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Microfacies Analysis, Depositional Environments and Sedimentary Model of Burdigalian Cycle in Zurbatiya Area, South-East of Iraq

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ABSTRACT

The stratigraphy and sedimentology study of Serikagni and Euphrates Formations of two surface sections in the area of Zurbatiya, located in the south-east of Iraq, the first section is represented by Wadi AL-Hashima section, and the second is represented by Ci-Coran section, research rocks composed from a repetition of limestone and marl rocks, and these rocks located within sedimentary cycle called (Burdigalian Cycle), this cycle includes Serikagni, Euphrates and Dhhban Formations, considers study area represents area overlap between Serikagni and Euphrates Formations.

Sedimentary microfacies were classified to main microfacies and submicrofacies where the recognized microfacies of Serikagni Formation are lime mudstone, lime wackstone, lime packstone and dolomitized limestone microfacies while Euphrates Formation is benthonic foraminiferal lime wackstone microfacies which contains bioturbation, that precipitated in the standard microfacies (SMF, 2,3,4,8,7) and the five facies zones (FZ-1) of basin environment, (FZ-2) in the open sea shelf environment, (FZ-3) in the deep shelf margin environment, (FZ-4) in the fore slope environment, (FZ-5) fore reef environment.

The correlation between the studied sections depending on these microfacies and the variations between the studied formation, we deduced the sedimentary environment for these formations and draw sedimentary model.

1. Introduction

Formations of the Tertiary period are considered one of the formations that occupied large areas of surface and subsurface outcrops. The feature of the Tertiary period that the sedimentary basin which reached to its completed development, and the construction movement for mountains (Orogenic belt) formed the general framework to distribute the sedimentary basins which helped of the deposition of these rocks. This study is one of the most important studies because the widespread the sediments of this period, and it coverage a large areas of the country, in addition to the economic importance of these rocks which contain oil reservoirs and industrial uses, The person who first described Serikagni Formation is [1]. from the type area at Bara village in (Jabal Sinjar). [2] determined Serikagni environment in the Sinjar region is open-sea environment depending on the planktonic foraminifera.[3] mentioned the

environment of Euphrates Formation are fore reef, reef and lagoon. [4] determined the environment of Euphrates Formation is a shallow beach environment depending on the benthic foraminifera. The study area is represented by two sections in Zurbatiya area, a Wasit governorate, south-east of Iraq which is located (18) km from Badra district, a border crossing Iran in the south-east of Iraq between latitudes (3682700) and (3662769) to the north and longitudes (602124) and (598884) to the east, showing in figure (1). The studied area tectonically located in the low folded zone of the Unstable Shelf according to [5]. showing in figure (2). The main goals of the study are studying petrographic and microfacies at these sequences, and locate its stratigraphy position and its lithological type and find the sedimentary environment for the sequences of this unit and to drawing its sedimentary model.

