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Maastrichtian to Middle Eocene ostracodes from Sinai, Egypt : Systematics, biostratigraphy and paleobiogeography

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Abstract
The exposed Maastrichtian and the overlying Paleocene-Middle Eocene succession at northern Sinai (Gabal El Dokh and Gabal Meshrak sections) and southwestern Sinai (Gabal Matulla and Gabal Ekma sections) are closely investigated for their ostracod content. Four lithostratigraphic units are detected and arranged from the base to the top as Sudr Chalk (Maastrichtian), Esna Shale (latest Maastrichtian-Early Eocene), Thebes Formation (Early Eocene), Minia Formation (Early-Middle Eocene and Mokattam Formation (Middle Eocene). The detailed investigation of these ostracodes has led to the recognition of 68 species and subspecies belonging to 34 genera, 13 families and 2 suborders. The vertical range enables the detection of 4 local biostratigraphic zones covering the studied interval. The paleobathymetric discussion of these assemblages reveals a wide habitat range from the inner neritic to upper bathyal environment. The cosmopolitan distribution of the recorded species reveals a direct connection all over the Tethyan realm through which the migration of the benthic organisms had occurred and supports the idea of Trans-Saharan seaway with some connection to the western Atlantic coast during that time.

Key words
Maastrichtian, Paleocene, Eocene, Biostratigraphy, Paleobathymetry, Paleobiogeography, Sinai, Egypt.

INTRODUCTION

The published ostracode biostratigraphy researches on this interval are still rare and it is urgent to complete the biostratigraphic framework of this interval by means of ostracodes. For this reason, four sections representing Northern Sinai and Southern Sinai were carefully measured and detailed studied (Fig. 1). The Maastrichtian is represented here in Northern Sinai (Gabal El Dokh section) and in southwestern Sinai (Gabal Matulla and Gabal Ekma sections) by the exposed part of the Sudr Chalk (chalky limestone) and the basal part of the Esna Shale. The overlying part of the Esna Shale (shale with limestone bands in between) represents the overlying Paleocene in all the studied sections. The Early Eocene is represented in all the studied sections by the upper part of the Esna Shale and the Thebes Formation (limestone with chert bands). The Minia Formation (yellowish chalky limestone) and the Mokattam Formation (white nummulitic limestone) represent the Middle Eocene in Gabal Meshrak section, Northern Sinai (Figs 2-5).
The recorded ostracode assemblages are compared with their coevals in Egypt (by many authors as stated hereinafter). They are also correlated with their equivalents in the Mediterranean countries such as Jordan (Bassiouni, 1969a, b ; 1970), Israel (Honigstein *et al.*,

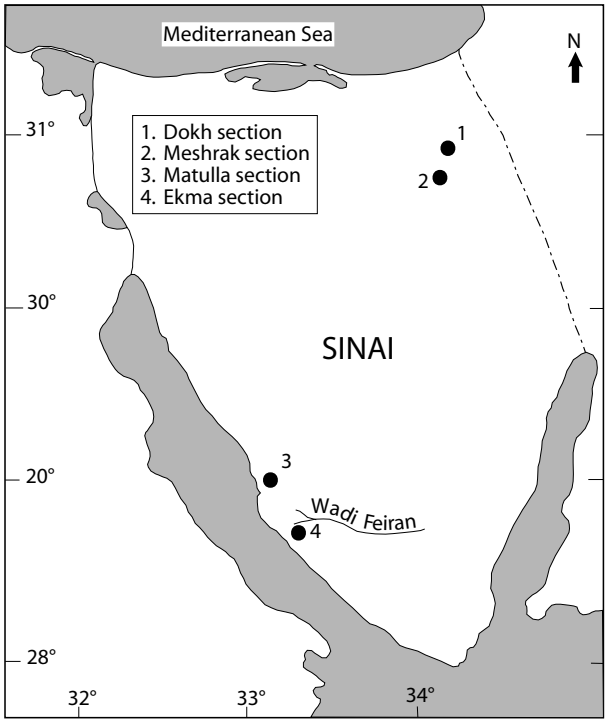

Fig. 1 : Location map of the studied sections.

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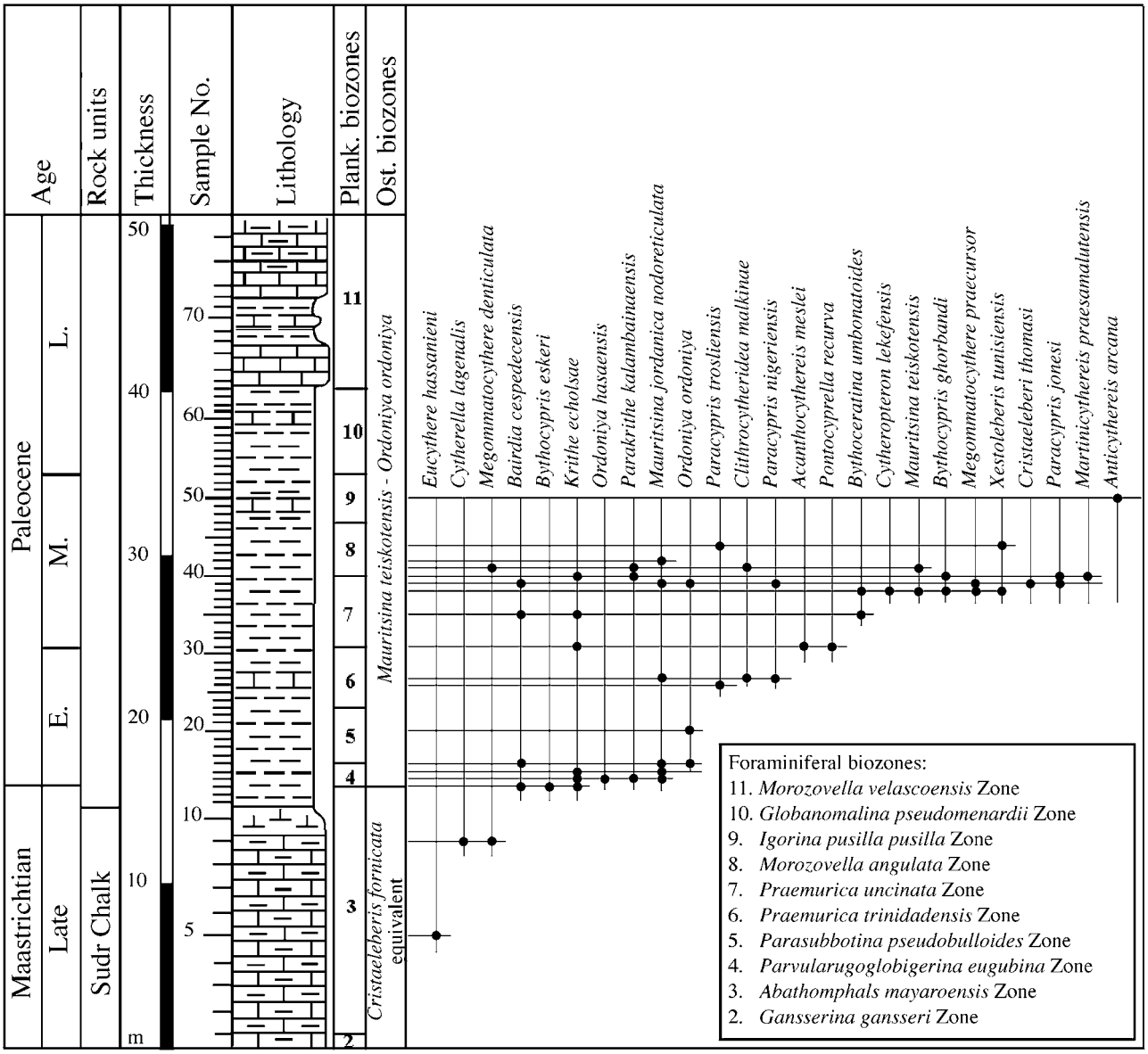

Fig. 2: Vertical distribution of the recorded ostracodes with the proposed biostratigraphy in the Dokh section.

1987; HONIGSTEIN *et al.,* 1991, HONIGSTEIN & ROSENFELD, 1995), Libya (SALAHI, 1966; EL WAER, 1992), Tunisia (SAID, 1978 and DONZE *et al.,* 1982), Algeria (GREKOFF, 1969). The works in western African basins such as APOSTOLESCU (1961, 1963), REYMENT (1963, 1981), REYMENT & REYMENT (1980) are also correlated since many of their ostracode assemblages are in common with the south Tethyan realm. The biostratigraphy, paleobathymetry and paleobiogeography of the recorded ostracodes are among the main targets of the present study.

All the studied materials are deposited in the Geology Department, Faculty of Science, Mansoura University, Mansoura, Egypt.

SYSTEMATIC PALEONTOLOGY

The studied Upper Maastrichtian-Middle Eocene succession in the studied sections yielded diverse and sometimes abundant ostracodes but there are some intervals nearly devoid of ostracodes. This ostracode content has led to the recognition of 68 species and subspecies belonging to 34 genera, 13 families and 2 suborders (Platycopina and Podocopina) and one order (Podocopida MÜLLER, 1894). The taxonomy is mainly based on that of the Treatise on Invertebrate Paleontology (MOORE, ed., 1961), but the later established genera are mostly treated as proposed by their authors. All the identified ostracode species are photographed by SEM and illustrated in 4 plates. Their vertical distribution with

