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Late Cretaceous Ostracoda in the Shiranish Formation Dokan Area, Kurdistan Region-NE Iraq

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Abstract

Ostracods are described for the first time from Late Cretaceous (Late Campanian - Maastrichtian) deep marine sediments of the Shiranish Formation of Dokan area. They were collected using a new technique for releasing ostracod shells from a bluish white marl and marly limeston (hemipelagite). Twenty- two ostracod species are identified, belonging to the genera *Bythocypris, Cytherella, Cypridopsis, Eucypris, Krithe, Mongolianella, Paracypris, Paracypretta, Parakrithe* and *Xestoleberis*. Only eight ostarcods species belonging to ten genera are systematically described as detail. The ostracod fauna supports a Late Cretaceous (Late Campanian- Early Maastrichtia) age for the Shiranish Formation of Dokan area.

Introduction

The Shiranish Formation was first demarcated from the village of Shiranish Islam located the High Folded Zone of northern Iraq about twenty Kilometres northern west of Zakho town (Henson1940; Bellen *et al*. 1959). According to the same authors the Shiranish Formation in the type section is approximately 228 m thick, and its subdivided into two units a lower unit dominated by marly limestone and marlstone that is rich in fossils, and an upper unit that is dominated by blue marlstone (Bellen *et al*. 1959; Buday 1980). The depositional environment of the formation in the type area is interpreted to be an outer shelf to basinal deposit (Jassim & Goff 2006). In Dokan area, the Shiranish Formation is about 220-230 m thick and lithologically consists of marly limestone to bluish grey marl. The formation in this area well studied palaeontologically and lithologically (see Abawi *et al*. 1982, Jaff *et al*. 2014, Jaff and Lawa 2018). The contact between the Shiranish Formation and the Kometan Formation conformable (Taha 2008; Karim *et al*. 2008; Al-Badrani *et al*. 2012; Karim *et al*. 2018) , and upper contact with the Tanjero Formation conformable (Karim 2004) (see figs. 1.2, 1.3). According to several authors (Kennedy & Lunn 2000; Al-Banna 2010; Aqrawi *et al*. 2010; Jaff *et al*. 2014) the age of the Shiranish Formation is Late Campanian to Maastrichtian, but it does not extend to the Late Maastrichtian (Kassab 1973; Jaff *et al*. 2014), However, Abdel- Kireem (1983) studied the foraminifera assemblage in the Shiranish Formation in the Dokan area palaeoecological and bathymetry, he concluded that the age of the formation is Late Campanian to Middle Maastrichtian. The goal of this study is to document the Ostracoda of the Shiranish Formation in the measured section in Dokan area, Kurdistan region, the northeastern Iraq. The main aim of the present study to through the light on the identify ostracoda and systematic description.

Geological setting

The studies area is placed in the western Zagros Fold- Thrust Belt toward the southwest of the main Zagros Suture Zone (Z.S.Z.) (Buday, 1980; Buday and Jassim. 1987; Jassim and Goff 2006) (see Fig 1.1).

Material and methods

1. Preparation techniques: the main method used to prepare Upper Cretaceous ostracods of the Shiranish Formation is chemical preparation, allowing ostracods to be released during sample break-down. This method is the best for marle and argillaceous limestones. The main advantage of chemical preparation is that it is possible to obtain large numbers of well-preserved specimens.
2. More than fifty samples of Upper Cretaceous Shiranish Formation have been studied, but only eleven (D2, D3, D4, D5, D6, D8, D9, D11, D12, D13 and D15) samples have been preserved ostracods (Figs. 1.2, 1.3). About 200-300gm of each sample was drowned in water for one or two days, and then add 15% hydrogen peroxide solution to sample then sieves with a diameter of 30 and 60 meshes. The dried samples by oven or sun and poured into a tray, then I picked up ostracods under binocular Microscope (MEIJI EMT).
3. Ostracod valves were cleaned by needles and by gently brushing with dilute (10%) acetic acid to remove extraneous sediment.
4. Ostracod species have been identified under the binocular microscope.
5. Measurements were taken using an optical lens micrometre in the objective lens of the (MEIJI EMT) binocular microscope

