

Planktonic Foraminiferal Biostratigraphy of Shiranish Formation in Dohuk Area/ Northern Iraq

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ABSITRACT

The litho-and biostratigraphy of Shiranish Formation have been investigated within a well-exposed section at the southern limb of Bekhair anticline, Dohuk area, Northern Iraq. The studied section consists mainly of marl, marly limestone, and limestone. The Formation unconformably overlies Bekhme Formation and it is overlain unconformably by the Kolosh Formation. The samples of the section under investigation yielded rich and well diversified planktonic foraminiferal taxa, where 55 planktonic species belonging to 16 genera have been recognized, the detailed foraminiferal investigation permits the recognition of 8 well defined zones. These are from older at the base:

8. *Plummerita hantkeninoides* Total range Zone (Part).
7. *Pseudoguembelina palpebra* Partial range Zone.
6. *Pseudoguembelina hariaensis* Interval Zone.
5. *Racemiguembelina fructicosa* Interval Zone.
4. *Planoglobulina acervulinoides* Partial range Zone.
3. *Contusotruncana contusa* Interval Zone.
2. *Gansserina gansseri* Interval Zone.
1. *Globo truncana aegyptiaca* Interval Zone (Part).

The Planktonic zones were correlated with other zonal schemes in and outside Iraq. They are considered to be extending from middle Late Campanian to latest Maastrichtian.

الطباقية الحياتية للفورامنيفرا الطافية لتكوين شرانس في منطقة دهوك/ شمال العراق

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جامعة الموصل

الملخص

تضمن البحث الحالي دراسة الصخرية والطباقية الحياتية لتكوين شرانس في المقطع السطحي الذي يقع في الطرف الجنوبي لطية بيخير المحدبة في منطقة دهوك، شمال العراق. يتكون تكوين شرانس من صخور المارل والحجر الجيري المارلي والحجر الجيري ويحده من الأسفل بصورة غير متوافقة طباقيا تكوين بخمة ومن الأعلى تكوين كولوش بشكل غير متوافق طباقيا. تحتوي تتابعات تكوين شرانس على حشود غزيرة ومتنوعة من الفورامنيفرا الطافية حيث تم تشخيص 55 نوعا منها تعود الى 16 جنسا، واعتمادا على المدى الجيولوجي لهذه الأنواع تم تقسيم التكوين الى ثمانية انطقة حياتية وهي كما يلي من الأقدم في الأسفل:

8. *Plummerita hantkeninoides* Total range Zone (Part).
7. *Pseudoguembelina palpebra* Partial range Zone.
6. *Pseudoguembelina hariaensis* Interval Zone.
5. *Racemiguembelina fructicosa* Interval Zone.
4. *Planoglobulina acervulinoides* Partial range Zone.
3. *Contusotruncana contusa* Interval Zone.
2. *Gansserina gansseri* Interval Zone.
1. *Globotruncana aegyptiaca* Interval Zone (Part).

تم مضاهاة هذه الانطقة الحياتية مع الانطقة الحياتية لدراسات داخل العراق وخارجه وحدد على اساس ذلك عمر تكوين شرانس في مقطع الدراسة بكونه يمتد من أواسط الكامبانيان المتأخر وحتى أواخر الماسترختيان.

INTRODUCTION

The studied section is located on southern limb of Bekhair anticline 9km northeast of Dohuk city (Fig . 1). The Shiranish Formation belongs to the most widespread units of the Campanian - Maastrichtian transgressive cycle in Iraq and also in the neighbouring countries. The Shiranish Formation was first defined by (Henson 1940 in Bellen *et al.* 1959) from the highly folded zone of northern Iraq near the village of Shiranish Islam about 17km Northeastern of Zakho, It attains a thickness of 227m. consist of foraminiferal marl, marly limestone and limestone, it was deposited in outer shelf to basinal environments (Jassim and Goff, 2006). The purpose of this paper is to record the planktonic species and establish the biostratigraphic zones and correlate them with their equivalent biozones in and outside Iraq in order to determine the age of the studied section.

Lithostratigraphy and Contact Boundaries:

Shiranish Formation 57m. thick composed of alternations of marl, marly limestone and thin beds of limestone (Fig. 2), it can be subdivided into two units, the lower part of this formation consists mainly of marly limestone beds alternate with thin marl beds, while the upper part consists mainly of marl beds alternate with marly limestone beds. Shiranish Formation unconformably overlies the Bekhme Formation (AL-Haidary, 2009) and unconformably overlain by Kolosh Formation. (AL –Wazan, 2007) (Fig.3 and 4).

Materials and Methods:

Therty seven rock samples were collected at (2 - 0.5) m. intervals from the studied section. About 30g. of each sample was weighed, crushted, and boiled for (10 - 30) hours, washed over 230 mesh sieve with tap water, dried and size - sorted using a set of sieves (40 , 60 , 80 , 100 , 120 mesh), then ultrasonically agitated for (10 - 30) minuts, all specimens were picked and mounted on microslides for identification under binocular microscope.

Biostratigraphy:

The investigation of foraminiferal assemblages within the studied section revealed that planktonic species are abundant within marl, whereas they are rare or absent within the marly limestone and the limestone bed. Planktonic foraminifera have been used for biostratigraphic analysis for the studied section, their systematic study enabled the writers to identify fifty–five planktonic species (Fig. 5).

