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Microfacies analysis and diagenetic Processes and their effects on the rock characteristics of Mishrif Formation, Nasiriyah oil field, southern Iraq

Research Project submitted to the Council of the Department of Petroleum Geology and Minerals as part of the requirements for obtaining a Bachelor’s degree in Petroleum Geology and Minerals..

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ {١} خَلَقَ
الإِنْسَانَ مِنْ عَلَق {٢} اقْرَأْ وَرَبُّكَ
الأَكْرَمُ {٣} الَّذِي عَلَّمَ
بِالْقَلَمِ {٤} عَلَّمَ الإِنْسَانَ
مَا لَمْ يَعْلَمْ {٥} .

صدق الله العلي العظيم

اقرار

اقر بأن مشروع البحث الموسوم (**Microfacies analysis and their effects on the rock characteristics of Mishrif Formation, Nasiriyah oil field, southern Iraq**) تم اعداده تحت اشرافي من قبل الطالبتين **(رفل نوري جواد واميره جواد كاظم)** في كلية العلوم-جامعة ديالى وهو جزء من متطلبات نيل درجة البكالوريوس في علوم جيولوجيا النفط والمعادن.

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Abstract

The abstract represents the formation of Al-Mishrif (Late Cenomanian - Early Turonian), the main reservoir in the Nasiriyah ceremony, southern Iraq. Two wells were chosen, they are 1-NS and 5-NS, located in Dhi Qar governorate, 38 km northwest of Nasiriyah, to study the facies and the type of fossil and link them to production Oil (57) samples were collected from the core of these wells and made of thin section for them, as well as (18) ready-made slices from the laboratories of the Southern Oil Company, as well as it was found through the examination of the thin slices that there are modification processes, the most important of which are the seals, pressure solutions, new formation and cementation. delta, dissolution and mechanical disintegration that affected the Mishrif formation rocks, which played a role in the deterioration and development of porosity.

Table of Content

Table of figers

Chapter One
Introduction

Chapter One

Introduction

1-1 Perface

The cretaceous period in Iraq and the Middle East is one of the most important geological periods. A part of the rocks of this period is a source rock, while the other is characterized by a good reservoir rock as Mishrif Formation

Mishrif formation is one important cretaceous formations because of the reservoir characteristic, in addition to its wide geographical extension. It is the second oil reserve after Zubair Formation in the south of Iraq (Al-Naqib, 1967).

Sequence stratigraphy of Cenomanian-Early Turonian succession is composed of (Ahmadi, Rumaila, and Mishrif) formations, Ahmadi formation (Early Cenomanian) characterized by open marine sediments during the transgressive conditions, and passes up into deep basinal sediments (Rumaila Formation) by conformably surface, Rumaila Formation (middle Cenomanian) was deposited in the deeper part of the intrashelf basin, with abundant of open marine fauna supportive of middle Cenomanian age. Rumaila Formation is represented time equivalent basin to the Mishrif Formation, and they deposited during highstand system tract.

The microfacies analysis at study wells supported the recognition of five environments (open marine, basin, Shoal marine, Rudist biostrome, and lagoonal). The diagenetic processes have influenced by factors (Micritization, Cementation, Dissolution, Neomorphism recrystallization, dolomitization, and compaction), the most effective are dolomitization, neomorphism, and dissolution.

The formation comprises of a complex bioclastic-detrital limestone in places, including algal, coral and rudist bioherms in the intra-shelf basin, formation was described by Rabanit (1952,cited in Bellen *et al*., 1959; Buday, 1980).The effective porosity increases toward the rudistid reefal build up and shoal microfacies more than the lagoonal facies which decrease toward the basinal facies of the reservoir units.

1-2 Aim of the Study

1-Determining the type of facies.

2-paleo environment of the Mishrif.

1-3 Geological Setting

The study area is located in the southern Mesopotamian Basin, southern Iraq, and northeast of Arabian Plate that was subjected to compressional tectonic system, illustrated by the uplift of major trends, was dominant and resulted from the collision with, and obduction of the series supra-subduction zone ophiolite complexes. This compression commenced in Iraq, Iran and Oman in the middle Turonian with the initiation of obduction of ophiolite complexes (Lippard *et al*., 1986).

The sediments were deposited on a larger-scale carbonate platform located on the north eastern passive margin, within intrashelf basins; the sedimentary record indicates the presence of widespread shallow-marine platform carbonates (Mishrif Formation), the repetitive interbedding of limestones with marly limestone and shales (Rumaila, Ahmadi) formations.

The Mishrif formation was deposited on uplifted ridge located to the north of Rumaila and Zubair oil field and extended from south of Kuwait towards north of Amara-Dujaila, Samara-Khleisia and to Gharraf and Nasiriya westerly, (Chatton and Hart,1961; Buday,1980).

Marine deposits of Mishrif Formation in study area were followed by a marked hiatus. This hiatus is the mid-Turonian sequence boundary that occurred at the base of Khasib formation (Sharland *et al*., 2001).
Rudist facies are recorded from most of the fields west of Basra, and also from Majnoon and the Buzurgan area, similar facies are presented all around the northern end of the Gulf, Ziegler (2001).

Dunnington (1958) recorded erosional truncations and weathering effects in the northern Iraq. West of Baghdad is an extensive evaporite basin (Kifl Formation) that is presumed to be located over a broad and stable Hercynian block and could be related to the Abu Jir fault zone of, Lovelock (1984).

