

Paleoenvironment of the Late Cretaceous (Late Turonian–Early Campanian) Ostracoda in the Kometan Formation, Dokan Area, Kurdistan region, NE-Iraq

Zardasht Ahmed Taha

*Dept. of Geology, College of Science, University of Suleiman,
Kurdistan Region, NE-Iraq.*

zardasht.taha@univsul.edu.iq

Abstract

In the present study, selected the Kometan Formation (Late Turonian - Early Campanian) from the Dokan area, NE-Iraq. In this formation studied Ostracoda and identified fifteen open Ostracoda species belonging to ten genera (*Bairdia*, *Bairdiacypris*, *Bythocypris*, *Bairdoppilata*, *Cavellina*, *Cypridina*, *Cytherella*, *Haplocytheridea*, *Pterygocythereis*, and *Paracypris*). The goal of the present study is to identify Ostracoda species under polarizing microscopes for the first time in the Kometan Formation in the Dokan area. The Ostracoda assemblage such as *Bairdia*, *Bairdiacypris*, *Cytherella*, *Cypridina*, and *Paracypris* with foraminifera species *Globotruncana linneiana*, *Globotruncanita stuartiformis*, *Marginotruncana schneeani*, and *Dicarinella asymetrica* indicate the Kometan Formation deposited in the deep marine environment.

Keywords: Dokan area; foraminifera; Kometan Formation; (Late Turonian – Early Campanian); Northeast Iraq; Ostracoda; Upper Cretaceous.

1. Introduction

The Upper Cretaceous Kometan Formation (Late Turonian - Early Campanian) consists of pelagic limestone (light gray to white, thin to thick-bedded Limestone) about 127 meters thick in the Dokan area, NE-Iraq (Taha, 2008; Karim & Taha, 2009). It contains large scale stylolites and chert nodules in Dokan area (Karim *et al.*, 2001; Taha, 2008). It was first described by Dunnington in 1953 at Kometan Village (Buday, 1980). The contact of the Kometan Formation is unconformable (Dunnington, 1953 in Bellen *et al.*, 1959; Buday 1980). However, Karim *et al.*, 2001; Taha, 2008; Karim & Taha, 2009, studied this section and mentioned the contact (upper and lower) of the Kometan Formation is conformable. Previous works studied the Kometan Formation palaeontologically and biostratigraphically proved that the age of the formation is Upper Turonian – Lower Campanian depending upon foraminifer's assemblages (Chatton & Hart, 1961; Buday, 1980; Kaddouri, 2001; Al-Khafaf, 2005; Abawi & Hammoudi, 2006 and Jaff *et al.*, 2015). For the first time studied this section from the Dokan area to determine an identification of Ostracoda (thin section) under polarizing microscopes.

Geological Setting

The present study is located (Dokan area N35° 56' 57" and E45° 56' 54") in the Western Zagros Fold-Thrust Belt (Buday, 1980; Buday & Jassim, 1987; Jassim & Goff, 2006). It is in the High Folded Zone (Buday & Jassim, 1987). The Late Cretaceous formations in the present study from oldest to youngest consist of Qamchuqa, Dokan, Gulneri Shale, Kometan, Shiranish, and Tanjero formations (see Figure 1).

