

Micro Facies Analysis and Development of Diagenetic Processes in Khasib Formation in Selected Oil Wells, South East of Iraq

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Abstract

Khasib Formation is considered an important formation in the Late Turonian-Early Campanian sequence and represented a transgressive system tract within deep and inner ramp environment, where Khasib Formation was studied in four oil wells, two from Noor oil field they are : (No-1,2), and the others form Amara oil field ,they are (Am-4,5) in Missan governorate ,southeast of Iraq. (Al-Badry,1999).

Five main microfacies had been recognized for Khasib Formation in studied oil wells , they are : grainstone, packstone , Wackstone, packstone –wackstone and mudstone microfacies , and the coarse texture was defined in the lower part of Khasib Formation while the fine texture was defined in the upper part of the studied formation which meaning deepening upward.

Many diagenesis processes which effect on the texture also had been detected, some of them were constructive which played positive role in enhancement the porosity while the other represented negative role.

Key Words: Khasib Formation, Microfacies, Diagenesis Processes

الخلاصة :

يعد تكوين الخصب من التكوينات المهمة في تتابع التوروني-الكامباني المبكر ، حيث يمثل نظام المسار التقدمي ضمن بيئة الرف الداخلي والعميق ، اذ تم دراسة تكوين الخصب في أربعة آبار نفطية، اثنان منهما من حقل نور النفطية هما (نور-1 ونور-2) والآخران من حقل العمارة النفطية وهما (عمارة-4 وعمارة-5) في محافظة ميسان ، جنوب شرق العراق .(البدري,1999) .
 تم تمييز خمسة سحنات دقيقة في تكوين الخصب هي : الحجر الجيري الحبيبي والحجر الجيري المترص والحجر الجيري الواكي والمترص- الواكي والحجر الجيري الطيني ، حيث تواجدت السحنات ذات النسيج الخشن في الجزء الاسفل من تكوين الخصب في الآبار المدروسة بينما تمثل الجزء الاعلى منه بالنسيج الناعم والذي يعني تعمقا باتجاه الأعلى .
 تم تمييز عدداً من العمليات التحويرية التي أثرت على نسيج تكوين الخصب ، حيث كان بعضاً منها يمثل عمليات بنائية والتي لعبت دوراً ايجابياً في تحسين نسبة المسامية بينما مثلت العمليات الأخرى دوراً سلبياً في تأثيرها على المسامية .

الكلمات المفتاحية : تكوين الخصب ، السحنات الدقيقة ، العمليات التحويرية

Introduction

Khasib Formation is considered an important formation in the Late Turonian-Early Campanian Sequence and represented a transgressive system tract within deep and inner ramp environment.(Al- Badrey, 1999)

Khasib Formation doesn't acquire more studies because most of these studies make a focus on economic aspects, so another formations get much luck from studies due to they're regarded main petroleum reservoirs like Mishrif Formation.

Khasib Formation represented first petroleum reservoir in some oil fields especially in Huiza oil fields from Missan oil fields ,This formation had a wide distribution in most of Iraqi areas especially in southern parts with variation in thickness .

Location of Study Area:

Khasib Formation was studied in two oil fields ,which are bounded between (47° 15' 36") , (46° 15' 43") longitude and (31° 45' 16") , (31° 15' 30") latitude, where is

located in south eastern of Iraq , in Missan governorate , within Mesopotamian zone (Tigris sub zone) , figure(1)