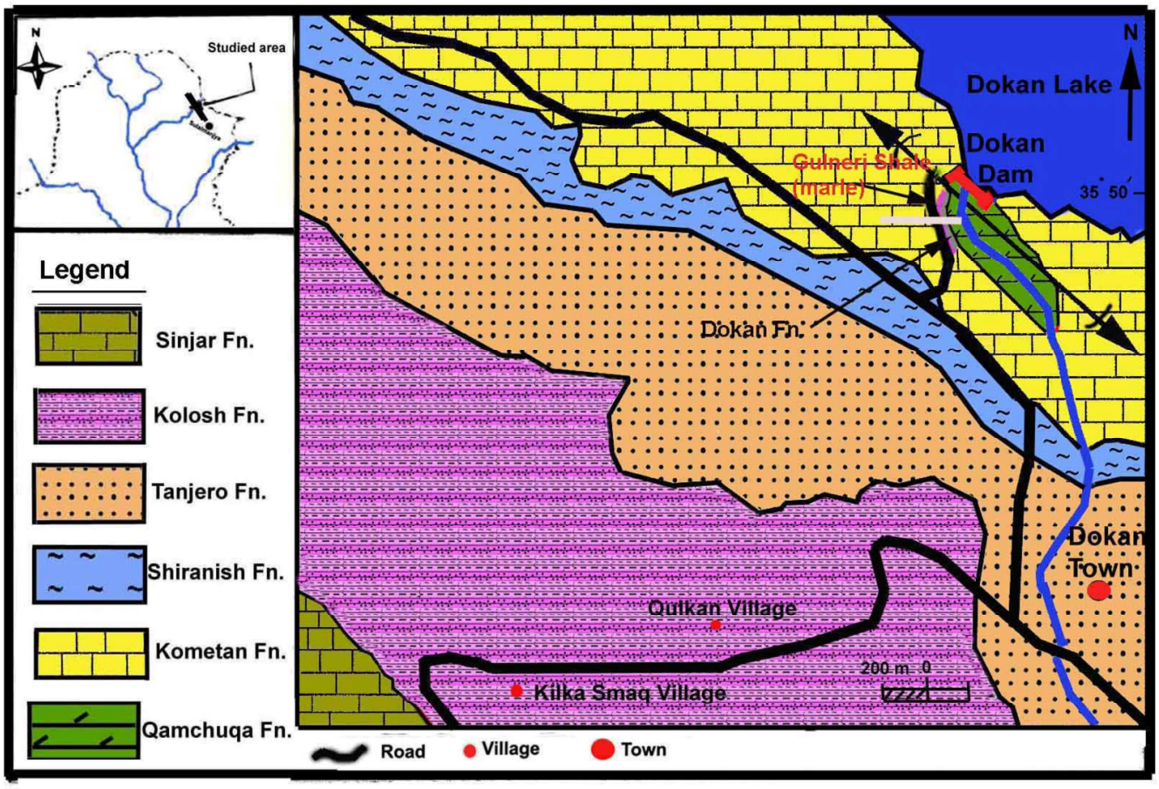


Fig. 1.1. Geological map of the studied area Dokan section (Taha 2008).

Dokan Section

Dokan Section located at the Dokan area near tourism village at latitude 35º 56' 23" and Longitude 44º 00' 39", which is placed approximately 3 km to the east of the Dokan dam site, its opposite Sara Mountain (see Fig 1.2).

Fig. 1.2. Geological cross section of the studied area (Taha 2008).

