

Paleoenvironmental Reconstruction by Calcareous Algae at Paleocene – Early Eocene In North-East Iraq.



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ABSTRACT

The Paleocene – E. Eocene is typically rich in algae, consisting of wide selection of genera and species such as, *Dasycladacean*, *Codiacean*, *Ethilia*, *Parachaetes*, and *Archiolithothaminiun* of back reef, reef and fore reef.

This carbonate sequence comprising the Sinjar, Khurmala, Walash Naupurdan Lst. Underlain by the flysch facies of Kolosh, lower volcanic unit of and shally group of Naupurdan. Tectonic events resulting in this facies inversion from deep environment to shallow algal carbonate over the large part of unstable shelf basin in Iraq.

The contact between these two different facies is the border between two different tectonic stage, the first one was the miogeosynclinal trough of Kolosh basin followed by the second facies of epeiric shelf or ramp which is the beginning of Molasse or post orogeny facies.

Introduction

In addition to the microfossils of Alage that have been identified by a (9) (4, 5), (12) and (1) this work represents a detailed study of the environmental change in Paleocene-Early Eocene within the widespread carbonate facies outcrop in unstable platform of Iraq (Fig.1). There is a regional change in environment from deep turbidite facies to shallow carbonate, Plaeocene-Early Eocene age representing the carbonate facies at a top of flysch or semi – flysch unit (Kolosh, Naupurdan) (Fig. 2).

This carbonate rock included algal bioclastic wackestone, packstone and boundstone (10).

The aim of this study is the reconstruction of depositional environment and basin configuration by algal assemblage analysis. The rock samples were collected from the Sinjar Limestone and Kolosh at Sulaymania area and from carbonate unit of Naupurdan and Walash group at Chwarta and Rayat, so from Khurmala at Haibatsultan and Bekhma (Fig. 1).

Paleocene – early Eocene sequence:

The Paleocene-Early Eocene cycle is characterized by the development of the inner foredeeps on the shelf and by the full development of Miogeosyncline.

Geosynclinal basin of Walsh and Naupurdan group separated from the depositional trough of Kolosh by an uplifted emerged and eroded zone (2) (Fig. 2).

The algal rich carbonate facies rested on the Kolosh and Naupurdan shale after filling and shallowing of this basin (Fig. 2). The carbonate unit formed during this sedimentary cycle in the geosyncline could be divided into three facies on the basis of algal content and Paleogeographic position. The succession of calcareous algae in carbonate rock of Paleocene-Early Eocene is transgressive – regressive cycle, (Fig. 3,4) because the lower part in most sections shows diagnostic abundance of the inner shelf or back reef green algae, and middle part that is too much thicker in Basian .

Tasluja and Rayat area are recognized by coralline algae or reefal algae. So the upper part consist of fore reef algal facies and the top of all the sections show the littoral and tidal stromatolites and algal mat or land word back reef algae (Fig. 3a).

Facies development and environmental distribution pattern of Algae:

The studied sections of Paleocene-Early Eocene carbonate rocks are composed of beds of different faunal and floral assemblage that form special biofacies type which infer a particular suite of environmental parameter including chemical physical and biological aspects.

The following is biofacies type of studied sections:

Back reef or lagoonal biofacies:

The biota is dominated by dasycladacean calcareous algal, genera and species such as (Indopolia sp. Satyavanti pai, Clypeina meriendae, Pagodoporella sp., Clypeina sp., Diplopora furcoporella, Cymopolia kurdistanesis, Trinocladucus perplexus, Larvaria sp., Pagodoporella wetzeli, Amphiroa iraqensis, Parkerrella sp., Beizungia sp.) (Plate 1,2). Most of the same species were studied by (Gollesstaneh, 1979) in the study of southern Iran stratigraphy.

Some of these genera and species consist of accretionary algal coated – grains were composed of roughly concentric laminar, (Toomey, 1985) has noted that this structure is most common in near shore sediment.

Reefal biofacies:

Only in Tasluja – Basian the build – up have a wide spread horizontal rather firm substratum at the reef tops, but in Rayat and other localities the reef has patch shape or biostrom shape. Since this area was uplifted at Paleocene-Early Eocene by the effect of post – laramide the reef build up was developed on it. (Fig.3).

The biota is characterized by rich crustose coralline algae which are often associated with corals.

The algae represent at the sea ward reef margin facies, land ward reef margin facies and reef body such as (Lithoporella melobesioids, Parachitites districhoplax biserialis, Lithoporella melobesioides, Amphiroa iraqensis, Amphiroa sp., Lithophyllum mengaudi, Pseudolithothamnium, Cordilite cretosus, Archiolithothamnium, Ovulites sp., Trinocladucus perplexus, Halimeda nano) (Fig. 5) (Plate 3)(7). A publication by (8) briefly deals with Paleocene strata in Oman which having same assemblage of biota.

