

## Biostratigraphy and Paleoecology by Calcareous Nannofossils and Ostracoda of Tanuma Formation, Central Iraq

Omar A. Al-Badrani

Sanad A. Al-Khashab

Department of Geology  
College of Science  
University of Mosul

(Received 13/11/2012 , Accepted 9/4/2013)

### ABSTRACT

Forty three samples of limestone and shales from Tanuma Formation obtained from East Baghdad well (No. 11) at depths of, (2067 - 2177 m.) that is with about (110 m). thickness were studied. Details investigation which were carried out identified twenty species of calcareous nannofossils, sixteen described from other region and four left with an open name due to rare and not clear samples. Furthermore, twenty four species of ostracodes belonging to fourteen genera were recorded, these are: *Bairdia*, *Brachycythere*, *Curfsina*, *Cythereis*, *Cytherella*, *Cytherelloidea*, *Dolococytheridea*, *Ovocytheridea*, *Paracypris*, *Protocythere*, *Pterygocythere*, *Schuleridea*, *Spinoleberis*, *Veenia*.

The recorded calcareous nannofossil assemblages permit to recognize two biozones; these are:

**2- *Micula cf. decussata* Interval Biozone (CC14).**

**1- *Marthasterites furcatus* Interval Biozone (CC13).**

On the basis of biocorrelation with previous works Coniacian age confirmed for the Tanuma Formation at the studied section. The analysis of the ostracode fauna led to conclude that the palaeoecology of the Tanuma Formation in this section is shallow marine environment at depth of about 200m in the neritic zone with warm water, under normal marine water salinity.

**Keywords:** Nannofossils, Paleoecology, Ostracoda, Tanuma, Iraq.

---

الطباقية الحياتية والبيئة القديمة باستخدام متحجرات النانو الكلسية والايوستراكودا لتكوين

التنومة، وسط العراق

سند عبد الإله الخشاب

عمر احمد البدراني

قسم علوم الأرض

كلية العلوم

جامعة الموصل

## المخلص

تم الحصول على ثلاثة وأربعين نموذجاً من الحجر الجيري والطين الصفحي لتكوين التتومة من بئر شرق بغداد (11) من الأعماق (2067 - 2177 متر) بحوالي 110 متر سما. قادت الدراسة التفصيلية للتعرف على عشرين نوعاً من متحجرات النانو الكلسية، ستة عشر منها موصوف من دراسات سابقة والأربعة الباقية تركت مفتوحة التسمية. بالإضافة إلى أربعة وعشرون نوع من الاوستراكودا تعود إلى أربعة عشر جنس قد سجلت هي:

*Bairdia, Brachycythere, Curfsina, Cythereis, Cytherella, Cytherelloidea, Dolocytheridea, Ovocytheridea, Paracypris, Protocythere, Pterygocythere, Schuleridea, Spinoleberis, Veenia.*

بالاعتماد على مجاميع حشود متحجرات النانو الكلسية المسجلة في الدراسة الحالية يمكن تمييز نطاقين حياتيين هما:

**2- *Micula cf. decussate* Interval Biozone (CC14).**

**1- *Marthasterites furcatus* Interval Biozone (CC13).**

من خلال المقارنات مع الدراسات السابقة يقترح الدراسة الحالية عمر الكونياسيان لتكوين التتومة في المقطع الحالي. وبالاعتماد على تحليل حشود متحجرات الاوستراكودا لنماذج المقطع قادت هذه الدراسة إلى الاستنتاج بان البيئة القديمة للتكوين في هذا البئر هي بيئة بحرية ضحلة حوالي 200 متر عمق في مياه دافئة تحت مياه ذات ملوحة اعتيادية.

**الكلمات الدالة:** متحجرات النانو، البيئة القديمة، الاوستراكودا، التتومة، العراق.

---

## INTRODUCTION

Tanuma Formation was first described by Rabanit, (1952) (unpublished report in Bellen *et al.*, 1959) in Zubair-3 well, between depths (2116.8 - 2146.3 m. depths) about 29.6 m in thickness at 30°23'01"N and 47°43'29"E, it consist of black shale with streaks of detrital limestone. Al-Hamdani, (1986) described supplementary type section of Tanuma Formation in well EB-12 (2222 - 2130 m depths) about 92 m. in thickness and divided it into two parts; these are; Lower Tanuma (45 m. in thickness) consists of black shale alternating with limestone, and Upper Tanuma (47m. in thickness) consists of Limestone; the formaton has been studied by from several authors as (Table 1):

Table 1: Authors Studied Tanuma Formation.