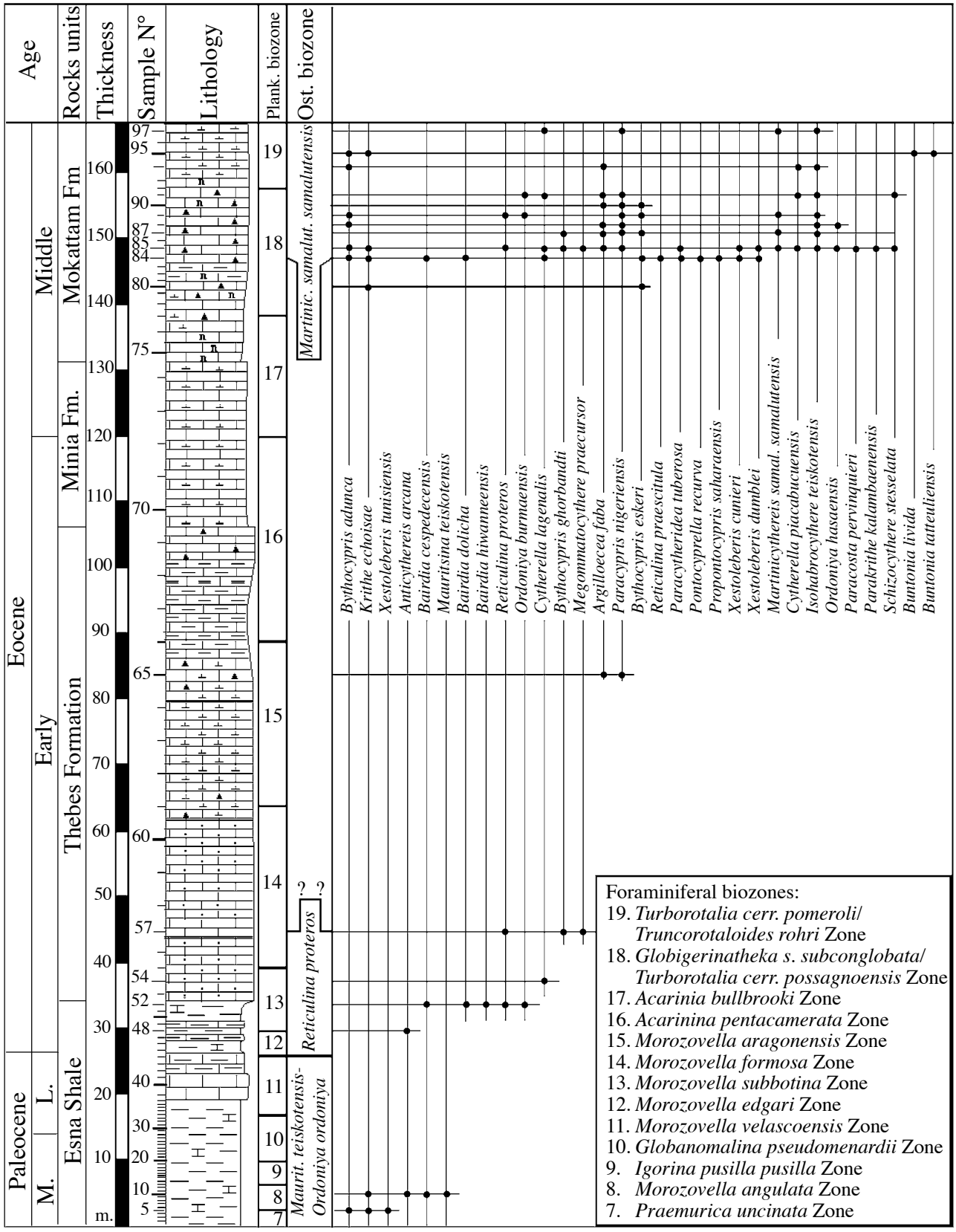

Fig. 3: Vertical distribution of the recorded ostracodes with the proposed biostratigraphy in Meshrak section.

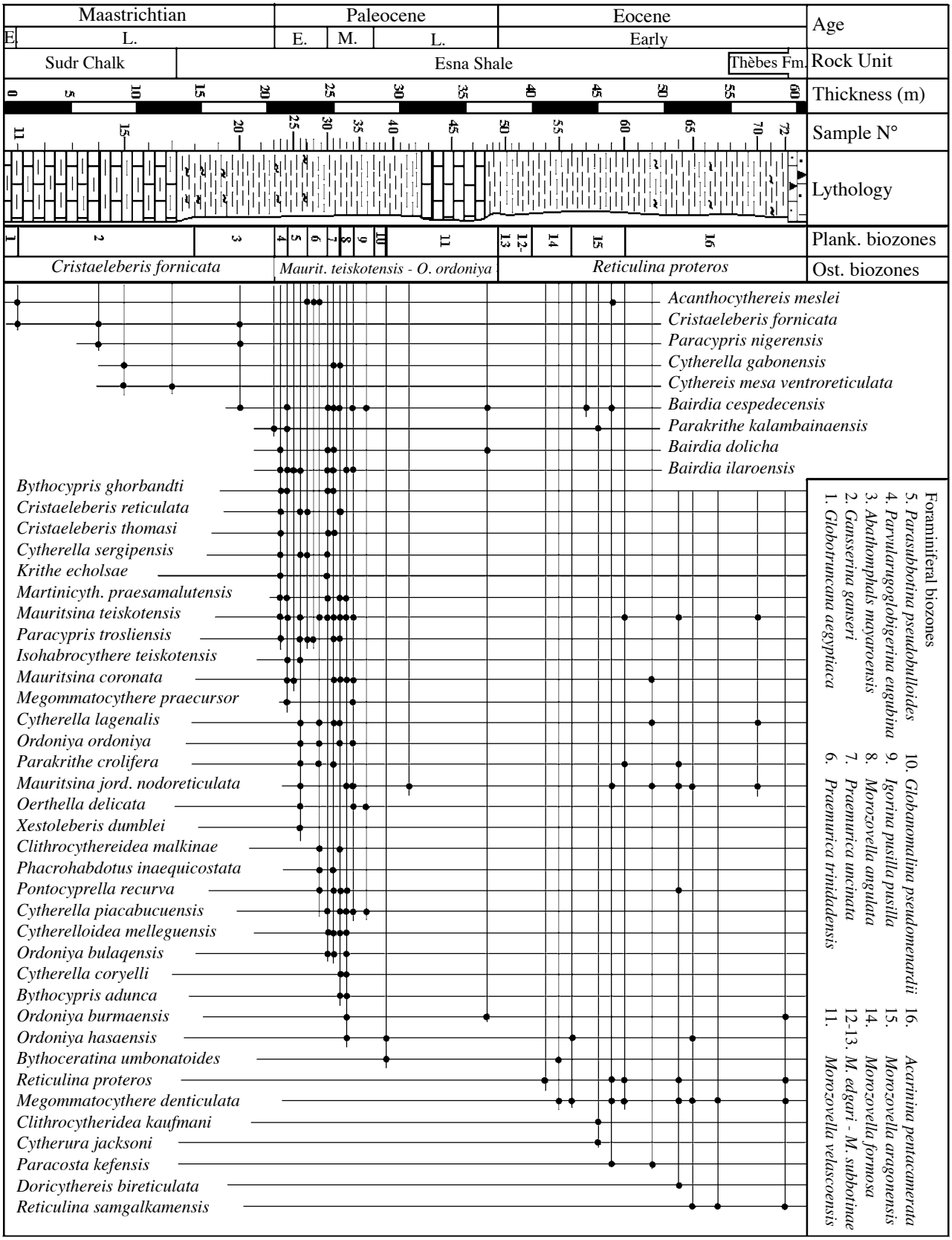

Fig. 4 : Vertical distribution of the recorded ostracodes with the proposed biostratigraphy in Matulla section.

Fig. 5 : Vertical distribution of the recorded ostracodes with the proposed biostratigraphy in Ekma section.

the proposed biozones are illustrated in faunal range charts (Figs 2-5).

Subclass Ostracoda Latreille, 1806
Order Podocopida Müller, 1894
Suborder Platycopina Sars, 1866
Family Cytherellidae Sars, 1866
Genus *Cytherella* Jones, 1849
***Cytherella coryelli* Benson & Tatra, 1964**
Pl. I, fig. 1

1964. *Cytherella coryelli* Benson & Tatra, p. 12, pl. 1, figs 9, 11, 12.
1984. *Cytherella coryelli* Benson & Tatra. – Honigstein, p. 5, pl. 1, figs 3, 6.

Material: 28 valves and carapaces.
Occurrence and age: Late Santonian-Early Campanian of Israel (Honigstein, 1984), Middle Campanian of Arkansas (Benson & Tatra, 1964). In the study area, it occurs in the Late Maastrichtian-Early Paleocene.

***Cytherella gabonensis* Neufville, 1973**
Pl. I, fig. 2

1973. *Cytherella gabonensis* Neufville, p. 121, pl. 7.1, figs 1 a-g.
2000. *Cytherella gabonensis* Neufville. - Morsi, p. 50, pl. 1, figs 3-6.
2001. *Cytherella gabonensis* Neufville.- Shahin & El Nady, p. 153, pl. 1, fig. 3.

Material: 8 carapaces.
Occurrence and Age: Late Cretaceous of Gabon (Neufville, 1973), Coniacian-Santonian of central Sinai (Morsi, 2000), Maastrichtian of northeastern Sinai (Shahin & El Nady, 2001). In the present study it occurs in the Late Maastrichtian-Early Paleocene.

***Cytherella lagenalis* Marliere, 1958**
Pl. I, fig. 3

1958. *Cytherella lagenalis* Marliere, p. 8, pl. 1, fig. 3.
1990. *Cytherella lagenalis* Marliere. - Bassiouni & Luger, p. 777, pl. 1, figs 1-2, 4-5.
1999. *Cytherella* cf. *lagenalis* Marliere.- Morsi, p. 33, pl.1, figs 1-3
2000. *Cytherella* cf. *lagenalis* Marliere.- Morsi, p.50, pl.1, figs 7-8.
2001. *Cytherella lagenalis* Marliere. - Shahin & El Nady, p.153, pl. 1, fig.4.
2002. *Cytherella lagenalis* Marliere. - Abd Elshafy *et al.*, p. 160, pl. 1, figs 20-21.

Material: 42 carapaces and valves.
Occurrence and age: Maastrichtian of northern Sinai (Shahin & El Nady, 2001), Maastrichtian-Paleocene of central Sinai (Morsi, 1999, 2000), Paleocene of Belgium (Marliere, 1958) and of Southern Egypt (Bassiouni & Luger, 1990) and the Gulf of Suez area (Abd Elshafy *et al.,* 2002). In the present material it occurs in the Late Maastrichtian to Middle Eocene.

***Cytherella piacabucuensis* Neufville, 1979**
Pl. I, fig. 4

1979. *Cytherella piacabucuensis* Neufville, p. 137, pl. 1, figs 3 a-d.
1990. *Cytherella piacabucuensis* Neufville. - Bassiouni & Luger, p. 777, pl. 1, figs 7-12.
1991. *Cytherella piacabucuensis* Neufville. - Honigstein *et al.,* p. 98, pl. 1, fig. 3.
2000. *Cytherella piacabucuensis* Neufville. - Shahin, p. 290, figs 4.8, 4.9.