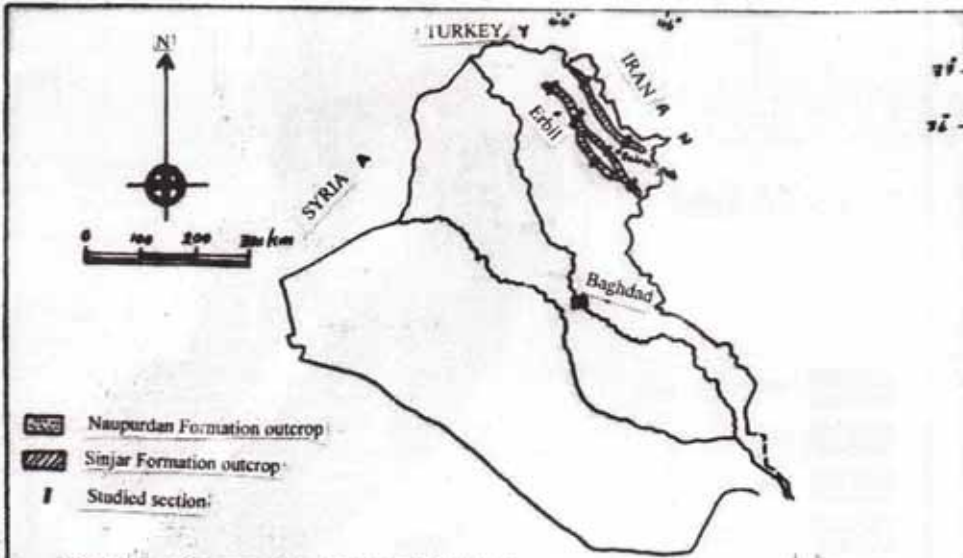


Fig (1) Location map of studied area and outcrop.

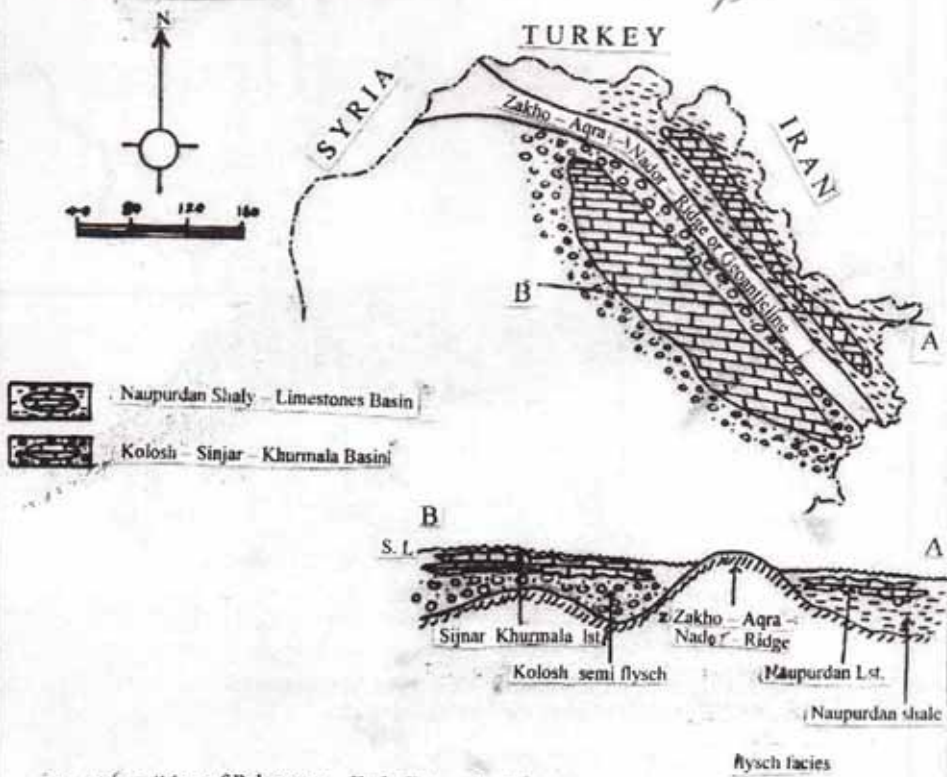


Fig (2) condition of Paleocene - Early Eocene basin.