Authors	Date	Age
Owen and Nasr	1958	Late Senonian
Bellen <i>et al.</i>	1959	?Late Campanian
Chatton and Hart	1961	Turonian-Early Campanian
Al-Naqib	1967	Late Coniacian
Ditmar <i>et al.</i>	1971	Turonian-Early Campanian
Darmoian	1975	Coniacian
Hammoudi	1995	Late Turonian-Early Santonian
Al-Khashab	1996	Coniacian
Al-Shareefi	2004	Coniacian

The studied section situated in central Iraq, it lies at unstable shelf from Iraqi tectonic units (Buday and Jassim, 1987), (Fig. 1). Forty three samples were studied from Tanuma Formation from EB-11 (2067 -2177m. depths) about 110 m. thickness, consist of black shale with streaks of detrital limestone. Underlying formation is Khasib Formation which consist of shaly Limestone and overlying formation is Sa'adi Formation which consist of Limestone.

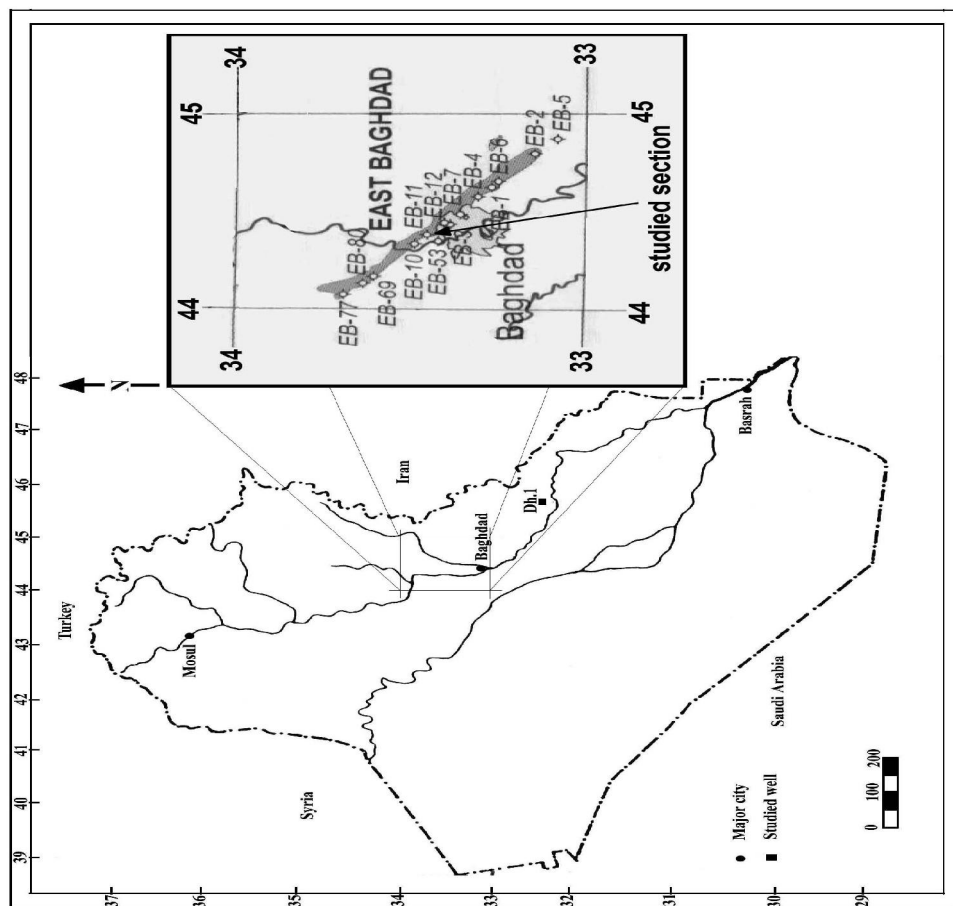


Fig. 1: Location Map of Studied Well Modified from Aqrawi *et al.*, (2010).