1-4 Study Area

The Nassiriya oil field is located in the Dhi Qar Governorate, the coordinates of oil field are (31˚26′53″)N and (45˚58′ 0″)E (figer 1-1)

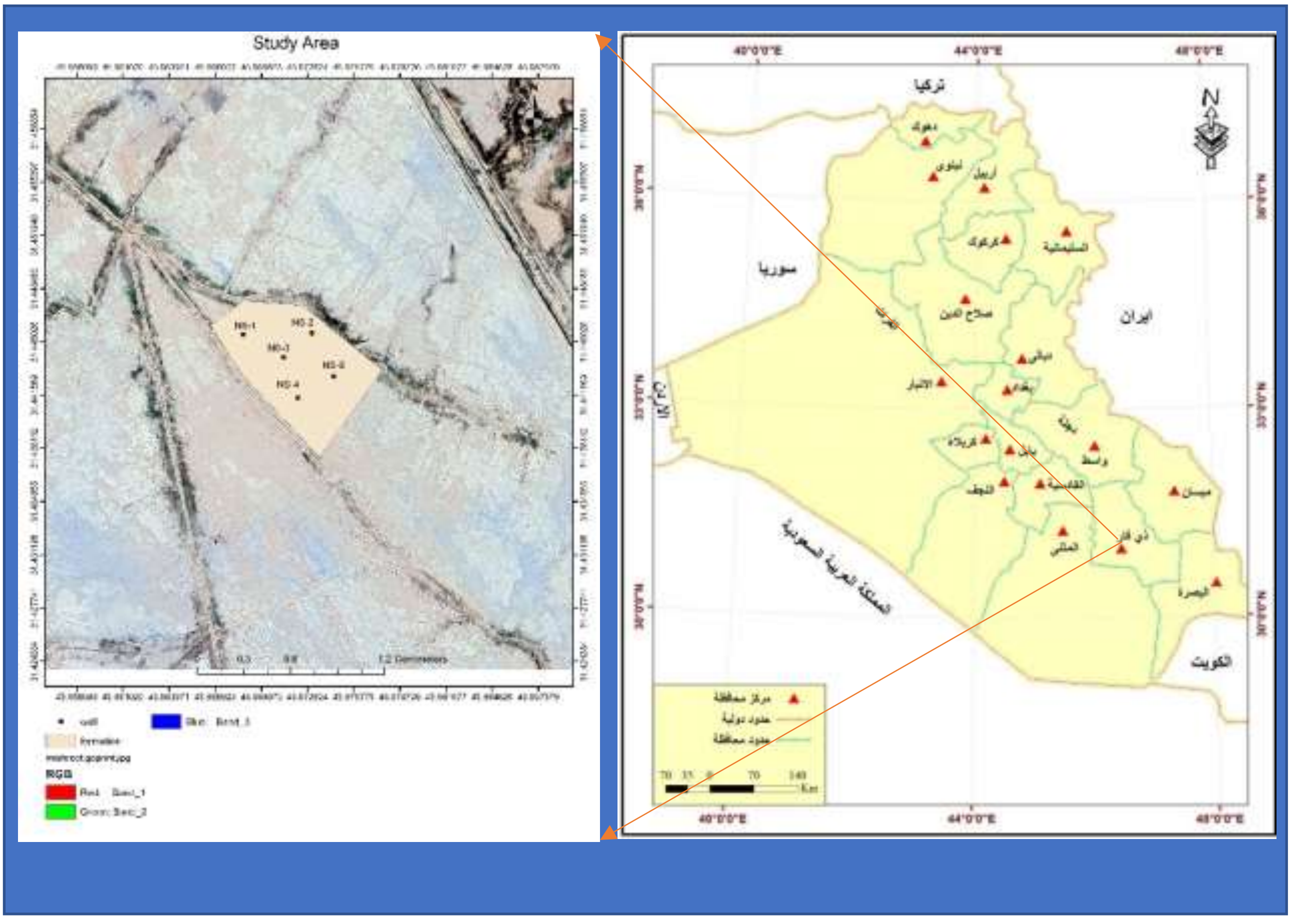

Figure 1.1: location map of study area and studies boreholes.

1-5 Tectonic Setting

The Cenomanian-Early Turonian cycle divided into three tectonic stages, this cycle was began on the gentle slope of the carbonate platform model (Ahmadi platform) during passive margin, but when the reverse migration of the Eurasia plate towards the Arabian plate (initial collision), contribute to upgrowth of compressional tectonic system, which produce the peripheral bulge in the middle Cenomanian, that contributed to deposition of the shoal facies of Mishrif Formation.

The continuation of the compressional tectonic system, that led to the development of the sedimentary basin, and appearance of the facies change (Differentiated basin), from marly limestone facies of the Rumaila Formation passes to the bioclastic shoal, reef, and back-reef facies (Mishrif Formation).

The Cenomanian - early Turonian sequence ended with appearance of the erosional surface in the middle Turonian, resulted of compressional tectonic system that causes ophiolite obduction along the northern and northeastern of Arabian plate.

The structural situation of its type locality is not quite clear and might belong either to the Northern Thrust Zone, or (according to McCarthy *et al*., 1958) to the High Folded Zone. This is the former Mergi Formation, which is now considered to be identical with the Mishrif. The limestones are (according to Bellen *et al*., 1959, p. 182), massive, thick bedded, mostly recrystallized, conglomeratic, and dolomitized at base, with abundant rudist debris.