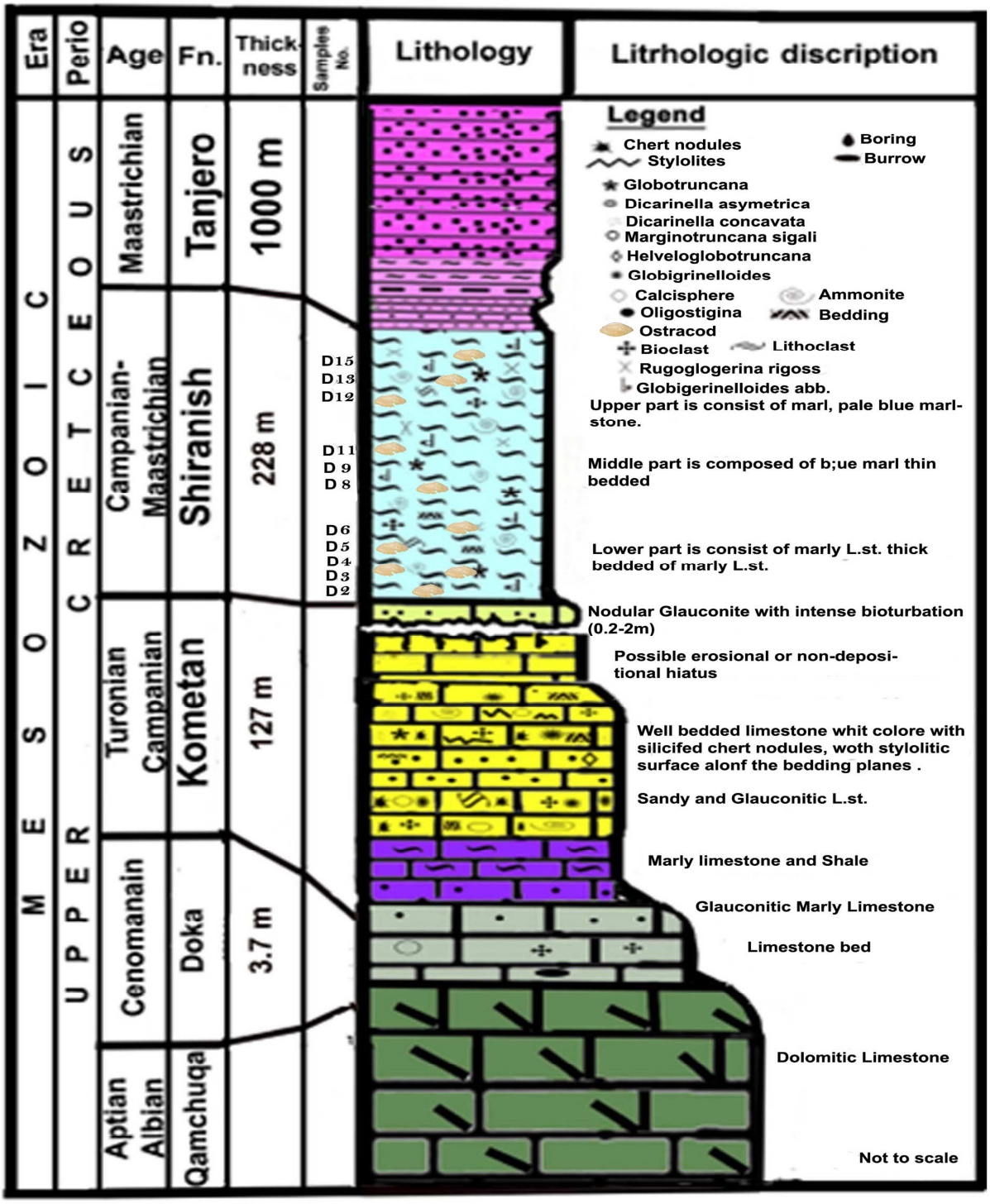


Fig. 1.3. Stratigraphic column of the Dokan section (after Taha 2008).

Morphology of the Ostracods carapace

The major taxonomic groups of Cretaceous ostracods are distinguished on the basis of morphological features of the carapace such as valve overlap, velar morphology, right and left valves size and surface ornament of the valves (see Fig. 1.4).