## SYSTEMATIC PALEONTOLOGY

### Calcareous Nannofossils Flora

- Braarudosphaera africana* Stradner, 1961  
*Braarudosphaera bigelowi* Deflandre, 1947  
*Lucianorhabdus arcuatus* Forchheimer, 1972  
*Lucianorhabdus maleformis* Reinhardt, 1966  
*Chiastozygus platyrhethum* Hill, 1976  
*Chiastozygus* sp.  
*Eiffelithius turriseiffeli* Deflandre, 1954  
*Nannoconus boletus* Deflandre and Deflandre, 1967  
*Nannoconus dauvillieri* Deflandre, 1959  
*Nannoconus donnatensis* Deres and Acheriteguy, 1980  
*Tetrapodorhabdus coptensis* Black, 1971  
*Micula* cf. *decussata* Vekshina, 1959  
*Prediscosphaera* sp.  
*Rhagodiscus angustus* Stradner, 1963  
*Corolithion singum* Stradner, 1963  
*Reinhardtites* sp.  
*Tranolithus phacelosus* Stover, 1966  
*Liliastrites angularis* Stradner and Steinmetz, 1984  
*Marthasterites furcatus* (Deflandre, 1959)  
*Marthasterites* sp.

### Ostracoda Fauna

- Bairdia* sp.  
*Brachycythere angulata* Grekoff, 1951  
*Curfsina nuda* Jones and Hinde, 1890  
*Cythereis* cf. *algeriana* Bassoulet and Damotte, 1969  
*Cythereis libanensis* Bischoff, 1963  
*Cytherella eosulcata* Colin, 1974  
*Cytherella* IRC22 Grosdidier, 1973  
*Cytherella khalidrazzaqi* Al-Abdul-Razzaq, 1981  
*Cytherella ovata* Römer  
*Cytherella* sp.  
*Cytherella sulcata* Rosenfeld, 1974  
*Cytherelloidea ghotaruensis* Singh, 1997  
*Cytherelloidea* IRC17 Grosdidier, 1973  
*Doloccytheridea atlasica* Bassoulet and Damotte, 1969  
*Ovocytheridea* cf. *producta* Grekoff, 1962

*Paracypris triangularis* Rosenfeld, 1974  
*Protocythere galileensis* Rosenfeld and Raab, 1984  
*Pterygocythere* IRE35 Grosdidier, 1973  
*Pterygocythere* IRD8 Grosdidier, 1973  
*Schuleridea* aff. *bilobata* Triebel, 1938  
*Schuleridea* IRR30 Grosdidier, 1973  
*Schuleridea washitaensis* Alexander, 1929  
*Spinoleberis yotvataensis* Rosenfeld, 1974  
*Veenia* IRD17 Grosdidier, 1973

## NANNOBIOSTRATIGRAPHY

Depending on the stratigraphic distribution of the recorded species, the two following Biozones are identified (Fig. 2):

### 1. *Marthasterites furcatus* Interval Biozone (CC13)

**Definition:** Interval from first occurrence of *Marthasterites furcatus* Deflandre(1959) to first occurrence of *Micula* cf. *decussata* Vekshina (1959).

**Thickness:** 65 m. consist of shale and limestone.

**Discussion:** The lower boundary of this biozone is not exposed in the studied section; the name *Marthasterites furcatus* zone has been used by several authors with different definitions for the lower part of the zone. Perch-Nielsen (1985) discussed this biozones in details, in this study the first occurrence of *Micula* cf. *decussata* Vekshina (1959) is it the top of biozone. Gradestine *et al.*,(2004) determinated a Turonian/Coniacian boundary which agreed with Sissingh, (1977) and Perch-Nielsen (1985); therefore, the present succession have on early-middle Coniacian.

### 2. *Micula* cf. *decussata* Interval Biozone (CC14)

**Definition:** this interval is from the first occurrence of *Micula* cf. *decussata* Vekshina (1959). to the first occurrence of *Reinhardites anthroporus*.

**Thickness:** 45 m. consists of Limestone.

**Discussion:** The lower boundary has just been explained above however, the upper boundary which is marked by the first occurrence of *Reinhardites anthroporus* was not been recorded in the studied section; therefore, the present succession has a middle-early Coniacian age, (Fig. 3).

### PALEOECOLOGY

The use of genera in paleoecological reconstruction, are more specific and gives us more details about the deposition of the formation.

The assemblage of genera of *Cytherella*, *Brachycythere*, *Ovocytheridea* refers to shallow marine environment (Salaj and Nairn, 1987). Athersuch (1994) assumed that these genera (especially *Brachycythere*) refers to shallow environment with fine grained deposits, while Ishizaki and Irizuki (1990) assigned that *Cytherella* live in a range from shallow to outer shelf environments, however, *Bairdia* indicates to shallow marine environments (Casier, 1988), while the recording of the genus *Cytherelloidea* indicates that the deposition were in a warm marine water (Morkhoven, 1963).