On the Stable Shelf, to the west of the Abu Jir Subzone mainly on the slopes of the Rutbah Uplift-the marine Cenomanian is represented by the M'sad Formation, which we consider as a facies of the Mishrif Formation. The study area is located in (31˚26′53″)N and (45˚58′ 0″)E (figer 1-1)

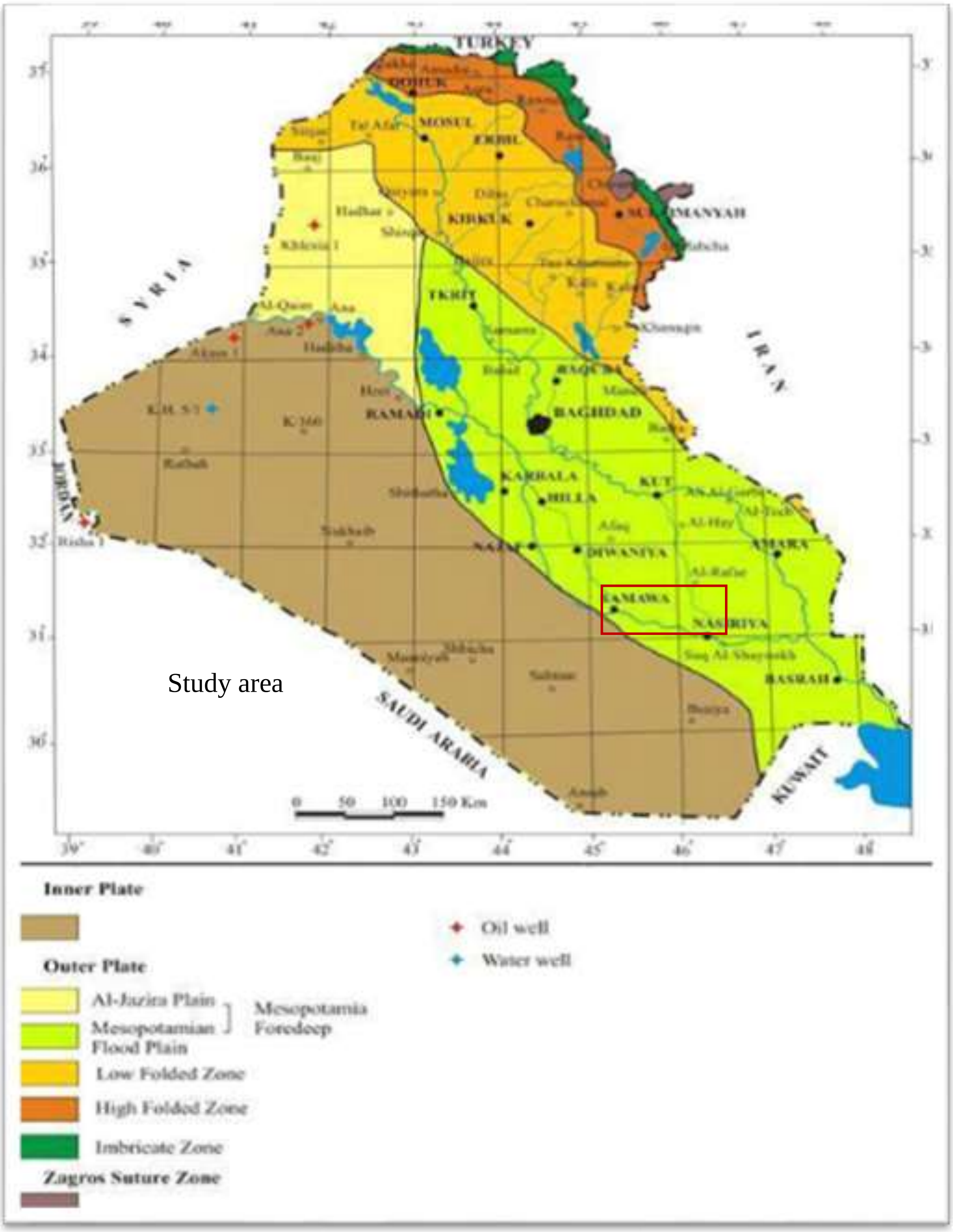

Figure 1-2: Tectonic divisions of Iraq. (after Fouad, 2012)

1-6 Methodology

1-Field Work

24 Sampling rock samples from the cutting and core to make a thin section.

2-laboratey work

Made 24 thin sectins to determine the grains type and groundmass in order to discriminate the microfacies and diagenesis processes

1-7 Previous Studies

-the Mishrif Formation studied by widely especially in central and southern Iraq, since it was first described by Rabanit, (1952) unpublished report, at the type section at well Zb-3 in the Zubair oil field in southern Iraq within the upper part of what was previously called the Khatiyah Formation within the Wasia Group which was later divided into Three formations (Musharraf, Ahmadi and Rumaila).

-Smout (1956) and Fox (1957) Mishrif Formation studied and described the lithological by cross-section of this formation in well Zubair-3; they refer to considered it as a typical section.

-Van Bellen *et al*. (1959) refer to the calcareous shales of the Rumaila Formation in southern Iraq, which represents transgressive carbonates, and in northern Iraq evidence for earliest Turonian compression comes from a large area which became elevated and partially eroded. This unconformity also marks a significant regional hiatus in the northern plate area.