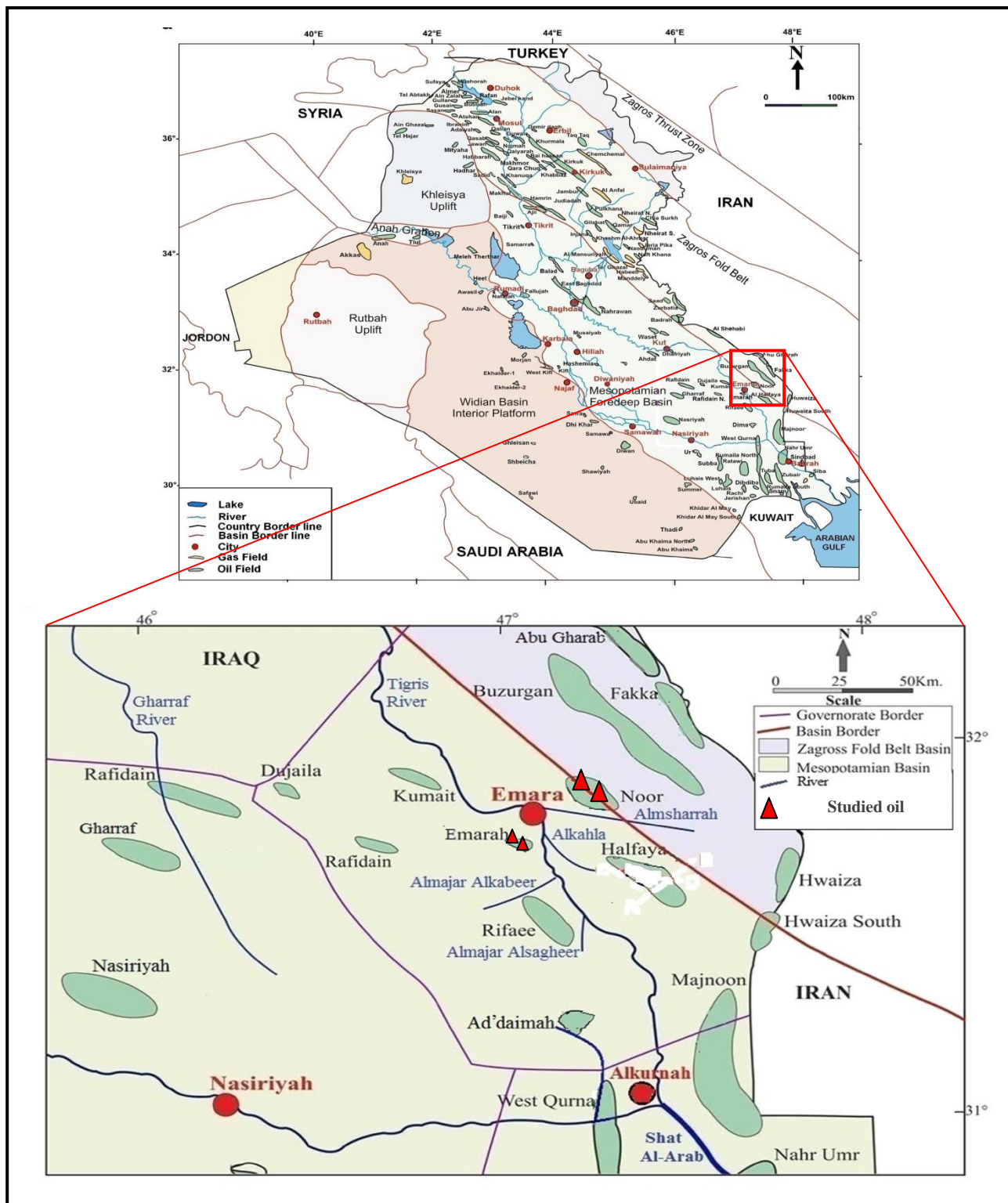


Figure (1) Location Map of Study Area , modified from Al-Ameri & *et al* ,2010.

Aims of study

Lithological description of Khasib Formation in studied oil wells

- 1- Study the microfacies and determine the sedimentary environment of Khasib Formation by thin sections study and fossils content in studied oil wells.
- 2- Study the diagenesis processes that effect on the Khasib Formation in studied oil wells .

Methodology

The present study had been done by following strategy:

- 1- Field work: collecting rock samples from Khasib Formation in studied oil wells at three stages.
- 2- Laboratory work: this represented by thin sections preparation of rock samples, examination and description the samples under microscope .
- 3- Using microfacies application to determine the sedimentary environment of Khasib Formation in studied oil wells .
- 4- Diagenesis processes had been done in studied oil wells .