Material: 8 carapaces.
Occurrence and age: Early Paleocene of Brazil (Neufville, 1979), Middle Paleocene-Early Eocene of Southern Egypt (Bassiouni & Luger, 1990), Middle and Late Eocene of Sinai (Shahin, 2000) and Middle Eocene of the Jordan Valley (Honigstein *et al.,* 1991). A similar new species of El Sogher (1996, *Cytherella bassiounii* n. sp., p. 290, pl. 1, figs 9-13, 16-17) was described from the Maastrichtian-Danian of Libya. In the present study it occurs in the Paleocene and Middle Eocene.

***Cytherella sergipensis* Neufville, 1979**
Pl. I, fig. 5

1979. *Cytherella sergipensis* Neufville, p. 136, pl. 1, figs 1a-c, pl. 8, fig. 6.

Material: 9 carapaces.
Occurrence and age: Paleocene-Early Eocene of Brazil (Neufville, 1979). In the present study it occurs in the Paleocene of Matulla section, southwestern Sinai.

***Cytherelloidea melleguensis* Damotte & Said, 1982**
Pl. I, figs 6-8

1982. *Cytherelloidea melleguensis* Damotte & Said. - Donze *et al.,* p. 280, pl. 1, figs 2-5.
2000. *Cytherelloidea melleguensis* Damotte & Said. - Morsi, p. 54, pl. 1, figs 11-12.

Material: 7 carapaces.
Occurrence and age: Early Maastrichtian of Tunisia (Donze *et al.,* 1982) and of east central Sinai (Morsi, 2000). In the present study, it occurs in the Middle Paleocene.

Genus *Isohabrocythere* Apostolescu, 1961
***Isohabrocythere teiskotensis* Apostolescu, 1961**
Pl. I, fig. 9

1961. *Isohabrocythere teiskotensis* Apostolescu, p. 794, pl. 1, figs 15-17 ; pl. 15, figs 297, 298.
1966. *Isohabrocythere teiskotensis* Apostolescu. - Salahi, p. 14, pl. 2, fig. 20.
1980. *Isohabrocythere teiskotensis* Apostolescu. - Reyment & Reyment, pl. 1, fig. 1.
1983. *Isohabrocythere teiskotensis* Apostolescu. - Foster *et al.,* p. 113, pl. 3, figs. 11-13 ; pl. 8, figs 1-2.
1990. *Isohabrocythere teiskotensis* Apostolescu. - Bassiouni & Luger, p.794, pl.6, figs 1-2, 4-5, 7-8.
1996. *Isohabrocythere teiskotensis* Apostolescu. - El Sogher, p. 294, pl. 3, figs 5-9.
2000. *Isohabrocythere teiskotensis* Apostolescu - Shahin, p. 292, fig. 4.10.

Material : 39 carapaces
Occurrence and age : Late Paleocene of Mali and Ivory Coast (Apostolescu, 1961), Paleocene of Libya (Salahi, 1966 ; Reyment & Reyment, 1980 and El Sogher, 1996), of Nigeria (Reyment & Reyment, 1980 and Foster *et al.,* 1983) and Southern Egypt (Bassiouni & Luger, 1990), Late Eocene and Late Oligocene of southwestern Sinai (Shahin, 2000). In the present study it occurs in the Paleocene to Middle Eocene.

Suborder Podocopina Sars, 1866
Superfamily Bairdiacea Sars, 1888
Family Bairdiidae Sars, 1888
Genus *Bairdia* Mc Copy, 1844
Bairdia cespedecensis Bold, 1946
Pl. I, fig. 10

1946. *Bairdia cespedecensis* Bold, p. 75, pl. 1, figs 8a-b.
1957. *Bairdia cespedecensis* Bold. - Bold, p. 6, pl. 2, figs 5a-b.
1968. *Bairdia cespedecensis* Bold. - Esker, pl. 3, fig. 5.
1979. *Bairdia cespedecensis* Bold. - Neufville, p. 138, pl. 2, figs 1 a-b.
1984. *Bairdia cespedecensis* Bold. - Steineck *et al.,* fig. 7, G and I.
2000. *Bairdia cespedecensis* Bold. - Shahin, p. 292, fig. 4.11.
2001. *Bairdia cespedecensis* Bold. - Shahin & El Nady, p. 153, pl. 1, fig. 3.

Material : 46 carapaces
Occurrence and age : Upper Cretaceous of Cuba (Bold, 1946), Paleocene of Trinidad (Bold, 1957) of Tunisia (Esker, 1968), of northern and southern Sinai (Shahin & El Nady, 2001), Early Eocene of Brazil (Neufville), Middle Eocene of Barbados, Caribbean area (Steineck *et al.,* 1984), Middle Eocene to Lower Miocene of southwestern Sinai (Shahin, 2000). In the present study it occurs in the Late Maastrichtian-Middle Eocene age.

Bairdia dolicha Bold, 1957
Pl. I, figs 11-12

1957. *Bairdia dolicha* Bold, p. 5, pl. 2, figs 2a-b.
1979. *Bairdia dolicha* Bold. - Neufville, p. 139, pl. 1, figs 4a-b.
2000. *Bairdia dolicha* Bold. - Shahin, p. 292, fig. 4.12.
2001. *Bairdia dolicha* Bold. - Shahin & El Nady, p. 155, pl. 1, fig. 13

Material : 17 carapaces.
Occurrence and age : Maastrichtian of northern Sinai (Shahin & El Nady, 2001), Paleocene of Trinidad (Bold, 1957), Early Eocene of Brazil (Neufville, 1979), Late Eocene of southwestern Sinai (Shahin, 2000). In the present study it appears in the Paleocene to Middle Eocene.

Bairdia hiwanneensis Howe & Lea, 1936
Pl. I, figs 13

1936. *Bairdia hiwanneensis* Howe & Lea, (in Howe & Law, 1936), p. 27, pl. 2, fig. 9 ; pl. 3, fig.1.
1979. *Bairdia hiwanneensis* Howe & Lea. - Neufville, p. 140, pl. 2, figs 4 a-b.
2000. *Bairdia hiwanneensis* Howe & Lea. - Shahin, p. 292, figs 4.13, 14.

Material : 3 carapaces.
Occurrence and age : Danian of Brazil (Neufville, 1979), Middle Eocene and Early Miocene of southwestern Sinai (Shahin, 2000), Oligocene of Louisiana (Howe & Law, 1936), Oligo-Miocene of Trinidad (Bold, 1957). In the present study it occurs in the Early Eocene of Meskrak section.

Bairdia ilaroensis Reyment & Reyment, 1959
Pl. I, figs 14-15

1959. *Bairdia ilaroensis* Reyment & Reyment, p. 61, pl. 1, figs 1-7, text figs 1 a-b, 3 a-m, 5 a-h.
1980. *Bairdia ilaroensis* Reyment & Reyment. - Reyment & Reyment, p. 250.
1981. *Bairdia ilaroensis* Reyment & Reyment. - Reyment, p. 56, pl. 9, figs 6-7.
1983. *Bairdopilata ilaroensis* (Reyment & Reyment). - Foster *et al.*, p. 109, pl. 1, figs 5, 7-11.
1990. *Bairdia ilaroensis* Reyment & Reyment. - Bassiouni & Luger, p. 780, pl. 1, fig. 15.
1996. *Bairdia ilaroensis* Reyment & Reyment. - Bassiouni & Luger, p. 8, pl. 1, figs 10-13.
2000. *Bairdia ilaroensis* Reyment & Reyment. - Shahin, p. 292, figs 4.15.
2001. *Bairdia ilaroensis* Reyment & Reyment. - Shahin & El Nady, p. 155, pl. 1, figs 13-15.

Material : 31 carapaces.
Occurrence and age : Maastrichtian of Ghana (Reyment, 1981), Maastrichtian to Early Eocene of southern Egypt (Bassiouni & Luger, 1990), of southwestern Sinai (Shahin, 2000) and of northern Sinai (Shahin & El Nady, 2001), Paleocene of Nigeria (Reyment & Reyment, 1959 ; Foster *et al.,* 1983) and of Libya (Reyment & Reyment, 1980), Middle Eocene of Somalia (Bassiouni & Luger, 1996). In the present study it occurs in the Late Maastrichtian - Paleocene age.

Family Bythocyprididae Maddocks, 1969
Genus *Bythocypris* Brady, 1880
***Bythocypris adunca* Esker, 1968**
Pl. I, figs 16-17

1968. *Bythocypris adunca* Esker, p. 321, pl. 2, figs 10-12; pl. 4, fig. 4.
1982. *Abythocypris? adunca* (Esker). - Donze *et al.,* p. 281, pl. 2, figs 3-4.
1987. *Abythocypris? adunca* (Esker). - Damotte & Fleury, p. 93, pl. 1, fig. 10.
1990. *Bythocypris adunca* Esker. - Bassiouni & Luger, p. 781, pl. 2, fig. 4.
2000. *Bythocypris adunca* Esker. - Bassiouni & Morsi, p. 33, pl. 2, fig. 3.

Material: 29 carapaces.
Occurrence and age: Maastrichtian-Danian of Tunisia (Esker, 1968 and Donze *et al.,* 1982), Paleocene of Algeria (Damotte & Fleury, 1987), Late Paleocene of southern Egypt (Bassiouni & Luger, 1990), Late Paleocene-Early Eocene of Farafra Oasis (Bassiouni & Morsi, 2000). In the study area it occurs in Late Maastrichtian-Middle Eocene age.

***Bythocypris eskeri* Bassiouni & Luger, 1990**
Pl. I, fig. 18

1968. *Bythocypris* sp. - Esker, p. 321, pl. 2, fig. 8.
1981. *Bythocypris* sp. - Reyment, p. 56, pl. 1, fig. 1.
1990. *Bythocypris eskeri* Bassiouni & Luger, p. 781, pl. 2, figs 2-3.

Material: 21 carapaces.
Occurrence and age: Late Paleocene-Early Eocene of southern Egypt (Bassiouni & Luger, 1990). The similar specimens of Esker (1968) are known from the Danian of Tunisia and that of Reyment (1981) is also identified from the Paleocene of Nigeria. In the present study it also occurs in the Paleocene-Middle Eocene.