-Chatton and Hart (1961) studied of the (Cenomanian- early Turonian) cycle almost covers the whole of Iraq. The cycle reaches its deepest facies on the shelf with subbasinal Rumaila limestone, then gradual regression starts and the neritic Mishrif limestone is deposited. The Cenomanian leads to the formation of the Dujaila shoal, where Mishrif neritic sediments replace subbasinal sediments.
There is general break of sedimentation between the Cenomanian cycle and its following cycle except in central part of the basin.

-Al-Kasim (1965) conducted a study of the Mishrif Formation and distinguished its facies sediments as it was divided into neritic, shoal facies, Miliolid facies and basinal environment.

-James and Wynd (1965) Mishrif Formation occur in the upper part of the Sarvak Formation, Sarvak Formation is developed in two major facies: one is a massive, feature-forming limestone deposited in the neritic environments, and containing rudists, gastropods, pelecypods and a rich microfauna; the other is a deeper-water facies of thinner-bedded, fine grained, dark-colored, argillaceous, Oligostegina limestone with a pelagic microfauna. The top Sarvak is a significant disconformity.

-Al-Naqib (1967) The Mishrif facies consists of neritic limestones are variable in texture and may be Oolitic or pelletal, shelly, and coquinoid types which contain algae, rudists, bryozoans, corals and miliolids, the lithologic sequence was divided into eight rock units in the type section.

EIf – Iraq Company (1970) studied Mishrif Formation in Buzergan oil field southeast of Iraq, and they division of the Mishrif formation to three main facies (mA, mB and mC).

-Gaddo (1971) carried out the division of the sedimentary environment of Mishrif Formation in the reefal build-up that interfere with lagoon littoral – Lake Environment, algal facies with facies of basinal and sub – basinal environment.

-Al-Khersan (1973) found that the Mishrif Formation in southern Iraq that represents the second of oil reservoir in of economic importance, and concluded the existence of five sedimentary environments.

-Al-Siddiki (1978) explained the microfacies of the Mishrif Formation in a geological sub-surface in the south-eastern region of Iraq. The thickness of the formation in the northern region of the Majnoon field was estimated at 400 meters and gradually disappears in the western region of Samawah field.

-Murris (1980), Harris *et al*. 1984), and Scott *et al*. (1988), discussed the regional distribution, facies, and stratigraphy in the middle Cretaceous around the Arabian Gulf.

-Reulet (1982) studied the facies, sedimentary environments and reservoir characteristics of the Mishrif Formation in southern Iraq and a model was made geological model represented developed sedimentary environments.

-Burchette (1993) studied the Mishrif Formation in the south of the Arabian Gulf in Oman, the UAE and northern Saudi Arabia. He divided the sedimentary sediments into six facies, Basin, platform slope, platform margin shoals, Biostrme or bioherm and lagoon.

-Sherwani and Mohammed (1993), pointed out to the Mishrif facies merge into each other and boundaries are not sharp or distinct.

-Aqrawi *et al*. (1998) The Mishrif Formation (Cenomanian – early Turonian) consists mainly of shallow water carbonates, and thicker in the east than the west. Shallow-water conditions were maintained in the east, however, above the Amara palaeo-high, resulting in the development of thick rudist dominated build-ups.

-Sharland *et al*. (2001) Earliest Cenomanian is best expressed by organic-rich, calcareous shales at the base, and open marine spicular carbonates near base Ahmadi Formation, thin limestone beds, this unit contains common pelagic microfossils, has a marked gamma ray spike on wireline logs, and is a potential source rock horizon, planktonic foraminifera. It also correlates with the lower Ahmadi Formation limestones of Kuwait. In central and southern Iraq, the Rumaila Formation carbonates represent the early HST systems tract, and the top of Mishrif Formation is marked by the widespread middle Turonian unconformity.

-Al-Sharhan and Nairn (2003) pointed out to the total number of Mishrif Formation cycles found varies locally from six to eight. Each cycle consists of fine-grained, dark-brown to almost black, bituminous lime mudstone/wackestone/ packstone grading up into fine-grained, argillaceous, and brown, slightly bituminous limestone with abundant Pithonella spp. The bedding is an alternation of lighter- colored, burrowed and cemented limestone and thinner darker and stylolitized limestone.

-Mahdi (2004) middle Cenomanian – early Turonian succession on southern Iraq by using analysis sequence stratigraphic concepts that led to distinguish three complete transgressive – regressive sequence and their correlative system tracts encompassing the middle Cenomanian – early Turonian interval.

-Al-Ubaidy (2004) studied the sequence stratigraphy the Mishrif Formation in Zubair Field and suggested four major environments within the shelf carbonate platform: such as (shallow restricted, shallow open marine, shoal, and deep marine environment).

-Al-Badry (2005) studied Mishrif Formation in four fields in the Mesan province and divided the Mishrif Formation into four sub-cycle, and diagnostic six depositional environments.

-Sadooni (2005) pointed out the restricted shelf facies includes porcellanous packstone- wackestones.

-Handel (2006) studied the Mishrif Formation in the Nasiriya oil field and proposed of the Mishrif Formation characterized by dominance of the primary porosity, but the secondary porosity is rare and described the reservoir units to four grads (Poor porosity, medium porosity, and very good porosity).

-Raheem, M.Kh. (2009) divided Mishrif Formation into (Upper mA, middle mB1, and Lower Mishrif mB2) these separated by two cap rocks as (CI and CII).

-Aqrawi *et al*. (2010), divided Mishrif Formation into four general facies can be recognized: restricted shelf, rudist build-up, open shelf and sub-basin.