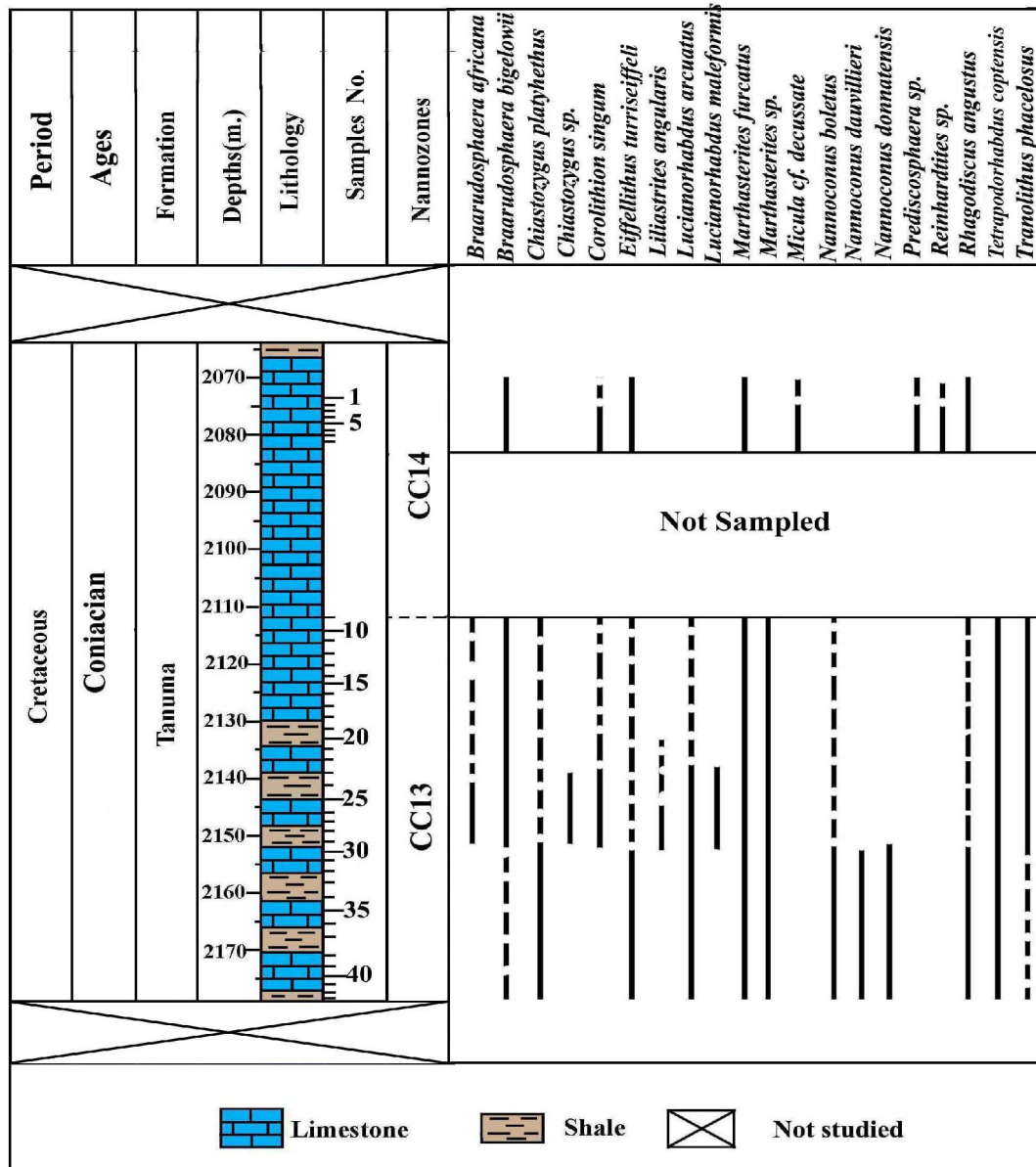


Fig. 2: Range Chart of Calcareous Nannofossils of the Studied Well, E13 (no. 11).