***Bythocypris ghorbandti* Esker, 1968**
Pl. I, fig. 19

1968. *Bythocypris ghorbandti* Esker, p. 320, pl. 1, fig. 14.
1968. *Bythocypris ghorbandti* Esker. - Donze *et al.,* p. 281, pl. 1, fig. 6.
1990. *Bythocypris ghorbandti* Esker. - Bassiouni & Luger, p. 781, pl. 2, fig. 5.
2000. *Bythocypris ? ghorbandti* Esker. - Bassiouni & Morsi, p. 35, pl. 2, fig. 6.

Material: 19 carapaces.
Occurrence and age: Maastrichtian-Early Paleocene of Tunisia (Esker, 1968; Donze *et al.,* 1982), Late Paleocene-Early Eocene of southern Egypt (Bassiouni & Luger, 1990; Bassiouni & Morsi, 2000). In the present material it occurs in the Paleocene-Middle Eocene age.

Superfamily Cypridacea Baird, 1845
Family Paracyprididae Sars, 1923
Genus *Paracypris* Sars, 1866
***Paracypris jonesi* Bonnema, 1941**
Pl. I, fig. 20

1941. *Paracypris jonesi* Bonnema, p. 115, pl. 3, figs 24-28.
1968. *Paracypris jonesi* Bonnema. - Esker, pl. 1, fig. 13.
1986. *Paracypris* cf. *jonesi* Bonnema. - Carbonnel, p. 103, pl. 3, fig. 6.
1990. *Paracypris jonesi* Bonnema. - Bassiouni & Luger, p. 783, pl. 2, figs 9, 11.
2000. *Paracypris jonesi* Bonnema. - Shahin, p. 93, fig. 4.20.

Material: 5 carapaces.
Occurrence and age: Late Cretaceous of Holland (Bonnema, 1941), Danian of Tunisia (Esker, 1968), Paleocene of Senegal (Carbonnel, 1986), Middle Paleocene-Early Eocene of Southern Egypt (Bassiouni & Luger, 1990), Late Eocene and Early Miocene (Shahin, 2000). In the present study it appears in the Maastrichtian-Middle Eocene rocks.

***Paracypris nigeriensis* Reyment, 1960**
Pl. I, fig. 21

1960. *Paracypris nigeriensis* Reyment, p. 66, pl. 4, figs 2a-b.
1981. *Paracypris nigeriensis* Reyment. - Reyment, pl. 1, fig. 6.
1990. *Paracypris ? nigeriensis* Reyment. - Bassiouni & Luger, p. 783, pl. 2, figs 13-18.
1995. *Paracypris ? nigeriensis* Reyment. - Honigstein & Rosenfeld, p. 53, pl. 1, fig. 6.
2000. *Paracypris nigeriensis* Reyment. - Shahin, p. 293, fig. 4.21

Material: 31 carapaces.
Occurrence and age: Maastrichtian-Paleocene of Nigeria (Reyment, 1960; Reyment, 1981), Paleocene of Israel (Honigstein & Rosenfeld, 1995) and of Libya and Nigeria (Reyment & Reyment, 1980), Early Eocene of Southern Egypt (Bassiouni & Luger, 1990), Middle and Late Eocene of southwestern Sinai (Shahin, 2000). In the study area it occurs in the Late Maastrichtian-Middle Eocene age.

***Paracypris trosliensis* Apostolescu, 1956**
Pl. II, fig. 1

1956. *Paracypris trosliensis* Apostolescu, p. 1333, pl. 1, figs 5-6.
1983. *Paracypris trosliensis* Apostolescu.- Foster *et al.,* p. 112, pl. 2, figs 8-9.

Material: 4 carapaces.
Occurrence and age: Late Paleocene of Nigeria (Foster *et al.,* 1983), Early Eocene of Paris Basin, France (Apostolescu, 1956). In the present study it occurs in the Paleocene.

Family Pontocyprididae Müller, 1894
Subfamily Pontocypridinae Müller, 1894
Genus *Argilloecia* Sars, 1866
***Argilloecia faba* Alexander, 1934**
Pl. II, fig. 2

1934. *Argilloecia faba* Alexander, p. 213, pl. 32, fig. 16.
1979. *Argilloecia faba* Alexander. - Neufville, p. 143, pl. 3, figs 6 a-b.
1990. *Argilloecea* sp. - Bassiouni & Luger, p. 785, pl. 3, figs 2-4.

Material : 11 carapaces.
Occurrence and age : Eocene of Texas (Alexander, 1934) and Early Eocene of Brazil (Neufville, 1979). The similar specimens of Bassiouni & Luger (1990) are known from the Middle-Late Paleocene. In the present study, it occurs in the Paleocene-Middle Eocene rocks of Meshrak section.

Genus *Pontocyprella* Lyubimova, 1955
***Pontocyprella recurva* Esker, 1968**
Pl. II, fig. 3

1968. *Pontocyprella recurva* Esker, p. 323, pl. 1, figs 6-7.
1982. *Pontocyprella recurva* Esker. - Donze *et al.,* p. 281, pl. 2, figs 1-2.
1982. *Pontocyprella recurva* Esker. - Boukhary *et al.,* pl. 2, fig. 10.
1987. *Pontocyprella recurva* Esker. - Damotte & Fleury, p. 93, pl. 1, fig. 12.
1990. *Pontocyprella recurva* Esker. - Bassiouni & Luger, p. 785, pl. 3, fig. 1.
1992. *Pontocyprella recurva* Esker. - El Waer, p. 73, pl. 57, figs 1-3.
1999. *Pontocyprella recurva* Esker. - Morsi, p. 38, pl. 1, fig. 12.
2000. *Pontocyprella recurva* Esker. - Morsi, p. 51, pl. 1, fig. 14.
2000. *Pontocyprella recurva* Esker. - Shahin, p. 294, fig. 4. 25, 26.

Material : 17 carapaces.
Occurrence and age : Maastrichtian-Early Paleocene of Tunisia (Esker, 1968 and Donze *et al.,* 1982), Maastrichtian of Libya (El Waer, 1992) and of east central Sinai (Morsi, 2000), Paleocene of Algeria (Damotte & Fleury, 1987) and of Egypt (Boukhary *et al.,*1982 ; Bassiouni & Luger, 1990 ; MorsI, 1999), Early-Middle Eocene of southwestern Sinai (Shahin, 2000). In the present study it was recorded from the Paleocene-Middle Eocene.

Genus *Propontocypris* Sylvester-Bradley, 1974
***Propontocypris saharaensis* Bassiouni & Morsi, 2000**
Pl. II, Fig. 4

2000. *Propontocypris saharaensis* Bassiouni & Morsi, p. 38, pl. 3, figs 13-15.

Material : one entire carapace.
Occurrence and age : Early Eocene of Farafra Oasis (Bassiouni & Morsi, 2000) and Middle Eocene of Meshrak section (present study).

Superfamily Cytheracea Baird, 1850
Family Brachytheridae Puri, 1954
Subfamily Brachytherinae Puri, 1954
Genus *Brachycythere* Alexander, 1933
***Brachycythere beershevaensis* Honigstein, 1984**
Pl. II, fig. 5

1984. *Brachycythere beershevaensis* Honigstein ; p. 16, pl. 5, figs 12-14.
1990. *Brachycythere beershevaensis* Honigstein. - Bassiouni & Luger, p. 786, pl. 3, figs 6,8.
2001. *Brachycythere beershevaensis* Honigstein. - Shahin & El Nady, p. 161, pl. 2, figs. 6,7.
2002. *Brachycythere beershevaensis* Honigstein. - Abd Elshafy *et al.,* p. 176, pl. 3, figs 28-29.

Material : 2 carapaces.
Occurrence and age : Early Campanian and Early Maastrichtian of Israel (Honigstein, 1984 and Honigstein *et al.,* 1987), Campanian of northern Sinai (Shahin & El Nady, 2001) and the Gulf of Suez area (Abd Elshafy *et al.,* 2002), Early-Middle Maastrichtian of Egypt (Bassiouni & Luger, 1990). In the present study it appears in the Maastrichtian.

Family Bythocytheridae Sars, 1926
Genus *Bythoceratina* Hornibrook, 1953
***Bythoceratina umbonatoides* (Kaye, 1964)**
Pl. II, figs 6-7

1964. *Monoceratina umbonatoides* Kaye, p. 57, pl. 4, figs 2, 5.
1982. *Bythoceratina* aff. *umbonatoides* Kaye. - Donze *et al.*, p. 297, pl. 12, figs 9-10.

Material : 2 carapaces.
Occurrence and age : Senonian of Ireland (Kaye, 1964), Maastrichtian of Tunisia (Donze *et al.,* 1982). In the present study it appears in the Middle Paleocene.

Family Cytheruridae Müller, 1894
Genus *Cytheropteron* Sars, 1866
***Cytheropteron lekefensis* Esker, 1968**
Pl. II, fig. 8

1968. *Cytheropteron lekefensis* Esker, p. 332, pl. 2, figs 3-5.
1982. *Cytheropteron lekefensis* Esker. - Donze *et al.,* p. 297, pl. 12, fig. 11.

1984. *Cytheropteron lekefensis* Esker. - Khalifa *et al.,* pl. 2, fig. 5.
1990. *Cytheropteron* cf. *lekefensis* Esker. - Bassiouni & Luger, p. 797, pl. 7, figs 7-9.
2000. *Cytheropteron lekefensis* Esker. - Bassiouni & Morsi, p. 45, pl. 5, figs 8-9.

Material : one carapace.
Occurrence and age : Paleocene of Tunisia (Esker, 1968 and Donze *et al.,* 1982), of southern Egypt (Bassiouni & Luger, 1990) and of Kharga Oasis (Khalifa *et al.,* 1984), Paleocene-Early Eocene of Farafra Oasis (Bassiouni & Morsi, 2000). In the present study it occurs in the Middle Paleocene of El Dokh section.

Genus *Cytherura* Sars, 1866
***Cytherura jacksoni* Huff, 1970**
Pl. II, figs 9-10

1970. *Cytherura jacksoni* Huff, p. 116, pl. 11, figs 14-16.

Material : 2 carapaces.
Occurrence and age : Late Eocene of Jackson Group of Mississippi (Huff, 1970) and Paleocene of the present study.

Genus : *Eucytherura* Müller, 1894
***Eucytherura hassanieni* Bassiouni & Luger, 1990**
Pl. II, Fig. 11

1990. *Eucytherura hassanieni* Bassiouni & Luger, p. 799, pl. 7, figs 16-19.