-Al-Dabbas, AL-jassim and Al-Jumaily (2010) studied the depositional environments of the Mishrif Formation in the southern of Iraq.

-Hadam (2011) studied the Mishrif Formation in the Buzurgan field (Missan province), and divided the formation into four reservoir units, and built for these units three dimension (3D) static geological model.

-Al-Baladawi (2012) studied the Mishrif formation in the Amara oil field, southern east of Iraq, and described the characteristic of the carbonate reservoirs, and built three dimension (3D) geological models.

-AL-Mohammad (2012) defined five main paleoenvironments, and sub-divided the Mishrif Formation into five reservoir units separated by no porosity units in the Tuba oil field southern Iraq.

-Al-Itbi (2013) studied The Mishrif Formation and sub-divided into six main microfacies in the Gharraf oilfield, the upper and lower parts was determined by using well logs.

-Aqrawi *et al*. (2014), the middle Cenomanian – early Turonian succession characterized by a major carbonate reservoir unit (Mishrif Formation) in southern Iraq, the microfacies interpretations together with well wireline log data interpretations the formation is composed of transgressive and regressive hemicycles, and show lateral and vertical facies variations depending on relative sea-level changes together with regional-scale tectonic deformation of the Arabian Plate controlled the availability of accommodation space.

Chapter two
Microfacies Analysis

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2-1 Introdaction

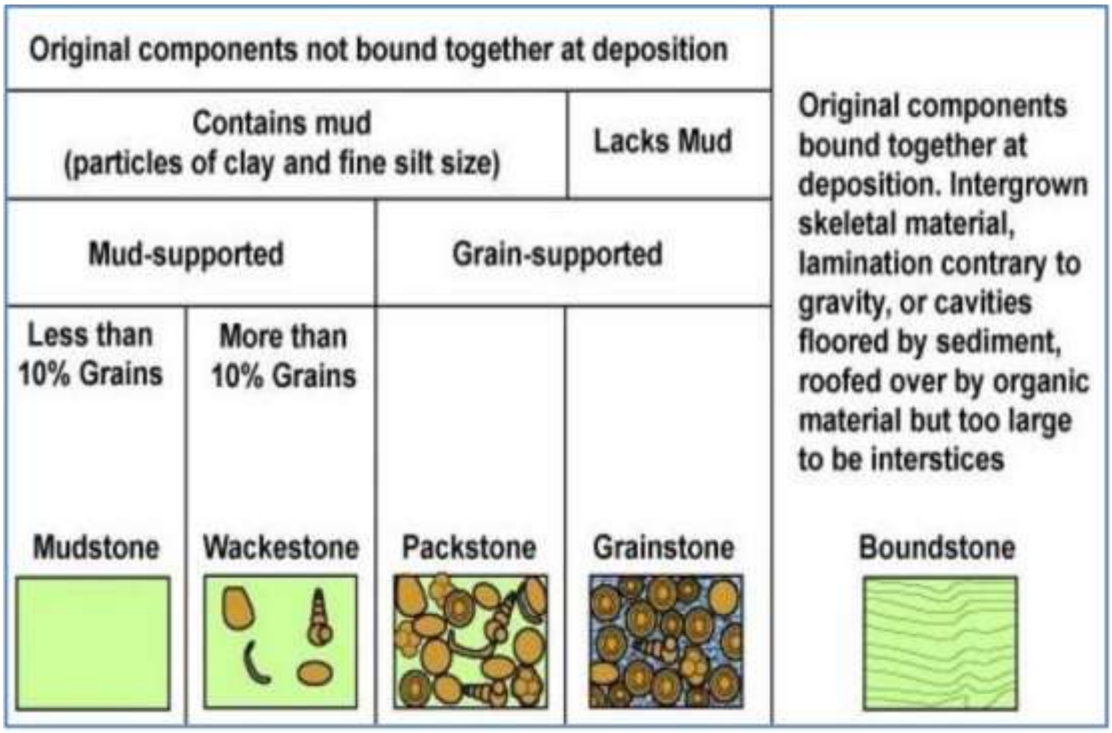
Microfacies are the total of all the paleontological and sedimentological criteria which can be classified in thin-section (Flugel, 1982).

The importance to study of the carbonate microfacies characterized by complex of biolithofacies buildup and relationship to the diagenesis processes affecting on the Cenomanian to early Turonian succession. This chapter discusses the carbonate microfacies by examining the thin section under the microscope to the determination of the sedimentary environments, facies change, and diagnosis of the diagenesis processes and their impact on the rock properties.

2-2 Petrographic Description

The Cenomanian - early Turonian cycle, have been subjected to many studies related to the facies through the study of the microfacies thin-section, because they are particularly important in giving a clear view of the sedimentary environments of any limestone formation. Facies description based on classified according to Dunham (1962). This classification produces two types of limestone, which are associated with each other (Grain supported) and that are not associated with each other (Mud supported), (Figure 2.1), compare them with standard microfacies (Wilson, 1975) and their identify the environments according (Flugel, 1982).

The current study aims at presenting the most important petrographic characteristics of the Cenomanian - early Turonian formations, and then divide into much type of microfacies, which consist of the matrix (micrite) and various grains (skeletal or non-skeletal).



Figer 2-1 Dunham Classification (1962).