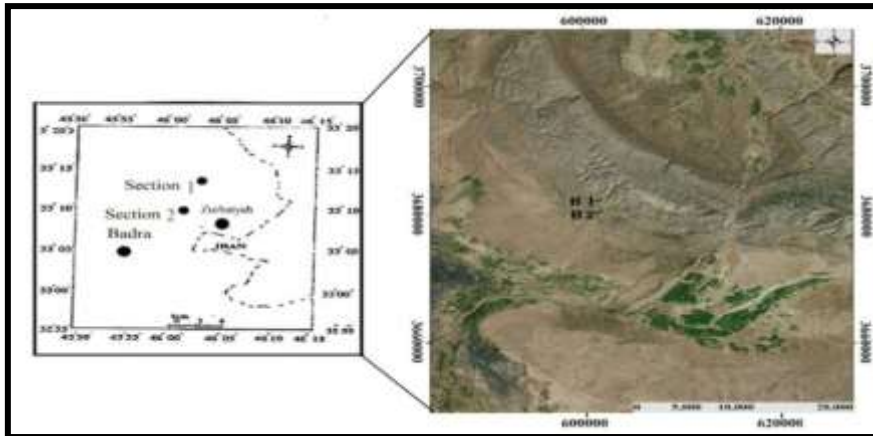


Fig.(1): The location of study in the (Zurbatiya) area at Iraqi-Iranian border

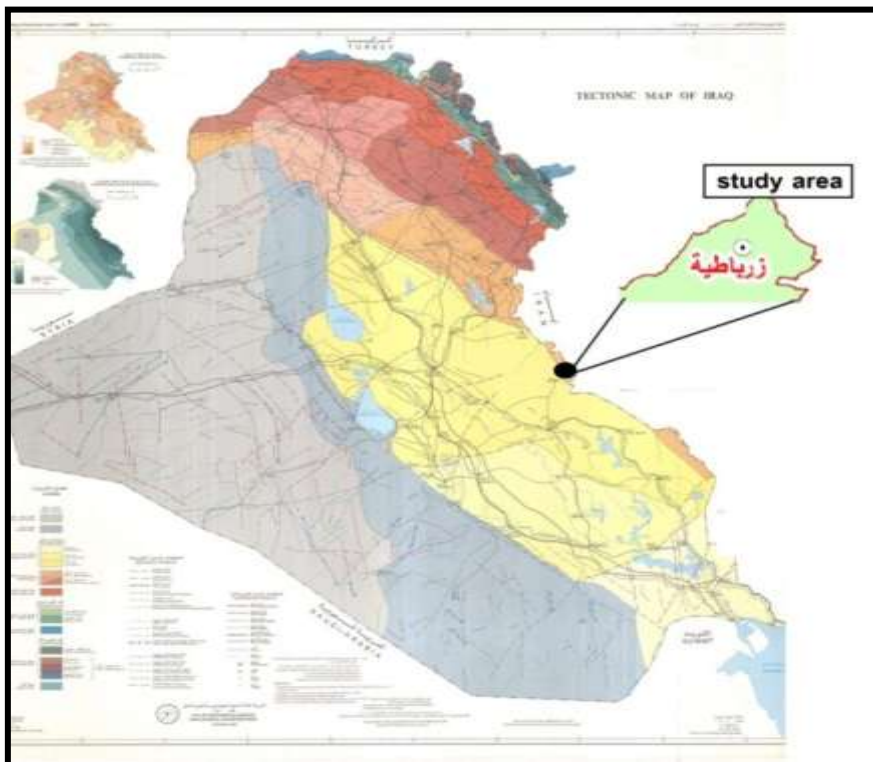


Fig.(2): Tectonic map of Iraq, modified From [5]

2. Methodology:

The research methods included several stages, such as the preparatory, field work and laboratory work stages, as follows:

preparatory work stage, this stage included collecting the necessary informations about the study area through reading the reports, researches and studies related of the Zurbatiya area or related to the same subject and benefit from it, and collect the topographic and geological maps for the study area and around it to benefit from it in the field work.

Field work stage, the present study is consist of two parts, sedimentary and stratigraphy studies, and the second part is a stratigraphy study, two sections were selected from the study area, the first section include (20) samples, and the second section include (18) sample.

Thin sections method, this method was adopted in the study of hard samples, where studied (38) thin sections by one slide and sometime two slides for each facies for the purpose of studying the microfacies.

3. Microfacies studies:

The present study was depended on classification [6]. Showing in figure (3) for nomenclature and classification of carbonate microfacies, for representing the different deposition textures through the relationship between skeletal grains and matrix because easy used it, then, the petrography study of limestone and skeletal components of organic and non-organic, skeletal components were composed of fossils and bioclasts, and the foraminifera is a high percentage where compare with other fossils, planktonic foraminifera is wide spreading, while percentage of benthic foraminifera is less than

planktonic foraminifera at the studied sections, and depending on these types, we can determine the conditions effected on paleosedimentary environments.

According to [7]. The changes which happening in the planktonic and benthic foraminifera and it's ratio will give us a guide changes at sedimentation conditions.

The lithoslides has been tested by using a polarized microscope, (38) slides were taken from two sections in this study, (20) slides from Wadi AL-Hashima section, (18) slides from Ci-Coran section. These microfacies were appeared in the studied sections were compared with standered microfacies (SMF).



Fig. (3): Classification of carbonate rocks [6]

3.A. Microfacies of Serikagni Formation:

Serikagni Formation microfacies were divided to four different main microfacies which recognized in the studied sections, with a several of submicrofacies according to classification of (Dunham, 1962) as follows :

3.A.1. Lime Mudstone Microfacies main (M):

This microfacies is a widespreade in Serikagni Formation, and it is a first grade in the studied sections, the skeletal grains in this microfacies are less than (10%). The skeletal grains are a floating in the matrix and non-contact with each other, or this microfacies may be free of skeletal grains, this microfacies was determined in the lower, middle and upper parts in Wadi AL-Hashima and Ci-Coran sections, which gives indicator that the sedimentation was happened in low energy environment [8]. The thickness of this microfacies is (12) m, it was divided into four submicrofacies:

First: Lime Mudstone Submicrofacies without Skeletal grains (M1):

In general, this submicrofacies is consist of lime mud without skeletal grains (pl. 1,fig. A), it was observed in Wadi Al-Hashima section as in samples (6&8), and in Ci- Coran section as in sample (4), while matrix is composed of dark micrite, which contains some of authigenic minerals such as pyrite, quartz, glauconite and phosphate.

This submicrofacies was subjected to dissolution, cementation, compaction, bioturbation and neomorphism (recrystallization) processes, while recrystallization process is wide spreading in this submicrofacies, as in sample (B4), the recrystallization process was affected on this submicrofacies and led to destroyed or hide fabric.

The cement types were observed in this submicrofacies are blocky, granular and drusy cement, while the porosity types represented by channel, vugy and fracture porosities, this submicrofacies matching with the standard facies (SMF-1) which precipitated in the microfacies zone (FZ-1), known with deep basin according to [9].

Second: Planktonic Foraminiferal Lime Mudstone Submicrofacies (M2):

This submicrofacies was observed in middle and top parts of the studied sections, it was occurred in Wadi Al-Hashima and Ci-Coran sections as in samples (A9, A14, A18 & B14) (pl. 1,fig. B), it composed of skeletal grains of the genus *Globigerina*, *Globotruncana* and *Globorotalia*, in addition to calcispheres.

The percentage of skeletal grains in this submicrofacies is less than (10%), the main components of the skeletal grains in this submicrofacies is the planktonic foraminifera, with a few of existences benthic foraminifera and ostracoda shells, the percentage of planktonic is more than (60%) of whole grains, while the percentage of benthic is reaching to (30%) of whole grains, the matrix is composed of micrite and microspar, and this submicrofacies is consists of quartz and phosphate grains, as well as containing mineral pyrite as veins filling for chumbers or surrounding it or spreaded in the matrix. This submicrofacies is a less spreading and mud existing is reflects the low energy environment [6].

This submicrofacies was affected by dissolution, cementation, bioturbation, compaction and neomorphism processes, while the cement types were determined in this submicrofacies are blocky,

granular, drusy and syntaxial rim cement, the syntaxial rim is appears less ratio in this submicrofacies of Ci-Coran section as in sample (14), the types of porosity was observed in this submicrofacies are channel, moldic and intraparticles porosities, non-found of planktonic and benthic foraminifera in this submicrofacies due to exposure the calcareous shells to dissolution, also non-found oxygen at deep bottoms [10].