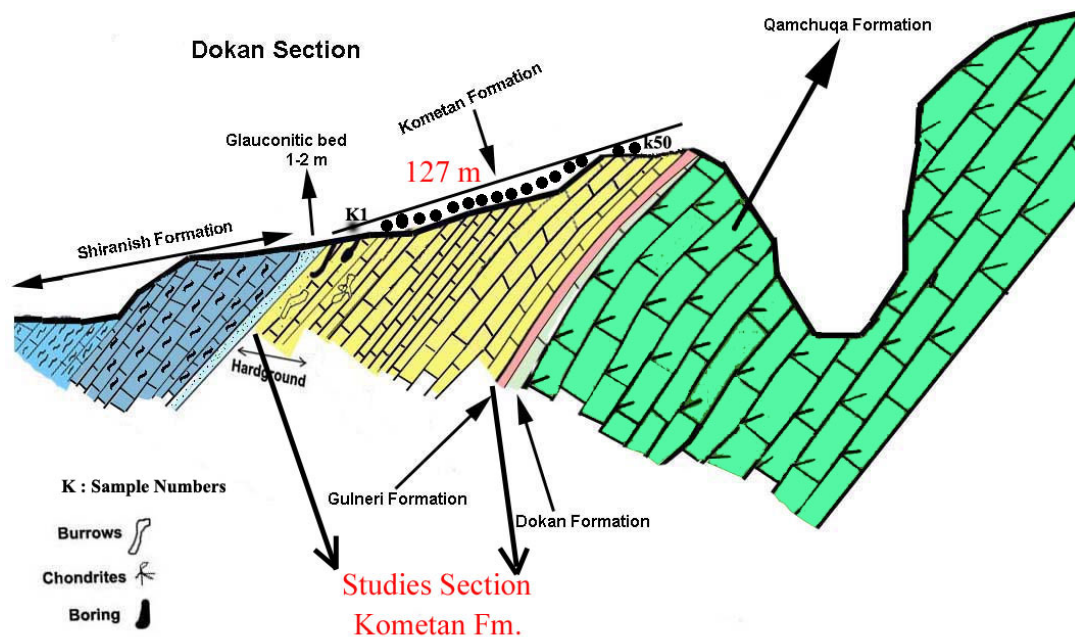


Fig. 1. Geological cross-section of the studied area (After Taha, 2008).

Materials and methods

Twenty samples were picked up from outcrops succession of the Kometan Formation in the Dokan section. Twenty thin sections were prepared. Identification of specimens was by using the polarizing microscope and photograph images were taken by a digital software program (Plates 1 and 2). The taxonomic determination of the species is based on the classifications by Sars (1866); Moore (1961) and Al-Shareef *et al.* (2010).

Ostracoda in the studied section (Dokan area)

The most familiar order of ostracoda assemblage in the Upper Cretaceous is Podocopida Sars (1866), it comprises three suborders Podocopina, Platycopina, and Cladocopina (Moor, 1961) (see Figure 3). The Kometan Formation comprises a diverse assemblage of Podocopina and Platycopina. The Platycopina family is most abundant in this formation and with its genera of *Bairdia*, *Bairdiacypris*, *Bythocypris*, *Cavellina*, *Cypridina*, *Cytherella*, *Haplocytheridea*, *Pterygocythereis*, and *Paracypris*. Ostracoda is not easy to identify the species by thin section because of lack of distinguishing external characteristics

such as free margin, outline, ornamentation, hinge, and muscle scars. Four genera *Bairdia*, *Bythocypris*, *Cytherella*, and *Paracypris* as index genera from the Upper Cretaceous Tanum, Khasib, Sa'di, and Mushorah formations in Northwest and middle Iraq (Al-Shareef *et al.*, 2010).

Age implications

The paleontological data from the Dokan area suggest a Late Turonian to Early Campanian for the Kometan Formation and rich in planktic foraminifera (Kaddouri, 2001; Al-Khafaf, 2005; Jaff *et al.*, 2015). The Ostracoda assemblage includes important forms like *Bairdia*, *Bythocypris*, *Cypridina*, and *Paracypris*, it is a determination as Late Turonian to Early Campanian, and these Ostracoda genera identified and recognized under a polarizing microscope (see table 1 and Figure 2).

Table 1. Ostracoda distribution during Upper Cretaceous (Turonian to Campanian) in the Kometan Formation, Dokan area compare with the other localities in Iraq.

