in this study, it became clear that water saturation is higher in all wells units of the study compared to oil saturation.
8- The results of study shows that oil saturation exists in the reservoir units' mB1 and mB2 oil saturation is higher in the reservoir unit mB2.
9- The results of the reservoir geological model show that the well is anticline fold whose extension is (north - northwest), (south- southeast) the structure includes one dome.

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