The presence of bioclasts in this submicrofacies may transformed from shallow to the deep areas due to currents activity, this submicrofacies matching with the standard microfacies (SMF-3) which precipitated in the facies zone (FZ-2), in the open sea shelf according to classification of [9] and [7]

Third: Intraformational Foraminiferal planktonic Lime Mudstone

Submicrofacies (M3):

This submicrofacies consists of fragments, the shapes of fragments is rounded to semi-rounded and it's color is brown, the matrix is composed of micrite, the percentage of planktonic is reaching to (75%) of whole grains, while the benthic is reaching to (25%) of whole grains (pl. 3,fig. C). This submicrofacies was affected by dissolution, cementation, bioturbation, and neomorphism processes, in addition to occurring the granular cement, it contains of extraclasts and intraclasts, while the authigenic minerals in this submicrofacies are pyrite, quartz, glauconite and phosphate, in addition to channel porosity by a high proportion in this submicrofacies, it was observed in the lower part of Ci-Coran section as in sample (B2).

The occurrence of glauconite in this submicrofacies give evidence of the unconformity surface any stoped in sedimentation, this submicrofacies matching with the standard microfacies (SMF-1) which precipitated in the facies zone (FZ-1), in the deep basin according to classification of [9] and [7].

Fourth: Benthic Foraminiferal lime mudstone Submicrofacies (M4):

This submicrofacies is one of the most common submicrofacies in the studied sections, it was determined in the lower and middle part of Wadi Al-Hashima section as in samples (A1, A2, A4, A5 & A11) and in the lower and upper part of Ci- Coran section as in samples (B7 & B17).

The matrix is composed of micrite, and it contains a small percentage of the skeletal grains less than (10%) (pl. 1,fig. D). it consists of different skeletal grains of benthic foraminifers and other organisms, which is mainly represented by *Lepidocyclina*, *Nodosarai*, Mollusca and Ostracoda, in addition to the existence of some planktonic formamenifera, the percentage of benthic in this submicrofacies is reaching to (80%) of whole grains.

This submicrofacies was affected by dissolution, cementation, bioturbation, neomorphism and compaction processes, the bioturbation process is one of the most important in the submicrofacies, the

authigenic minerals were observed are quartz, phosphates and pyrite (pyrite moldic).

This submicrofacies matching with the standard microfacies (SMF-4) which precipitated in the facies zone (FZ-4), known with fore slope according to classification of [9] and [7].

3.A.2. Planktonic Foraminiferal Lime Wackstone microfacies main (W):

This microfacies is less common the two sections, it is the fourth grade in the studied sections, the percentage of skeletal grains in this microfacies are more than (10%) according to (Dunham, 1962). This microfacies are consists of skeletal grains as echinoderms, ostracoda and spongy spines. The predominant matrix in this microfacies is micrite and microspar, the percentage of benthic skeletal grains is reaching to (65%) of whole grains, the thickness is (83) cm, it was observed in the middle part of Wadi Al-Hashima section as in sample (A12), the percentage of the skeletal grains are more than (10-40%) according to [6]. The matrix is sparite, this microfacies is mainly composed of skeletal grains which represented by *Globigerina*, *Globotruncana* and *Globorotalia* (pl. 1,fig. E) with a few species of benthic organisms which represented by echinoderm, ostracoda and *lepidocyclina*, in addition to occurrence of calcispheres. The percentage between the planktonic and benthic were calculated, and the result was percentage of planktonic organisms is more than (70%) of whole grains, while the percentage of benthic is less than (30%) of whole grains. This microfacies was affected by dissolution, cementation and bioturbation processes, while the authigenic minerals were observed in this microfacies are glauconite and quartz, the cement types were observed in this microfacies is only blocky cement, whereas the porosity is one type represented by the intraparticles porosities.

This microfacies matching with the standard microfacies (SMF-2) which precipitated in the facies zone (FZ-2), represented by the open Sea shelf environment according to [9] and [7].

3.A.3. Lime Packstone Microfacies main (P):

This microfacies is wide spreading in Serikagni Formation, this microfacies was observed by high percentage in Ci-Coran section and less percentage in Wadi AL-Hishima section, it is the second grade in the studied sections, where it was observed in the middle part of Wadi Al-Hashima section and in the middle and upper part of Ci-Coran section, the thickness is about (5) m.

This microfacies is contains many types of skeletal grains, and the percentage of this grains are more than (60%) of total grains, depending on the comopnents grains occurs in this microfacies, it was divided into two submicrofacies:

First: *Lepidocyclina* lime packstone Submicrofacies (P1):

This submicrofacies consists of *Lepidocyclina* more than (50%) of whole grains, (pl. 1,fig. F), while the

planktonic foraminifera in this submicrofacies is very little, it was effected by dissolution process, it was observed in the middle part of Ci-Coran section and in the lower part of Wadi Al-Hashima section as in samples (B10, B11&A3), and the percentage of grains is about (55-65%) of total grains, while matrix composed of micrite, the percentage between the planktonic and benthic were calculated, and the result is the percentage of benthic foraminifera is more than (90%), and the percentage of the planktonic less than (10%) in the two sections.

The authigenic minerals were observed in this submicrofacies represented by pyrite, pieces of phosphate and quartz grains, while the porosity types were determined in this submicrofacies represented by moldic, channel and interparticle porosities.

This submicrofacies matching with the standard microfacies (SMF-4) which precipitated in the facies zone (FZ-4) represented by the fore slope environment according to [9] and [7].