Genera (Present study)	Type species	Other Formation Al-Shareef <i>et al.</i>, 2010	Age
<i>Bairdia</i> M' Coy, 1844	<i>Bairdia Curta</i> M' Coy, 1844	Tanuma Formation	Turonian Campanian
<i>Bairdiacypris</i> Bradfield, 1935	<i>Bairdiacypris hoxbarensis</i> (Harlton, 1927)	/	/
<i>Bythocypris</i> Brady, 1880	<i>Bythocypris reniformis</i> <i>Brady</i> , 1880	Mushorah Formation	Campanian
? <i>Bairdoppilata</i> Coryell, Sample, and Jennings, 1935	<i>Bairdoppilata martini</i> Coryell, Sample and Jennings, 1935	/	/
<i>Cavellina</i> Coryell. 1928	<i>Cavellina pulchella</i> Coryell, 1928	/	/
<i>Cypridina</i> Milne Edwards, 1840	<i>Cypridina pyrocypris</i> Mueller, 1890	/	/
<i>Cytherella</i> Jones, 1849	<i>Cytherella ovate</i> (Roemer, 1841) Bosquet, 1860	Khasib, Tanum, and Sa'di formations	Turonian Campanian
? <i>Haplocytheridea</i> Stepenson, 1936	<i>Haplocytheridea agilis</i> (Guan, 1978)	/	/
<i>Paracypris</i> Sars, 1866	<i>Paracypris abscissa</i> (Reuss, 1850)	Mushorah Formation	Cenomanian Campanian
<i>Pterygocythereis</i> Baird, 1850	<i>Pterygocythereis jonesii</i> (Baird, 1850)	/	/