Microfacies and Diagenesis Processes

The facies was defined by (Boggs, 2006) , as a body of rock with specified characteristics that reflect the condition under which it was formed. And it was characterized by a particular combination of lithology , physical and biological structures that give an aspect (facies) different from the bodies of rock above, below and laterally adjacent.

Dunham classification (1962) that was depended in present study , where it classified the carbonate rocks depending on the " grain supported" or "mud supported" , and the percentage of the grain related to the ground mass , fig. (2).

Depositional texture recognizable					Depositional texture not recognizable
Original components not bound together during deposition			Original components were bound together		
Contains mud (clay and fine silt-size carbonate)		Grain-supported	Lacks mud and is grain supported	Boundstone	
Mud-supported					
Less than 10% grains	More than 10% grains				
Mudstone	Wackestone	Packstone	Grainstone	Boundstone	Crystalline

Figure (2) : Classification of carbonate rocks (Dunham 1962)

Diagenesis is all of the changes that happen to sedimentary rocks after deposition and before metamorphism. All changes in size, shape, volume, chemical composition, or crystalline structure of a sedimentary rock after its detrital, biogenic, or crystalline constituents have been deposited (Ahr, 2008).

Microfacies and Diagenesis Processes in Am-4:

In the lower part of Khasib Formation ; the domination of facies is very clear , so the grain stone facies are located at the depth ;(2865-2870) m and (2862-2852) m, in addition to that ; there is abundance to the facies at depth (2861 - 2864) m , and at the depth (2849 – 2852.5) m.

The cause of spreading of and facies related to the nature of the environment of lower Khasib which reflects the environment of high energy and shallow water with domination of currents and abundance of large organisms and turbidity .

The domination of facies is obvious from the depth (2849 –2839) m. with interruptions to that facies and replaced by facies sequentially facies appears clearly in the top of the formation related to the domination of the deep marine environment which reflects the energy and good sorting with low or lack of turbidities currents .

The abundance of facies is at the depth from (2808-2790)m. with the presence of facies from the depth(2806-2803) m and (2820- 2796) m., and the presence of facies at the depth(2804-2802) m.

The stylolite process appears in the lower part of the Khasib Formation clearly with the abundance of dissolution processes ; especially at the depth (2830-2843) m , and (2808 -2820) m., while the cementation process can be noticed in the upper part of the Am-4 oil well at the depth(2801-2809) m.

The Neomorphism phenomena appear at the depth (2804-2799) m. Figure (3) illustrates the microfacies distribution and the Diagenetic processes .