Second: Planktonic Foraminiferal lime packstone Submicrofacies (P2):

This submicrofacies is composed of skeletal grains, with percentage of planktonic foraminifera reaches to (70%) of whole grains represented by *Globigerina* and *Globorotalia* (pl. 2, fig. A), as well as occurrence of calcispheres with high ratio, while percentage of benthic is less than (30%) of total skeletal, the grains are represented by *Nodosria*, *Ostrocodea*, *Echinoderms* and *Mollusca*, in addition to found the bioclasts, the matrix is composed of micrite, it was observed in middle part of Wadi Al-Hashima section as in sample (A7), and in the middle and upper parts of Ci-Coran section as in samples (B12&B15).

The most important diagenetic processes in this submicrofacies are dissolution, cementation, bioturbation and compaction, while the authigenic minerals were observed by pyrite, phosphates and glauconite, the porosity types were observed in this submicrofacies are moldic, channel and intraparticle porosities, it matching with the standard microfacies (SMF-3) which precipitated within in the facies zone (FZ-3), represented by the shelf margin according to classification of [9] and [7].

3.A.4. Dolomitized lime mudstone Microfacies (D):

It less spreading in the studied sections, and is the third grade in the studied sections, it was observed in the upper part of Wadi Al-Hashima section as in samples (A19 & A20), it was subjected to dolomitization process led to destroyed of all fossils

with a staying some of the traces of skeletal grains as ghosts fossils, and we could not know the types of skeletal grains, in addition to convert the mud limestone submicrofacies to dolomitized limestone submicrofacies, the skeletal grains in this submicrofacies are rarely, it consists of the dolomite textures such as fogged dolomite and sieve dolomite [11]. (pl. 2, fig. B) & (pl. 2, fig. C), the thickness is (2.4) m, it was effected by dissolution and authigenic minerals processes, the porosity types were observed are represented by vuggy, moldic and channel porosities.

3.B. Microfacies of Euphrates Formation:

The Euphrates Formation showed only one submicrofacies in the studied sections, this microfacies was observed in the lower part of Ci-Coran section, it was appear as overlap zone between Euphrates and Serikagni Formations.

Benthonic Foraminiferal lime Wackstone Microfacies (W1):

This microfacies consists from benthic foraminifera, which represented by miliolids genus *Purgo* (pl. 2, fig. D), it was observed in the lower part of Ci-Coran section as in sample (1), with (83) cm thickness, the matrix is composed of microspare, while the percentage of the skeletal grains is more than (10%), it composed mainly of benthic and it's percentage up to (100%) (pl. 1, fig. E), while planktonic foraminifera are absent in this submicrofacies, one of the most important benthic foraminifera, which appeared at the first time in the present study is (Milliolide) as in sample (B1), the presence of milliolide give an evidence of the shallow closed environment, this submicrofacies contains of bioturbation, it was effected by neomorphism, cementation, dissolution and bioturbation processes, as well as the authigenic minerals such as pyrite and quartz, while cement types were observed are drusy cement and granular, in addition to the channel porosity. This microfacies corresponding with the standard microfacies (SMF-7) which precipitated in the microfacies zone (FZ-3), as fore reef environments according to [9] and [7].

Finally, Table (3) presents a brief comprehensive presentation of all the submicrofacies within the studied formations and spreading pattern for the two sections, as well as their correlation with the standard microfacies and facies zones which deposited it. Figure (5) showing the relative distribution of submicrofacies in the two studied sections.

Table (1): microfacies in studied formations and spreading and Correlation with standard microfacies and facies zones

Microfacies	Facies existence in the sections		SMF	FZ
	Hashima	Coran		
Lime Mudstone SubMicrofacies Free Skeletal grains(M1)	M	R	1	1
Planktonic Foraminiferal lime Mudstone SubMicrofacies(M2)	C	R	3	2
Intraformational Foraminiferal lime Mudstone SubMicrofacies(M3)		C	1	1
Benthonic Foraminiferal lime mudstone Submicrofacies(M4)	C	C	4	4
Planktonic Foraminiferal lime Wackstone SubMicrofacies(W1)	R	R	2	2
Lepidocyclina lime packstone SubMicrofacies(P1)	M		4	4
Planktonic Foraminiferal lime packstone SubMicrofacies(P2)	R	M	3	3
Dolomitized lime stone microfacies(D)	M	R		
Benthonic Foraminiferal lime Wackstone Microfacies contains Bioturbation(W1):		M	7	3

Legend

C	Common
R	Rare
M	Middle
	Serikagni Fm.
	Euphrates Fm.

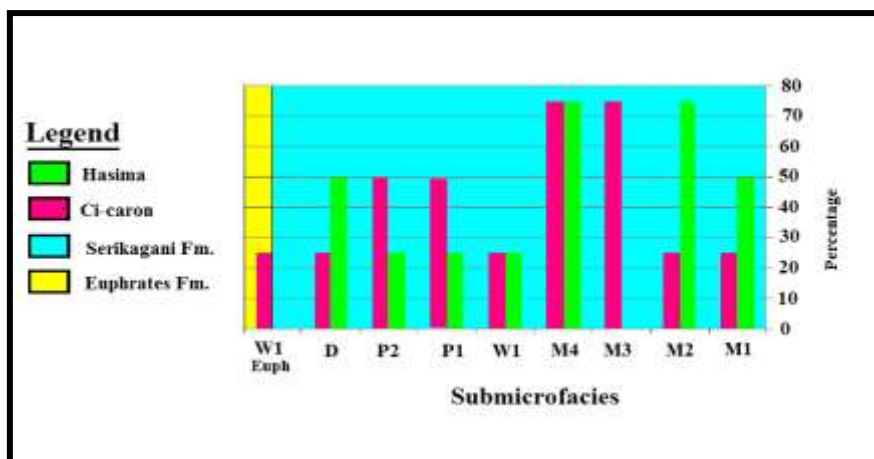


Fig.(5) : Relative distribution of microfacies in the two sections under study.