2-3 Matrix (Micrite)

The Micrite in the Mishrif formation is microcrystalline and a represents the matrix of most facies types filling the spaces between presence of grains or shell fragment. It may have dark color (Brown) due to the organic matter, Iron Oxides or clay, some diagenetic processes can produce the micrite such as, Vadose silt or may through the micritization process (Ginsburg,1957).

2-4 Carbonate Grains

The grains are divided into two types: Skeletal and Non-skeletal grains, the following are a review of the most important components of the limestone gains:

A- Skeletal grains

There were many types of skeletal grains, some of which gave a specific characteristic of this formation, as Mishrif Formation is abundantly contained in the skeletal grains which include red algae plate, green algae, benthonic foraminifera, molluscs, echinoderms, rudist fragments and bioclastic, whose propagation in the formation varies from one plate to another.

-Foraminifera

Larger Benthonic Foraminifera

They are located in the different succession of the Mishrif Formation, which are generally characterized by their large size and the relative thickness of their walls, and most of their species are characterized by good preservation. The presence of these organisms is a proof of the environment of the fore-reef.

Smaller Benthonic Foraminifera

This type of the fauna represents (Miliolid, Pseudolituonella, Textularids), which prefer to live in the lagoonal environment with low energy. When they are present in such a facies, can assume that they were deposited in highly saline- water.

Planktonic Foraminifera

Planktonic foraminifera are common in the open marine environments such as (slope to the basin center or outer-shelf)

B- Non Skeletal Grain

This group includes all the grains of non- organisms and their debris, which are mostly composed of limestone and are rooted in different origins and through different mechanisms, and include the following types:

-Peloids

These are spherical or oval granules. They are made of calcite with a diameter of between (0.05-0.20 mm), free of internal structures of regular sizes (Flugel, 1982).

There are different types of peloids in the limestone, both in terms of origin and formation.

Flugel (1982) suggested that Peloidal be described as a descriptive term for these grains, regardless of their origin, since at first they appear to be similar in appearance, although they are formed in different ways, (Micritization), which is made by algae as a result of the process boring, especially red algae on the remains of structures.

-Rudast

Rounded skleletal grains and other grains covered by a thin micrite envelope . Boundary between the central grain and the envelope indistinct . Size between < I mm to a few centimeters .

2-5 Microfacies analysis

The term microfacies were suggested by Brown (1943) microfacies refers to the criteria appearing in thin-section under the microscope Flugel (1982) defined microfacies: is the total of all the paleontological and sedimentological criteria which can be classified in thin-sections, peels, and polished slabs.

2-5-1 Bioclastic wackestone microfacies

These are common in the study wells of the Mishrif Formation, they are mainly composed from skeletal and non-skeletal grains with mud-supported (Dunham),(1962,plate 1- b). Microfacies contain components such as bioclastic of (Rudist,foraminifera, algae, molluscs, echinoids, and non-skeletal grains such as peloids.(When compared with the standard microfacies of Wilson (1975), they were found to be similar to the standard microfacies (SMF-10) within the Facies Zone (FZ-2and 7(Deep shelf, open marine environment.

2-5-2 Lime Mudstone Microfacies

The matrix is a fine-bioclastic micrite, is defined as the type of limestone whose basic consists of calcite fine crystalline (Dunham, 1962), which corresponds to the term "micrite" Folk (1962), where it does not exceed the sizes crystals of calcite (4)micron with a specific percentage of fossils not exceeding (10%) within mud-supported, this facies was identified in all the study wells. This microfacies wasdeposited in the low energy environments toe of slope and basin environments),plate 2-c), they were found to be similar to the standard

(SMF-23) within the Facies Zone (FZ8and9) which reflect evaporitic platform interior as depositional environment.

2-5-3 Bioclastic packstone microfacies

These are composed of skeletal or non-skeletal bioclastics about (90%) with micrite or microsparite texture (10%) or less (Dunham, 1962),occurs in the Mishrif Formation,(plate 2-a) . Packstone microfacies are characterized by the diversity of skeletal grains, benthic foraminifera, rudist, echinoderms and mollusks.

When compared this microfacies with standard microfacies, these were found to be similar to the (SMF 4-6) within the range (FZ- 4) as they are deposited in a coral reef environment, in front of reefs or shallow marine barriers, according to (Wilson, 1975).

2-5-4 Bioclastic Grainstone microfacies

Grainstones are grain-supported and mud-free carbonate rocks which consist of skeletal and non-skeletal carbonate grains. The absence of mud has various causes:

deposition of grains in high-energy environments, and contain the groundmass,which consists of sparry cement.

these located in stander microfacies (SMF-11) within the Facies Zone (FZ-6) which refect platform-margen sand shoals.

2-6 Diagenetic processes

Diagenesis is the entire chemical, physical and biological change undergone by sediments after its initial deposition (i.e. after it has reached its final resting place in the current cycle of erosion, transportation, and deposition), (Flugel, 1972). These changes include leaching, cementation, fluid expulsion, and fracturing, and their products are essential for carbonate reservoirs because they affect their properties (Longman, 1980).

2-6-1 Micritization

Micritization is an early diagenetic process which resulted from microbiota effects on carbonate allochems during their deposition or final resting place, and it means, all the perforation processes on a sea floor in early diagenetic processes. Micritization processes are very common in the (wackestone and packstone) microfacies Mishrif Formation, micritization comprises the boring operations and these voids were infilled with micrite materials after the death of organisms, the internal structure of the skeletal components being subjected to deformation.