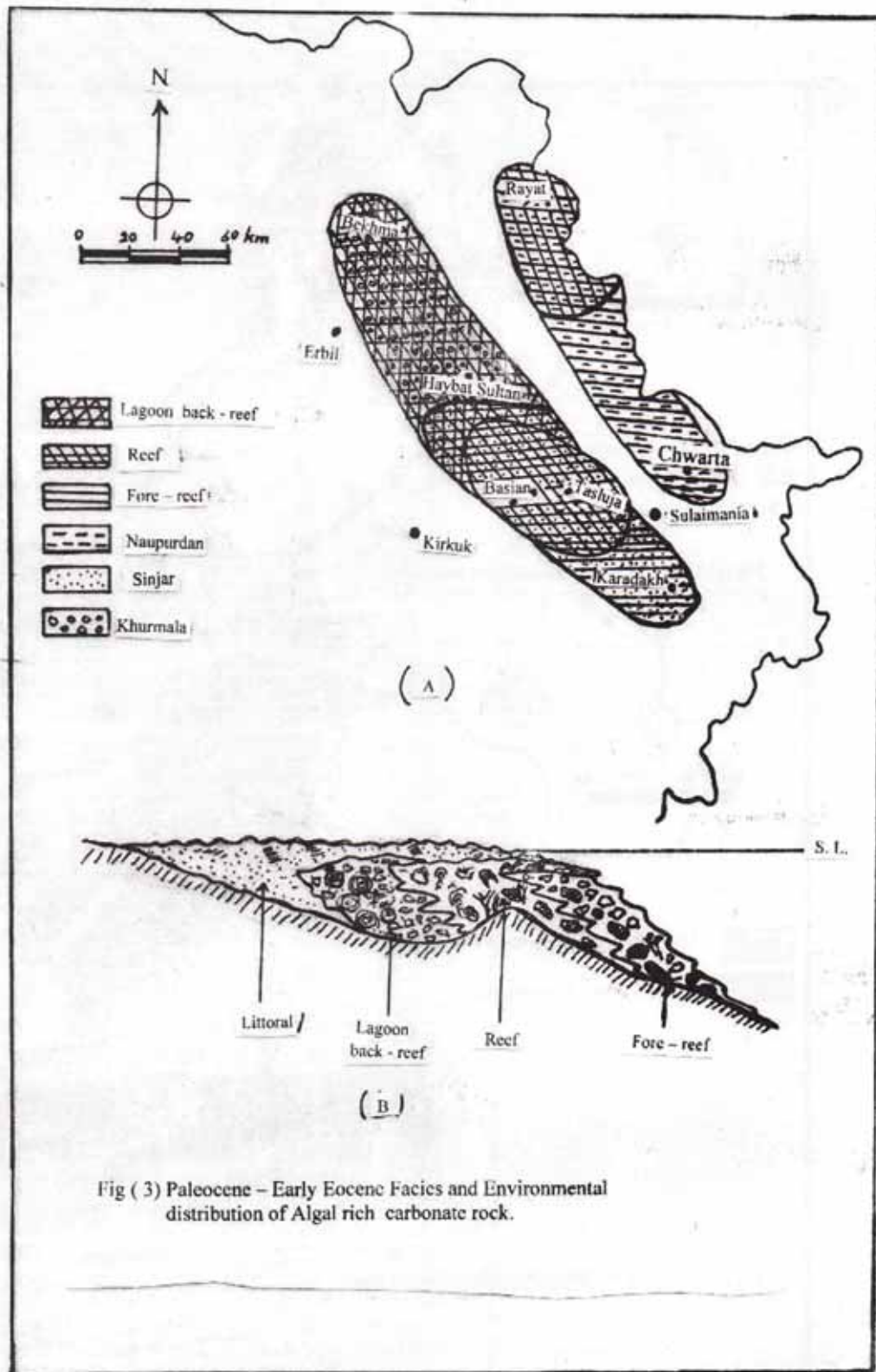


Fig (3) Paleocene - Early Eocene Facies and Environmental distribution of Algal rich carbonate rock.

Fore reef biofacies:

This facies extends from seaward reef margin into the open marine environment. Occasionally, a distinct well-bedded bank development is present. This facies is well-developed in Sulaymaniyah and Chwarta sections and has a small thickness beneath the top of other sections. The carbonate texture is composed of bioclast, mainly algal – foraminiferal packstone, grainstone and floatstone.

The biota are characterized by both encrusting and articulated types such as (*Ovulites* sp. *Trinocladus perplexus*, *Distichoplax biserialis*, *Parachitites*, *Halimeda nano*, *Ethelia* sp.) (Plate 4, 3).

Conclusion:

During the Paleocene -Early Eocene, the Laramide tectonic event resulting the Danian hiatus or uplifting were followed by the rapid subsidence of Iraqi northeastern basin. This open space depressions are filled by Red bed series, Walsh – Naupurdan group and Kolosh formation, followed by the deposition of mainly shallow water carbonates of (Sinjar–Khurmala– Naupurdan carbonate units) over the large part of northeastern Iraq in different thickness and facies.

The depositional sequence of Kolosh deep facies tend to be of second order eustatic highstand because of rapidly increasing rate of accommodation (total

space available for sedimentation) so a younger regressive progrades over the deep basin deposit. This period correlates with the eustatic sea level curve of (6).

The Paleocene-Early Eocene cycle was characterized by the development of the inner fore deeps on the shelf and the algal assemblage rests upon it. This appearance of algal assemblage was for the second time after the Jurassic in northern basin. The first one was related the Pre-flysh facies of Jurassic and the second one was combined with the post orogenic facies of Lower-Tertiary. During the deposition of algal Limestone at Lower-Tertiary the gradual sea level fluctuation left the sequence composed of three facies of algal limestone.