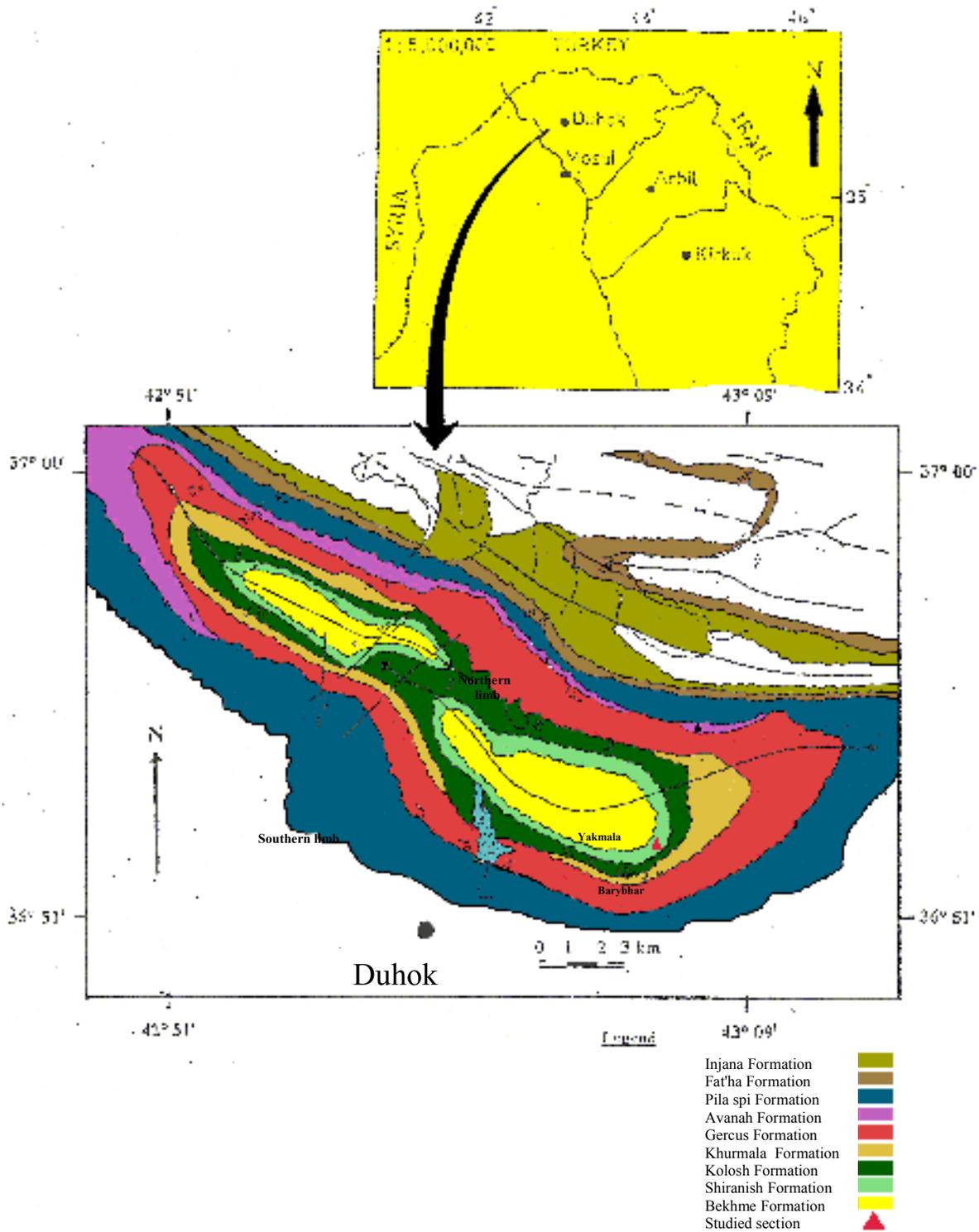


Fig. 1: Geological Map Explained the Studied Section, Modified from (F.A.O. 1994).



Fig.2: Field View of the Lower Boundary of the Shiranish Formation with Bekhme Formation.



Fig. 3: Field View of the Upper Boundary of the Shiranish Formation with Kolosh Formation.