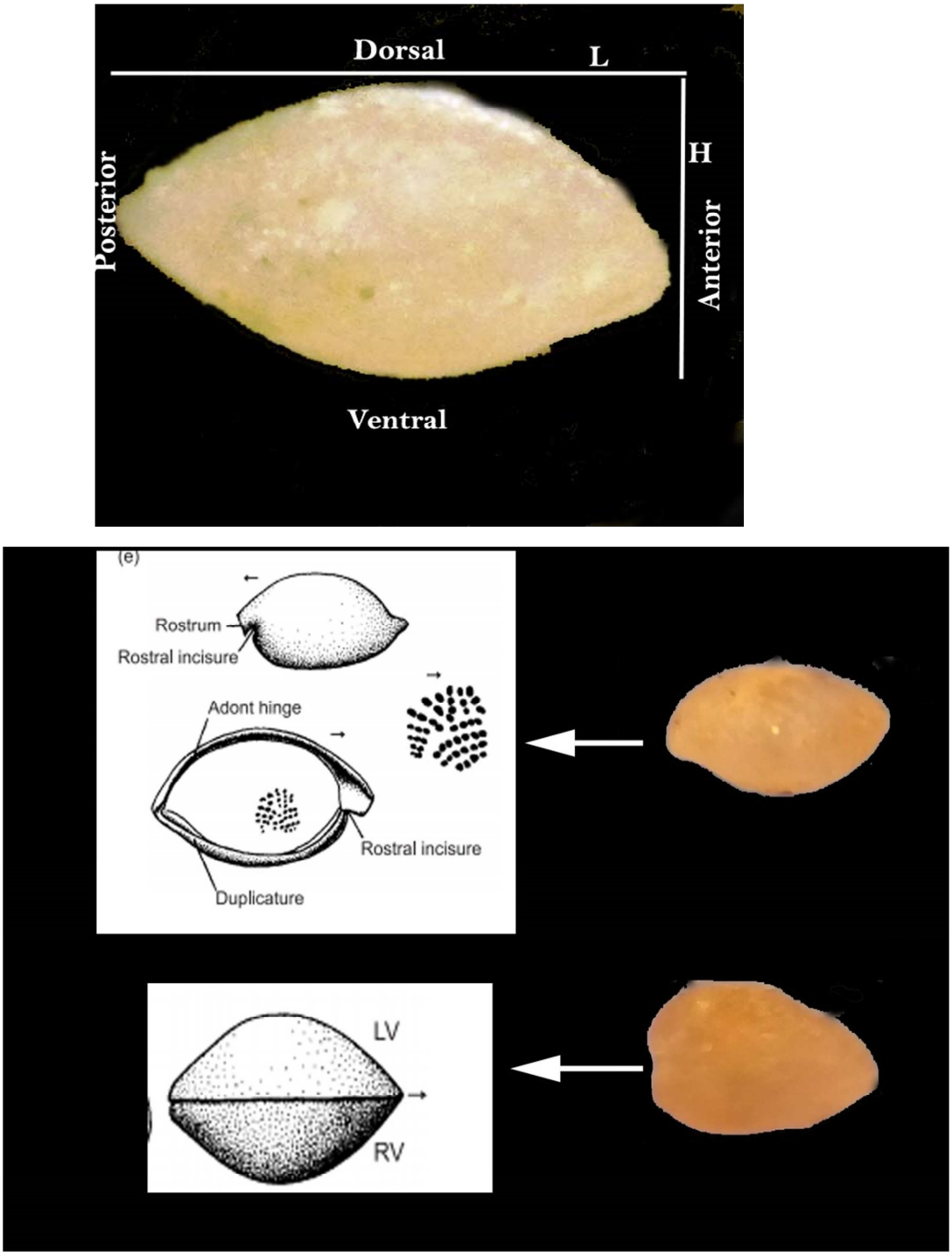


Fig. 1.4. The terminology of morphology used herein for Cretaceous ostracods. Symbol: L, length; H, height; LV, left valve; RV, right valve.

Systematic Descriptions

The taxonomy and terminology of ostracoda follow that of the Treatise Moore (Moore, 1961). The abbreviations, R, L, H, L, V, in the descriptions and explanation denote to right, left, height

length, valve, respectively. All material is deposited in theGeological Department, College of Science, University of Sulaimani, Kurdistan region underneath the list of the number SHD. In this study eight species belonging to ten genera described systematically as detail.

Ostracods

Phylum Crustacea Pennant, 1777

Class Ostracoda Latereille, 1806

Order Podocopida Muller, 1894

Suborder Podocopina Muller, 1894

Superfamily Cytheracea Baird, 1850

Subfamily Herpetocypridinae Kaufmann, 1900

Genus *Mongolianella* Mandelstam, 1956

***Mongolianella* sp. Pl. 1, fig. 2**

Measurements (mm). Length 0.78 , Height 0.43.

Material. Two specimen from sample D5 .

Description. Carapace fusiform, elongate, length twice the height. The maximum height and width is medial. The carapace is moderately inflated laterally, and is narrowly rounded with the apex below mid-height. The posterior margin is pointed, and the dorsal and ventral margins are slightly arched and straight, respectively. Left valve overlaps right, the overlap being especially obvious along the free margins. Valve surface smooth.

Remarks. *Mongolianella* sp. differs from *Mongolianella palmosa* Mandelstam, 1955 with slightly convex dorsal margin and the posterior margin is pointed.

Occurrence. Upper Cretaceous (Late Campanian- Early Maastrichtia) Shiranish Formation, Dokan area.

Subfamily Eucypridinae Bronsthein, 1947

Genus *Eucypris* Vavra, 1891

***Eucypris* sp. Pl. 1, figs 1a, 1b**

Measurements (mm). Length 0.70 , Height 0.47.

Material. Five specimens, samples D3 and D5.

