On Some Species Of The Ostracode Genera *Cytherella,Bairdia* and *Bairdoppilata* From Avanah Formation , Dohuk Area, Northern Iraq.

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Abstract
Thirteen Ostracode species belong to the genera *Cytherella, Bairdia* and *Bairdoppilata* were identified from Avanah Formation (M.Eocene), Dohuk area, Northern Iraq. These species previously recorded from India, Pakistan and Middle East.The stratigraphic distribution and the environmental signifacance of the described species were outlined.

Introduction

The present paper is part of work investegating Ostracoda from Avanah Formation, Dohuk area Geli-Bessri, northern Iraq. (1). All the figured specimens wer£ deposited at Geology Dept. Mosul University under prefix.

Mo: Mosul University.
T: Tertiary Collection.
Av: Avanah Formation.
All dimensions in (mm.)

Avanah Formation

The formation was first described in Iraq by (2) from Kirkuk well 116 located on Avanah dome of Kirkuk oil field N.Iraq.At Dohuk area, the Formation is represented with good exposure of which the studied section is located at Geli Bessri about 6 Km east of Dohuk city along the Dohuk-Zawita road at latitude (36° 46 5 N) and longitude (43° 15 10 E) (Fig.l). The thickness of the Formation at Geli- Bessri 30 ms (Fig.2).

At the studied section the Formation consists of hard well bedded recrystallized limestone alternating with shale, marly shale and marly limestone beds. Pila spi Formation overlain conformably the Avanah Formation which consists of dolomitic recrystallized and chalky limestone with chert nodules, while Gercus Formation underlain unconformably the Avanah Formation with mainly clastic components. (3) (1).

(4), recorded different species belong to the following genera *Alveolina, Orbitolites, Somalina, Spiroculina.*

(3) recorded the follwing larger Foraminifera from the studied section. *Alveolina ellipticavar.nutalli, A.fusiformis,*

A.mnnicri, A.cf.oblonga, Coskinalina liburnica, Rhapy dionina urensis, R.cf. huberi, Somalina danieli, Opertobitolites cf. donvillei, Orbitolites complanata et *al.*, in the present study thirty surface samples were investigated from the Avanah Fomation at Geli Bessri section. The samples yielded well preserved Ostracode species.

Systematic Description

The classfication of Ostracodes is followed that of (5). (6).

Class Ostracoda Latereille, 1806
Order podocopida G.W. Muller,1894 Family Cytherllidae Sars, 1866 Genus *Cytherella* Jones, 1849

Type-species *Cytherella ovata* Roemer, 1840

Cytherella tawaica Tewari and Singh 1966
PI. 1,Fig.l

1966 *Cytherella tawaica* (7), p. l27, pl.2, figs 3 a-d
Material: Eleven specimens.
Horizon: Avanah Formation, sample No. Do.27.
Dohuk area.

Dimensions:	L.	H.	W.	L / H.
Carapace Mo.T.Av.l	0.55	0.31	0.22	1.77

Remarks: This species was originally dscribed from the lower Eocene of Kutch areajndia (8) The Iraqi specimens were identical with *Cytherella tawica* (7), with slight differences in the anterior end.

Family : Bairdiidae Sars, 1888.
Genus : Bairdia Mc'coy, 1844

Type-species; Bairdia curtus Mc'coy, 1844

Bairdia kutchensis Tewari and Tandon 1960
Pl.l Fig.2

1960 *Bairdia indica (* 8), PP.148-149.
Text.fig.l, figs,la-b
1972 *Bairdia kutchensis* (8) in (9)
P.483,pl.l.Fig.l0
Material: Twenty specimens
Horizon:Avanah Formation, Dohuk area,sample No.Do34