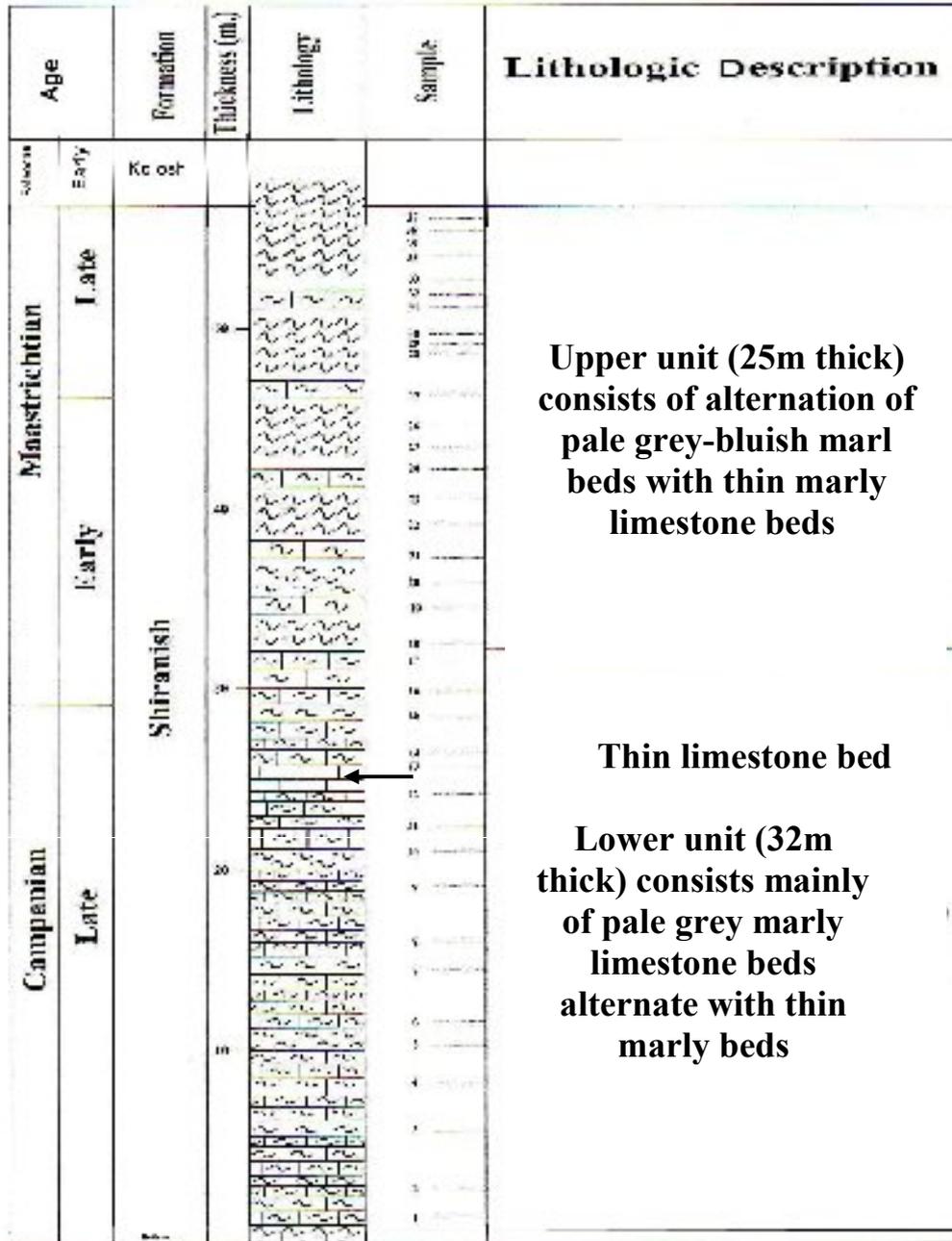


Fig. 4: Lithologic Description of Shiranish Formation in the Studied Section.

The identified planktonic foraminiferal biozones were correlated with their equivalent standard biozones in other regions of the world (Figs. 6 and 7). Furthermore, these biozones have been correlated locally with previous studies in Iraq. The studied section can be subdivided into eight biozones, these biozones were described below starting from older to younger.

1- *Globotruncana aegyptiaca* Interval Zone(CF8)(Part):

Definition: This zone was originally established by (Caron,1985). It represents the stratigraphic range of the index species *Globotruncana aegyptiaca* Nakkady which precede the appearance of *Gansserina gansseri* (Bolli).

Age: middle Late Campanian.

Boundaries: In this study the lower boundary is marked by unconformity and marked by the first appearance of index species *Globotruncana aegyptiaca*, whereas its upper boundary is indicated by first appearance of index species *Gansserina gansseri* (Bolli).

Thickness: 25.2m represented by the samples (1 - 12).