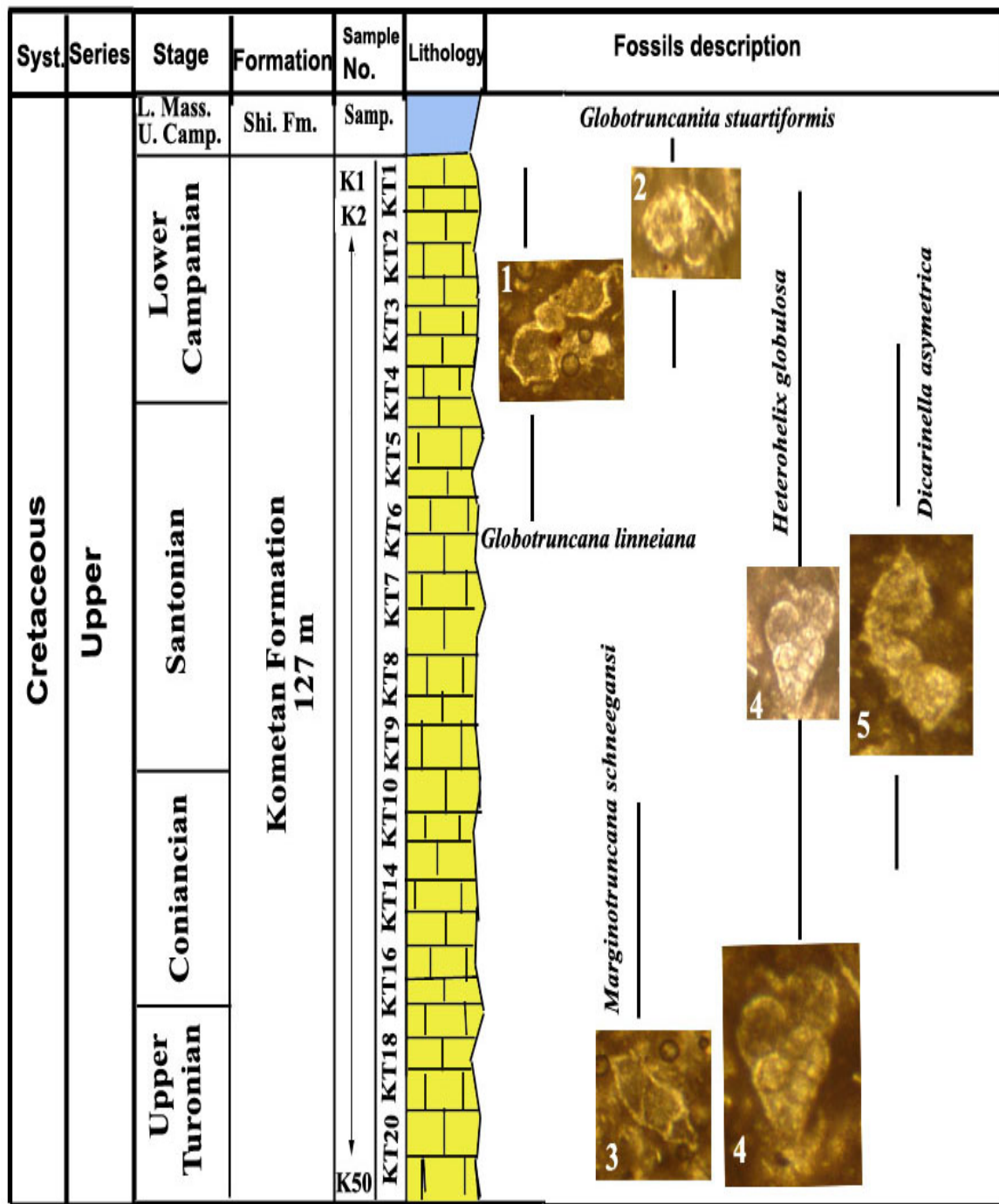


Fig. 2. A stratigraphic column with the key species of planktic foraminifera association with Ostracods in the Kometan Formation, Dokan section, Dokan area, Kurdistan Region, NE-Iraq (see Plate 3).