Dimension:	L.	H.	W.	L/H.
Carapace Mo.T.Av.2	092	0.59	0.49	1.55

Pl.Fig.2

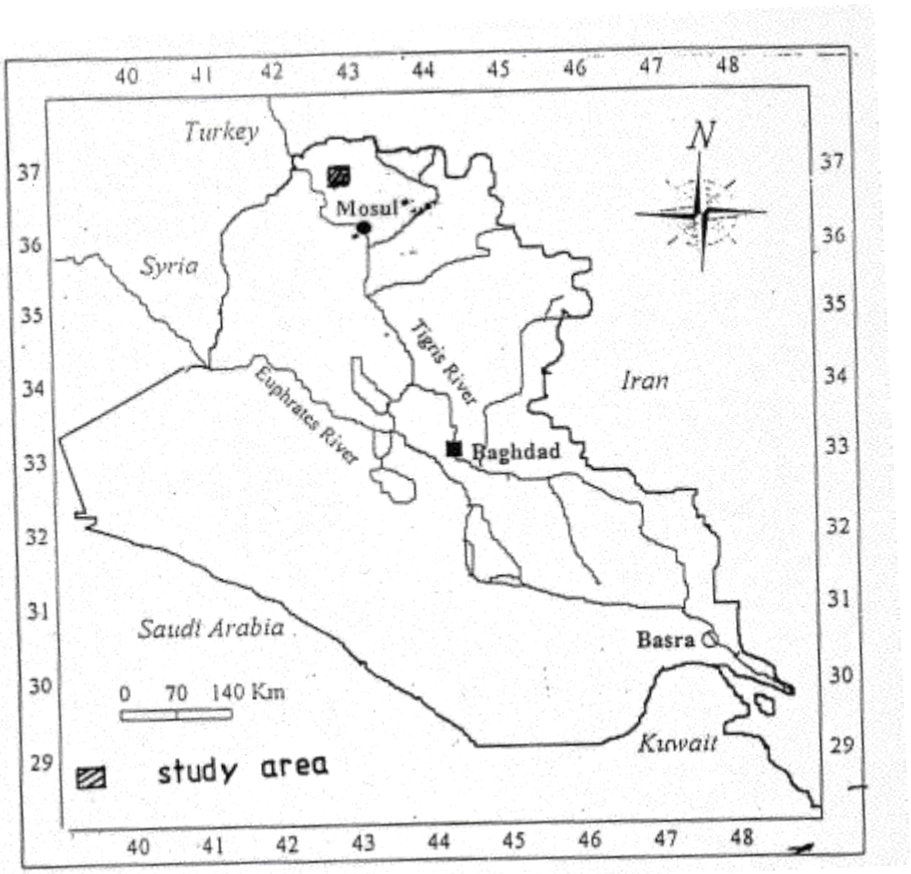
Remarks: This species was originally described as *Bairdia indica* by (8) from the M. Eocene of Kutch area India. (10) marked that the name *B. indica* is preocupied by Nesidea (Bairdia indica) (11) from the Tertiary deposits of Brono. (9) renamed the species *Bairdia kutchensis* instead *of B. indica* .The Iraqi specimens entirelly identical in all characters with the Indian species

*Bairdia subdeitoidea (*Munster) (12)
Pl.l,Fig.3

1934 *Bairdia subdeitoidea (* Munster) in (13).
P.344, Fig.l
Material: Thirty one specimens
Horizan: Avanah Formation , Dohuk area, sample No.Do.37

Dimensions:	L.	H.	W.	L/H.
Carapace Mo.T.Av. 3	1.24	0.81	0.62	0.53

Pl.l Fig.3


40 41 42 43 44 45 46 47 48
37 36 35 34 33 32 31 30 29
Turkey
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Tigris River
Iran
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Baghdad
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study area