Material : one carapace.
Occurrence and age : The Middle Maastrichtian of southern Egypt (Bassiouni & Luger, 1990). In the present study it occurs in the Late Maastrichtian of Gabal Dokh section.

Family Schizocytheridae Mandelstam, 1960
Subfamily Schizocytherinae Mandelstam, 1960
Genus *Schizocythere* Triebel, 1950
***Schizocythere tessellata* (Bosquet, 1852)**
Pl. II, Fig. 12

1852. *Cythere tessellata* Bosquet, p. 84, pl. 4, fig. 6.
1955. *Schizocythere tessellata tessellata* (Bosquet).- Apostolescu, p. 258, pl. 4, figs 60-65.
1957. *Schizocythere tessellata* (Bosquet).- Keij, p. 154, pl. 20, figs 14-15.

Material : 2 carapaces.
Occurrence and age : Early to Middle Eocene of France (Bosquet, 1852 and Apostolescu, 1955) and of Belgium (Keij, 1957). In the present study it appears in the Middle Eocene of Meshrak section.

Family Cytherideidae Sars, 1925
Subfamily Cytherideinae Sars, 1925
Genus *Clithrocytheridea* Stephenson, 1936
***Clithrocytheridea kaufmani* Hazel, 1968**
Pl. II, fig. 13

1968. *Clithrocytheridea kaufmani* Hazel, p. 132, pl. 23, figs 17-19 ; pl. 25, fig. 12 ; pl. 26, figs 4, 9.

Material : 2 carapaces.
Occurrence and age : Danian of Maryland, U.S. (Hazel, 1968) and Paleocene-Early Eocene of the present study.

***Clithrocytheridea malkinae* Schmidt, 1948**
Pl. II, fig. 14

1948. *Clithrocytheridea malkinae* Schmidt, p. 428, pl. 64, figs 24-26.

Materials : 3 carapaces.
Occurrence and age : Early Eocene of Virginia, U.S. (Schmidt, 1948) and the Paleocene of the present study.

***Clithrocytheridea marylandica* Hazel, 1968**
Pl. II, fig. 15

1968. *Clithrocytheridea marylandica* Hazel, p. 132, pl. 23, figs 1, 2, 8-12 ; pl. 25, figs 1, 6.

Material : 2 carapaces.
Occurrence and age : Danian of Maryland, U.S. (Hazel, 1968). In the present study it occurs in the Late Maastrichtian-Early Paleocene of Ekma section.

Subfamily Krithinae Mandelstam, 1958
Genus *Krithe* Brady, Corsskey & Robertson, 1874
***Krithe echolsae* Esker, 1968**
Pl. II, figs 16

1968. *Krithe echolsae* Esker, p. 33, pl. 3, figs 1-4.
1982. *Krithe echolsae* Esker. - Boukhary *et al.,* pl. 2, figs 8-9.
1982. *Krithe echolsae* Esker. - Donze *et al.,* p. 283, fig. 4.
1990. *Krithe echolsae* Esker. - Bassiouni & Luger, p. 795, pl. 6, figs 10-11.
1995. *Krithe echolsae* Esker. - Honigstein & Rosenfeld, p. 53, pl.1, figs 4, 5.
1999. *Krithe echolsae* Esker. - Morsi, p. 38, pl. 1, figs 13-15.
2001. *Krithe echolsae* Esker. - Shahin & El Nady, p. 163, pl. 2, fig. 17.

Material : 16 carapaces.
Occurrence and age : Late Campanian-Middle Paleocene of Tunisia (Esker, 1968 and Donze *et al.*, 1982), Early Maastrichtian-Early Paleocene of northern Sinai, Egypt (Shahin & El Nady, 2001), Paleocene-Early Eocene

of Israel (Honigstein & Rosenfeld, 1995), Paleocene of Egypt (Boukhary *et al.,* 1982; Bassiouni & Luger, 1990 and Morsi, 1999). In the study area it occurs in the Paleocene-Middle Eocene age.

Genus *Parakrithe* Bold, 1958
Parakrithe crolifa Bassiouni & Luger, 1990
Pl. II, fig. 17

1990. *Parakrithe crolifa* Bassiouni & Luger, p. 796, pl. 6, figs 13-22.
1999. *Parakrithe crolifa* Bassiouni & Luger - Morsi, p. 38, pl. 1, fig. 16.
2000. *Parakrithe crolifa* Bassiouni & Luger.- Bassiouni & Morsi, p. 44, pl. 5, fig. 4.

Material: 37 carapaces.
Occurrence and age: Early and Late Paleocene of east central Sinai (Morsi, 1999), Middle Paleocene-Early Eocene of Egypt (Bassiouni & Luger, 1990) and Late Paleocene-Early Eocene of Farafra Oasis (Bassiouni & Luger, 2000). In the present study it occurs in the Maastrichtian-Early Eocene.

Parakrithe kalambainaensis (Reyment, 1981)
Pl. II, fig. 18

1979. *Krithe* sp. Cronin & Khalifa, p. 410, pl. 1, figs 26-27.
1981. *Bythocypris kalambainaensis* Reyment, p. 56, pl. 1, figs 2-3.
1990. *Parakrithe ? kalambainaensis* (Reyment). - Bassiouni & Luger, p. 797, pl. 7, figs 1-4.
1996. *Krithe kalambainaensis* (Reyment). - El Sogher, p. 298, pl. 6, figs 11-14.

Material: 14 carapaces.
Occurrence and age: Late Cretaceous and Paleocene of Libya (El Sogher, 1996), Late Paleocene of Nigeria (Reyment, 1981), Paleocene-Early Eocene of southern Egypt (Bassiouni & Luger, 1990) and Middle Eocene of the Nile Valley (Cronin & Khalifa, 1979). In the present study it occurs in the Paleocene-Middle Eocene.

Family Paracytherideidae Puri, 1957
Subfamily Paracytherideinae Puri, 1957
Genus *Paracytheridea* Müller, 1894
Paracytheridea tuberosa Lienenklaus, 1900
Pl. II, fig. 19

1900. *Paracytheridea tuberosa* Lienenklaus, p. 535, pl. 21, figs 9 a-c.
1955. *Paracytheridea tuberosa* Lienenklaus. - Apostolescu, p. 250, pl. 2, figs 26-27.
1969. *Paracytheridea tuberosa* Lienenklaus. - Pietrzeniuk, p. 69, pl. 14, fig. 10; pl. 24, figs 22-23.
1971. *Paracytheridea tuberosa* Lienenklaus. - Moos, p. 79, pl. 10, figs 7-12.

Material: 2 carapaces.
Occurrence and age: Eocene of Germany (Pietrzeniuk, 1969), Middle Eocene of France (Apostolescu, 1955) and Early-Late Oligocene of Germany (Lienenklaus, 1900; Moos, 1971). In the present study it occurs in the Middle Eocene of Meshrak section.

Family Trachyleberididae Sylvester-Bradley, 1948
Subfamily Campylocytherinae Puri, 1960
Genus *Anticythereis* Bold, 1946
Anticythereis arcana Bertels, 1975
Pl. II, fig. 20

1975. *Anticythereis arcana* Bertels, p. 116, pl. 6, figs 17-18.

Material: 2 carapaces.
Occurrence and age: Middle Maastrichtian of Argentina (Bertels, 1975) and Paleocene-Early Eocene of the present material.

Subfamily Trachyleberidinae Sylvester-Bradley, 1948
Genus *Acanthocythereis* Howe, 1936
Acanthocythereis meslei Donze & Oertli, 1982
Pl. II, fig. 21

1982. *Acanthocythereis ? meslei* Donze & Oertli, in Donze *et al.,* p. 292, pl. 10, fig. 1-10.
1987. *Acanthocythereis meslei* Donze & Oertli. - Damotte & Fleury, p. 96, pl. 3, fig. 10.
1999. *Acanthocythereis meslei meslei* Donze & Oertli. - Morsi, p. 40, pl. 2, fig. 10.
2001. *Acanthocythereis ? meslei* Donze & Oertli. - Shahin & El Nady, p. 164, pl. 2, figs 21-22.

Material: 11 carapaces.
Occurrence and age: Coniacian of northern Sinai (Shahin & El Nady, 2001), Early Maastrichtian of Tunisia (Donze *et al.*, 1982), Paleocene of Algeria (Damotte & Fleury, 1987) and of Egypt (Morsi, 1999). In the present study it occurs in the Maastrichtian-Early Eocene age.

Genus *Cristaeleberis* Bassiouni, 1970
Cristaeleberis fornicata Bassiouni, 1970
Pl. III, fig. 1

1970. *Cristaeleberis fornicata* Bassiouni, p. 29, pl. 3, figs 9-10.
1984. *Cristaeleberis fornicata* Bassiouni. - El Sweify, p. 57, pl. 6, fig. 4.
1984. *Cristaeleberis fornicata* Bassiouni. - Khalifa *et al.,* pl. 1, fig. 3.
1984. *Cristaeleberis fornicata* Bassiouni. - Honigstein, p. 35, pl. 10, figs 5-8.
1990. *Cristaeleberis fornicata* Bassiouni. - Bassiouni & Luger, p. 81, pl. 16, figs 4-6.

1996. *Cristaeleberis fornicata* Bassiouni. - El Sogher, p. 310, pl. 17, figs 9-11.
2001. *Cristaeleberis fornicata* Bassiouni. - Shahin & El Nady, p. 165, pl. 3, figs 5-6.

Material: 9 carapaces.
Occurrence and age: Santonian-Maastrichtian of Israel (Honigstein, 1984), Maastrichtian of Jordan (Bassiouni, 1970), of Egypt (El Sweify, 1984, Khalifa *et al.,* 1984; Bassiouni & Luger, 1990; Shahin & El Nady, 2001, 2001) and of Libya (El Sogher, 1996). In the present study it occurs in the Maastrichtian.

Cristaeleberis reticulata Bassiouni, 1970
Pl. III, fig. 2

1970. *Cristaeleberis reticulata* Bassiouni, p. 26, pl. 3, figs 5-6.
1984. *Cristaeleberis reticulata* Bassiouni. - Honigstein, p. 34, pl. 10, figs 1-4; pl. 15, figs 19-20.
1984. *Cristaeleberis reticulata* Bassiouni. - Khalifa *et al.,* p. 2, figs 1a-b.
1995. *Cristaeleberis reticulata* Bassiouni. - Honigstein & Rosenfeld, p. 56, pl. 2, figs 7-9.
1999. *Cristaeleberis reticulata* Bassiouni. - Morsi, p. 40, pl. 2, fig. 11.
2001. *Cristaeleberis reticulata* Bassiouni. - Shahin & El Nady, p. 166, pl. 3, figs 7-8.