4. Correlation

Depending on the variation of submicrofacies we made a correlation between to studied sections and

consider *Lepidocyclina* (P1) as marker bed showing in figure (6).

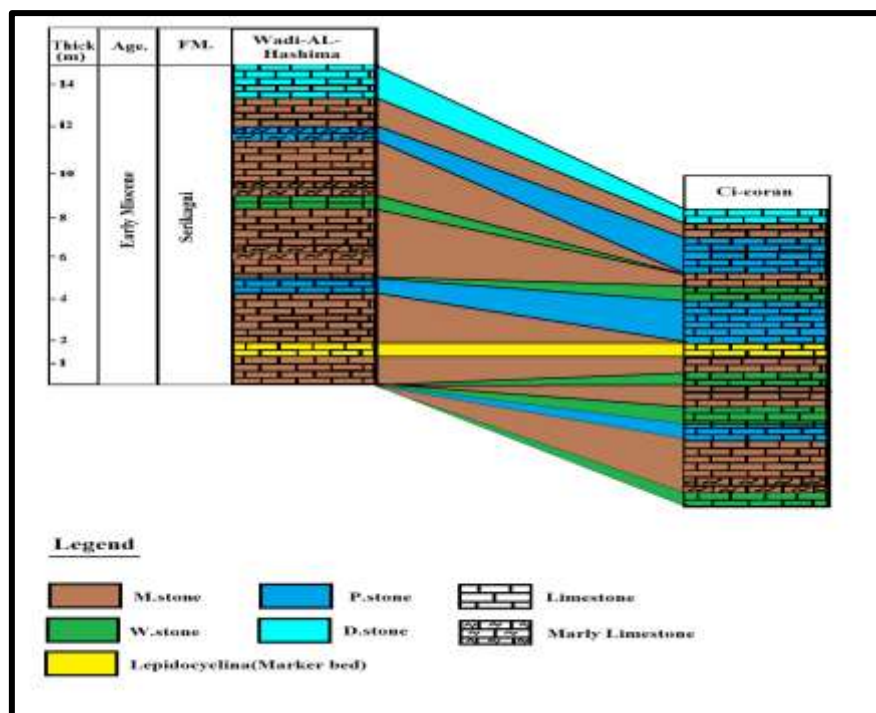


Fig.(6): Microfacies Correlation for successions Serikagni and Euphrates Formations in of Wadi AL-Hashima and Ci-Coran sections.

5. Sedimentary Environment

The sedimentary environment is any part of the land surface which can be distinguished from neighboring parts depended on the differences in the conditions of the physical, chemical and biological [8]. Wadi AL-Hashima and Ci-Coran sections were distinguished by horizontal and vertical variations, and these variations reflecting the topography of the sedimentary basin from region to other, as well as to sea-level changes during the period of deposition, figure (7) showing the sea transgression and regression for the studied sections. The geographic environments are change rapidly and their changes were affected by sea-level fluctuations, these fluctuations are controlled on the environment model and their depositional systems, Wadi AL-Hashima section was more affected by changes in sea level during the sedimentation compared with Ci-Coran section. (Jervy, 1988) explains that any change in

the sea-level (Eustatic) will lead to change in the size of sea water or size of the basin, and sea level change is associated by many factors including climate and tectonic.

The marine depth is one of the most important environmental factors which affecting on the distribution of planktonic and benthic foraminifera [12].

[13] mentioned the percentage of planktonic foraminifera/whole foraminifera increasing with depth, at depth (70) m reaches to (20%), and at water depth (85) m, the ratio reaches to (50%), at depth of less than (1000) m, the percentage reaches to (90%).

In the present study, we were depended on the information from the sedimentary submicrofacies and rate of planktonic and benthic foraminifera to explain the paleoenvironment of the Serikagni and Euphrates Formations.

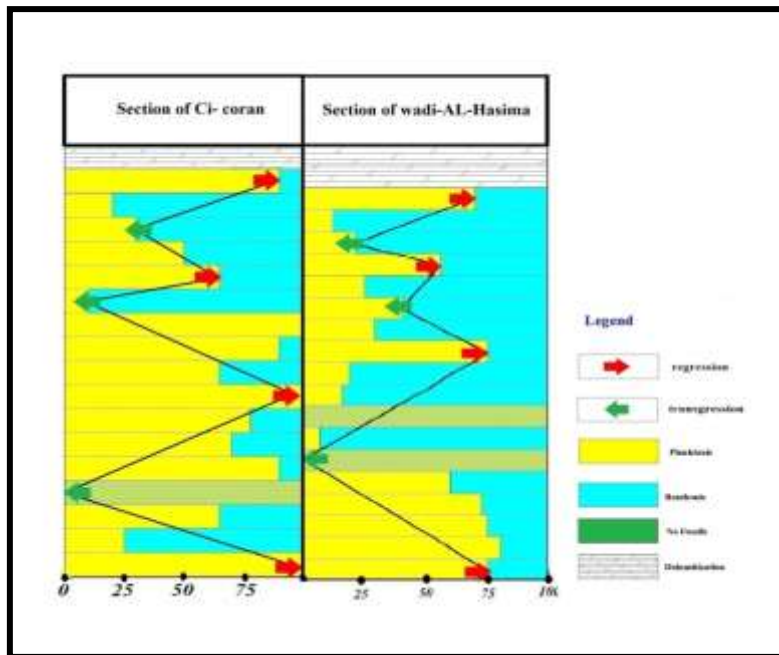


Fig.(7): represents transgression and regression for studied sections.