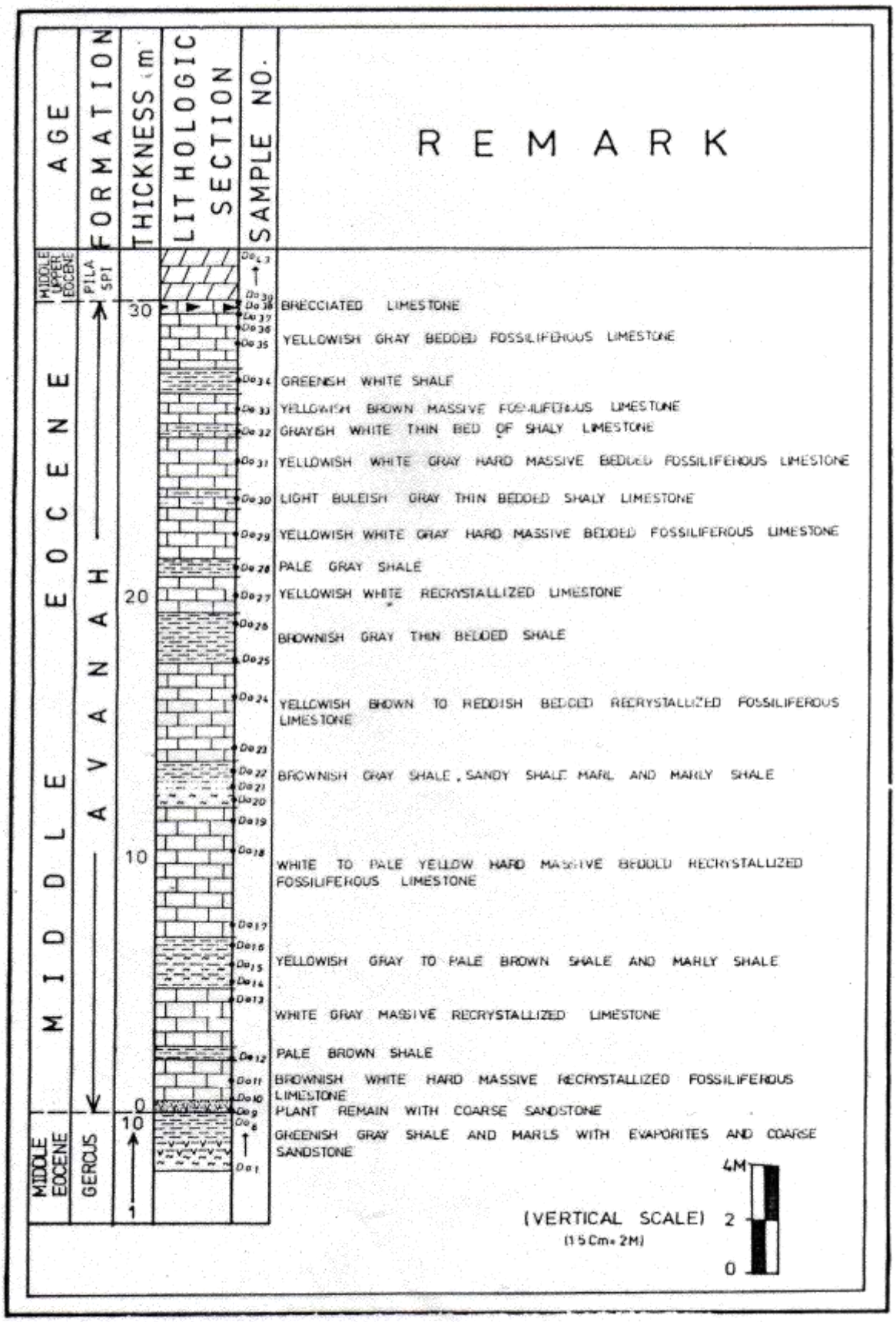


Fig.2 Lithological Section

Remaks: *Bairdia subdeitoidea* was originally described from the M.Eocene beds of NW India (12).the Iraqi specimen's slightly differs from the Indian species in having narrower posterior end.

Bairdia poddari Lyubimova, Guha and Mohan . 1960
Pl.l, fig .4
1960 *Bairdioppilata poddari* (14)
P.21-23,pl.l,fig.la-b
1972 *Bairdioppilata poddan:* (14) in (9)
P.488Pl.l,fig.l2
Material: Twenty carapace and seventeen valves
Horizon: Dohuk area (M. Eocene)
Sample: No.Do.35

Dimensions:	L.	H.	W.	L/H
Carapace Mo.T.Av.4	0.89	0.61	0.48	1.45

Pl.1,%,4
Remarks: Originally the species was described under the genus *Balrdoppilata* by (14) from the M.Eocene of India. (9) reassigned the species to
the genus *Bairdia* on the basis of internal features. The Iraqi specimens fairly identical with Khosla specimens.

Bairdia beragnaensis Tewari and Singh, 1960
Pl.l,Fig.5
1966 *Bairdia beraguaensis* (7). p. 119-120, PI. I, figs 4a-d
1970 *Bairdioppilata sy.* (15) ,p.60,Pl,l figs;5-6
1972 *Bairdia beraguaensis (* 7) in (9)
p.483,Pll.,fig.8
Material: Twenty eight specimeas
Horizon: Dohuk area, Avanah Formation
(M.Eocene).
Sample: No.Do.34

Dimensions:	L.	H.	W.	L/H
Carapace Mo.T.Av.5	1.29	0.80	0.65	1.61

Fig.l Fig.5
Remarks: Originally described from the M. Eocene beds of India (7) The Iraqi specimens differs from the Indian species in having broadly convex dorsal margin

Bairdia dohukensis Khalaf and Aziz, 1994
Pl.l,Fig.6-8 1994
Bairdia dohukensis (16), P.235 - 245
Pl.l,Fig. 1-3
Material: Twenty seven specimens
Horizon: Dohuk area (M.Eocene).
Sample: No.Do.37

Dimensions:	L.	H.	W.	L/H
Carapace Mo.T.Av.6	0.99	0.64	0.54	1.54
Pl.l,Fig,6				
Carapace Mo.T.Av.7	1.02	0.67	0.56	1.52
Pl.l,Fig.7				
Carapace Mo.T.Av.8	1.01	0.66	0.56	1.53
Pl.l.Fig.S				