Athersuch, (1987) suggested that *Brachycythere*, *Cythereis*, *Ovocytheridea* and *Cytherella* refers to shallow environment deposits, while *Schuleridea* indicates o shallow marine environment with a depth less than 200m in the neritic zone (Sheppard, 1981) (Fig. 4).

From the above discussion, it is we conclude that the depositional environments of Tanuma Formation were shallow marine with a depth less than 200m in the neritic zone and warm water. the absence of salinity indicators genera points out to depositions were in a normal marine water salinity.

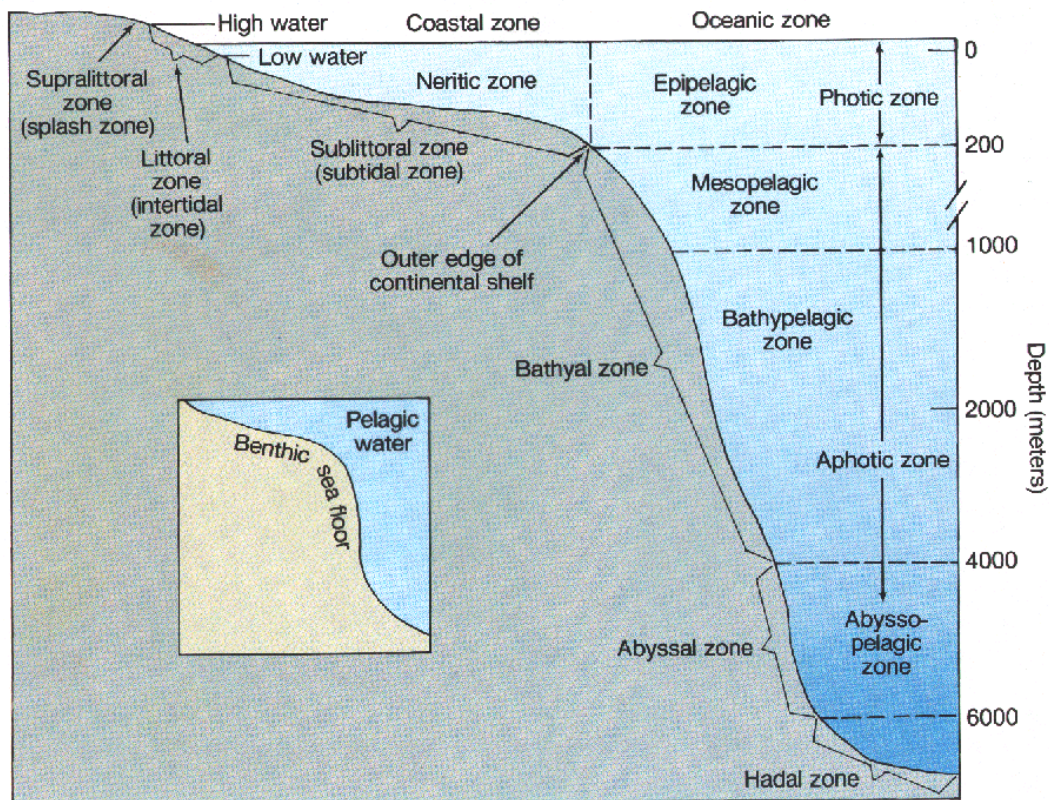


Fig. 4: Marine Environment Zones from Duxbury and Duxbury, 1994.

### ACKNOWLEDGMENT

The authors would like to express thier thanks to Dr. Abdul- Aziz M. Al-Hamdani / Dept. of Geology/ Science College/ Mosul University, for supplying the samples of the present study.