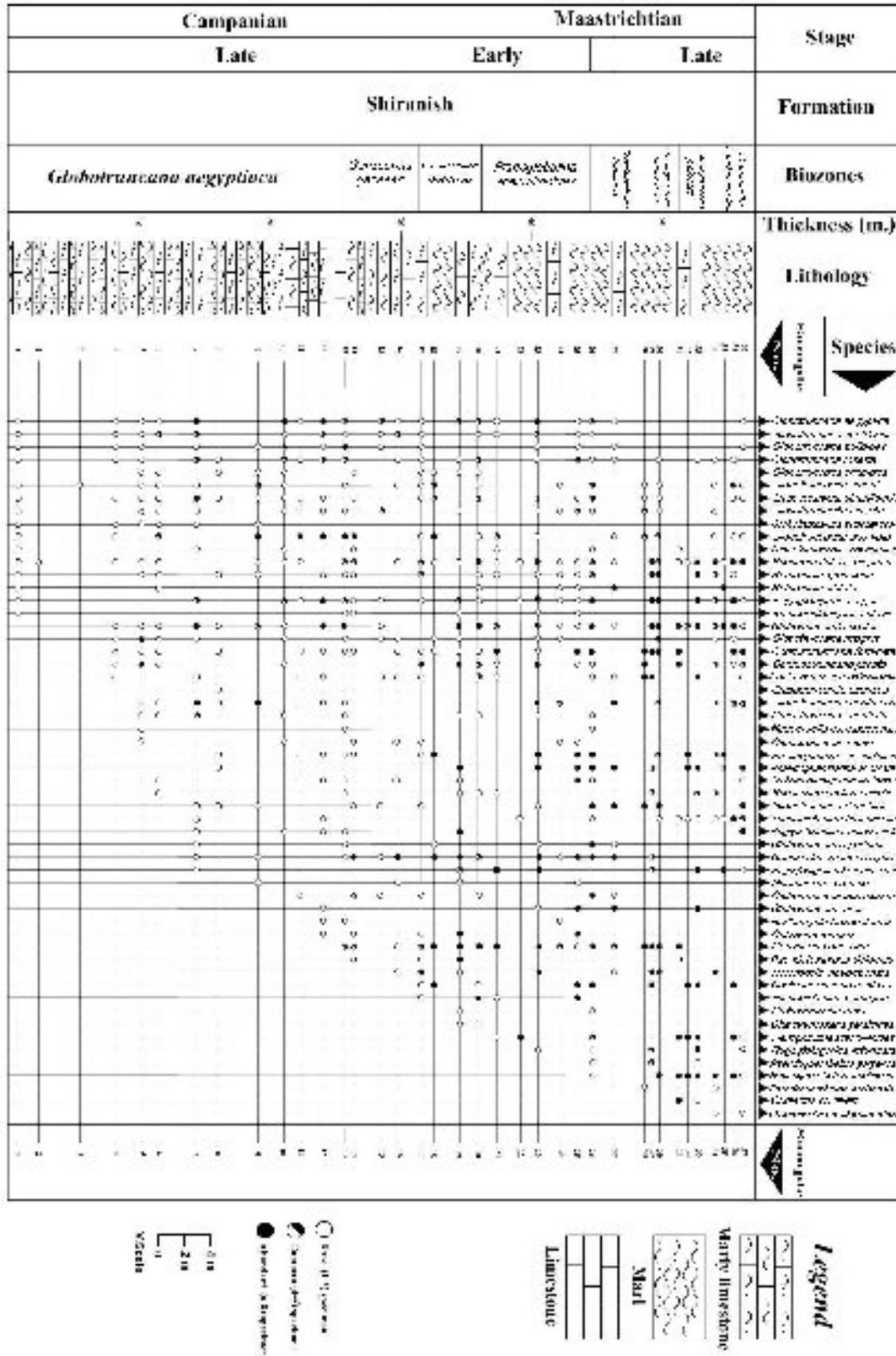
Correlation and Age Determination: The present zone is equivalent to the upper part of *Globotruncana stuartiformis* Zone of (Postuma, 1971), and to the *Globotruncana aegyptiaca* Zone of (Caron, 1985 and Sliter, 1989). It is equivalent to the *Globotruncana aegyptiaca* (CF8a) and *Rugoglobigerina hexacamerata* (CF8b) Zone of (Li *et al.*, 1999) which are considered of Latest Campanian - Early Maastrichtian age. This zone is equivalent to *Globotruncana aegyptiaca* Zone of (Gradstein *et al.*, 2004) which supports the same age of this zone.

Locally, in Iraq, this zone is equivalent to the upper part of *Globotruncana arca - tricarinata - subcircumnodifer* Subzone of (Kassab, 1979), and to the upper part of *Rugotruncana subcircumnodifer* Subzone of (Abawi *et al.*, 1982) and (Abdel Kireem, 1983). The present zone is correlatable with the *Globotruncana aegyptiaca* Zone of (AL-Juboury, 2002 and AL-Omari *et al.*, 1994), and (AL-Mutwali and AL-Juboury, 2005) and (Bamerni, 2010), and equivalent to the same zone of (AL-Mutwali *et al.*, 2008) and (AL-Haidary, 2009) which is considered by them of middle Late Campanian age.

2- *Gansserina gansseri* Interval Zone(CF7) :

Definition: This zone was introduced by Bronnimann (1952).It represents the stratigraphic range of the index species *Gansserina gansseri* (Bolli) which precede the appearance of *Contusotruncana contusa* (Cushman).

Fig. 5: Geological ranges and relative abundance of planktonic foraminifera and its biostratigraphic zonation in Shiranish Formation.



Age: latest Campanian – earliest Maastrichtian.

Boundaries: The lower boundary of this zone marked by the first appearance of *Gansserina gansseri* (Bolli), whereas its upper boundary is indicated by the first appearance of *Contusotruncana contuse*. (Cushman).

Thickness: 6m represented by the samples (13 - 16).

Correlation and Age Determination: The present zone is equivalent to the lower part of *Gansserina gansseri* Zone of (Postuma, 1971),(Robaszynski *et al.*,1984) (Caron, 1985), (Sliter, 1989) (Mogaddam, 2002). The present zone is equivalent to the *Gansserina gansseri* Zone (CF7) of (Li *et al.*, 1999),(Gradestein *et al.*, 2004) which they considered it of Late Campanian - Early Maastrichtian age.

Locally in Iraq, this zone is equivalent to *Globotruncana gansseri - bahijae*, *Gublerina cuvillieri* Subzone of (Kassab, 1973 and 1979), and to the lower part to *Globotruncana gansseri* Subzone of (Abawi *et al.*, 1982). The present zone is equivalent to the lower part of *Gansserina gansseri* Zone of (Hammoudi, 2000), (AL-Joubory, 2002). this zone equivalent to *Gansserina gansseri* Zone of (AL-Haidary, 2009) which is considered it of Latest Campanian age.

3- *Contusotruncana contusa* Interval Zone (CF6):

Definition: This zone was originally proposed by Dalbeiez (1955), it represents the stratigraphic range of the index species *Contusotruncana contusa* (Cushman) from its first appearance at the base to the last appearance of *Globotruncana linneiana* (d'Orbigny) at the top.

Age: Early Maastrichtian.

Boundaries: The lower boundary of this zone is marked by the first appearance of *Contusotruncana contusa* (Cushman), where as its upper boundary is indicated by the last appearance of *Globotruncana linneiana* (d'Orbigny).

Thickness: 4.6m represented by the sample (17 - 20).