Remarks: Previously
Formation (M.Eocene) N.Iraq (16)

Bairdia eocaenica Khalaf and Aziz 1994
Pl.l, Figs.9.10
1994 *Bairdia eocaenica* (16),P.235-245,
Pl.lFigs.4,5
Material: Twenty specimens
Horizon: Avanah Formation,(M.Eocene)
Sample: No.Do.34,

Dimensions:	L.	H.	W.	L/H
Carapace Mo.T.Av.9	0.70	0.51	0.53	1.37
Pl.l,Fig.9				
Carapace Mo.T.Av.1	0.74	0.53	0.56	1.39
Pl.l,Fig.l0.				

Remarks: *Bairdia eocaenica* has so far been recorded from the Avanah Formation (M.Eocene) N.Iraq (16), and from Khurmala Formation (M.Eocene) Shaqlawa area (17).

Bairdia bhateai Khalaf and Aziz ,1994
P1.2,Figs, 1-2
1994 *Bairdia bhateai* (16) P.235-245
Pl.l.Figs,6-7
Material: Twenty one specimens.
Horizon: Avanah Formation (M.Ecocene).
Sample: No.Do.37

Dimensions:	L.	H.	W.	L/H
Carapace Mo.T.Av.11	1.29	0.77	0.61	1.67
P1.2, Fig.l				
Carapace Mo.T.Av. 12	1.29	0.77	0.63	1.63

P1.2Fig.2
Remarks :Originally described from the M. Ecocene Avanah Formation Dohuk area N. Iraq (16) also recorded from Khurmala Formation M.Eocene Shaqlawa area (17)

Bairdia angulata Khalaf and Aziz, 1994
PI.2, Figs. 3,4.
1994*Bairdiaangulata* (16)
P.235-245, PI.l,Fig.8,9.
Material, Twenty specimens.
Horizon: Avanah Formation , M.Eocene.
Sample: No.Do37

Dimension:	L.	H.	W.	L/H
Carapace Mo.T.Av. 13	1.24	.71	.60	1.74
P1.2,Fig.3				
Carapace Mo.T.Av. 14	1.24	.71	.60	1.74
P1.2,Fig,4				

Remarks: *Bardia angulata* previously described
From Avanah Formation (M.Eocene) N.Iraq, (16)

Bairdia SP.A
P1.2, Fig.5
Material: Two carapace.
Horizon: Avanah Formation (M.Eocene).
Sample: No.Do34.

Dimesion:	L.	R.	W.	L/H.
Carapace Mo.T.Av.15	1.36	0.82	0.59	1.63
P1.2,Fig.5				

Description: Thick carapace, subtriangular is lateral view with greatest height at the anterior part, maximun length just below the centre of the body. Anterior margin narrowly rounded, posterior margin is slightly pointed. Dorsal margin strongly convex, ventral margin broadly convex.
Remarks: The present species shows some similarties to the *Bairdia* Sp.2 (18) recorded from Maastrichtian-Danian deposits of Tunisia but the Iraqi species differes in having different dorsal and ventral margins. Due to the lack of material the present species, left under open nomenclature.

Genus: *Bairdioppilata* Coryell, Sample & Jenings, 1935.

Type species: *Bairdioppilata martym* coryell, Sample & Jenning,1935.

Bairdioppilata gliberti Keij, 1957
P1.2, Fig, 6,7

1957 *Bairdioppitata gliberti* (19), P,53, P1.1, Fig. 18-21.
Material: sixteen specimens.
Horizon: Avanah Fm (M.Eocene).
Sample: No.Do36.

Dimensions	L.	H.	W.	L/H
Carapace Mo.T.Av. 16 P1.2,Fig.6	1.24	.84	.63	1.47
Carapace Mo.T.Av. 17 P1.2,Fig.7	1.24	.84	.63	1.47

Remarks: The Iraqi specimens entirely agread with *Bairdioppilata gliberti* (19), recorded from M.Eocene of France .*B.gliberti* also reorded from Eocene sequene of western India (9).

Bairdioppilata rajnathi Tewari and Tandon 1960
PI.2, Figs 8,9

1960 *Bairdoppilata rajnathi,* (8) P.lSOJoe Figs.5 a-b.
Material: Ten specimens.
Horizon: Avanah Formation ,M.Eocene,
Sample: No.Do28.