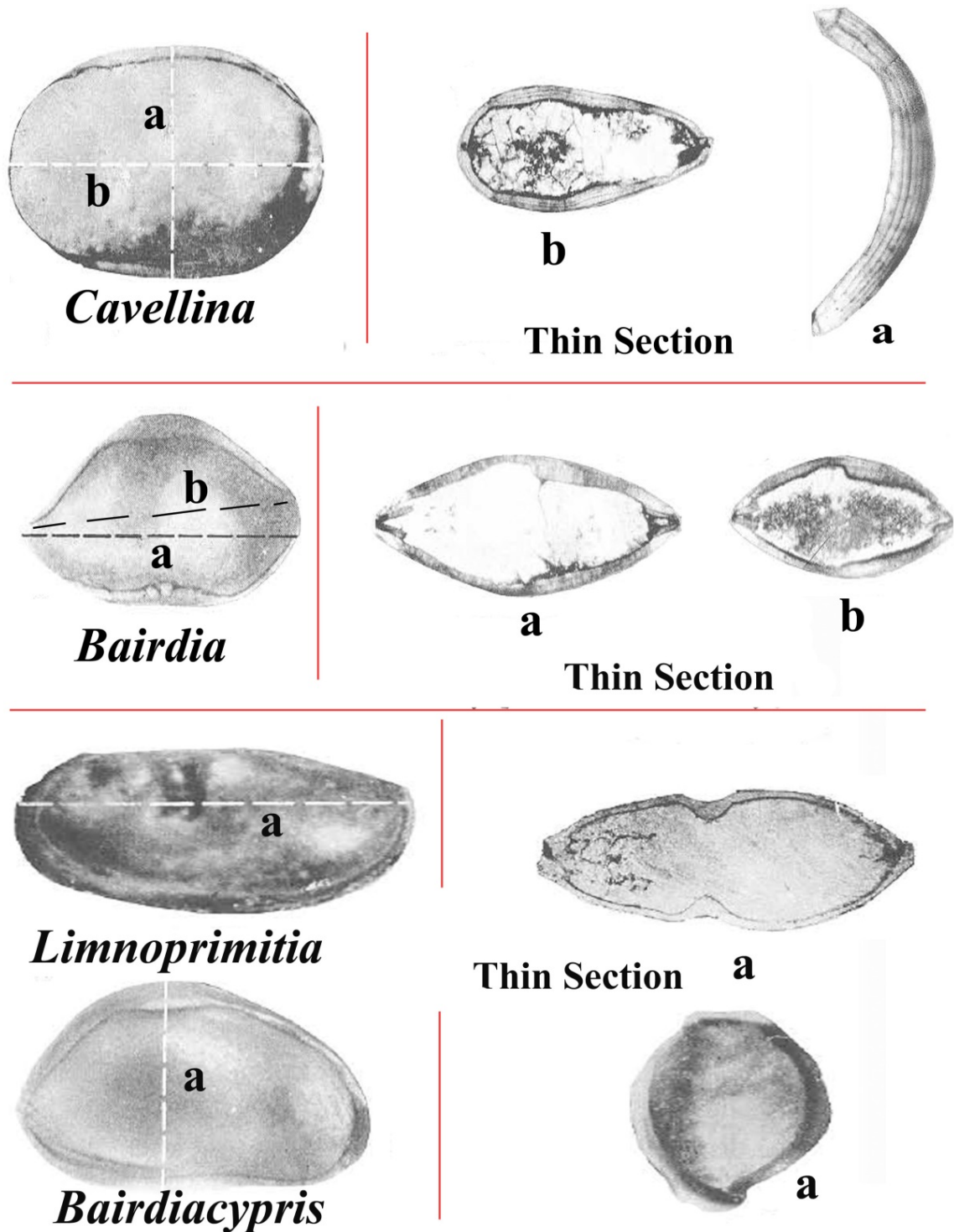


Fig. 3. Photomicrograph shows Ostracoda thin section for some genus *Cavellina*, *Bairdia*, *Limnoprimitia*, and *Bairdiacypris*

(Sars, 1899 and Moor, 1961).