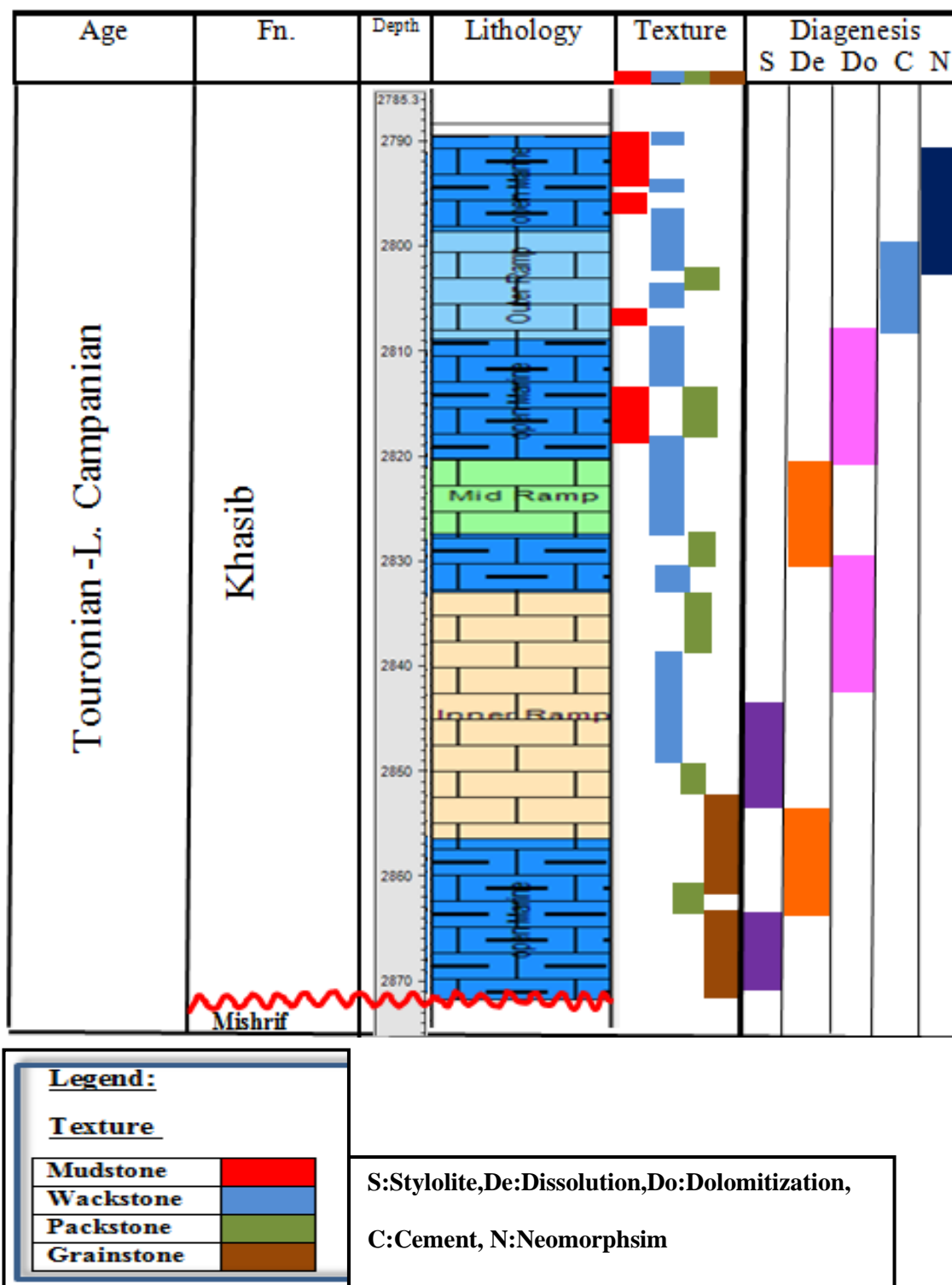


Figure (3) Microfacies and Diagenesis processes of Khasib Formation in Am-4.

Microfacies and Diagenesis Processes of Khasib Formation in Am – 5:

The lower part of Khasib in Am-5 is similar to his counterpart in Am-4 with some differences such as :

The presence of facies is at the depth (2888-2866)m with lack of (2875-2878)m , As it illustrated in Am-4 ;the cause of abundance and facies may be related to the actin of Mishrif Formation , where it is typical for reef environment .

The Middle part of Khasib Formation in Am-5 is characterized by the

existence of facies consequentially with facies, and lack in facies.

The Upper part of Khasib in Am-5 is distinguished by the abundance of and facies with lack of facies and absence of facies and this feature belongs to the fact or sand the depositional circumstances of the deep marine environment which characterized the Upper part of the studied formation .

The presence of facies reflects the quite environment ,low energy ,rarity of currents, abundance of microfossils "Planktonics" and deep water with high accommodation space . Fig(4)

The Diagenetic processes that can be noticed in Am-5 as follow :

Stylolite : This process distributed on the whole section of the Am -5 oil well , from the top , at the depth(2808-2814) m , in the middle; at the depth (2847-2851)m, and finally ; in the bottom ; at the depth(2847-2886) m .

Dissolution : this process appears in the Lower and middle part of the formation; at the depth(2844 -2839) ,(2852 - 2868)m.