Description. Carapace**,** elongate to subovate in lateral view. Greatest length at mid-height, whereas greatest height at mid-length. The dorsal margin is distinctly umbonate at mid-length, from which it slopes rectilinearly towards the posterior end. Anterior margin rounded, but posterior margin is narrowly rounded; apex below mid-height, and antero-dorsal slope is long. Ventral margin approximately straight and shallowly concave orally. In dorsal view, the carapace are pointed ends. The left valve is larger than the right, with pronounced overlap all around the free margins. Smooth valve surface.

Remarks. The present species is closely similar in carapace outline to *Eucypris pelasgicos* described by Whatley and Bajpai (2000) from the intertrappean beds of Lakshmipur (Gujarat), but differs in being much smaller and in degree of overlap. Specimens of *Eucypris pelasgicos* Whatley and Bajpai (2000) differ from the *Eucypris* sp. in being considerably larger (length = 1.02 and height = 0.65 mm).

Occurrence. Upper Cretaceous Shiranish Formation, Dokan area.

Superfamily Cypridacea Baird, 1845

Family Cyprididae Baird, 1845

Subfamily Cypridinae Baird, 1845

Genus *Paracypretta* Sars, 1924

***Paracypretta* sp. Pl. 2, figs 1a, 1b, 5a, 5b**

Measurements (mm). Length 0.63 , Height 0.55.

Material. Four specimens from samples D4, D8, D13 and D15.
Description. Subovate species of *Paracypretta* subtriangular in lateral view and with a convex dorsal margin, subangulate in the middle. The greatest height is in the middle. In dorsal view, the carapace is timidly fusiform. Dorsal margin strongly arched, and the ventral margin is straight and somewhat curved in the middle. End margins rounded; anterior margin broadly rounded, and posterior margin more narrowly rounded than the posterior. The anterior margin has a lip-like extension. Left valve larger than right valve, and the ornament is finely punctuate; one of the carapaces

Subfamily Cypridopsinae Kaufmann, 1900
Genus *Cypridopsis* Brady, 1868
***Cypridopsis* sp. Pl. 1, fig. 5**

Measurements (mm). Length 0.55 , Height 0.49.
Material. Two specimens from sample D13.
Description. Carapace tiny, globular and subcircular in lateral outline, with the highest point slightly posterior to the middle. The carapace is inflated and fusiform in dorsal view. Anterior margin generally rounded; posterior margin narrower, dorsal margin arched, ventral margin is concave. The left valve is slightly and laterally compressed on the anterior side, overlapping the right valve. Valve surface smooth.

Occurrence. Upper Cretaceous (Late Campanian- Early Maastrichtia) Shiranish Formation, Dokan area.

Family Cytherellidae Sars, 1866
Genus *Cytherella* Jones, 1849
***Cytherella* sp. Pl. 1, fig. 11**
Type Species: *Cytherina ovata* Roemer 1840
Material. Three specimens from sample D5.
Measurements. Length of valve 0.55 mm, height of valve 0.45 mm
Description. Carapace sub-ovate to ovate in lateral view, maximum height at the middle of the carapace, greatest length at the middle of the carapace. Anterior and posterior end well rounded. Dorsal margin strongly convex in the right and left valves, Right valve ly slightly larger than the left. Ventral margin convex in the right and left valves. Valve surface smooth.

Remarks. *Cytherella* sp. differs from the *Cytherella shiranishensis* AL- Ubide and Khalaf , 2010 by dorsal view carapace sub-ovate without compressed anterior end and anterior and posterior end well rounded. The present species is fairly similar to *Cytherella iraqiensis* AL- Ubide and Khalaf, 2010 by Ovate Carapace in lateral view broadly rounded.

Occurrence. Upper Cretaceous (Late Campanian- Early Maastrichtia) Shiranish Formation, Dokan area.

Table 1.1. Species of *Cytherella* from other localities compared with *Cytherella* sp. from the Shiranish Formation.

Species name	Length and height of Carapace (mm)	Type of ornament	Important features	Formation	References
Cytherella shiranishensis AL-Ubide and Khalaf , 2010	0.80-0.49	Smooth	Anterior end well rounded, Posterior end pointed at the middle in the right valve.	Shiranish Fm. Hamrin area	AL- Ubide and Khalaf , 2010
Cytherella iraqiensis AL- Ubide and Khalaf , 2010	0.53-0.40	Smooth	Posterior end strongly narrower than the broadly rounded anterior end.	Shiranish Fm. Hamrin area	AL- Ubide and Khalaf , 2010
Cytherella sp.	0.55-0.45	Smooth	Anterior and posterior end well rounded.	Shiranish Fm. Dokan area	This study

Discussion. For distinction of *Cytherella* sp. from other species of *Cytherella* see Table 1.1.
Occurrence. Upper Cretaceous from Khashab oil well No. 1, Shiranish Formation, Hamrin area at depth (2100-3600 m) (AL- Ubide and Khalaf, 2010; Al-Ubide, 1989), Shiranish Formation, Doan area, North Eastern Iraq.