2-6-2 Cementation

Cementation by a wide range of minerals may take place at various stages in the diagenetic history of sediment, from the time of deposition to the period of deep burial event, after uplift when the rock again comes under the influence of surface water. Recognition of times of cementation and diagenetic environments is often extremely difficult, and it is sufficient to note here that cementation results in a worsening of the reservoir characteristic of sediment (Illing et al., 1965) (plat 1-d)

2-6-3 Dolomitization

In the initial stages of dolomitization, up to around 50% dolomite, porosity is reduced since the dolomite rhombs replace porous lime mud, with greater percentages of dolomite a volume reduction from calcite to dolomite occurs and where sucrose dolomites are produced intercrystalline porosity is high (Deffeyes et al., 1965).

Dolomitization occurs as scattered fine rhombs within the micritic groundmass of the Mishrif Formation mud-supported microfacies, other coarse crystal rhombs of dolomite in the studied wells, (plate 1- e).

2-6-4 Compaction

Is a group of processes that occur under the influence of sedimentary cover and works to reduce the initial porosity of sediments such as upper part of the Mishrif Formation, and reduce the size of rocks by discharging the fluids that occupy the pores between the granules and the compression of the late diagenesis processes and affect the compression on the granule as a result of the compression process can distinguish the action of the provisions through the crash, destroy, which leads to increase the surface area of the granules as well as through the contact boundary between the granules.

In the sequence stratigraphic there is an increase in compression effect when there is an increase in mud supported and fine granules, in which the compression effect decreases with increasing of components such as skeletal and early cementation and dolomitization processes (Flugel, 1982).Another type of compaction is called Pressure Solution that may dissolve calcareous material on the matrix or along the edges of the granules or crystals. The stylolite, which is represented a late stage of the diagenesis (Friedman, 1975).

The stylolite occurs in the most mud supported facies or deep marine facies and have irregular configuration (plate2- c).

2-6-5 Dissolution Processes

are important as it enhances reservoir quality by increase the porosity values. Where dissolution has been prevalent, creating common enlarged and secondary intergranular porosity as a result of this effect the permeability are also improved.

The dissolution processes probably occurred during a relative early diagenetic history, later, the dissolution of micrite has created secondary porosity.

This type of dissolution occurred at shallow burial depth, possibly postdating the aragonite dissolution .

The cause of the different phases of dissolution due to the earliest leaching of aragonitic grains and mud could be related to episodes of local platform emergence, or meteoric flushing, and, the late, calcite dissolution which affected grains and lime mud could be associated with extensive subaerial exposure and sequence boundary (plate 2- a and f). However dissolution is a more effective diagenetic process than cementation in most of the reservoir units.

2-9 Plate 1

a- Bioclast Lime mudstone ،NS-5-2075-19

b- Bioclast wakestone ،NS-5-1902-87

c- Intraclast grainestone ،NS-5-2031-80

d- Bioclast mudstone ،NS12031-87

e- Lithoclast packstone ،NS1-2027-42

f- Peloidal Packestone , NS1-2047-61

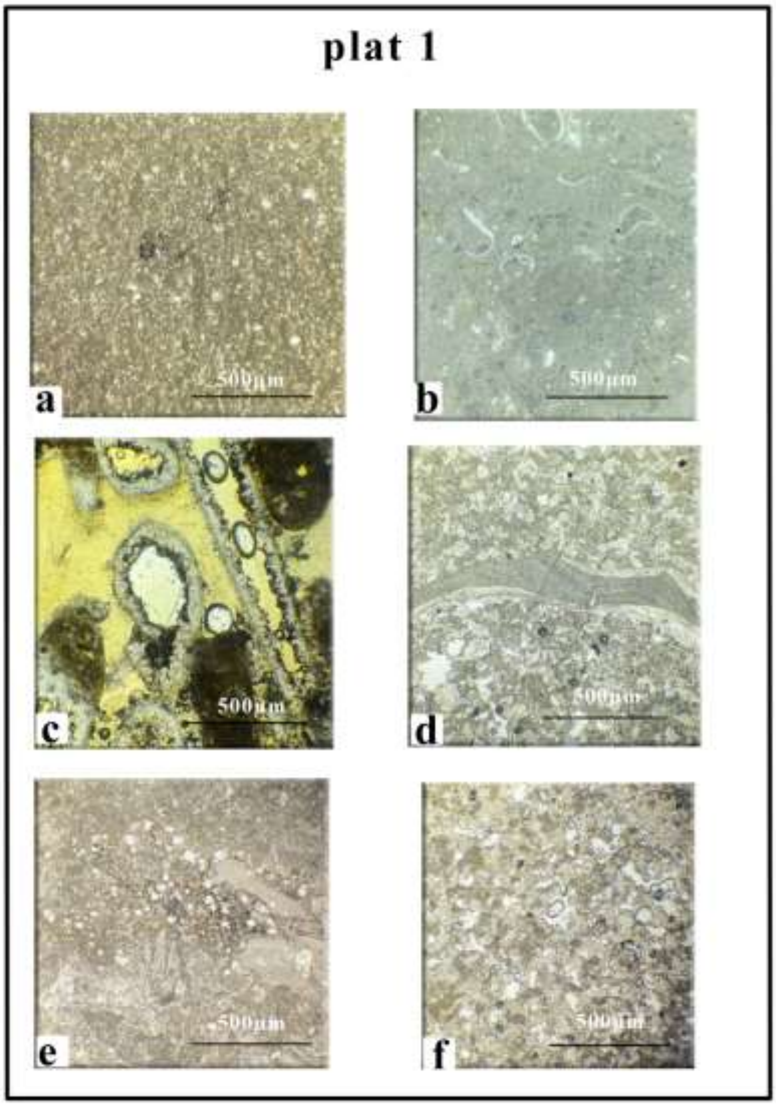


Figure 2-2 Evolution Porosity

2-10 Plate 2

a- Bioclastic packstone , NS-5-2049-47

b- mudstone , NS-5-1904-74

c- Lime mudstone ،NS-5-1899-33

d- Bioclast Packestone ،NS-5-2051-77

e- Foraminifera interaclast, packestone ،NS1-2052-90.