Dolomitization : The abundance of this process is rare (somehow), in the most wells of the study area , so in (Am-5) , the dolomitization process noticed at the depth (2834-2839)m .

Cementation : This process is common in the wells of study area ,in (Am -5) well at the depth (2814 -2822) m ,(2847-2851),(2869-2873)m.

Neomorphism: The abundance of this process is rare in most of the wells in study area ; in (Am - 5) appears at the depth(2812-2814)m .

Fracturation: The fracturation process is very common in Khasib Formation in the study wells, and this appears at the depths from the top (2821-2831)m,(2841-2844)m ,fig.(4)

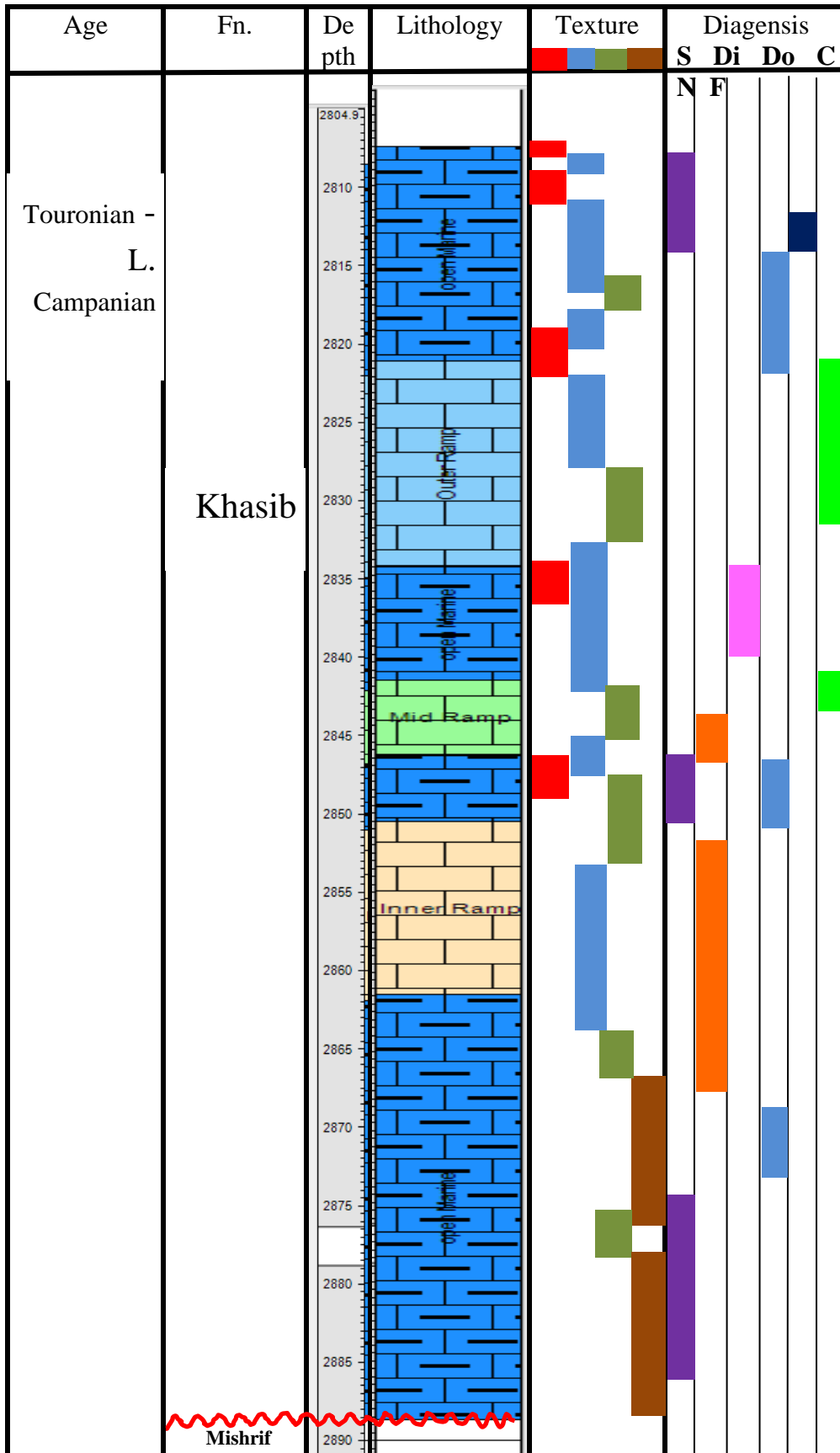
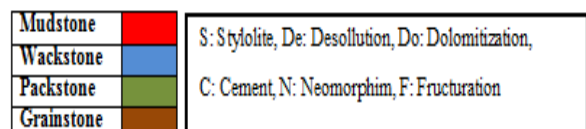