Correlation and Age Determination: This zone is correlatable with *Contusotruncana contusa* (CF6) Zone of (Li *et al.*, 1999) and (Darvishzab and Abdolalipour, 2008) of Early Maastrichtian age, it is equivalent to the Lower part of *Contusotruncana contusa* Zone of (Dimitrova and Valcher, 2007) and *Contusotruncana contusa* Zone of (Rostami *et al.*, 2009) which considered it of Early Maastrichtian age. In Iraq this zone is correlatable with *Contusotruncana*

contusa Zone of (Sharbazheri, 2008 and 2010) and (Ismael, *et al.*,2011) which is assigned by them of Early Maastrichtian age.

4- *Planoglobulina acervulinoides* Partial range Zone (CF5):

Definition: This zone recorded by Arenillas *et al.*,2006 ,which represent the partial range zone of the index species *Planoglobulina acervulinoides* (Egger) between last appearance of *Globotruncana linneiana* (d'Orbigny) and first appearance of *Racemiguembelina fructicosa* (Egger).

Age : late Early Maastrichtian.

Boundaries: The lower boundary of this zone is marked by the last appearance of *Globotruncana linneiana* (d'Orbigny), while the upper boundary is indicated by the first appearance of *Racemiguembelina fructicosa* (Egger).

Thickness: 8.8m represented by the samples (21 - 25).

Correlation and Age Determination: The present zone is equivalent to the *Pseudotextularia intermedia* Zone (CF5) of (Li *et al.*, 1999), to the *Planoglobulina brazoensis* Zone of (Darvishzab and Abdolalipour, 2008), (Rostami *et al.*, 2009) which they considered it to be of Latest Early Maastrichtian age, and to the *Planoglobulina acervulinoides* Zone which described from Early Maastrichtian deposits by (Arenillas *et al.*, 2006). In Iraq this zone is correlated to the *Pseudotextularia intermdia* Zone of (Sharbazheri, 2008) which is assigned to the latest Early Maastrichtian age.

5- *Racemiguembelina fructicosa* Interval Zone (CF4):

Definition: This zone was introduced by Li and Keller(1998 a and b). It represents the stratigraphic range of the index species *Racemiguembelina fruticosea* (Egger) which precede the appearance of *Pseudoguembelina hariaensis* Nederbragt.

Age: early Late Maastrichtian.

Boundaries: The lower boundary of this zone is marked by the first appearance of *Racemiguembelina fructicosa* (Egger), whereas its upper boundary is marked by the first appearance of *Pseudoguembelina hariaensis* Nederbragt.

Thickness: 3.2m that represented by the samples (26 - 27).

Correlation and Age Determination: This zone is apparently equivalent with *Racemiguembelina fructicosa* Zone which described by (Li *et al.*, 1999), (Darvishzad and Abdolulipour, 2008), (Rostami *et al.*, 2009) of Early late Maastrichtian age, and correlated to the upper part of *Globotruncana contusa* - *Racemiguembelina fructicosa* Zone of (Premoli Silva *et al.*, 1998), and (Arenillas *et al.*, 2006).

Locally in Iraq this zone is correlated with *Racemiguembelina fructicosa* Zone of (Sharbazheri, 2008) which considered it of early Late Maastrichtian age.

6- *Pseudoguembelina hariaensis* Interval Zone (CF3):

Definition: This zone was originally defined by Li and Keller (1998a).the Interval zone which represented by the stratigraphic range of the index species *Pseudoguembelina hariaensis* Nederbragt between its first appearance and the last appearance of *Gansserina gansseri* (Bolli).

Age: middle Late Maastrichtian.

Boundaries: The lower boundary of this zone is marked by the first appearance of *Pseudoguembelina hariaensis* Nederbragt, whereas its upper boundary is marked by the last appearance of *Gansserina gansseri* (Bolli).

Thickness: 3.6m represented by the samples (28 - 31).

Correlation and Age Determination: The present zone is equivalent to the *Pseudoguembelina hariaensis* Zone which described by(Li *et al.*, 1999), (Arenillas, *et al.*, 2006) and (Darvishzad *et al.*, 2007), they considered it to be of middle Late Maastrichtian age.

Locally in Iraq the zone is correlated with *Pseudoguembelina hariaensis* Zone of (Shanbazheri, 2008) which assigned it to the middle Late Maastrichtian age.

7- *Pseudoguembelina palpebra* Partial range Zone (CF2):

Definition: This zone was defined by Li and Keller(1998 a and b), it represent the partial range of *Pseudoguembelina palpebra* Bronnimann and Brown between the last appearance of *Gansserina gansseri* (Bolli) and the first appearance of *Plummerita hantkeninoides* (Bronnimann).

Age: Late Maastrichtian.

Boundaries: The lower boundary of this zone is marked by the last appearance of *Gansserina gansseri* (Bolli), whereas its upper boundary is marked by the first appearance of *Plummerita hantkeninoides* (Bronnimann).

Thickness: 1.8 m that represented by the samples (32 - 33).

Correlation and Age Determination: The present zone is equivalent to the *Pseudoguembelina palpebra* Zone of (Li *et al.*, 1999), (Darvishzad *et al.*, 2007) which they considered it of Late Maastrichtian age. Locally in Iraq, this Zone is correlated with *Pseudoguembelina palpebra* Zone of (Sharbazheri, 2008) which is assigned to the Latest Maastrichtian.

8- *Plummerita hantkeninoides* Total range Zone (CF1)(Part):

Definition: This zone was introduced by(Pardo, *et al.*, 1996), which defined by the total range of the nominate taxon.

Age: Latest Maastrichtian.