f- Lime mudstone , NS1-2090-70

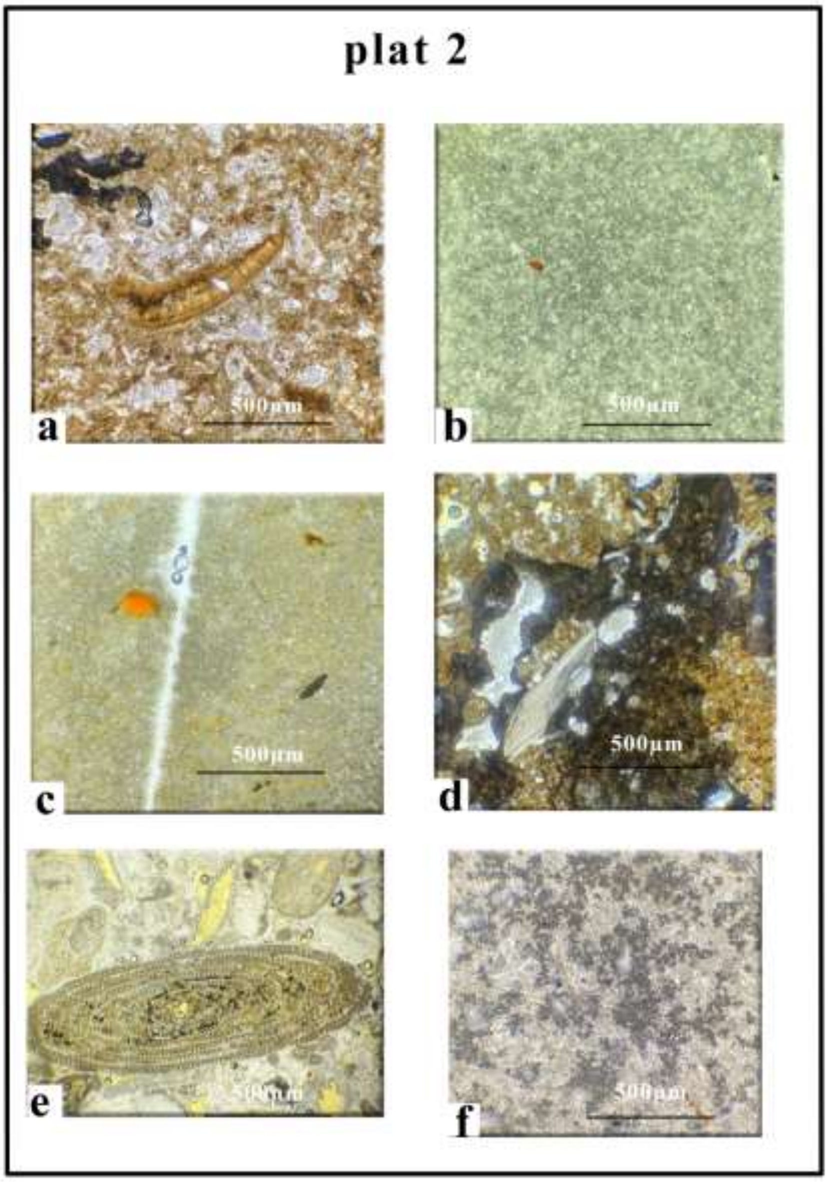


Figure 2-3:plate 2

Chapter Three

Summary And Conclusions

Summary And Conclusions

Petrographic study and microfacies analysis assist to found five type of microfacies**(foraminifera ,Bioclastic wackestone microfacies , Lime Mudstone Microfacies , Bioclastic packstone microfacies , Bioclastic Grainstone microfacies)** and recognition of five main environments **(open marine, basin, shoal, Rudist biostrome, and lagoon).**

The diagenetic processes were affected by **(Cementation, Dissolution, Dolomitization, and Compaction)** most effective are dolomitization, and dissolution, but other processes **(pressure solution, cementation, and less effective).**

Primary and secondary porosities determined by using **(Neutron, Density and Sonic logs).**

Primary porosity is the most effective, but the secondary porosity appears to be related with dolomitization and dissolution**.**

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جمهورية العراق

وزارة التعليم العالي والبحث العلمي

جامعة ديالى/كلية العلوم

قسم جيولوجيا النفط والمعادن

تحليل السحنات الدقيقة والعمليات التحويرية وتأثيرها على الخصائص الصخرية لتكوين المشرف ، حقل نفط الناصرية ، جنوب العراق

بحث مقدم الى مجلس قسم جيولوجيا النفط والمعادن وهو احد متطلبات الحصول على شهادة الباكالوريس في قسم جيولوجيا النفط والمعادن

من قبل الطلبة

رفل نوري جواد

اميره جواد كاظم

بأشراف

أ.م.د صلاح علي حسين

2022م **1443هـ**