5.A. Sedimentary Environment For Serikagni Formation:

The Serikagni Formation is part of the second secondary sedimentary cycle for the Early Miocene (Burdigalian Cycle). It consists of limestone and marl sequences in Wadi Al-Hashima and Ci-Coran sections. The Formation is characterized by planktonic foraminifera such as (*Globigerina*, *Globotruncana* and *Globorotalia*), as well as to benthonic foraminifera such as (*Lepidocyclina* and *Nodosarai*). The percentage of planktonic foraminifera / total foraminifera within the formation sequences in Wadi Al-Hashima section is (50-70%) and in Ci-Coran is (50%).

According to [9] and [7]. depending on [6]. The sediments of the Serikagni Formation are deep facies (Pelagic), which have a high proportion of planktonic foraminifera with a few benthic foraminifera and from this the large planktonic whales believe that the deposition environment of the Serikagni Formation is a pelagic marine environment far from the coast. [14] mentioned that planktonic foraminifera adapted to living off the coast adapt to a lack of competition with benthic foraminifera, and kept shells of these foraminifera after their deposition in micrite under low environmental conditions.

[15] said that the diversity of planktonic foraminifera is a feature of the deep marine environment. The preferred environment for the living of these foraminifera is determined by the range between the outer shelf and the continental slope [16] The high rate of planktonic and the small diversity of benthonic point to sedimentation occurs in a quiet environment [17].

The presence of marly limestone gives evidence of the deep environment, and the two sections under study showed the sea transgression and sea regression

through variations between marl layers and limestone, and the standard microfacies were determined [9] and [7], depending on the [6] classification are (SMF-2,3,4,8) precipitated within four facies zones (FZ-1) known as (Basin) (FZ-2), known as (Open Sea Shelf), (FZ-3) known as (Deep Shelf Margin) and the (FZ-4), known as (ForeSlope). Most importance genres that have been identified in the present study are (*Globigerina*, *Globotruncana*, *Globorotalia*). They were observed through the lithoslides, the most common planktonic foraminifera in the sections under study are (*Globigerina*, *Globorotalia*) this genres gives an evidence of the deep environment of sedimentation that represented by bathyal and outer shelf.

5.A.1.Bathyal:

This environment was represented by basin, open sea shelf and deep shelf margin zones, which included (FZ₁, FZ₂, FZ₃), basin depth is called the deep sediments, which is more than (200) m. The bathyal environment has a wide range of the deep reaches to (1000) m [7]. This environment was determined by the grains components and the nature of the matrix. Through the microscopic study, it was observed that the mainly of Serikagni Formation submicrofacies was deposited in the deep pelagic, and these submicrofacies contains of high percentage of the skeletal grains and micrite. The submicrofacies were determined in Serikagni Formation are (M1), (M2), (M3), (W1) & (P2).

The planktonic foraminifera are more found, while benthic foraminifera are less found, this high percentage of planktonic gives evidence for the deep environment, and this agreement with [10] which mentioned that the planktonic foraminifera abundance and less benthic foraminifera gives strong evidence on the deep environment.

[10] mentioned that the occurrence of the high proportions of planktonic foraminifera in the sediments gives evidence that it was deposited towards the open sea.

occurs of calcisphere gives evidence of the deep environment. the planktonic foraminifera live in depths of (200-2000) m, while under this depth is called carbonate compensation depth (CCD), carbonate grains will dissolve because of change in conditions [10].

5.A.2. Outer shelf:

The outer shelf environment include fore slope depending on the skeletal grains and non-skeletal grains, the most important submicrofacies in this environment are (M4&P1), and these submicrofacies were determined in the lower and middle parts of the studied sections, these submicrofacies (M4&P1) were deposited in the Serikagni Formation (outer shelf) depending on some indicators such as the abundance of glauconite grains, genus *Lepidocyclina* and bioturbation, all these indicators give an indicator on the shallow environment, as well as the presence of some lithoclasts (extraclasts and intraclasts).

This agree with [18] the existence of glauconite and bioturbation in sediments gives provide that deposition was done in the shallow marine environment with slow sedimentation called the outer shelf, this is agree with [19] and [20] which they were suggested that the presence of the hard ground phenomenon and the bioturbation, all these indicators were pointed to deposition in a shallow marine environment.

5.B. Sedimentary Environment for Euphrates Formation:

The Euphrates Formation was determined in the lower part of Ci-Coran section, it composed of limestone which contains the benthic foraminifera, and the environment of Euphrates Formation is fore reef environment depending on the criteria of microfacies.

Euphrates Formation was appeared in only one sample as in (B1), this sample was appeared in lower part of Ci-Coran section.

The Euphrates Formation was represented by one submicrofacies is (benthic foraminiferal lime wackstone microfacies contains bioturbation (W1), this microfacies is shallowest in the studied sections, this microfacies was precipitated in fore reef environment, and it contains miliolids.

In the present study, it can be said the Euphrates Formation environment is fore reef environment.

6. Sedimentary model for Serikagni and Euphrates Formations:

Depending on the previous results, especially which was observed from biologically and sedimentary indicates, so, the ideas was collected for constructing the sedimentary model for how deposition formations of the present study area, and Lower Miocene (Burdigalian Cycle) in the area of (Zurbatiya) in the

south-east of Iraq will distinguish it by the sedimentary model.