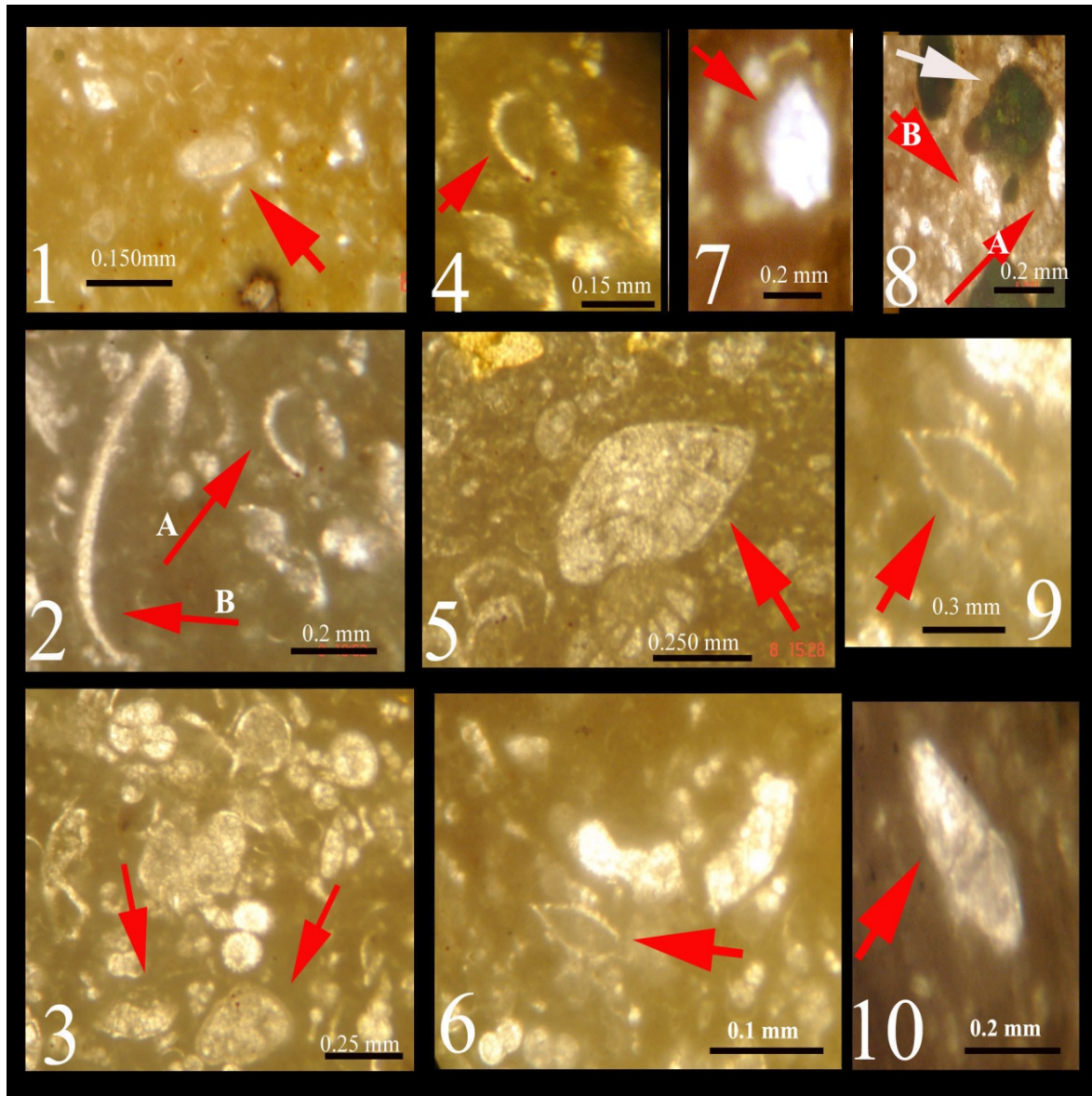


Plate 1. Photomicrograph shows 1. *Cytherella* sp., samples number KD-3, 4. 2. A. and B. *Cavellina* sp, sample number KD-6. 3. *Bairdoppilata* sp., sample number KD-12. 4. *Cavellina* sp., sample number KD-8. 5. *Bairdoppilata* sp, sample number KD-15. 6. *Bythocypris* sp1., sample number KD-5. 7. *Pterygocythereis* sp, sample number KD-18. 8. *Paracypris* sp., samples number KD-1, 2. 9. *Bythocypris* sp 2., samples number KD-5, 13, 14. 10.? *Haplocytheridea* sp., samples number KD-7, 13. Upper Cretaceous, Kometan Formation, Dokan section.