Material: 10 carapaces.
Occurrence and age: Late Coniacian-Maastrichtian of Israel (Honigstein, 1984), Maastrichtian of Sinai (Shahin & El Nady, 2001), Middle Paleocene of Jordan (Bassiouni, 1970), Late Paleocene of Egypt (Khalifa *et al.*, 1984 and Morsi, 1999). In the present study it occurs in the Paleocene.

Cristaeleberis thomasi Donze & Said, 1982
Pl. III, fig. 3

1982. *Cristaeleberis thomasi* Donze & Said, p. 289, pl. 7, figs 3-12.
1987. *Cristaeleberis thomasi* Donze & Said. - Damotte & Fleury, p. 96, pl. 2, fig. 24.
1987. *Cristaeleberis thomasi* Donze & Said. - Salaj & Nairn, pl. 7, figs 5-6.
2000. *Cristaeleberis thomasi* Donze & Said. - Morsi, p. 58, pl. 2, fig. 12.
2001. *Cristaeleberis thomasi* Donze & Said. - Shahin & El Nady, p. 166, pl. 3, figs 9-10.

Material: 30 carapaces.
Occurrence and Age: Late Campanian-Early Maastrichtian of northern Sinai (Morsi, 2000 and Shahin & El Nady, 2001), Maastrichtian-Paleocene of Tunisia (Donze *et al.,* 1982) and Algeria (Damotte & Fleury, 1987), Maastrichtian of Libya (Salaj & Nairn, 1987). Here, it occurs in the latest Maastrichtian and Paleocene.

Genus *Cythereis* Jones, 1849
Cythereis mesa ventroreticulata Honigstein, 1984
Pl. III, fig. 4

1984. *Cythereis mesa ventroreticulata* Honigstein, p. 22, pl. 13, figs 7-11.
1993. *Cythereis mesa ventroreticulata* Honigstein. - Honigstein *et al.,* pl. 1, figs 3, 5, 9, 10.
1995. *Cythereis mesa ventroreticulata* Honigstein. - Honigstein & Rosenfeld, p. 60, pl. 3, fig. 4.
1999. *Cythereis mesa ventroreticulata* Honigstein. - Morsi, p. 41, pl. 2, figs 13-14.

Material: 9 carapaces.
Occurrence and age Late Santonian, Campanian and Paleocene of Israel (Honigstein, 1984; Honigstein *et al.*, 1993 and Honigstein & Rosenfeld, 1995) and Early Paleocene of east central Sinai (Morsi, 1999). In the present study it occurs in the Maastrichtian.

Genus *Doricythereis* Gründel, 1976
Doricythereis bireticulata Colin & Damotte, 1982
Pl. III, fig. 5

1982. *Doricythereis bireticulata* Colin & Damotte, p. 291, pl. 13, figs 9-10.

Material: one entire carapace.
Occurrence and age: Maastrichtian of Tunisia (Donze *et al.,* 1982) and Early Eocene of Matulla section (present study).

Genus *Martinicythere* Bassiouni, 1969c
Martinicythere praesamalutensis Bassiouni & Luger, 1990
Pl. III, fig. 6

1990. *Martinicythere praesamalutensis* Bassiouni & Luger, p. 805, pl. 9, figs 3, 5-12.

Material: 34 carapaces.
Occurrence and age: Late Paleocene to Early Eocene of Southern Egypt (Bassiouni & Luger, 1990) and Paleocene of the study area.

Martinicythere samalutensis dorsocosta Bassiouni, 1969
Pl. III, figs 7-8

1969b. *Martinicythere samalutensis dorsocosta* Bassiouni, p. 220, pl. 19, figs 3-5.

Material: 2 carapaces.
Occurrence and age: Middle Eocene of Samalut, Upper Egypt (Bassiouni, 1969b) and Early Paleocene of the study area.

Martinicytherei samalutensis samalutensis Bassiouni, 1969
Pl. III, fig. 9

1969b. *Martinicythere samalutensis samalutensis* Bassiouni, p. 217, pl. 18, figs 8-11 ; pl. 19, figs 8-10.
1979. *Martinicythere samalutensis* Bassiouni. - Cronin & Khalifa, p.404, pl. 1, figs 11-12.
1993. *Martinicythere samalutensis samalutensis* Bassiouni. - Boukhary *et al.,* p. 206, pl. 4, figs 5-6.

Material : 2 carapaces.
Occurrence and age : Middle Eocene of various localities in Egypt (Bassiouni, 1969b ; Cronin & Khalifa, 1979 and Boukhary *et al.,* 1993) and of the Meshrak section (study area).

Genus *Mauritsina* Deroo, 1962
Mauritsina coronata (Esker, 1968)
Pl. III, fig. 10

1968. *Cythereis coronata* Esker, p. 323, pl. 1, figs 1-3 ; pl. 4, fig. 5.
1982. *Mauritsina coronata* (Esker). - Boukhary *et al.,* pl.1, figs 5-8.
1982. *Actinocythereis ? coronata* (Esker). - Donze *et al.*,p. 291, pl. 9, figs 7-10 ; pl. 14, fig. 8.
1987. *Actinocythreis* ? *coronata* (Esker). - Damotte & Fleury, p. 96, pl. 3, figs 8-9.
1990. *Mauritsina coronata* (Esker). - Bassiouni & Luger, p. 812, pl. 11, figs 13 - 15.
1995. *Mauritsina coronata* (Esker). - Honigstein & Rosenfeld, p. 58, pl. 3, fig. 10.
1999. *Mauritsina coronata* (Esker). - Morsi, p. 39, pl. 2, fig. 5.
2000. *Mauritsina coronata* (Esker). - Bassiouni & Morsi, p. 55, pl. 8, figs 1-2.
2001. *Mauritsina coronata* (Esker). - Shahin, fig. 8.5.

Material : 11 carapaces.
Occurrence and age : Maastrichtian-Paleocene of Algeria (Damotte & Fleury, 1987), of Egypt (Boukhary *et al.,* 1982) and of Tunisia (Esker, 1968 and Donze *et al.,* 1982), Paleocene-Early Eocene of Israel (Honigstein & Rosenfeld, 1995), Middle-Late Paleocene of Egypt of Egypt (Bassiouni & Luger, 1990 ; Morsi, 1999 ; Bassiouni & Morsi, 2000 ; Shahin, 2001. In the present study it occurs in the Paleocene and basal Eocene.

Mauritsina jordanica nodoreticulata Bassiouni, 1970
Pl. III, fig. 11

1970. *Mauritsina jordanica nodoreticulata* Bassiouni, p. 20, pl. 1, figs 3-4 ; pl. 2, figs 6-7.
1982. *Doricythereis cf. jordanica nodoreticulata* (Bassiouni). - Donze *et al.,* p. 291, pl. 9, fig. 6.
1990. *Mauritsina jordanica nodoreticulata* Bassiouni. - Bassiouni & Luger, p. 812, pl. 11, figs 16-17.
1995. *Mauritsina jordanica nodoreticulata* Bassiouni. - Honigstein & Rosenfeld, p. 56, pl. 3, figs 1-2.
1999. *Mauritsina jordanica nodoreticulata* Bassiouni. - Morsi, p. 39, pl. 2, fig. 6.
2000. *Mauritsina jordanica nodoreticulata* Bassiouni. - Bassiouni & Morsi, p. 55, pl. 8, fig. 3.
2001. *Mauritsina jordanica nodoreticulata* Bassiouni. - Shahin, fig. 8. 6 - 7.

Material : 20 carapaces.
Occurrence and age : Maastrichtian-Paleocene of Tunisia (Donze *et al.,* 1982), Paleocene of Jordan (Bassiouni, 1970), of Israel (Honigstein & Rosenfeld, 1995) and of Egypt (Bassiouni & Luger, 1990, Shahin, 2001), and Paleocene-Early Eocene of Egypt (Morsi, 1999 ; Bassiouni & Morsi, 2000). In the present study it occurs in the Paleocene-Early Eocene.

Mauritsina teiskotensis (Apostolescu), 1961
Pl. III, fig. 12

1961. *Bradleya teiskotensis* Apostolescu, p. 819, pl. 12, figs 214-145.
1963. *Bradleya teiskotensis* Apostolescu. - Barsotti, p. 1527, pl. 2, fig. 13.
1963. *Cythereis teiskotensis* (Apostolescu). - Reyment, p. 161, pl. 2, fig. 3 ; pl. 4, fig. 1 ; pl. 15, figs 1-2.
1966. *Cythereis teiskotensis* (Apostolescu). - Salahi, p. 24, pl. 4, fig. 24.
1980. *Cythereis teiskotensis* (Apostolescu). Reyment & Reyment, p. 251, pl. 1, fig.7.
1984. *Mauritsina teiskotensis* (Apostolescu). - El Sweify, p. 73, pl. 10, figs 1-8.
1990. *Mauritsina teiskotensis teiskotensis* (Apostolescu). - Bassiouni & Luger, p. 813, pl. 12, fig. 1.
1996. *Cythereis teiskotensis* (Apostolescu). - El Sogher, p. 309, pl. 16, figs 8-12 ; pl. 17, figs 1-4.

Material : 55 carapaces.
Occurrence and age : Paleocene of Mali (Apostolescu, 1961), of Nigeria (Reyment, 1963), of Libya (Barsotti, 1963 ; Salahi, 1963 ; Reyment & Reyment, 1980 and El Sogher, 1996) and of Egypt (El Sweify, 1984 ; Bassiouni & Luger, 1990 and the present study).

Genus *Megommatocythere* Colin & Oertli, 1982
Megommatocythere denticulata (Esker), 1968
Pl. III, fig. 13

1968. *Acanthocythereis denticulata* Esker, p. 329, pl. 2, figs. 6-7 ; pl. 4, fig. 1.
1982. Acanthocythereis ? *denticulata* Esker. - Donze *et al.,* p. 293, pl. 11, figs 1-4.
1990. *Megommatocythere denticulata* (Esker). - Bassiouni & Luger, p. 825, pl. 17. fig. 7.
1991. *Megommatocythere* cf. *denticulata* (Esker). - Honigstein *et al.,* p. 105, pl. 2, figs 11-12.
1995. *Megommatocythere* cf. *denticulata* (Esker). - Honigstein & Rosenfeld, p. 53, pl. 1, fig. 8.
2000. *Megommatocythere* cf. *denticulata* (Esker). - Morsi, p. 62, pl. 3, figs 5-6.