Figure (4) Microfacies and diagenesis processes of Khasib Formation in Am -5



Microfacies and Diagenesis of Khasib Formation No -1:

The Lower part of the Khasib Formation (as in the other oil wells below) is characterized by the abundance of grainstone facies with packstone facies and an absence of wackstone and mudstone facies. The grainstone facies lies at the depth (3308-3323)m, but the packstone facies lies at the depth (3308 – 3297) m. The middle Khasib is characterized by the abundance of wackstone and packstone facies with an absence of mudstone and grainstone facies.

The mudstone facies is the main microfacies and the most abundant in the upper part of the Formation, Fig (5). The diagenetic processes in **No-1** are as follows:

Stylolite: This process is dominated in the upper part of the formation at the depths (3245-3250)m, (3255-3263)m, (3267-3272)m.

Dissolution: This type of Diagenetic process is abundant in the lower and middle part of the formation and rare in the upper part of it, so the distribution of this process in (No-1) is at the depths (3273-3250)m, (3255-3263)m, (3304-3220)m.

Cementation: The cementation process affects the Khasib Formation and this is obvious at the depths (3247-3251)m, (3267- 3272)m, (3299-3313)m.

Fracturation: As mentioned; this process is dominant in the Upper part of the formation; especially here at the depths (3250 - 3264), (3272-3287) m. figure (5).