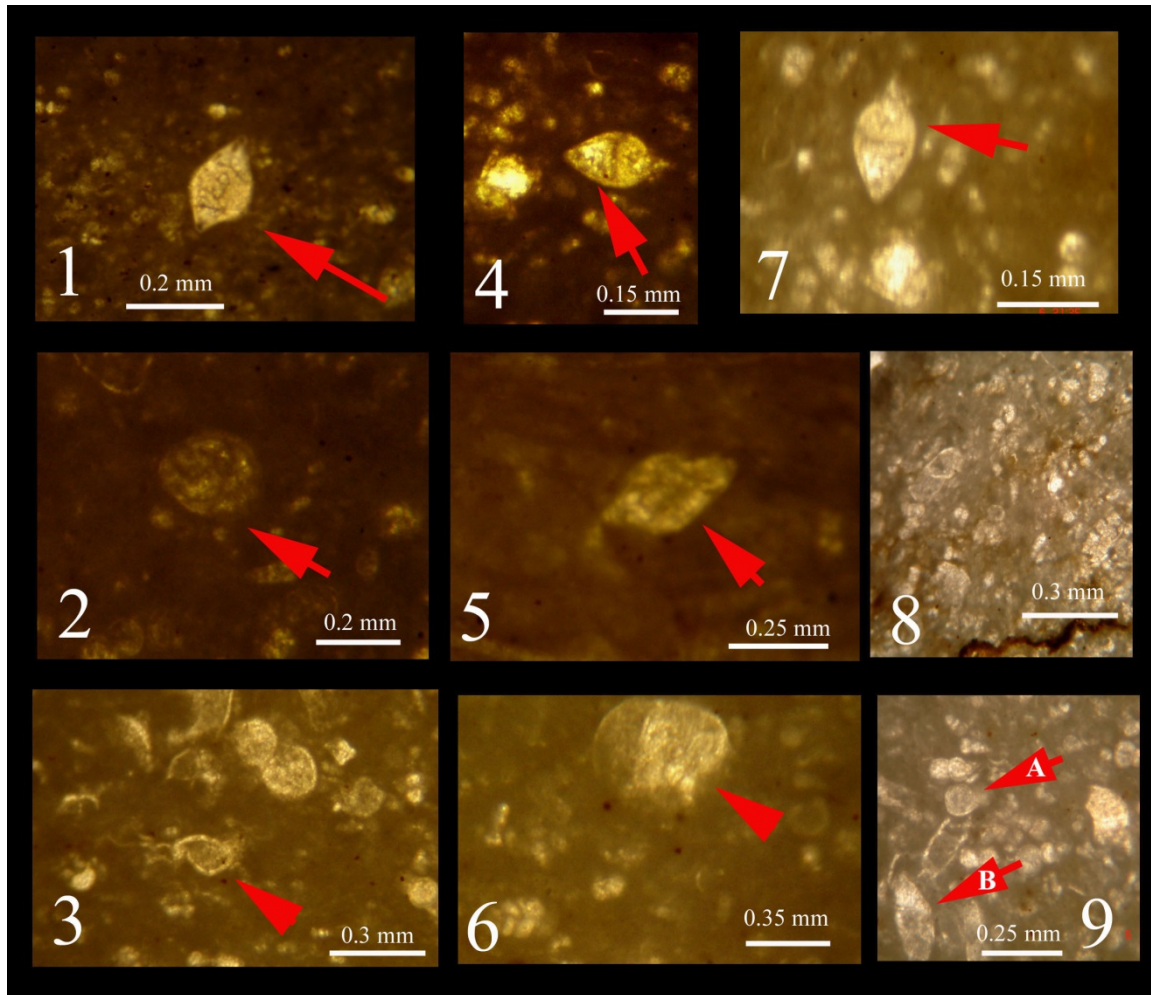
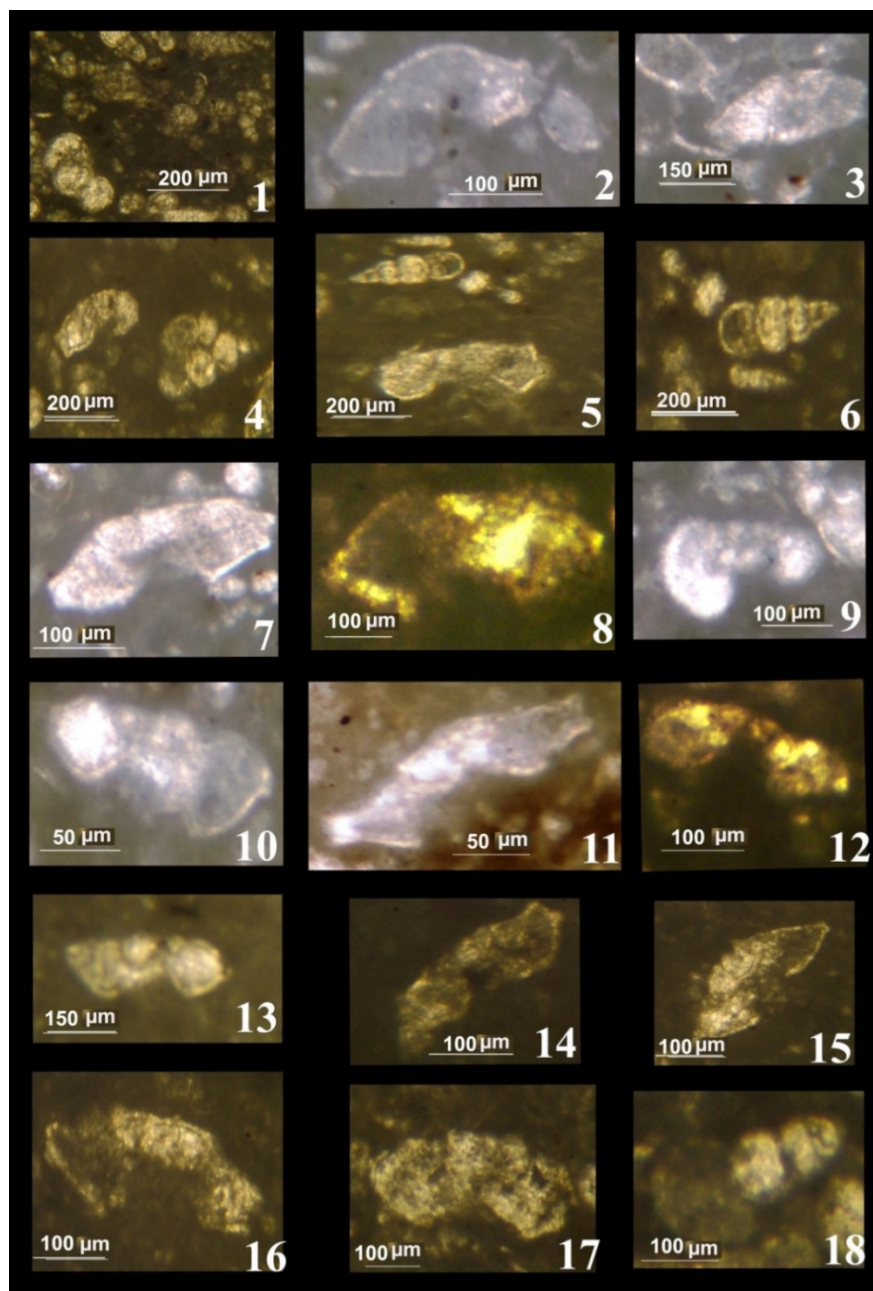