Back – reef or lagoonal facies with its algal assemblage was deposited in the lower part of all the sections at Dokan, Haibatsultan, and Bekhma area. Typical reef facies was developed in Tasluga, Basian and Rayat area, and as a shape of biostorm at the middle part of all other sections, fore reef facies are recognized in Baranan mountain (Sulaymaniyah) and Chwarta area, at a top of the Paleocene – Early Eocene succession.

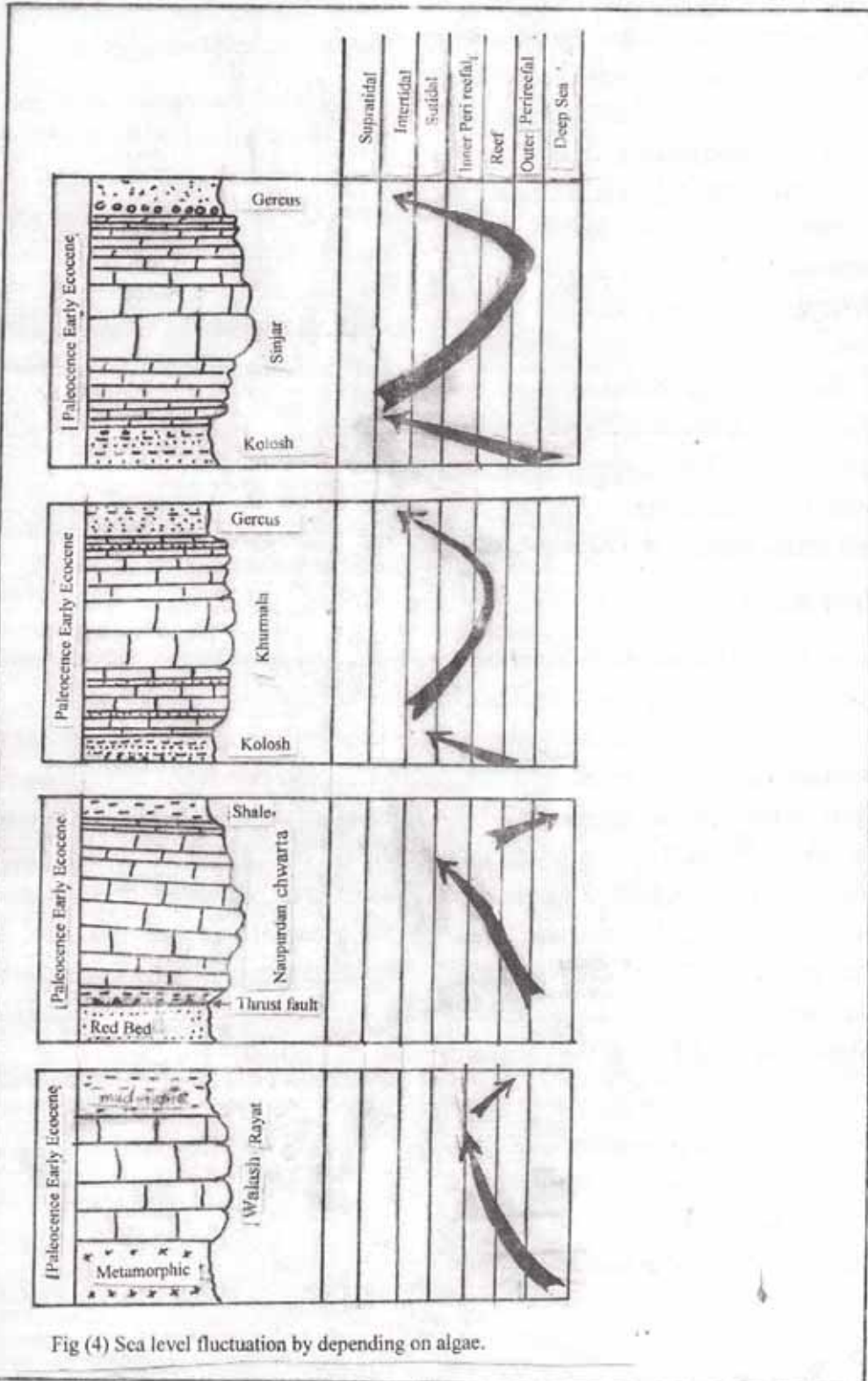


Fig (4) Sea level fluctuation by depending on algae.