Boundaries: The lower boundary of this zone is marked by the first appearance of *Plummerita hantkeninoides* (Bronnimann), while its upper boundary is marked by its last appearance.

Thickness: 3.8m represented by the samples (34 - 37).

Correlation and Age Determination: *Plummerita hantkeninoides* is easily identified within the uppermost part of Late Maastrichtian, the range of this excellent marker species spans the youngest 300 kyr of the Maastrichtian below the Cretaceous / paleogene boundary (keller *et al.*, 2002). The present zone is equivalent to the *Plummerita hantkeninoides* Zone (CF1) which described by (Li *et al.*, 1999), (Darvishzad *et al.*, 2007), they considered it of Latest Maastrichtian age, this zone is also correlated with the upper part of *Abathomphalus mayaroensis* Zone of (Robaszynski *et al.*, 1984) (Caron, 1985), (Premoli Silva *et al.*, 1998) (Chacon *et al.*, 2005) of Late Maastrichtian age.

In Iraq this Zone is equivalent to the upper part of *Kassabiana falsocalcarata* Zone of (Kassab *et al.*, 1986) of Late Maastrichtian age, it is also correlated with *Plummerita hantkeninodes* Zone which is described by (Sharbazheri., 2008) of Latest Maastrichtian age.

CONCLUSION

Planktonic foraminiferal investigation of the Upper Cretaceous Shiranish Formation in Dohuk area northern Iraq yielded 55 species that belong to 16 genera, According to their stratigraphic range, the formation divided into eight zones. The distribution of faunal sequence and the correlation between these zones and other zonal schemes in and outside Iraq reveals a middle Late Campanian age for the first zone and Late Campanian – Early Maastrichtian for the second zone, whereas other six biozones extended from Early – Late Maastrichtian.

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PLATE 1

Fig. 1a: *Globotruncanita angulata* (Tilev). Umbilical side. Sample No. 6.

Fig. 1b: *Globotruncanita angulata* (Tilev). Spiral side. Sample No. 6.

Fig. 2a: *Globotruncana rosetta* (Carsey). Spiral side. Sample No. 8.

Fig. 2b: *Globotruncana rosetta* (Carsey). Umbilical side. Sample No. 8.

Fig. 3a: *Globotruncana aegyptiaca* Nakkady. Spiral side. Sample No. 4.

Fig. 3b: *Globotruncana aegyptiaca* Nakkady. Umbilical side. Sample No. 4.

Fig. 4a: *Globotruncana insignis* Gandolfi. Spiral side. Sample No. 8.

Fig. 4b: *Globotruncana insignis* Gandolfi. Umbilical side. Sample No. 8.

PLATE 2

Fig. 1a.: *Globotruncana duwi* Nakkady. Spiral side. Sample No. 20.

Fig. 1b.: *Globotruncana duwi* Nakkady. Umbilical side. Sample No. 20.

Fig. 2.: *Pseudotextularis elegans* (Rzehak). Side view. Sample No. 27.

Fig. 3.: *Pseudotextularis deformis* (Kikoine). Edge view. Sample No. 20.

Fig. 4a.: *Gansserina gansseri* (Bolli). Edge view. Sample No. 26.

Fig. 4b.: *Gansserina gansseri* (Bolli). Umbilical side. Sample No. 26.

Fig. 5: *Gansserina wiedenmayei* (Gandolfi). Side view. Sample No. 26.

Fig. 6: *Globotruncanella havanensis* (Voorwijk). Spiral side. Sample No. 27.