## REFERENCES

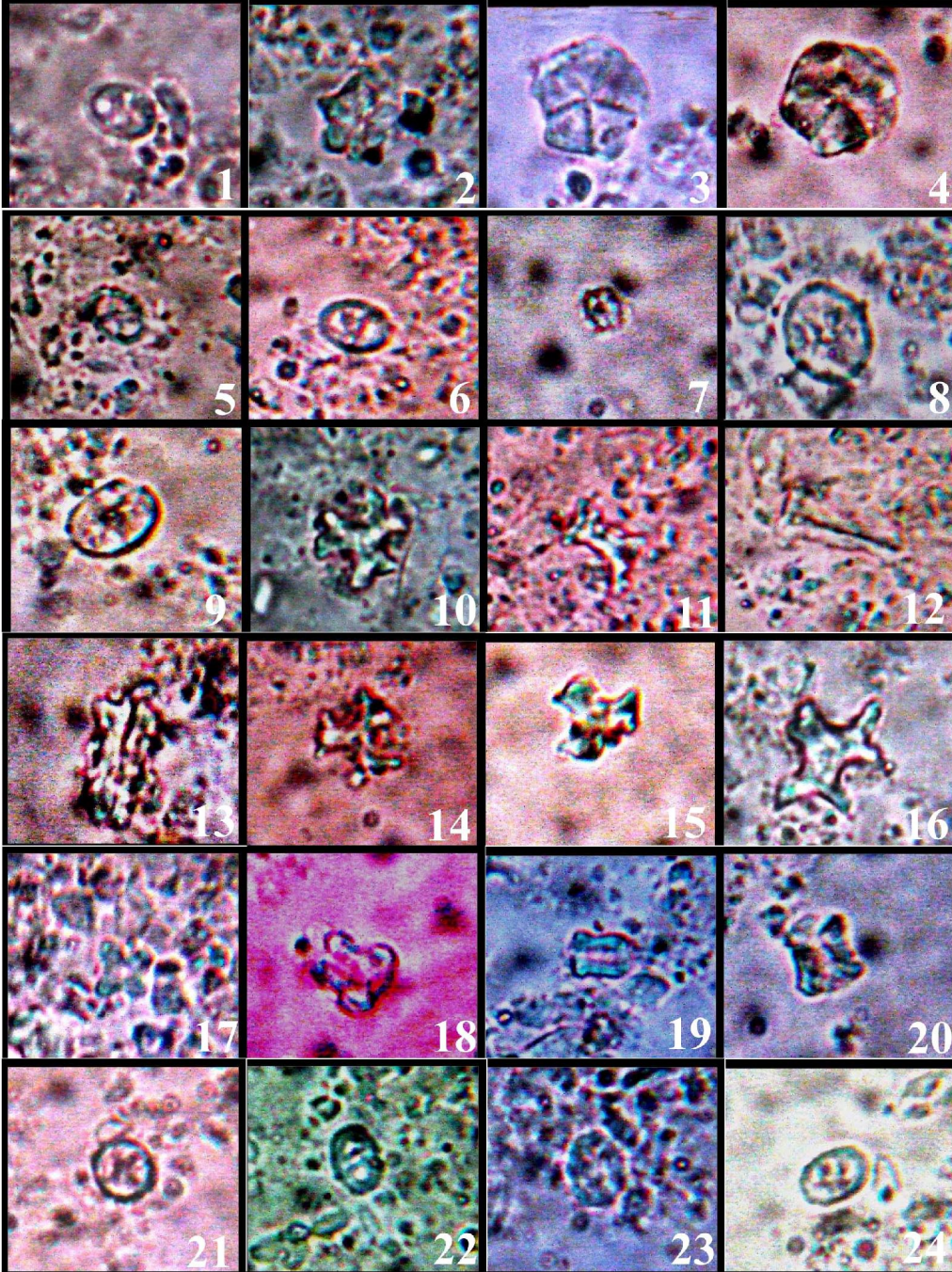
- Al-Hamdani, A. M., 1986. Stratigraphy and Geochemistry of Khasib, Tanuma and Sadi Formation, Unpublished Ph. D. thesis, Baghdad University, pp.1 - 328 (In Arabic).
- Al-Khashab, S. A., 1996. Ostracoda of Tanuma Formation in Borehole EB - 12 Northeast Baghdad city, Iraq. Unpublished M. Sc. thesis, Mosul University, pp. 1 - 93, (In Arabic).
- Al-Naqib, K. M., 1967. Geology of the Arabian Peninsula Southern Iraq. United States Government Printing office, Washington, Professional paper, 560 - G.
- Al-Shareefi, I. Y., 2004. Biostratigraphy of Ostracode and Sedimentological study of some Upper Cretaceous Formations from Selected Wells Northwest and Middle Iraq. Unpublished Ph.D.thesis, Mosul University.
- Aqrawi, A. A. M., Horboury, A. D., Goff, J. C. and Sadooni, F. N., 2010. The Petroleum Geology of Iraq. Scientific Press, 424 p.
- Athersuch, J., 1987. Ostracod faunas from the Halul, Laffan and Nahr Umr Formations of Offshore Abu Dhabi, U. A. E. *J. Micropaleontol.*, Vol. 5, No. 2, pp. 1 - 10.
- Athersuch, J., 1994. The Biostratigraphic Significance of Cretaceous Ostracodes from the Arabian Gulf. In: M. Simmons (ed.) *Micropalaeontology and Hydrocarbon Exploration in the Middle East*, Chapman and Hall, London, pp. 253 - 65.
- Bellen, R. C. van., Dunnington, H. V., Wetzel, R. and Morton, D. M., 1959. *Lexique Stratigraphic International*, V.III: Asie, Fasc. 10 a, Iraq. 333 p.
- Buday, R.T. and Jassim S.Z. 1987. *The Regional Geology of Iraq*, 2, Tectonism, Magmatism and Metamorphism, Baghdad, 352 p.
- Casier, J. G., 1988. Les ostracodes des sediments envasants du recif de la carriere beauchateau, a senzeilles (partie superieure du Frasnien, Bassin de Dinant).
- Chatton, M. and Hart, E, 1961. Reivew of the Cenomanian to Maastrichtian Stratigraphy in Iraq. *IPR.12/141*, 6/6298.
- Chira, C., Blac, R. and Vulc, A., 2004. Cretaceous Calcareous Nannofossils from Ceru Bacainiti Area, Apuseni Mountains, Romania. *Acta Paleontologica Romaniaae*, Vol. 4, pp. 89 - 96.
- Darmoian, S., 1975. Stratigraphy and Micropaleontology of the Upper Cretaceous Aruma Super Group, Southern Iraq. *Jour. Geol. Soc. Iraq. Spec. Iss.* pp. 151 - 209.
- Ditmar, V., Afanasiev, J. and Shanakova, E., 1971. Geological condition and Hydrocarbon prospects of the republic of Iraq (Northern and Central Parts). INOC Library Baghdad.
- Doeven, P. H., 1983. Cretaceous nannofossils stratigraphy and paleoecology of Canadian Atlantic Margin. In Bolli, H. M., Saundes, J. B., and Perch-Nielsen, K. (eds.), 1985, *Plankton stratigraphy*. Cambridge University Press, Cambridge, pp. 329 - 426.