The sedimentary model is a general summary of the sedimentary environment, it use for interpreting the conditions of the sedimentary environment and then constructing applied model.

The movement construction for mountains of the (Savian) which was ended the sediments of the Oligocene, and then, occurred a series of sedimentary basins, the present study formations in the basin that formed is one of these series, with the end of the Oligocene and the beginning of the Miocene, then, the Serikagni and Euphrates Formations were deposited.

In the present study, depending on observation of the percentage of the planktonic foraminifera, which were found more in Wadi Al-Hashima section, and percentage of the benthic foraminifera in Ci-Coran section were found more than in Wadi- Hishima section, then, it was observed in Wadi AL-Hishima section contains deep submicrofacies compared with submicrofacies where found in Ci-Coran section.

The submicrofacies analysis showed the common of deep basin submicrofacies in the successions of Wadi Al-Hashima section compared with Ci-Coran section.

The tectonic events are one of important factors for determining the shape of the sedimentary basin, whereas the difference in the depth of the sedimentary basin from region to other may be due to the amount of basin subsidence, as well as changes in sea-level.

These factors were affected little on Wadi AL-Hashima section compared with Ci-Coran section, the thickness of Serikagni Formation is (15) m in Wadi AL-Hashima section and (14) m in Ci-Coran section, while the thickness of the Euphrates formation is less than (1) m in Ci-Coran section. Ci-Coran section is located south of Wadi AL-Hashima section, it far a way (5) km from Wadi AL-Hashima section.

The submicrofacies which were determined in the present study are represented by the facies zones, they were determined in the studied section are (M1&M3) which were deposited in the deep basin and this environment is deepest point in the sedimentary basin, and (M2&W1) which were deposited in open sea shelf, and (P2) which was deposited in the shelf margin, and (P1, W1&M4) were deposited in fore slope, while the Euphrates Formation include only one submicrofacies represented by (benthic foraminiferal lime wackstone submicrofacies contains bioturbation (W1) which was deposited in the fore reef.

Finally, depending on the information in this present study, we worked sedimentary model for Serikagni and Euphrates Formations in the study area as in figure (8).

7-Conclusion :

In the present study, we were taken lithostratigraphy unit, and this unit was non - detailed studied in

Zurbatiyah area at south-east of Iraq, to the following conclusions:

1- The main microfacies of the formations were divided into lime mudstone microfacies, lime wackstone microfacies, lime packstone microfacies, dolomitized limestone microfacies and benthic foraminiferal lime wackstone microfacies contents bioturbation, this microfacies were divided into submicrofacies according to their presence in each formation.

2- At the first time, lime mudstone submicrofacies free skeletal grains (M1) was determined in Serikagni Formation.

3- At the first time, correlation is done depending on the microfacies and take the samples containing the *Lepidocyclus* (marked bed).

4- By dividing the microfacies and comparing them with the standard microfacies, then, the environment of both formations as (FZ-1) known as the basin, (FZ-2) known as the open sea shelf, (FZ-3) known as the deep shelf margin, (FZ-4) known as fore slope, finally, (FZ-5) known as the fore reef.

5- Drawing a sedimentary model for studied formations.

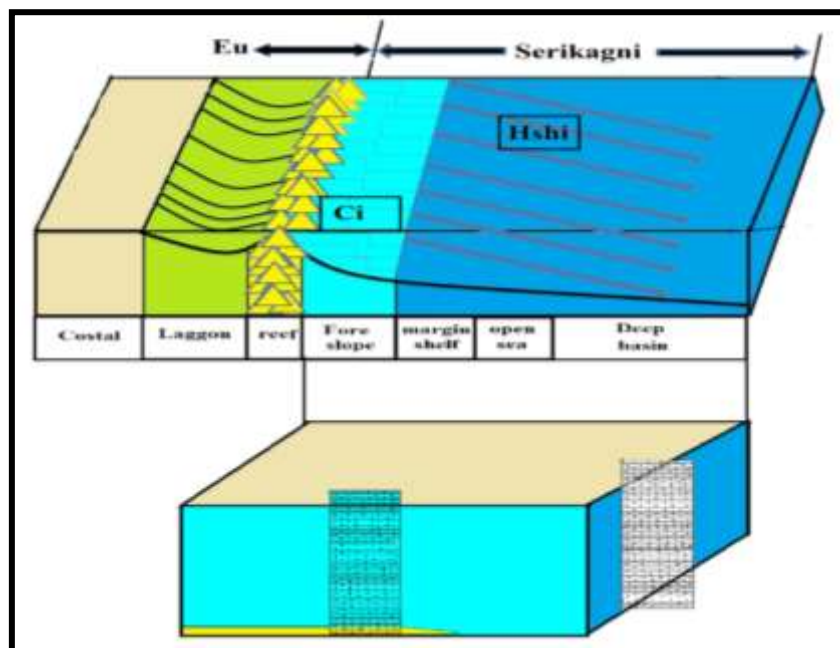


Fig.(8): Sedimentary model for studied formations in study area.

Plate number:(1)

A- Lime mudstone submicrofacies free skeletal grains in Wadi Al-Hashima section, sample number (6) (40X).

B- Planktonic foraminiferal lime mudstone submicrofacies in Wadi Al-Hashima section, sample number (18) (10X).

C- Intraformational foraminiferal lime mudstone submicrofacies, in Ci-Coran section, sample number (2) (40X).

D- Benthonic foraminiferal lime mudstone submicrofacies in Ci-Coran section sample, number (7) (40X).

E- Planktonic foraminiferal lime wackstone submicrofacies in Wadi Al-Hashima, section sample number (12) (40X).