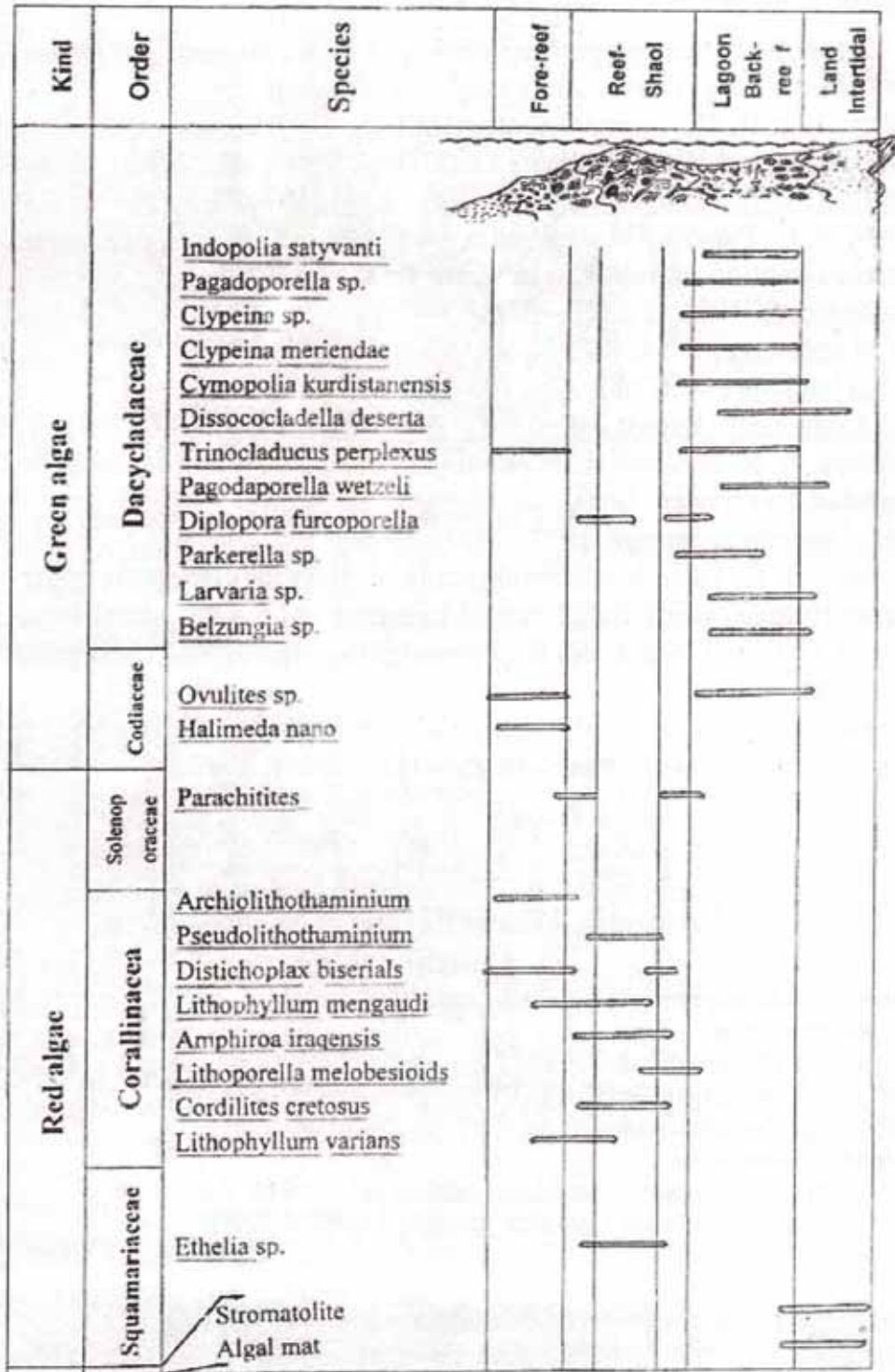


Fig. (5) Facies distribution of skeletal calcareous algae in different environment of Paleocene - Early Eocene.

References

- 1- Al – Sakri, S. I., Stratigraphy and carbonate facies formation of paleogen in North East of Iraq, Msc. Thesis, 2000, Baghdad University.
- 2- Buday, T. et al, The regional geology of Iraq, 1987 Volume 2, Tectonism, Magmatism and Metamorphism. D. G. Geol. Surv., Min. invest., 352p.
- 3- Iran Bull., Cent Rech. Explore prod Elf – Aquitaine 1979, 3,(2), 619 – 624.
- 4- Elliott, G. F., Paleocene algae from Kurdistan part2, Listed determination from the Sinjar Formation **unpublishe Inoc, No Ir/ GFG** , 1954, 105 .
- 5- Micropaleont 1956, 2 , 327 – 334.
- 6- SEPM spec. pul , 1988, 42 , 71-80.
- 7- AAPG Bulletin , 1999 , 83 (2) , 193-211
- 8- Bull, Cent. Rech. Explor – prod Elf – Aquitaine , 1979, 3, (2) ,767 – 779.
- 9- Shathaya, H. F., Biostratigraphy of sinjar Formation, unpublished M.Sc. **Thesis, Baghdad University**, 1980 .
- 10- Iraqi Geological Journal, 1997, 30(2), 79-90
- 11-Toomey, D. F., Paleodepositional setting of Rhodoliths from the upper Pennsylvanian (virgil) Salem school Limestone of North Central Texas, 1985 in Toomy D. F. and Nitecki M. H., **Paleoalgology springer – verlag Berline – Germany**, 1988.
12. Zahawi, A. W., Facies analysis of Paleocene lower Eocene sequence in Northern Iraq, unpublished M.Sc. thesis, Baghdad University, 1998.