Family Bythocyprididae Maddocks, 1969
Genus *Bythocypris* Brady, 1880
***Bythocypris* sp. 1 Pl. 1, fig. 8**

Measurements (mm). Length 0.64 , Height 0.40.
Material. Four specimens from sample D15.
Description. Carapace sub-elongate with a sub-ovate outline. The maximum length is below the center of the carapace and the maximum height appears in the mid of the carapace. The posterior and anterior margins are curved to rounded. Ventral and dorsal margins are parallel and slightly straight. Valve surface smooth.
Occurrence. Upper Cretaceous (Late Campanian- Early Maastrichtia) Shiranish Formation, Dokan area.

***Bythocypris* sp. 2 Pl. 1, fig. 9**

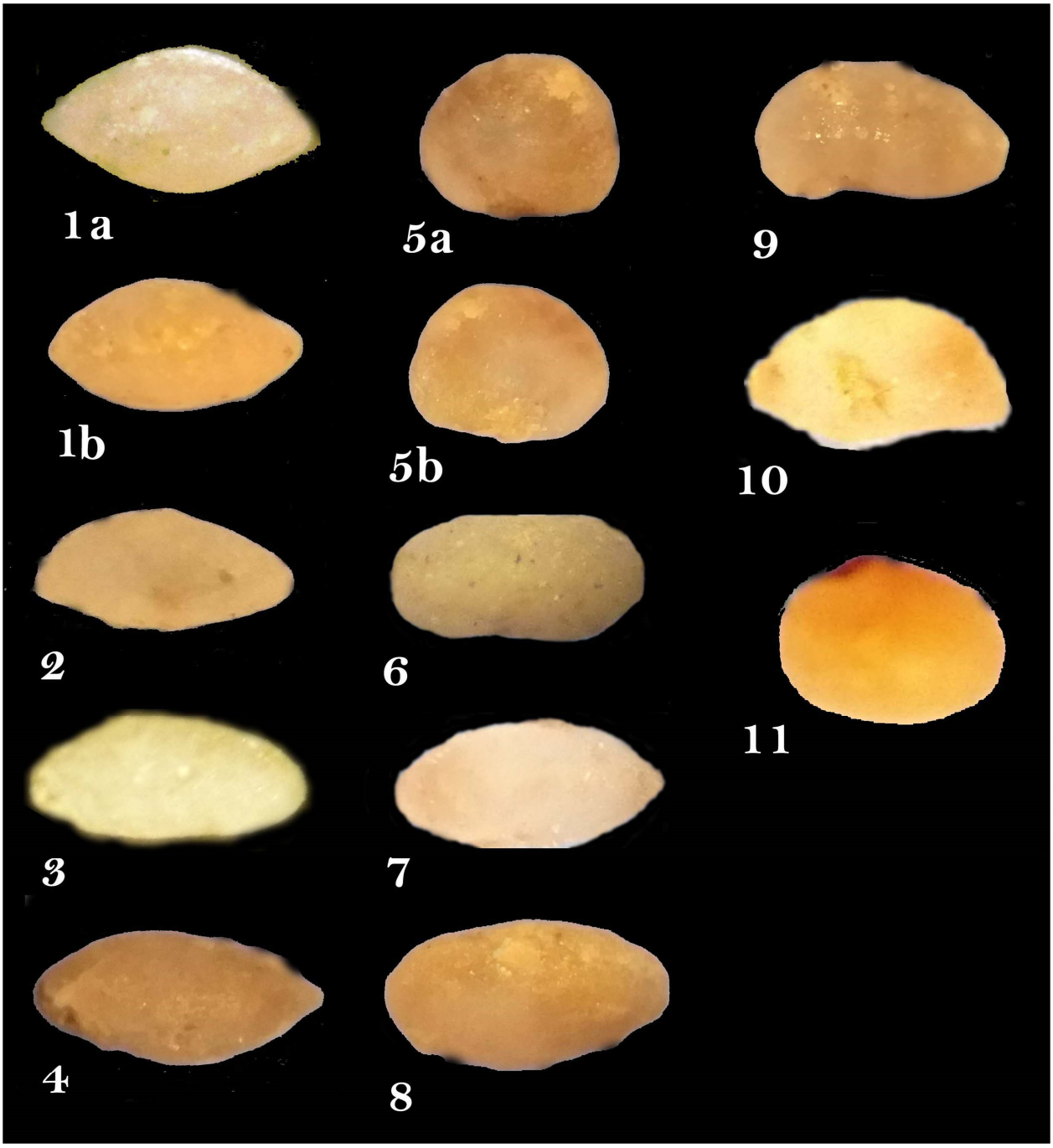
Measurements (mm). Length 0.60 , Height 0.42.
Material. one specimen from sample D13.
Description. Carapace sub-elongate to sub-beans form. The maximum length is below the center of the carapace and the maximum height is in the middle of the carapace. The anterior margin is rounded and more acute ventrally. The posterior margin is broadly rounded. Dorsal margin is convex and ventral margin concave. Valve surface smooth.
Occurrence. Upper Cretaceous (Late Campanian- Early Maastrichtia) Shiranish Formation, Dokan area.
***Bythocypris* sp. 3 Pl. 1, fig. 10**