Dimesions	L.	H.	W.	L/H.
Carapace Mo.T.Av. 18 P1.2,fig.8	.94	.57	.61	1.64
Carapace Mo.T.Av. 19 P1.2, Fig.9	.89	.56	.59	1.58

Remarks: *B.rajnathi* previously recorded from L.Miocene of W,India (8), (9), recorded the species from M-Eocene of NW.Iraqi, (20), (1) recorded the species from M-U Eocene from north Iraq.

Bairdioppilata rakhdiensis Khosla and Pant, 1988
P1.2,Fig 10

1988 *Bairdioppilata rakhdiensis* (21), P.337-338-Fig.2,2H.
Material: Eight specimens.
Horizon: Avanah Formation (M.Eocene).
Sample: No Do. 34.

Dimension:	L.	H.	W.	L./H
Carapace Mo. T.Av.20 P1.2,Fig.lO	1.17	0.82	0.59	1.41

Remarks: Originally recorded from Indian Eocene, (20) and recorded from Avanah Formation,Dohuk area, north Iraq (1).

General Conlusions

1. On the basis of the stratigraphic occurence of Ostracode species in the present study, compared with the stratigraphic value of larger Foraminifera recorded by (3), Middle Eocene age confirmed to the Avanah Formation Dohnk area. N.Iraq (Table1).
2. The majority of Cytherella species lives in normal saline, shallow water enviroment in addition to that the genera Bairdia and Bairdioppilata reorded from shallow warm water under normal salinity (5), (22)