Paleocene – Early Eocene calcareous algae Classification

- 1- **Phylum** : Rhodophycophyta (marine red algae)
Class: Rhodophyceae
Subclass : Florideophycidae
Order : Cryptonemiales
- A. **Family** : Corollinaceae
- 1- **Subfamily: Corollineae**
Genera : Amphiroa species: Amphiroa iraqensis (ELLIOTT)
Genera : Cordilites species: Cordilites cretasus (LIMOUREUX)
- 2- **Subfamily: Melobesieae**
Genera :
1- Archiolithothaminium species: Archiolithothaminium sp. (ROTHPLEZ)
2- Lithophyllum species: Lithophyllum mengaudi (PHLIPPI)
3- Lithoporella species: Lithoporella melobesioides (FOSLIE)
4- Distichoplax species: Dischoplax biserials (DIETRICH)

- B. Family** : **Squamaviaceae**
Genera : Ethelia species: Ethelia sp.(PFENDER)
- C. Family** : **Solenoporaceae**
Genera : Parachactetes species: Parachactetes sp. (DENIGER)

Phylum : **Chlorophycophyta** (marine green algae)

Class : Chlorophyceae

A. Order : Dasycladales

Family : Dasycladaceae

1- Subfamily : **Furcoporella**

Genera : Furcoporella species: Diplopora furcoporella (SCHAFHAUED)

Genera : Clypeina species: Clypeia merindae, Clypeina sp (MICHELIN)

2- Subfamily : **Thyrosoporelleae**

Genera : Trinocladus species: Trinocladus perplexus (RAINERI)

Genera : Belzangia species: Belzangia sp. (MORELLET)

3-Subfamily : **Neomereae**

Genera : Cymopolia species: Cymopolia Kurdistanensis (ELLIOTT)

Genera : Parkevella species: Parkerella sp. (MORELLET)

Genera : Larvaria species: Larvaria sp. (ELLIOTT)

4- Subfamily : **Pagodaporellae**

Genera : Payodaporellae species: Pagodaporella wetzeli (ELLIOTT)

5- Subfamily : **Dissococladellae**

Genera : Dissococladella species: Dissococladella deserta (RAINERI)

Order : Siphonales

Family : Codaceae

Genera : Halimeda

species: Halimeda nano (LAMOUREOLIX)

Genera : Ovulites

species: Ovulites sp.(LAMARCK)

Plate 1

Fig. A Back – reef facies with Pagodaporella sp. 32x Sinjar fm. 25k.

Fig. B Sea ward back – reef grainstone with Larvaria sp. 160x 30B Sinjar fm.

Fig. C Diplopora furcoporella 160 x Khurmala 11H.

Fig. D Back – reef packstone with Dacycladacian Bioclast 32x Naurpurdan 35 ch.

Fig. E Packstone with unknown species (U) and Indopolia sp. (T) Dissocladella deserta (X) 160x Sinjar fm. 8 B

Fig. F Longitudinal and traversal section of Cymopolia kurdistanensis 90x Khurmala fm. 10kh.

Fig. G Clypeina sp. Back – reef facies 160x Sinjar fm. 10k.

Fig. H Back- reef facies with Pagodaporella wetzeli 130x Naupordan fm. 33ch.

Plate 2

- Fig. A Indopolia satyavanti 130x Sinjar fm. 9k.
Fig. B Back – reef facies with Clypenia merienda 130x Khormal fm. 10H
Fig. C Back – reef wackstone sea ward with Clypenia merienda (I) Trinocladucus perplexus (T) Dissocladella deserta (X) 32x Sinjar fm. 54k.
Fig. D Back – reef facies Clyeinia sp. 160x Khurmala 13 H.
Fig. E Parkerella sp. 160x Khurmala 13 H.
Fig. F Landward back – reef Wackstone facies with Dissocladella deserta 32x Sinjar fm. 18 B.
Fig. G Landward back – reef facies with unknown sp. (X) and Belzungia sp. (S) 160x Sinjar fm. 7k.

Plate 3

- Fig. A Seaward reef margin facies with Archolithothamnium 70x Sinjar fm. 9t.
Fig. B Landward reefal grainstone with Cordilites Cretosus (O) 32x Sinjar 18 T.
Fig. C Reefal facies with Lithophyllum mengaudi (R), Amphiroa sp. (N) unknown sp. (X) 32x Sinjar fm.. 30 B.
Fig. D Seaward reefal facies with crustaceous algae, Ethelia sp. 70x Naupurdan fm. (5R)..
Fig. E Reefal facies with Lithoporella melobesioids 160 x Naupurdan 7R.
Fig. F Reefal Facies with Pseudolithothamnium , 32x Sinjar fm. 20B..
Fig. G Reefal Facies with Amphiroa Iraqnesis 32x Sinjar fm. 14 T..