Measurements (mm). Length 0.58 , Height 0.41.
Material. Two specimens from sample D15.
Description. Carapace sub-elongate. The maximum height is in the middle of the carapace. The anterior and posterior margins are more acute. Ventral margin concave and dorsal margin is convex. Valve surface smooth.
Occurrence. Upper Cretaceous (Late Campanian- Early Maastrichtia) Shiranish Formation, Dokan area.

EXPLANATION OF PLATE 1

Fig. 1. ***Eucypris*** sp., Shiranish Formation samples D3 and D5.
1a. carapace, left lateral view x40.
1b carapace, right lateral view x40.
Fig. 2. ***Mongolianella*** sp. Shiranish Formation sample D5.
carapace, right lateral view x40.
Fig. 3. ***Paracypris*** sp1. Shiranish Formation sample D13.
Fig. 4. ***Paracypris*** sp2. Shiranish Formation lower member sample D3.
carapace, left lateral view x40.
Fig. 5.***Cypridopsis* sp.** Shiranish Formation sample D13.
5a, 5b. carapace, right and left lateral views x40.
Fig. 6. ***Cytherella suranensis* sp**. Shiranish Formation sample D15.
Carapace , right lateral view x40.
Fig. 7. ? ***Paracypris*** sp. Shiranish Formation lower member sample D3.
Fig. 8. ***Bythocypris*** sp1. Carapace (D15) left lateral view x 40,Shiranish Formation.
Fig. 9. ***Bythocypris*** sp2., Carapace (D13) left lateral view x 40,Shiranish Formation.
Fig. 10. ***Bythocypris*** sp3., Carapace (D15) left lateral view x 40,Shiranish Formation.
Fig. 11. ***Cytherella* sp**. Carapace, sample D5, left lateral view x40, Shiranish Formation.