- Duxbury, A. C. and Duxbury, A. B. 1994. An Introduction to the World's Oceans, Wm. C. Brown Publishers.
- Gradstein, F. M., Ogg, J. G., Smith, L. J., 2004. A new Geologic Time Scale, with Special Reference to Precambrian and Neogene. *Episodes, Articles*, Vol. 27, No. 2, pp. 83 - 100.
- Hammoudi, R. A., 1995. Stratigraphy of the Turonian-Early Campanian depositional subcycle from selected wells in Iraq. Unpublished Ph. D. Thesis, Mosul University, pp. 1 – 215, (In Arabic with English abstract).
- Ishizaki, K. and Irizuki, T., 1990. Distribution of Bathyal Ostracodes in Sediments of Toyama Bay, Central Japan. *Cour. Forsch. - Inst. Senckenberg*, 123, pp. 53-67.
- Morkhoven, F. P. C. M. (VAN.), 1963. Post Paleozoic Ostracoda Their Morphology Taxonomy and Economic use. Vol. 2, pp. 1 - 478, Elsevier, Amsterdam.
- Owen, R. and Nasr, S., 1958. Stratigraphy of the Kuwait –Basra Area. In: G.L. Weeks (ed.), *Habitat of the Oil. Symp. Amer. Ass. Petrol. Geol. Tulsa*, pp. 1252 - 1278.
- Perch-Nielsen, K. (1985). Mesozoic Calcareous Nannofossils. In Bolli, H. M., Saundes, J. B., and Perch-Nielsen, K. (eds.), *Plankton Stratigraphy*. Cambridge University Press, Cambridge, pp. 427 - 554.
- Roth, P. H., 1978. Cretaceous Nannoplankton Biostratigraphy and Oceanography of the Northwestern Atlantic Ocean. In Bolli, H. M., Saundes, J. B., and Perch-Nielsen, K. (eds.), 1985, *Plankton Stratigraphy*. Cambridge University Press, Cambridge, pp. 329 - 426.
- Salaj, J. and Nairn, A., 1987. Age and Depositional Environment of the Lower Tar "Member" of the Ziman Formation (Upper Senonian) in the Northern Hamada Al Hamra, Libya. *Paleog. Paleoc. Paleoe.*, Vol. 61, pp. 121 - 143.
- Sheppard, L. M., 1981. Bathonian Ostracod Correlation North and South of the English Channel with the Description of Two New Bathonian Ostracods. - In: Neale, J. W. and Brasier, M. (eds.): *Micro Fossils from Recent and Fossil Shelf Seas*, pp. 73 – 89, Chichester (Horwood).
- Sissingh, W., 1977. Biostratigraphy of Cretaceous Calcareous Nanno-Plankton. In Bolli, H. M., Saundes, J. B., and Perch-Nielsen, K. (eds.), 1985, *Plankton Stratigraphy*. Cambridge University Press, Cambridge, pp. 329 - 426.