The above genera were recorded from the Avanah Formation, Dohuk ara associated withe the Ostracode genera Xestoleberis Echinocythereis Occultocythereis, Herman ites, phalcocythere, and Quadracythere,all were known from shallow enviroment under normal salanity. Therefore from the above informations we can conclude that the Avanah Formation was deposited under shallow water environment, warm temperature and normal salinity with well oxgyeneted conditions

3. In genral ostracode genera and species recorded from the Avanah Formation shows strong affmtes with those described from the Eocene of India, Pakistan North Africa and Middle east explained that the migration route from Africa towards Middle east

.

Table. 1 Stratigraphical Occurrence of Ostracode species in Iraq and other regions.

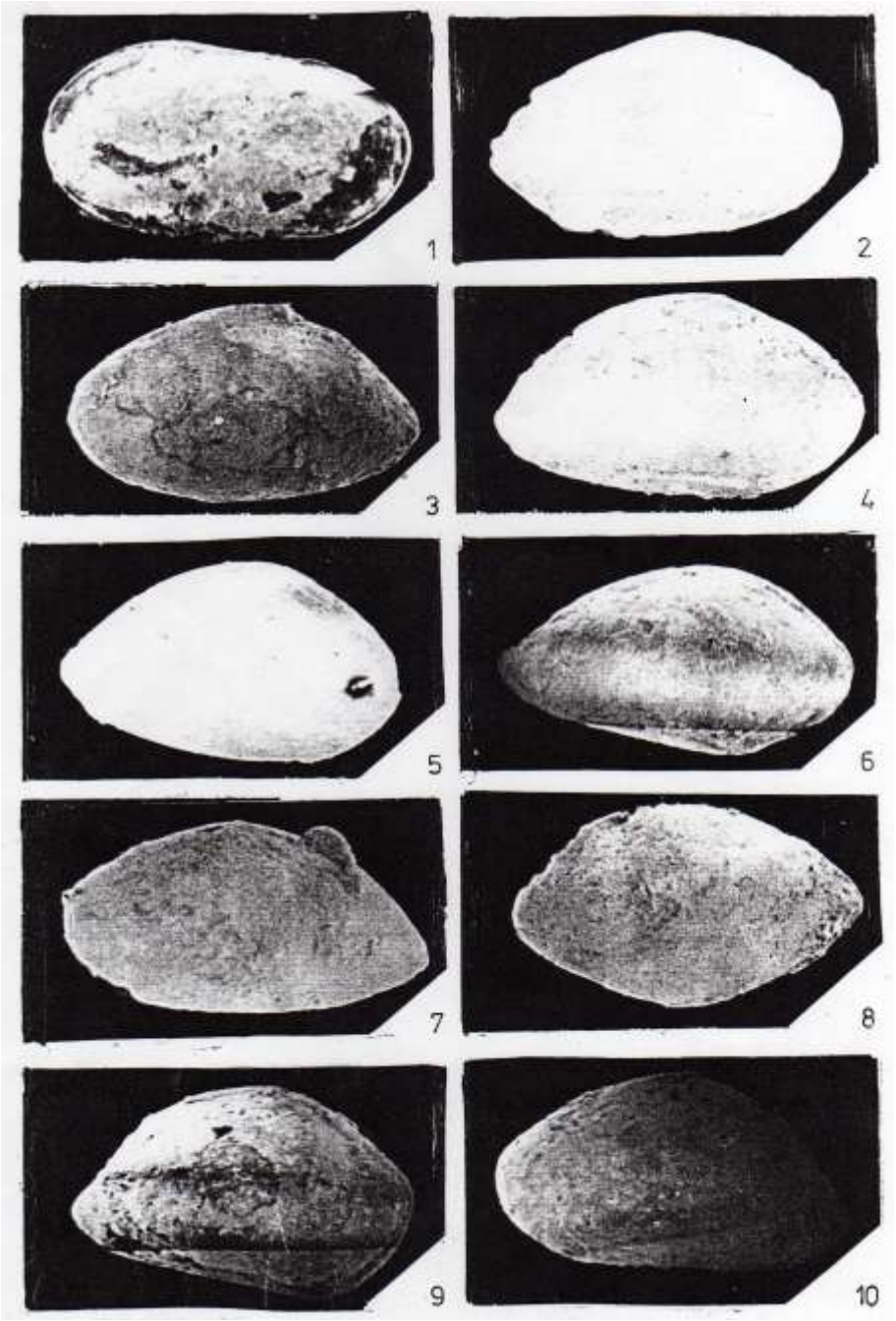
Species	Formations/ Iraq				Other.regions
	Khurmala	Avanah	Dammam	Serikagni	
Ctherella tawacia	-	X	-	-	lndia(L. Eocene)
Bairdia poddri	X	X	X	X	India.(M. Eocene)
Bairdia berguaensis	X	X	X	X	India(L-M. Eocene) Pakistan(L. Eocene)
Bairdia kutchensis	-	X	X	-	India(L-M.)Eocene)
Bairdia subdealtoidea	X	X	X	-	India(M.)Eocene)
Bairdia dohukensis	-	X		-	India(M.)Eocene)
Bairdia eocaenica	X	X	-	-	India(M.)Eocene)
Bairdia bhatai	X	X	-	-	India(M.)Eocene)
Bairdia angulate	-	X	-	-	India(M.)Eocene)
Bairdoppilata gliberti	-	X			France (M.Eocene) Turkey, Hungery (M. Eocene)
Bairdoppilata rajanthi		X			Lower Miocene(India)
Bairdoppilate rakhdiensis		X			India(M. Eocene)