Material : 18 carapaces.
Occurrence and age : Maastrichtian of east central Sinai, Egypt (Morsi, 2000), Maastrichtian-Paleocene of Tunisia (Donze *et al.,* 1982), Paleocene of Tunisia (Esker, 1968) and of Egypt (Bassiouni & Luger, 1990), Paleocene-Middle Eocene of Israel (Honigstein *et al.,* 1991 and Honigstein & Rosenfeld, 1995). Here, it occurs in the Late Maastrichtian to Early Eocene.

Megommatocythere praecursor Colin & Oertli, 1982
Pl. III, figs 14-15

1982. *Megommatocythere praecursor* Colin & Oertli, p. 294, pl. 13, fig. 6-8.

Material : 9 carapaces.
Occurrence and age : Maastrichtian of Tunisia (Donze *et al.,* 1982) and Paleocene to Middle Eocene of the present study.

Genus *Oertliella* Pokorny, 1964
Oertliella delicata Bassiouni & Luger, 1990
Pl. III, fig. 16

1990. *Oertliella delicata* Bassiouni & Luger, p. 829, pl. 18, figs 11-17.

Material : 9 carapaces.
Occurrence and age : Paleocene of Southern Egypt (Bassiouni & Luger, 1990) and Early Paleocene of the present study.

Genus *Ordoniya* Al Sheikhly, 1985
Ordoniya bulaqensis Bassiouni & Luger, 1990
Pl. III, fig. 17

1990. *Ordoniya bulaqensis* Bassiouni & Luger, p. 832, pl. 16, figs 1-15.
1995. *Ordoniya bulaqensis* Bassiouni & Luger. - Honigstein & Rosenfeld, p. 54, pl. 2, figs 1-2.
1999. *Ordoniya bulaqensis* Bassiouni & Luger. - Morsi, p. 42, pl. 3, figs 8-11.
2000. *Ordoniya bulaqensis* Bassiouni & Luger. - Bassiouni & Morsi, p. 61, pl. 9, fig. 18.

Material : 6 carapaces.
Occurrence and age : Paleocene of Egypt (Bassiouni & Luger, 1990 ; Morsi, 1999 ; Bassiouni & Morsi, 2000) and of Israel (Honigstein & Rosenfeld, 1995). Here, it occurs in the Paleocene of Matulla section.

Ordoniya burmaensis (Bassiouni, 1970)
Pl. III, fig. 18

1970. *Hazelina burmaensis* Bassiouni, p. 32, pl. 5, figs 3-4.
1982. *Hazelina burmaensis* Bassiouni. - Boukhary *et al.,* pl. 2, figs 2, 4.
1985. *Ordoniya (O.) burmaensis* (Bassiouni). - Al Sheikhly, p. 250, pl. 2, figs 6, 8-10 ; pl. 3, figs 1, 3, 4, 7.
1995. *Ordoniya* cf. *burmaensis* (Bassiouni). - Honigstein & Rosenfeld, p. 54, pl. 2, fig. 3.
1999. *Ordoniya burmaensis* (Bassiouni). - Morsi, p. 42, pl. 3, fig. 12.
2000. *Ordoniya burmaensis* (Bassiouni). - Bassiouni & Morsi, p. 61, pl. 9, figs 19-20.

Material : 13 carapaces.
Occurrence and age : Early-Middle Paleocene of Jordan (Bassiouni, 1970), of Egypt (Boukhary *et al.,* 1982 ; Morsi, 1999 ; Bassiouni & Morsi, 2000), Early Paleocene of Syria (Al Sheikhly, 1985) and of Israel (Honigstein & Rosenfeld, 1995). In the present study it ranges from Middle Paleocene to Middle Eocene.

Ordoniya hasaensis (Bassiouni, 1970)
Pl. III, fig. 19

1970. *Hazelina hasaensis* Bassiouni, p. 33, pl. 5, figs 5-6.
1991. *Ordoniya hasaensis* (Bassiouni). - Honigstein *et al.,* p. 104, pl. 2, fig. 5.
1999. *Ordoniya hasaensis* (Bassiouni). - Morsi, p. 42, pl. 3, fig. 13.

Material : 13 carapaces.
Occurrence and age : Paleocene of Jordan (Bassiouni, 1970), Paleocene to Early Eocene of east central Sinai (Morsi, 1999) and Middle Eocene of Israel (Honigstein *et al.,* 1991). Here, it occurs in the Paleocene to Middle Eocene.

Ordoniya maanensis (Bassiouni, 1970)
Pl. III, fig. 20

1970. *Hazelina maanensis* Bassiouni, p. 33, pl. 5, figs 1-2.
1995. *Ordoniya maanensis* (Bassiouni). - Honigstein & Rosenfeld, p. 56, pl. 2, fig. 4.
2000. *Ordoniya maanensis* (Bassiouni). - Bassiouni & Morsi, p. 62, pl. 10, figs 1-3.

Material : 2 carapaces.
Occurrence and age : Paleocene of Israel (Honigstein & Rosenfeld, 1995), Late Paleocene of Farafra Oasis, Egypt (Bassiouni & Morsi, 2000), Early Eocene of Jordan (Bassiouni, 1970). In the present study it occurs in the Paleocene.

Ordoniya ordoniya (Bassiouni, 1970)
Pl. III, fig. 21

1970. *Hazelina ordoniya* Bassiouni ; p. 31-32, pl. 4, figs 4-8.
1982. *Hazelina* cf. *H. ordoniya* Bassiouni. - Donze *et al.,* p. 284, pl. 3, figs 2-3.
1984. *Hazelina* cf. *H. ordoniya* Bassiouni. - Honigstein, p. 35, pl. 2, figs 17-18.
1984. *Hazelina* cf. *H. ordoniya* Bassiouni. - Khalifa *et al.,* pl. 1, fig. 7.

1990. *Ordoniya ordoniya* (Bassiouni). - Bassiouni & Luger, p. 832, pl. 16, figs 7-8, 10.
1999. *Ordoniya ordoniya* (Bassiouni). - Morsi, p. 42, pl. 3, figs 6-7.
2001. *Ordoniya ordoniya* (Bassiouni). - Shahin & El Nady, p. 171, pl. 4, figs 1-2.

Material : 21carapaces.
Occurrence and Age : Maastrichtian of northeastern Sinai (Shahin & El Nady, 2001), Maastrichtian-Paleocene of Israel (Honigstein, 1984), Late Maastrichtian to Middle Paleocene of Tunisia (Donze *et al.*,1982), Early to Middle Paleocene of Jordan (Bassiouni, 1970) and Paleocene of various localities of Egypt (Khalifa *et al.,* 1984; Bassiouni & Luger, 1990; Morsi, 1999). In the present study, it occurs in the Paleocene and Early Eocene.

Genus *Paracosta* Siddiqui, 1971
Paracosta bensoni (Damotte & Donze, 1982)
Pl. IV, fig. 1

1982. *Paleocosta bensoni* Damotte & Donze. - Donze *et al.*, p. 285, pl. 4, figs 4-8.
1990. *Reymenticosta bensoni* (Damotte & Donze). - Bassiouni & Luger, p. 839, pl. 21, figs 7-9.
1992. *Paleocosta bensoni* Damotte & Donze. - El Waer, p. 113, pl. 20, figs 1-3, 8.
1996. *Paracosta bensoni (*Damotte & Donze). - El Sogher, p. 321, pl. 26, figs 10-13; pl. 27, figs 1-14; pl. 29, figs 1-4.
2000. *Paracosta bensoni* (Damotte & Donze). - Shahin, p. 302, fig. 6.20.

Material : 3 carapaces.
Occurrence and age : Maastrichtian-Danian of Libya (El Waer, 1992 and El Sogher, 1996), Late Paleocene of Tunisia (Donze *et al.,* 1982) and of southern Egypt (Bassiouni & Luger, 1990) and Early Eocene of southwestern Sinai (Shahin, 2000). Here it occurs in Late Maastrichtian to Early Paleocene. However, the true range is believed to be Late Paleocene only (Keen *et al.,* 1994).

Paracosta kefensis (Benson, 1977)
Pl. IV, figs 2-3

1977. *Paleocosta kefensis* Benson, p. 36, figs 4G, 7B; pl. 1, fig. 1.
1988. *Paleocosta* aff. *kefensis* Benson. - Carbonnel, p. 149, pl. 1, figs 10-12.
1982. *Paleocosta kefensis* Benson. - Donze *et al.,* p. 286, pl. 4, figs 9-10; pl. 14, figs 1-4.
1990. *Paracosta kefensis* (Benson). - Bassiouni & Luger, p. 833, pl. 19, figs 1-9, 11-12.

Material : 7 carapaces.
Occurrence and age : Middle Paleocene of Tunisia (Benson, 1977 and Donze *et al.,* 1982) and of Egypt (Bassiouni & Luger, 1990) and Early Eocene of Mauritania (Carbonnel, 1988). In the present study it occurs in the Late Paleocene to Early Eocene.

Paracosta pervinquieri (Donze & Said, 1982)
Pl. IV, fig. 4

1982. *Paleocosta pervinquieri* Donze & Said, in Donze *et al.*, p. 284, pl. 3, figs 4-10.
1987. *Paleocosta pervinquieri* Donze & Said. - Damotte & Fleury, p. 95, pl. 2, figs 10-12.
1990. *Paracosta pervinquieri* (Donze & Said). - Bassiouni & Luger, p. 834, pl. 20, figs 7-10, 12.
1996. *Paracosta pervinquieri* (Donze & Said). - El Sogher, p. 323, pl. 30, figs 1-5.
1999. *Paracosta pervinquieri* (Donze & Said). - Morsi, p. 43, pl. 3, fig. 16.
2000. *Paracosta pervinquieri* (Donze & Said). - Shahin, p. 303, figs 6. 25-26.
2001. *Paracosta pervinquieri* (Donze & Said). - Shahin & El Nady, p. 171, pl. 3, figs 24-25.