Plate 1

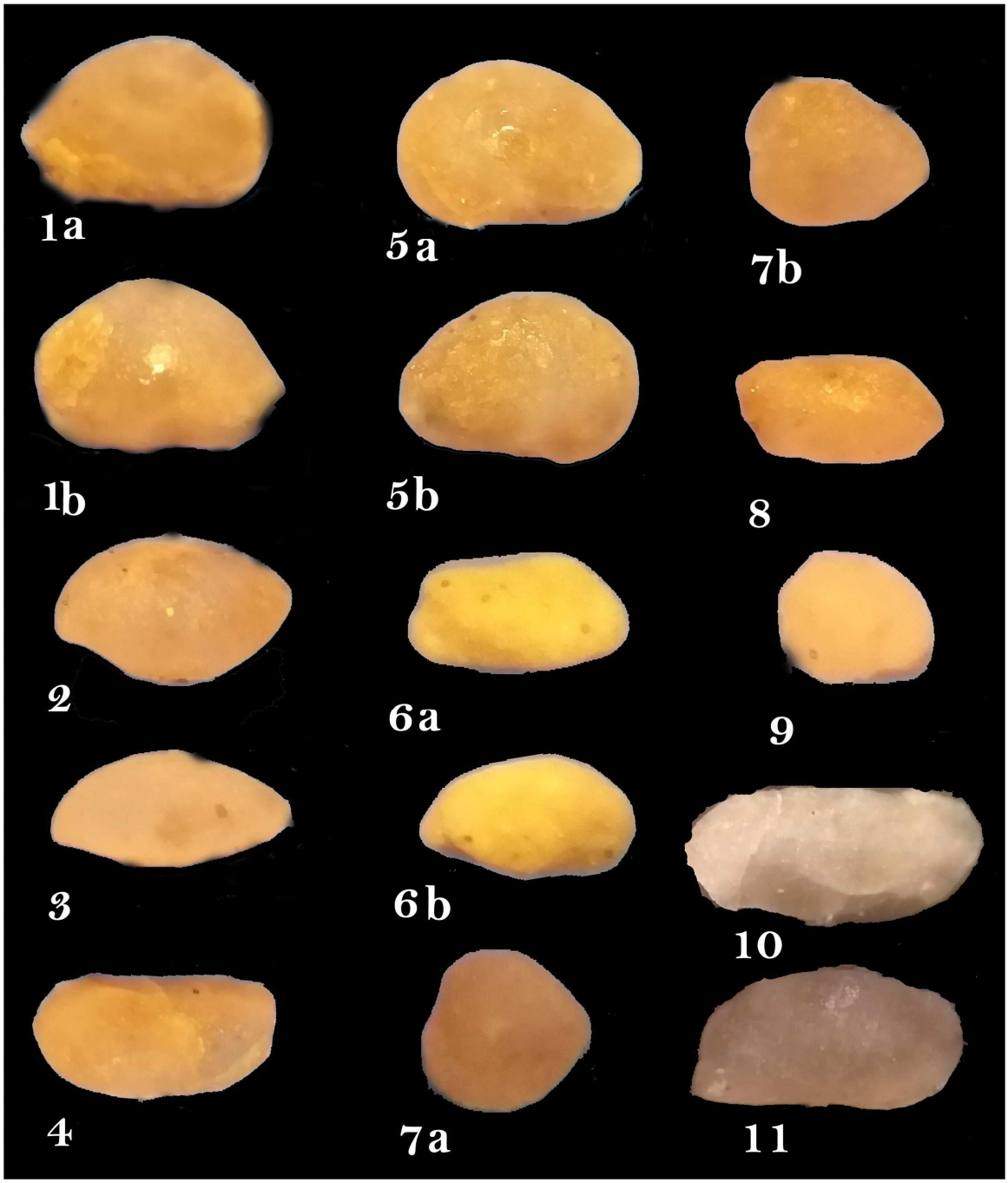


EXPLANATION OF PLATE 2

Fig. 1. ***Paracypretta*** sp1., Shiranish Formation, samples D4 and D13.
1a, 1b carapace ,left and right lateral view.
Fig. 2. ? ***Bythocypris*** sp. Shiranish Formation lower member sample D4.
Fig. 3. ***Paracypris Jonesi*** Bonnema,1940. Carapace (D5) External right lateral view x 40, Shiranish Formation.
Fig. 4. ***Krithe*** sp. Shiranish Formation sample D4.
Fig. 5. ***Paracypretta*** sp2. Shiranish Formation samples D8 and D15.
5a, 5b carapace ,right and left lateral view x40.

Fig. 6. ***Paracypris*** sp.B Esker,1968. Shiranish Formation samples D3 and D5. 6a,
6b carapace , left and right lateral view x40.
Fig. 7. ? ***Xestoleberis*** sp1. Shiranish Formation sample D6.
57a, 7b carapace , left lateral view x40.
Fig. 8. ***Parakrithe*** sp. Shiranish Formation sample D13, Lateral view x 40.
Fig. 9. ? ***Xestoleberis*** sp2. Shiranish Formation sample D5. lateral view x 40.
Fig. 10. ***Krithe fortidmophica*** El-waer, 1992. right valve lateral view x 40.
Fig. 11. ***Parakrithe lasaensis*** Lazaro, 1988. Shiranish Formation sample D13, Carapace, right lateral view x 40.

Plate 2



Conclusions

1. The Late Cretaceous Shiranish Formation is outcropped in Dokan area, which has yielded adiverse microfossils including ostracods, foraminifera (benthonic and planktonic), etc. This study has focused on the systematics of ostracods.
2. Identified Twenty-Two species in the Shiranish Formation belonging to the genera *Bythocypris, Cytherella, Cypridopsis, Eucypris, Krithe, Mongolianella, Paracypris, Paracypretta, Parakrithe* and *Xestoleberis*.
3. Described detail for eight species of the Shiranish Formation of Dokan area.
4. The ostracod fauna from the Shiranish Formation of Dokan area supports a Late Cretaceous (Late Campanian-Early Maastrichia) age.

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