Plate 4

- Fig. A Fore – reef facies with Echelia sp.. 32x Sinjar fm. 60B
Fig. B Fore – reef facies with Parachitites sp.. 32x Sinjar 50K
Fig. C Fore – reef facies with Distichoplax biserials 32x Walash 10R..
Fig. D Fore – reef facies Ovulites sp.. 70x Sinjar 55k.
Fig. E Distichoplax biserials sinjar 60K 32x..
Fig. F Cymopolia sp... 160x Sinjar 30 B.
Fig. G Halimeda sp. 22x Sinjar 29k.
Fig. H Fore – reef facies Halimeda nano 32x Sinjar 55k.

I LATE I



A



B



C



D



E



F

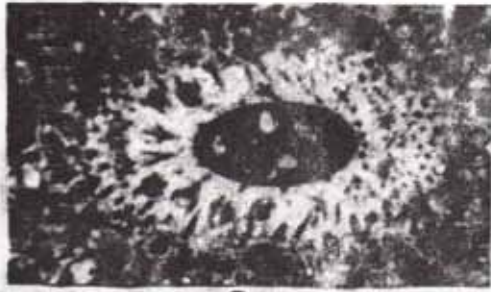


G



H

PLATE 2



A



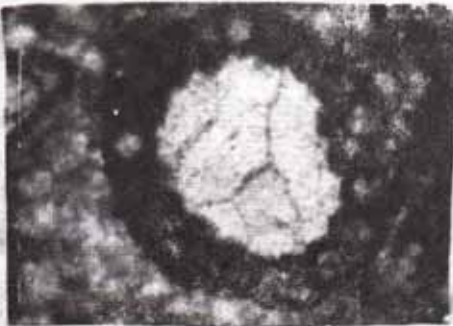
B



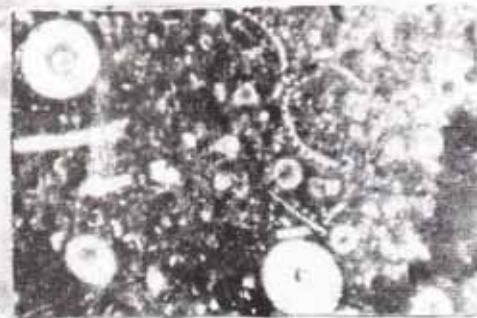
C



D



E



F



G

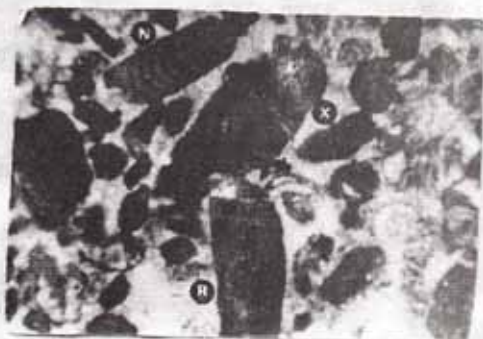
PLATE 3



A



B



C



D



E

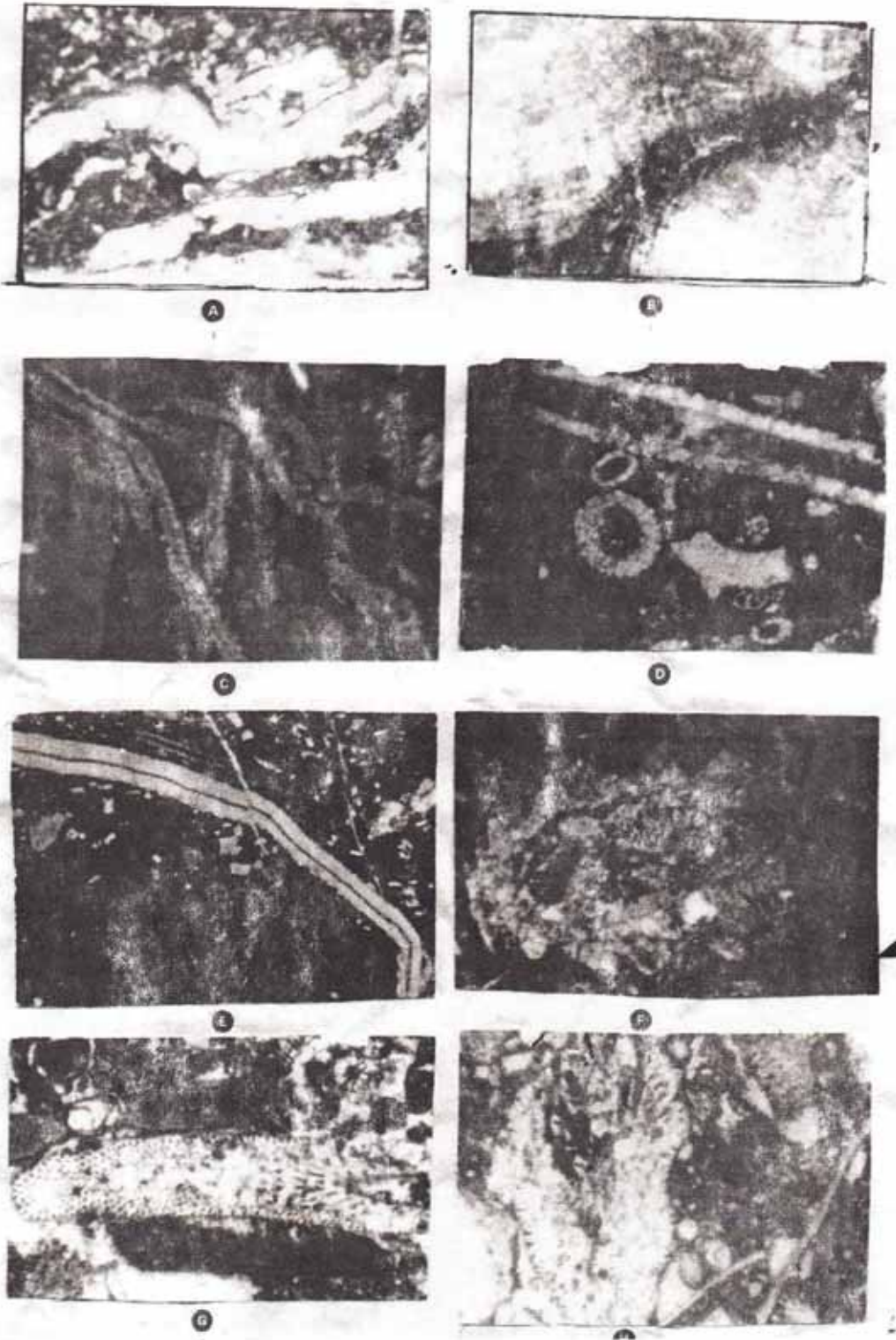


F



G

PLATE 4



دیرینه شۆئنه وار بنیاتنانه وه به هۆی قهوزه کلسیه کانه چاخى پالیوسین - نیوسینى ژیرینه له باکوورى رۆژهه لاتی عیراق

علی محمود اسعد سورداشی

بهشی زهوی ناسی کۆلیجی زانست

زانکۆی سه لاجه ددین / شهولیر - شه ریمی کوردستانی عیراق

پهخته

چاخى پالیوسین - نیوسینى ژیرینه به شه یوه یه کی تاییه تی زهنگینه به
قهوزه که پیک هاتوو له چه ندین ره گه ز و جوری جیاواز وه کو
(*Dasycladacean, Codiacean, Ethilia, Parachaetes, Archiolithothaminium*) که تایه تن
به لوتکه قهله زو پشت و پینشی لوتکه قهله ز.

ئه م چینه کلسیه یه که له دوا یه کانه پیک هاتوو له پیکهاته کانی سنجار و خورمانه و ناوپردان که دانیش توونه
له سه روه به رده فلیشی کۆلۆش و گروه زیخه کانی ناوپردان . کاره ساته تیکتونیه کان بوونه ته هۆی گۆرانی