Plate 1

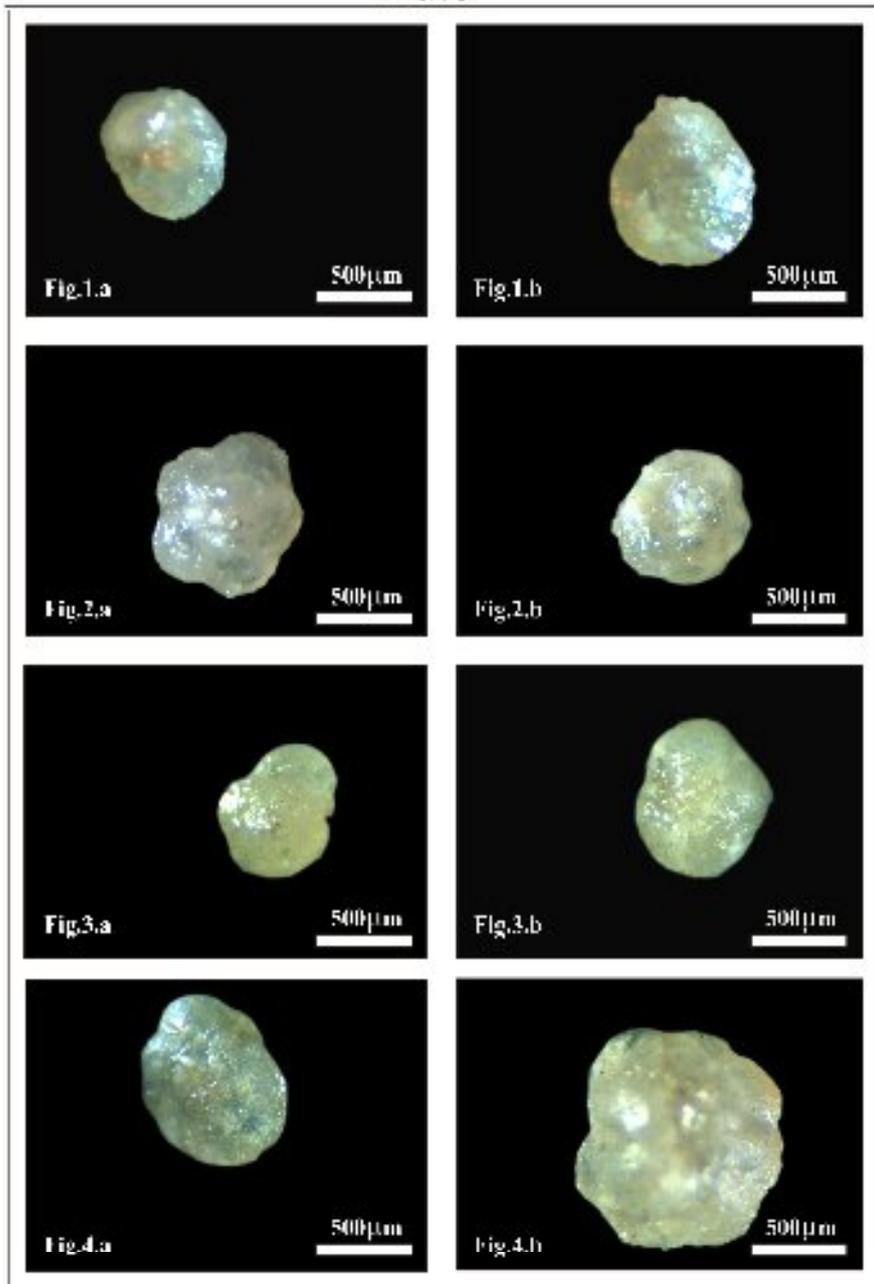


Plate 2

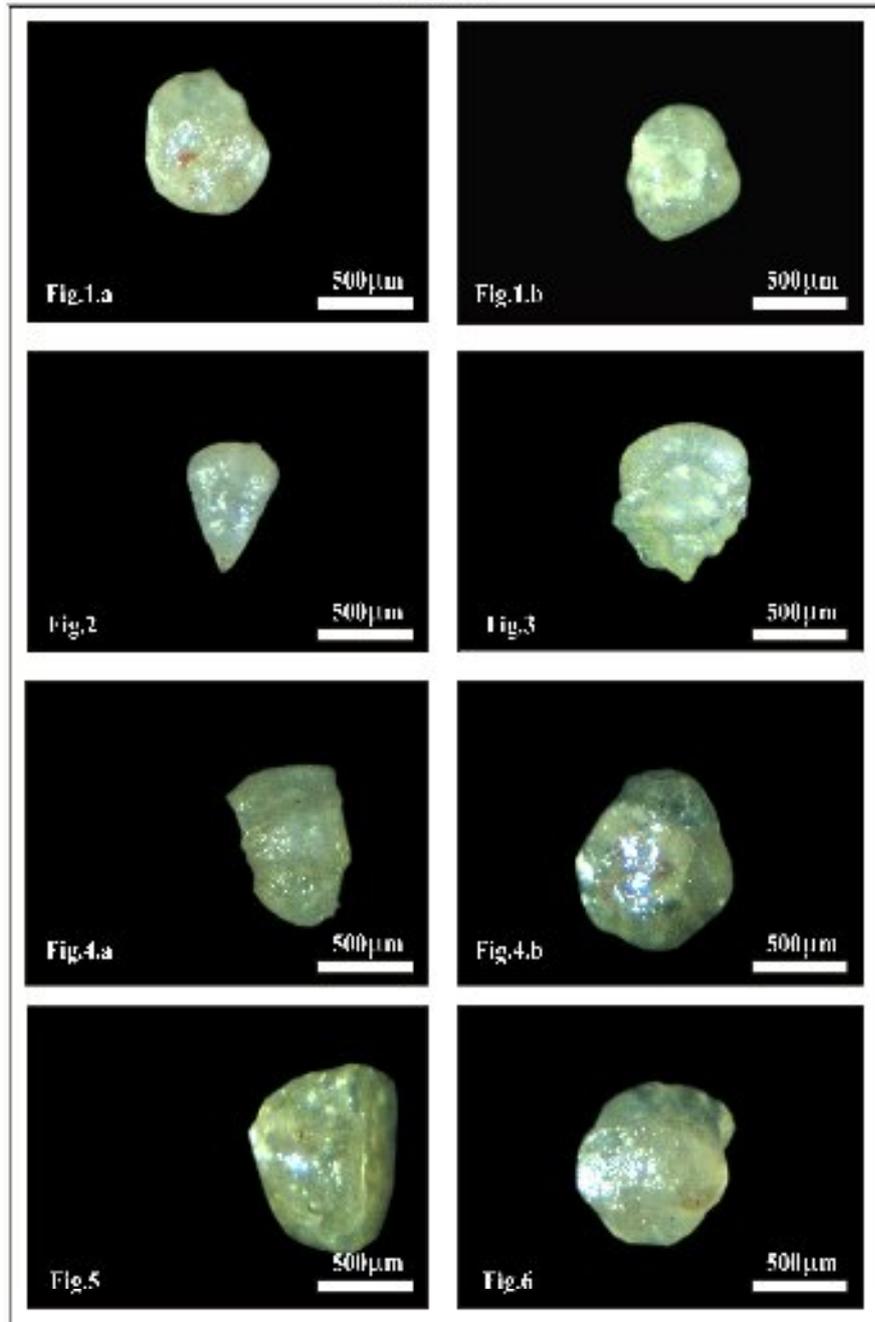


PLATE 3

- Fig. 1a.: *Globotruncana falsostuarti* Sigal. Spiral side. Sample No. 12.
Fig. 1b.: *Globotruncana falsostuarti* Sigal. Umbilical side. Sample No. 12.
Fig. 2.: *Globotruncanella petaloidea* (Gandolfi). Spiral side. Sample No. 20.
Fig. 3a.: *Contusotruncana contusa* (Cushman). Spiral side. Sample No. 35.
Fig. 3b.: *Contusotruncana contusa* (Cushman). Side view. Sample No. 35.
Fig. 4.: *Rugoglobigerina macrocephala* Bronnimann. Umbilical side. Sample No. 12.
Fig. 5.: *Rugoglobigerina rugosa* (Plummer). Umbilical side. Sample No. 8.
Fig. 6.: *Rugoglobigerina hexacamerata* Bronnimann. Umbilical side. Sample No. 22.