## PLATE 1

- 1 *Tetrapodorhabdus coptensis* Black, 1971
- 2 *Braarudosphaera africana* Stradner , (1961)
- 3,4 *Braarudosphaera bigelowii* Deflandre, (1947)
- 5 *Chiastozygus platyhetus* Hill, (1976)
- 6 *Chiastozygus* sp.
- 7 *Corolithion singum* Stradner, (1963)
- 8,9 *Eiffelithius turriseiffeli* Deflandre,(1954)
- 10 *Liliastrites angularis* Stradner and Steinmetz, (1984)
- 11 *Lucianorhabdus arcuatus* Forchheimer, (1972)
- 12,13 *Lucianorhabdus maleformis* Reinhardt, (1966)
- 14,15 *Marthasterites furcatus* Deflandre, (1959)
- 16 *Marthasterites* sp.
- 17 *Micula* cf. *decussate* Vekshina, (1959)
- 18 *Nannoconus boletus* Deflandre, (1967)
- 19 *Nannoconus dauvillieri* Deflandre, (1959)
- 20 *Nannoconus donnatensis* Deres and Acheriteguy, (1980)
- 21 *Prediscosphaera* sp.
- 22 *Reinhardtites* sp.
- 23 *Rhagodiscus angustus* Reinhardt, (1971)
- 24 *Tranolithus phacelosus* Stover, (1966)

# Plate 1



— 5 micron

## PLATE 2

- 1 *Bairdia* sp. 40X, Carapace, LV.
- 2 *Brachycythere angulata* Grekoff, 1951. 40X, Carapace, LV.
- 3 *Curfsina nuda* Jones and Hinde, 1890. 40X, Carapace, LV.
- 4 *Cythereis* cf. *algeriana* Bassoulet and Damotte, 1969, 40X, Carapace, LV.
- 5 *Cythereis libanensis* Bischoff, 1963. 40X, Carapace, LV.
- 6 *Cytherella eosulcata* Colin, 1974. 40X, Carapace, LV.
- 7 *Cytherella IRC22* Grosdidier, 1973. 40X, Carapace, LV.
- 8 *Cytherella khalidrazzaqi* Al-Abdul-Razzaq, 1981. 40X, Carapace, LV.
- 9 *Cytherella ovata* Römer, 40X, Carapace, LV.
- 10 *Cytherella* sp. 40X, Carapace, LV.
- 11 *Cytherella sulcata* Rosenfeld, 1974. 40X, Carapace, RV.
- 12 *Cytherelloidea ghotaruensis* Singh, 1997. 40X, Carapace, RV.
- 13 *Cytherelloidea IRC17* Grosdidier, 1973. 40X, Carapace, RV (overturned).
- 14 *Dolococytheridea atlasica* Bassoulet and Damotte, 1969. 40X, Carapace, LV.
- 15 *Ovocytheridea* cf. *producta* Grekoff, 1962. 40X, Carapace, LV.
- 16 *Paracypris triangularis* Rosenfeld, 1974. 40X, Carapace, RV.
- 17 *Protocythere galileensis* Rosenfeld and Raab, 1984. 40X, Carapace, LV (overturned).
- 18 *Pterygocythere IRE35* Grosdidier, 1973. 40X, Carapace, DV.
- 19 *Pterygocythere IRD8* Grosdidier, 1973. 40X, Carapace, RV (overturned).
- 20 *Schuleridea* aff. *bilobata* Triebel, 1938. 40X, Carapace, LV (overturned).
- 21 *Schuleridea IRR30* Grosdidier, 1973. 40X, Carapace, LV.
- 22 *Schuleridea washitaensis* Alexander, 1929. 40X, Carapace, RV.
- 23 *Spinoleberis yotvataensis* Rosenfeld, 1974. 40X, Carapace, RV.
- 24 *Veenia IRD17* Grosdidier, 1973. 40X, Carapace, LV.

## Plate 2