.

Explanation of plate 1

Fig.l *Cytherella tawaica* Sing and Tewari 1966 xl 14 (Mo.T.As.l) ...
Carapace.L.V.lateral view
Fig.2 *Bairdia kutchensis* Tewaeri and Tandon 1960 X.68.Mo.T.Av.2
Carapace R.V.Lateral view .
Fig.3 *Bairdia subdeltoidea* (Munster) Latham 1938 x.50 Ms.T.Av.3
Carapace L.w leteral view.
Fig4. *Bairdia poddari* Lyubimova *et al* 1960 x.74 Mo.T.Av.4
Carapace.R.V.lateral view
Fig.5 6-8 *Bairdia dohukensis* khalaf and Aziz 1994
X.64 Mo.T.Av.6 Carapace.R.v.lateral view.
X.63 Mo.T.Av.7 Carapace,L.V. lateral view.
X.62 Mo.T.Av.8 Carapace dorsal view .
Fig.5,9,10 *Bairdia eocaenica* khalaf and Aziz 1994
X.85 Mo.T.Av.9 Carapace .R.V.lateral view.
X.86 Ms.T.Av.10 Carapace L.v. lateral view

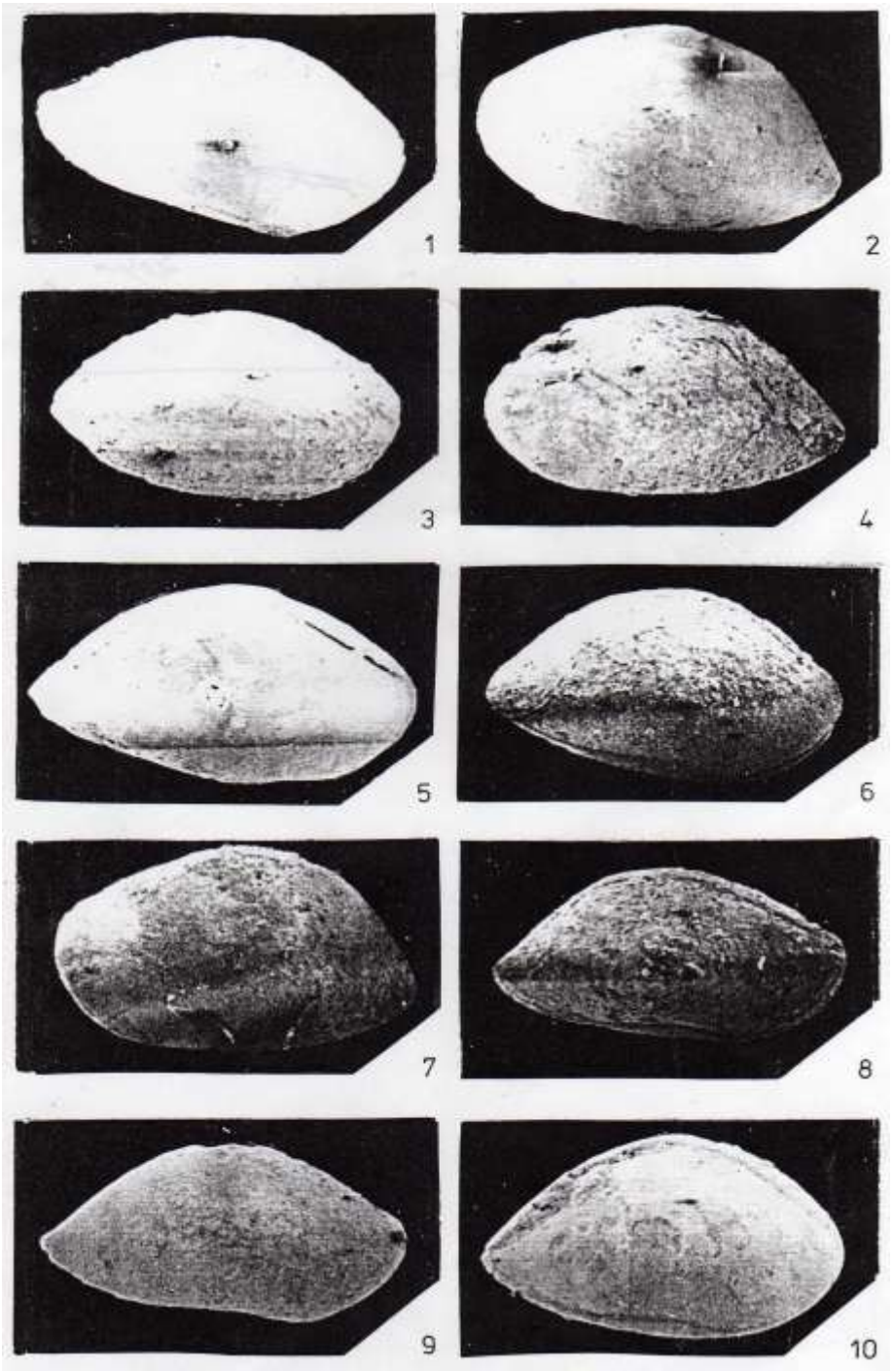
PLATE -1-



Expiation of plate 2

Fig.5,1,2 *Bairdia bhateai* Khalaf and Aziz 1994
X.49 M.T.Av.l 1 Carapace ,R.v. lateral view
X.48 Mo.T.Av.12 Carapace L.v lateral view
Figs.3,4 *Bairdia angulata* khalaf Aziz 1994
X.49 Mo.T.Av.13 Carapace R.V.lateal view
X.50 Mo.T.Av.14 Carapace L.V.lateral view
fig5.*Bairdia* sp.A
X.50 .Mo.T.Av.15 *Carapace Rv.lateral view*
.
Figs. 6.7 *Bairdappilata gliberti* keij ,1957
X.50 Mo.T.Av.16 Carapace R.v.lateral view
X.50 Mo.T.
Figs.8,9 *Bairdoppilate rajanathi* Teweri and Tandon,1960.
X.64 Mo.T.Av.18 Carapace Rv lateral view
X.72 Mo.T.Av.19 Carapace Rv lateral view
Fig.10 *Bairdoppilata rakhdiensis* Knosla and pant 1988.
X.53 Mo.T.Av. Carapace Rv lateral view

PLATE -2-



Reference

l-Aziz,N.M.,1990.Middle Eocene Ostracode from Dohuk area N.Iraq. (M.Sc .thesis) Dept. of Geo.Mosul Unvi.,Iraq,244p.

2-Bellen,R.C.Van.,Dunnington, H.V.Wetzel,R. and Morten, D.M., 1959. Lexique Stratigrahique International. Asie, V.S.Fase, lOa ,Iraq, Pars, 333p.

3- Abawi.T.S.and Sharbazheri, K.M.,1987. Larger Foraminifera from the Avanah Formation (M.Eocene) of Dohuk area, N.Iraq. Jour. Geol. Soc.Iraq.Vol.2,pp70-88,2pis.3 figs.