Plate 2. Photomicrograph shows 1. *Bairdia* sp.1., 2. *Bairdiacypris* sp., sample number KD-6. 3. *Cypridina* sp., sample number KD-9. 4. *Bairdia* sp. 2, sample number KD-8. 5. *Bairdia* sp.1, sampleS number KD-3, 10. 6. *Pterygocythereis* sp., samples number KD-4, 8, 11. 7. *Bairdia* sp.1, 8. planktic foraminifera, samples number KD-3, 12, 15. 9. A. *Bairdiacypris* sp., samples number KD-13, 14 and B. *Haplocytheridea* sp., sample number KD-14. Upper Cretaceous, Kometan Formation, Dokan section.

Paleoenvironment

Ostracoda lived in both marine and non-marine environments. They are recognized from different kinds of aquatic habitats Martens (2001). Some genera indicate the marine environment for instance *Paracypris* Elpson (1941); Al-Shareef *et al.*, (2010). The present study depends on the Ostracoda genera (*Bairdia*, *Bairdiacypris*, *Cytherella*, *Cypridina*, and *Paracypris*), the Kometan Formation deposited in the deep marine environment. The preserved planktic foraminifera *Globotruncana linneiana*, *Globotruncanita stuartiformis*, *Marginotruncana schneeansi*, *Heterohelix gobulosa*, and *Dicarinella asymetrica* indicates to deep-marine (Al-Khafaf, 2005) (see Plate 3). According to Al-Qayim *et al.*, 2020, there was no gap or hiatus at the end of the Cretaceous at the Sulaimani area.



Explanation of Plate 3. Planktic foraminifera of the Kometan Formation. Fig 1,4,6,18.

Heterohelix globulosa (Ehrenberg, 1840), sample number KD-15. Fig. 2.

Contusotruncana fornicata (Plummer). Fig. 3. *Globotruncana conica* (White), sample number KD-10. Fig. 5. *Globotruncana bulloides* Vogler, sample number KD-14. Fig. 7, 8. *Dicarinella asymetrica* (Sigal), sample number KD-12. Fig. 9. *Macroglobigerinella prairiehillensis*, sample number KD-8. Fig. 10. *Dicarinella concavata* (Brotzen), sample number KD-9. Fig. 11. *Marginotruncana marginata* (Reuss). Fig. 12. *Marginotruncana Renzi* (Gandolfi), sample number KD-5. Fig. 13. *Globotruncana bulloides* Vogler sample number KD-4. Fig. 14. *Dicarinella asymetrica* (Sigal). Fig. 15. *Globotruncanita arca* (Cushman), sample number KD-14. Fig. 16. *Globotruncana linneiana* d’Orbigny, sample number KD-13. Fig. 17. *Globotruncanita stuarti* (de Lapparent), sample number KD-10.

Conclusions

1. The Kometan Formation consists of 127 m of light grey to white, thin- too thick-bedded oligosteginal-globigerinal limestones with stylolite and chert nodules.
2. Thin section studied under polarizing microscopes of the Kometan Formation illustrations nine genera (*Bairdia*, *Bairdiacypris*, *Bairdoppilata*, *Cavellina*, *Cypridina*, *Cytherella*, *Haplocytheridea*, *Pterygocythereis*, *Paracytheridea*, *Paracypris*) with foraminifera (planktic and benthonic) species.
3. The most important result of this study is the identification of some species of foraminifera in the Kometan Formation pelagic sediments (e. g. *Globotruncanita arca*, *Globotruncana linneiana*, *Globotruncanita stuartiformis*, *Marginotruncana schneeansi*, *Heterohelix gobulosa*, and *Dicarinella asymetrica*).
4. The Ostracoda genera such as *Bairdia*, *Bairdiacypris*, *Cytherella*, *Cypridina*, and *Paracypris* with foraminifera species *Globotruncana linneiana*, *Globotruncanita stuartiformis*, *Marginotruncana schneeansi*, and *Dicarinella asymetrica* indicate the Kometan Formation was deposited in a warm, basin, deep marine environment.

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