PLATE 4

- Fig. 1: *Planoglobulina carseyae* (Plummer). Side view. Sample No. 24.
Fig. 2.: *Planoglobulina brazoensis* Martin. Side view. Sample No. 31.
Fig. 3.: *Planoglobulina acervulinoides* (Egger). Side view. Sample No. 31.
Fig. 4.: *Pseudoguembelina palpebra* Bronnimann and Brown. Side view, Sample No. 30.
Fig. 5.: *Racemiguembelina fructicosa* (Egger). Side view. Sample No. 31.
Fig. 6.: *Racemiguembelina powelli* Smith and Pessagno. Side view. Sample No. 30.
Fig. 7.: *Pseudoguembelina hariaensis* Nederbragt. Side view. Sample No. 35.
Fig. 8.: *Plummerita hantkeninoides* (Bronnimann). Spiral side. Sample No. 35

Plate 3

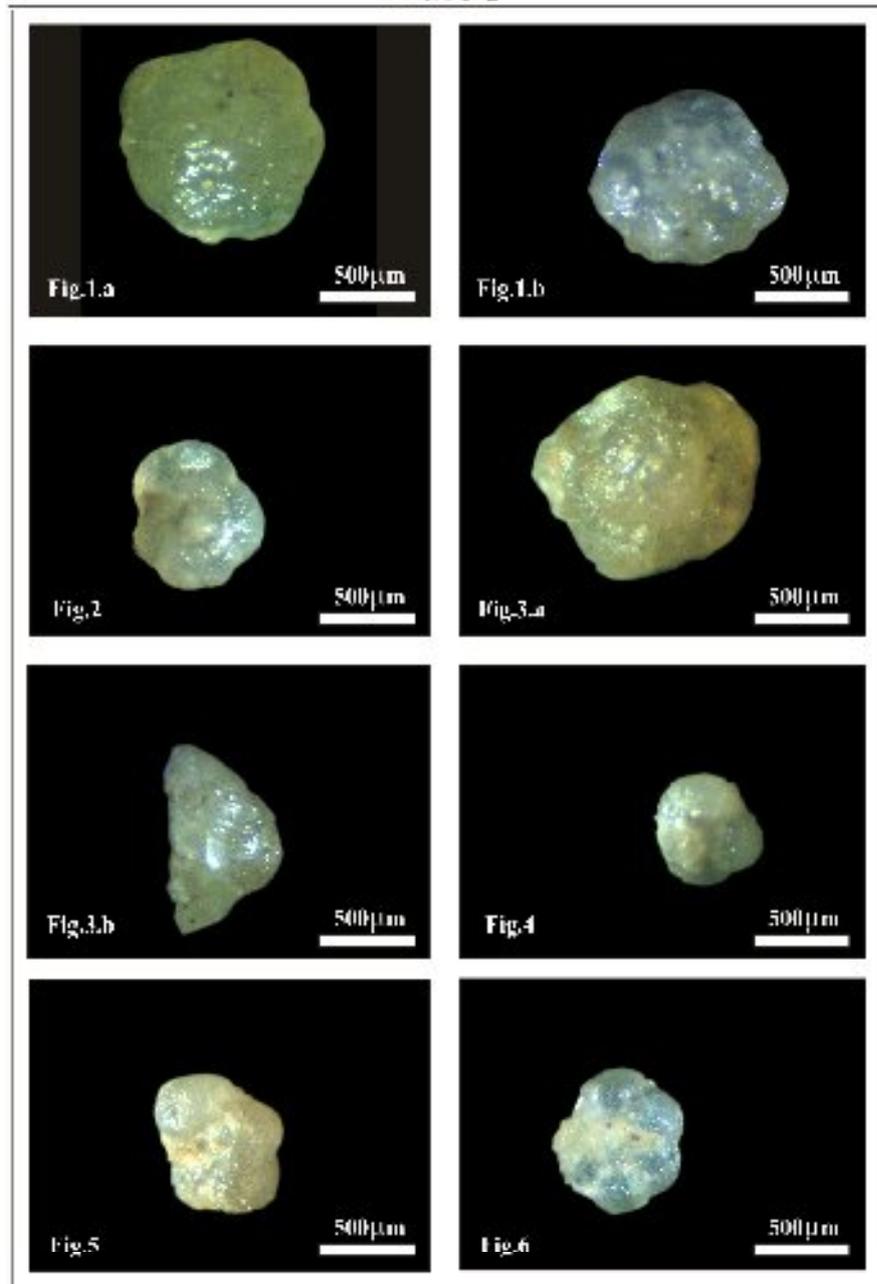


Plate 4