گۆماوه کانی نیشتنی قول به ره و نیشتن له گۆمه تهنک و نهویه کاندایه شه یوه قهوزه ی کلسی له سه ر رووبه ریکی
فراوانی ناوچه ی ناجیگیری عیراق . ناوینی نیوان شه م دوو رووبه ره به رده سنوره له نیوان دوو قوناغی
جیاوازی تیکتونی ، یه که میان بریتی یه له نشیری مایوجیوسینکلاینی کۆلۆش وه دووه میان بریتی یه له شه سته
که ناری گۆماوینکی تهنکی مۆلاسی دوا ی جووله چیا بنیاتنه ره کان .

أعادة بناء البيئة القديمة بواسطة الطحالب الكلسية في باليوسين - الأيوسين المبكر في شمال شرق العراق

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الخلاصة

ان فترة الباليوسين - الأيوسين المبكر ممثلة بكثرة تواجد الطحالب من الاجناس والانواع المختلفة مثل (*Dasycladacean, Codiacean, Ethilia, Parachaetes, Archiolithothaminium*) المترسبة في بيئات خلف الحيد ، الحيد وامام الحيد.

ان تتابع الكربونات لتكوين سنجار و خورماله و ولاش و ناوبردان تقع فوق السحنات الفليشية لتكوين كولوش والوحدات البركانية السفلية لتكوين ولاش مع مجاميع السجيلية لتكوين ناوبردان . ان الاحداث التكتونية هي المسببة لتقلب السحنات من العميقة الى السحنات الطحلبة الكلسية الضحلة فوق الجزء الواسع لنطاق غير المستقر في العراق .

ان الحد الفاصل بين هذين السحنتين عبارة عن الحد بين مرحلتين تكتونيتين مختلفتين ، المرحلة الاولى عبارة عن سحنات كولوش المترسبة في غور المايوجيوسينكلايني وتلاحقه المرحلة الثانية من السحنات المترسبة في الرف القاري الضحل الذي عبارة عن بداية ترسيب السحنات المولاسية بعد الحركات البانية للجبال .

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