4 - Al-Omari,F.S.and Sadek,A.,1975. Stratigraphy *of Alveolina* — bearing strata from Dohuk area N. Jb Geol palaont.H.10, 577-585.

5 -Hartmann,G., and puri,H.S., 1975. Summary neontological and palaeontological classification of ostracoda.Mitt. Hamburg, 2001.Mus.Inst., 70,pp

6-Ahmad,M.Neale,J.W.and Siddiqui, Q.A.,1991. Tertiary Ostracode from the Linidi area Tanzania Bull. Br. Mus. Nat.Hist (Geol).,46 (2): 115-270.

7-Tewari, B. S. and Singh, P. 1966. Ostracoda from the Nunnulitic beds of Kalakot, jammu and Kashmir state. Center adv. Study Geol. Panjab Univ. 3, 117-130

8- Tewari, B. S. and Tandon, K.K.,1960, Kutch microfauna from Lower Teriary Ostracoda of India, Nat. Inst. Sci. Proc. Ser. B. 26, 148-167.

9- Khosla,S.C.,1972.Ostracoda from the Eocene beds of Rajasthan .India, Micropal 18 (4), pp.476-507.

10- Bold, Van Den, 1964, Ostracoden aus deroberkreide von abu Rawash, Agypten. Palaeontographica. 123. ppl 11-136.

11- Doeglas, 1931 in Bold 1964 (10).

12-Latham,M.H.,1938,Some Eocene Ostracoda from northwest India Proc. Roy. Soc .Edinb., 59 (l),P.38.48.text.fig.l-8.

13- Howe, H.V. and Laurencich, L. 1958, Introduction to the study of Cretaceous Ostracoda.Louisiana State Univ.Press,563p.

14- Lyubimova-P.s.,Guha,D.K.and Mohan, M., 1960.Ostracoda Jurassic and Tertiary deposit from kutch and Rajasthen Jaisalmer, India, Geol. Min. Metal Soc.Calcutta Bull. 22, p. 1-16.

15- Sohn, I. G. 1970, Early Tertiary Ostracoda from west Pakistan, Palaeontologia, Pakistanica, Vol 3, No 1, pp 1-19.

16-Khalaf,S.K. and AzizN.M.,1994.The ostracoda genus *Bairdla* from the Tertiary of west and north west Iraq. J. Edu. Sci, 23,pp.235-245.

17-Aziz,N.M.,2001.Some Ostracode of family (Bairdidae) from the Khurmala Formation (Middle Eocene) Shaqlawa area, Northern Iraq .Iraqi Jour. Earth. Sci., 11(2),pp. 19-37.

18-Coryell, S,and Jennings, P. 1935, Bairdobbilata Bairdobbilata new genus of ostracoda with tow new speises. Am. Museum, Navitates, 777, 1-5.

19-Keij, A.J.,1957. Eocene and Oligocene Ostracoda of Belgium Inst. Roy. Sc.Nat.Belgique, Men. 136,pp. 1-210 pis, 1-26. basin. England Bull, centre. Res.pau-SNPA, Suppl., pp.545-558 Res.pau-SNPOm,suppl., pp. 545-558.

20- Yousif, M.S, 1987, Middle Eocene- Lower Miocene Ostracoda from Sinjar Anticline NW Iraq, MSC Thesis, Mosul Univ.

21-Khosla ,S.C. and pant , P.C,1988. Ostracoda from Eocene and Oligocene beds of Kaujarat area, India,Cytherllidae Bairdiidae and Trachyleberidae Indian Earths Sci. 15(4). pp.325-346.

22-Monostori, M.,1985.Eocene Ostracoda from the Dorog Basin (Norther Transdanubia Hungary). Akademia kiado, Budapest. PP: l-214, pls. I-X

بعض انواع متحجرات الاوستراكودا للأجناس سايثيرلا، بيرديا، بيرديوباليتا Cytherella, Bairdia and Bairdioppilata من تكوين آفانا منطقة دهوك – شمال العراق

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الملخص:

تم تشخيص ثلاثة عشر نوعاً من الاوستراكودا تعود الى اجناس سايثيرلا، بيرديا، بيرديوباليتا Cytherella, Bairdia and Bairdioppilata من تكوين آفانا (الايوسين الأوسط) –منطقة دهوك– شمال العراق، هذه الأنواع سجلت سابقاً من الهند، باكستان ومناطق اخرى من الشرق الأوسط، تم تحديد الانتشار الطباقي والأهمية البيئية للأنواع الموصوفة.