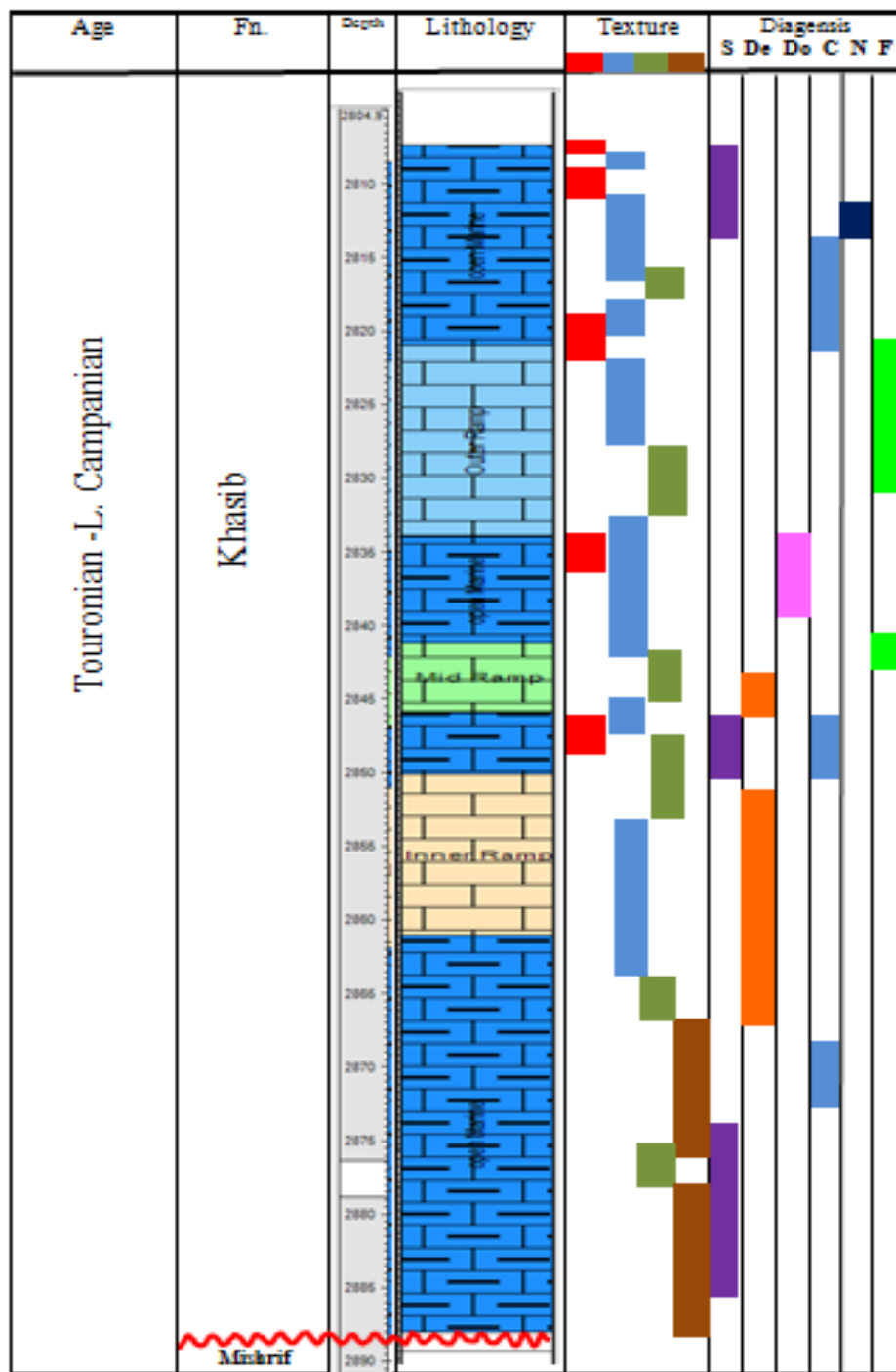


Figure (5) Microfacies and Diagenesis of Khasib Formation in No-1.

Legend

Mudstone	Red	S: Stylolite, De: Desolution, Do: Dolomitization, C: Cement, N: Neomorphism, F: Fracturation
Wackstone	Blue	
Packstone	Green	
Grainstone	Brown	

Microfacies and Diagenesis of Khasib Formation No-2 :

The distribution of the microfacies in No-2 is the same in (No-1) with few differences such as ; the mudstone facies in (No-2) is less than the counterpart in (No-1) , and there is difference in percentage of distribution between the two wells.

The Diagenetic processes in (No-2) represented by the processes; Stylolite, Dissolution , Dolomitization , Cementation , and Fracturation, as follows:

Stylolite : It is common in the upper part of Khasib Formation which is found at the depths (3233-3238)m ,(3247-3252) m.

Dissolution: This process is very common in the lower part of the formation; and it located at the depth (3274- 3294)m .

Cementation: In this well ; this process is located at the lower part of the formation especially at the depths (3263 - 3272) m, (3294-3302) m .

Fructuration: It is very common and abundant in the upper part of the formation and it located at the depth (3238-3264) m , figure (6) .