F- *Lepidocyclus* lime packstone submicrofacies in Ci-Coran section, sample number (10) (40X).

Plate number:(2)

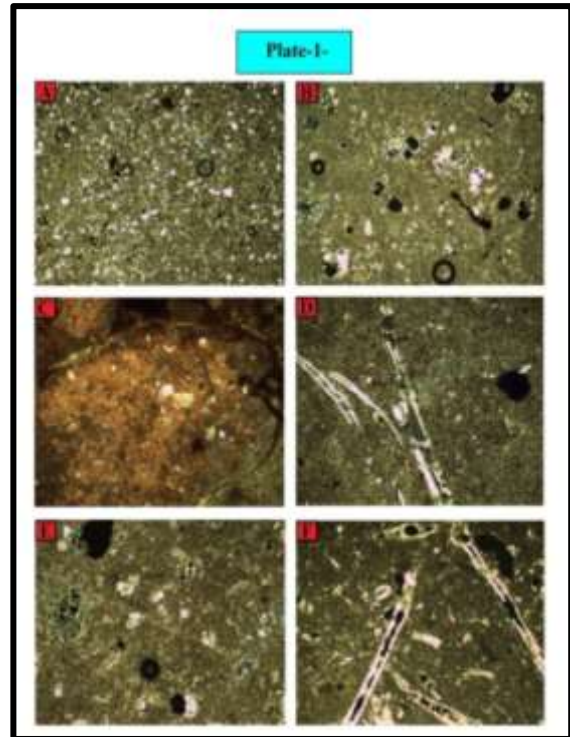
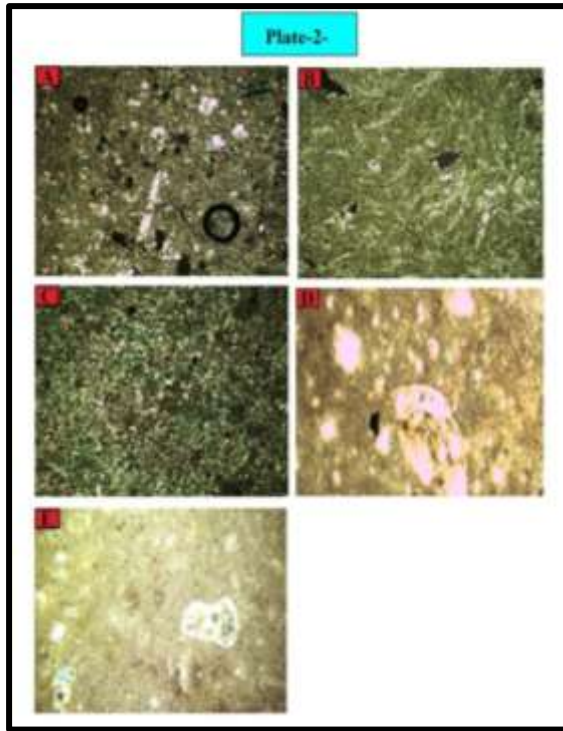
A- Planktonic foraminiferal lime packstone submicrofacies in section Wadi Al-Hashima, sample number (7) (40X).

B- Dolomitized lime mudstone microfacies contains fogged dolomite texture, in section Wadi Al-Hashima, sample number (20) (40X).

C- Dolomitized lime mudstone microfacies contains Sieve dolomite texture in section Wadi Al-Hashima sample number (19) (40X).

D- Benthonic foraminifera (*Miliolid*), of genus *Purgo* within lime wackstone microfacies in section Ci-Coran, sample number (1) (40X).

E- Benthonic foraminiferal lime wackstone submicrofacies contains bioturbation, in section Ci-Coran, sample number (2) (40X).



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التحليل السحني والبيئات الترسيبية والموديل الرسوبي لفترة البرديكالين في منطقة زرباطية، جنوب

شرق العراق

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الملخص

تم دراسة طباقية و رسوبية لتكويني سريكاكني وفرات في مقطعين سطحيين في منطقة زرباطية الواقعة جنوب شرق العراق، تمثل الاول بمقطع (وادي الهشيمة)، في حين يتمثل الثاني بمقطع (سي كوران). تتألف صخور التكوين من الحجر الجيري والمارل. تقع صخور الدراسة الحالية ضمن دورة رسوبية واحدة هي دورة البرديكالين، والتي تضم تكوينات سريكاكني والفرات والذبيان، وقد تبين ان صخور قيد الدراسة تمثل منطقة تداخل بين تكويني سريكاكني والفرات. كما تضمنت الدراسة الحالية وصف السحنات الرسوبية الدقيقة الرئيسية للتكوينات التي قسمت الى: سحنة الحجر الجيري الطيني وسحنة الحجر الجيري الواكي وسحنة الحجر الجيري المرصوص وسحنة الحجر الجيري المتدلمت و سحنة الحجر الجيري الواكي المنخري القاعي الحاوية على التعكر الحياتي والمطابقة للسحنات القياسية (SMF-2,3,4,8,7) المترسبة ضمن خمسة انطقة سحنية هي (FZ-1) المعروف بالبحر العميق (Basin)، و(FZ-2) المعروف بالرصيف البحري المفتوح (Open Sea Shelf) و(FZ-3) المعروف بالحافة العميقة Deep Shelf Margin) و(FZ-4) المعروف بنطاق مقدمة المنحدر (ForeSlope)، و(FZ-5) المعروف بنطاق امام الحيد(Fore reef)، تم المضاهاة بين المقاطع المدروسة اعتمادا على السحنات الدقيقة والتغيرات بين التكاوين المدروسة، واستنتاج البيئة الترسيبية لهذه التكاوين ورسم الموديل الرسوبي.