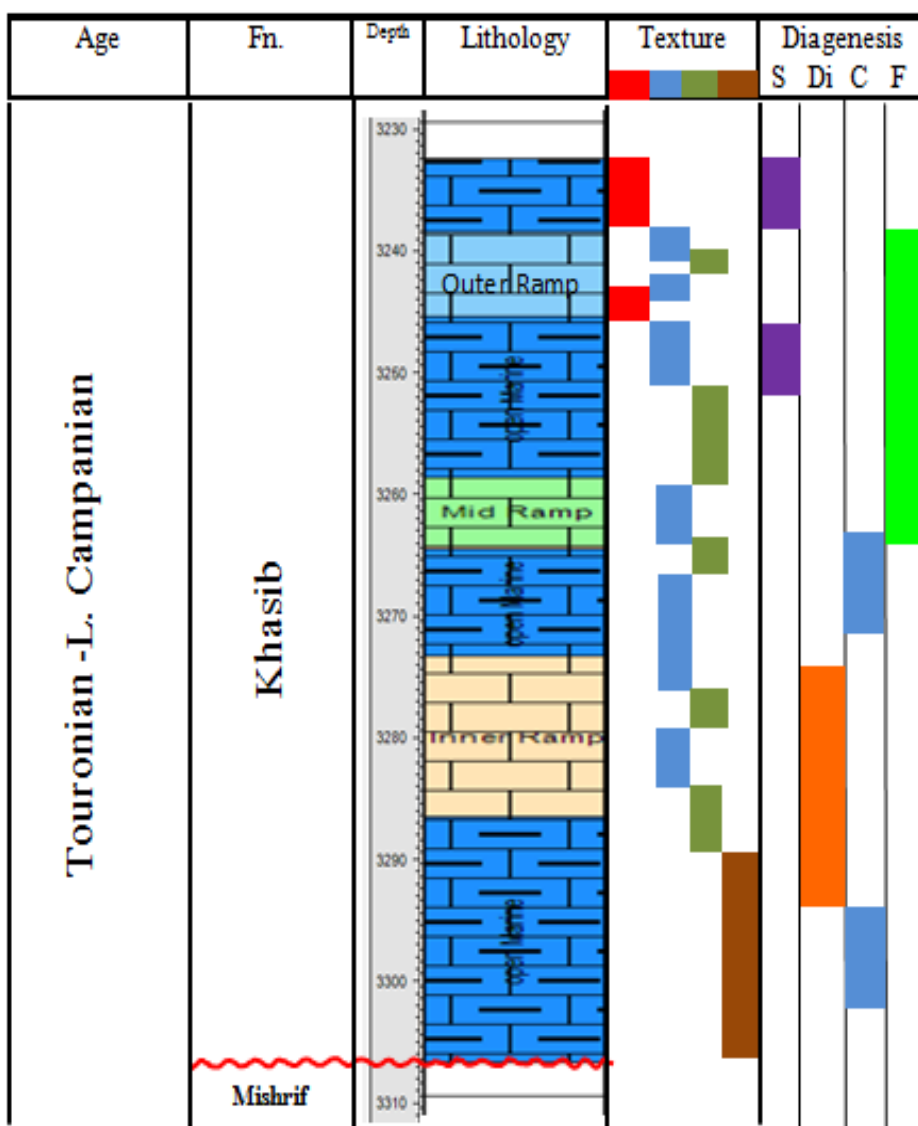


Figure (6) ,Microfacies and Diageneses of Khasib Formation in No-2.

Legend

Mudstone	Red	S: Stylolite, Di: Dissolution, C: Cement , F: Fracturation
Wackstone	Blue	
Packstone	Green	
Grainstone	Brown	

Conclusions

After study and examine of the thin sections and build a geologic model by using Petrel software with the logs interpretations ; many features can be noticed, so they are as it follow :

- There are five microfacies discovered in whole studied area, which are :grainstone , packstone ,packstone-wackstone and mustone wackstone and mudstone.
- The microfacies type , that dominated in the Upper Khasib is wackstone and mudstone , while the domination in Lower Part is to the grainstone and packstone microfacies .Four sedimentary environments had been detected in the studied Formation;(Inner Ramp ,Mid Ramp ,Outer Ramp , and Open marine environments) .
- The reservoir characterizations in study area had become more developed and increased toward Iranian borders (southeast the study area) .
- The lateral variation in microfacies distribution can be noticed clearly from the figures below which display the variations in microfacies distributions in the area between Noor and Buzurgan Oil Fields .

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