Material : 8 carapaces.
Occurrence and age : Middle Maastrichtian of southern Egypt (Bassiouni & Luger, 1990), Late Maastrichtian of northern Sinai (Shahin & El Nady, 2001), Late Maastrichtian to Early Paleocene of Tunisia (Donze *et al.*, 1982) and of Libya (El Sogher, 1996), Early to Middle Paleocene of Algeria (Damotte & Fleury, 1987), Paleocene of central Sinai (Morsi, 1999), Middle and Late Eocene of southwestern Sinai, Egypt (Shahin, 2000). In the present material it occurs in the Paleocene to Middle Eocene.

Genus *Reticulina* Bassiouni, 1969
Reticulina praescitula Bassiouni, 1969
Pl. IV, fig. 5

1969a. *Carinocythereis (Reticulina) scitula praescitula* Bassiouni, p. 13, pl. 2, fig. 5
1991. *Reticulina scitula praescitula* Bassiouni. - Honigstein *et al.,* p. 104, pl. 2, fig. 8.

Material : One carapace.
Occurrence and age : Middle Eocene of Jordan and Egypt (Bassiouni, 1969 a), Early-Middle Eocene of Jordan Valley (Honigstein *et al.,* 1991). In the present study it occurs in the Middle Eocene of Meshrak section.

Reticulina proteros Bassiouni, 1969
Pl. IV, figs 6-7

1969a. *Carinocythereis (Reticulina) scitula proteros* Bassiouni, p. 11, pl. 1, figs 6-7.
1982. *Reticulina proteros* Bassiouni. - Donze *et al.,* p. 287, pl. 5, figs 7-8.
1986. *Reticulina proteros* Bassiouni. - Carbonnel, p. 119, pl. 13, figs 13-14.

1987. *Reticulina proteros* Bassiouni. - Damotte & Fleury, p. 95, pl. 2, figs 17-19.
1990. *Reticulina proteros* Bassiouni. - Bassiouni & Luger, p. 836, pl. 20, figs 16-21.
1991. *Reticulina proteros* Bassiouni. - Honigstein *et al.,* p. 104, pl. 2, fig. 7.
1995. *Reticulina proteros* Bassiouni. - Honigstein & Rosenfeld, p. 60, pl. 3, figs 5-6.
2000. *Reticulina proteros* Bassiouni. - Bassiouni & Morsi, p. 62, pl. 10, figs 6-8.
2000. *Reticulina proteros* Bassiouni. - Shahin, p. 303, fig. 7.2.

Material : 11 carapaces.
Occurrence and age : Paleocene of Algeria (Damotte & Fleury, 1987), of Senegal (Carbonnel, 1986) and of Southern Egypt (Bassiouni & Luger, 1990), Late Paleocene-Early Eocene of Jordan (Bassiouni, 1969a), of Kharga Oasis, Egypt (Bassiouni & Morsi, 2000), of Tunisia (Donze *et al.,* 1982), Early Eocene of Israel (Honigstein *et al.,* 1991 and Honigstein & Rosenfeld, 1995). In the present material it occurs in the Early Eocene.

Reticulina sangalkamensis (Apostolescu, 1961)
Pl. IV, figs 8-9

1961. *Bradleya? sangalkamensis* Apostolescu, p. 818, pl. 14, figs 280-290.
1990. *Reticulina sangalkamensis* (Apostolescu). - Bassiouni & Luger, p. 836, pl. 20, figs 11, 13-15.
1990. *Reticulina sangalkamensis* (Apostolescu). - Morsi, p. 43, pl. 3, figs 18-19.

Material : 4 carapaces.
Occurrence and age : Early Paleocene of Senegal (Apostolescu, 1961), Late Paleocene-Early Eocene of southern Egypt (Bassiouni & Luger, 1990) and of east central Sinai (Morsi, 1999). In the present study it occurs in the Early Eocene of Matulla section.

Subfamily Buntoninae Apostolescu, 1961
Genus *Buntonia* Howe , 1935
Buntonia attitogonensis Apostolescu, 1961
Pl. IV, fig. 10

1961. *Buntonia attitogonensis* Apostolescu, p. 799, pl. 3, figs 46-49.
1963. *Buntonia attitogonensis* Apostolescu. - Reyment, p. 200, pl. 6, figs 3-4 ; pl. 17, fig. 8.
1969. *Buntonia attitogonensis* Apostolescu. - Grekoff, p. 246, pl. 3, fig. 49.
1983. *Buntonia (Buntonia) fortunata* Apostolescu. - Foster *et al.,* p. 129, pl. 6, figs 2, 5, 15, 16.

Material : One carapace.
Occurrence and age : Paleocene of Nigeria (Reyment & Reyment, 1980 and Foster *et al.,* 1983) and of Libya (Reyment & Reyment, 1980), Early Eocene of Togo (Apostolescu, 1961) and Algeria (Grekoff, 1969), Eocene of southwestern Nigeria (Reyment, 1963), Late Eocene of southwestern Sinai (Shahin, 2000). In the present study it occurs in the Late Paleocene of Ekma section.

Buntonia livida Apostolescu, 1961
Pl. IV, fig. 11

1961. *Buntonia livida* Apostolescu, p. 802, pl. 3, figs 53-55.
1983. *Buntonia* sp. aff. *B. (Quasibuntonia) livida* Apostolescu. - Foster *et al.,* p. 121, pl. 6, fig. 1.

Material : 2 carapaces.
Occurrence and age : Paleocene of Dahomey and Ivory Coast (Apostolescu, 1961) and Nigeria (Foster *et al.,* 1983). In the present study it occurs in the Middle Eocene of Meshrak section.

Buntonia tatteuliensis (Apostolescu), 1961
Pl. IV, fig. 12

1961. *Ambocythere ? tatteuliensis* Apostolescu, p. 814, pl. 9, figs 175-179.
1963. *Ambocythere ? tatteuliensis* Apostolescu. - Barsotti, p. 1526, pl. 1, fig. 9.
1981. *Nucleolina tatteuliensis* (Apostolescu). - Reyment, p. 58, pl. 3, figs 8-12.
1983. *Buntonia tatteuliensis* (Apostolescu).- Foster *et al.,* p. 122, pl. 5, figs 3-9 ; pl. 6, fig. 12 ; pl. 7, figs 4-5.
1990. *Nucleolina tatteuliensis* (Apostolescu). - Bassiouni & Luger, p. 793, pl. 5, figs 9-11.
1996. *Buntonia tatteuliensis* (Apostolescu). - El Sogher, p. 307, pl. 13, figs 5-8.
2000. *Nucleolina tatteuliensis* (Apostolescu). - Shahin, p. 298, fig. 5.25.

Material : One carapace.
Occurrence and age : Late Cretaceous to Paleocene of Libya (El Sogher, 1996), Paleocene of Mali (Apostolescu, 1961), of Nigeria (Reyment, 1981 and Foster *et al.,* 1983) and of Libya (Barsott, 1963 and Reyment & Reyment, 1980), latest Paleocene or basal Eocene of southern Egypt (Bassiouni & Luger, 1990) and late Eocene of southwestern Sinai (Shahin, 2000). Here, it occurs in Middle Eocene.

Genus *Phacrohabdotus* Howe & Laurencich, 1958
Phacrohabdotus inaequicostata Colin & Donze, 1982
Pl. IV, figs 13-14

1982. *Phacrohabdotus inaequicostata* Colin & Donze, in Donze *et al.,* p. 769, pl. 13, fig. 11.
1984. *Phacrohabdotus inaequicostatus* Colin & Donze. - Honigstein, p. 34, pl. 2, figs 13-16.
1995. *Phacrohabdotus inaequicostatus* Colin & Donze. - Honigstein & Rosenfeld, p. 54, pl. 1, figs 9-10.

1999. *Phacrohabdotus inaequicostatus* Colin & Donze. - Morsi, p. 43, pl. 3, figs 20-21.

Material: 3 carapaces.
Occurrence and age: Campanian of Israel (Honigstein, 1984), Latest Campanian-Maastrichtian of Tunisia (Donze *et al.,* 1982) and Paleocene of Sinai, Egypt (Morsi, 1999) and of Israel (Honigstein & Rosenfeld, 1995). In the present study it occurs in the Paleocene.

Genus *Soudanella* Apostolescu, 1961
Soudanella laciniosa triangulata Apostolescu, 1961
Pl. IV, fig. 15

1961. *Soudanella laciniosa triangulata* Apostolescu, p. 810, pl. 7, figs 130-135.
1969. *Soudanella laciniosa triangulata* Apostolescu. - Grekoff, p. 239, pl. 3, fig. 44.
1970. *Soudanella laciniosa triangulata* Apostolescu. - Bassiouni, pl. 3, figs 11a-c
1979. *Soudanella laciniosa triangulata* Apostolescu. - Neufville, p. 153, pl. 6, figs 1 a-b.
1982. *Soudanella laciniosa triangulata* Apostolescu. - Donze *et al.,* p. 295, pl. 12, figs 2-3.
1990. *Soudanella laciniosa triangulata* Apostolescu. - Bassiouni & Luger, p. 847, pl. 24, fig. 18.
2000. *Soudanella laciniosa triangulata* Apostolescu. - Shahin, p. 306, figs 7.20-23.

Material: One carapace.
Occurrence and age: Maastrichtian-Early Paleocene of Algeria (Grekoff, 1969), Paleocene of Senegal (Apostolescu, 1961), of Nigeria and Libya (Reyment & Reyment, 1980) and NE Brazil (Neufville, 1979), Late Paleocene-Early Eocene of Tunisia (Donze *et al.,* 1982), Late Paleocene of Southern Egypt (Bassiouni & Luger, 1990) Early Eocene of Jordan (Bassiouni, 1970) and of the Egyptian Red Sea area (Aref, 1995), Middle and Late Eocene of southwestern Sinai (Shahin, 2000). Here, it occurs in the Early Eocene of Ekma section.

Family Xestoleberididae Sras, 1928
Genus *Xestoleberis* Sras, 1866
Xestoleberis cunteri Howe, 1951
Pl. IV, fig. 16

1951. *Xestoleberis cunteri* Howe , Pt. 1, p. 30, pl. 2, figs 17-19.

Material: 7 carapaces.
Occurrence and age: Middle Eocene of Florida (Howe, 1951) and of Meshrak section (present material).

Xestoleberis dumblei Stephenson, 1946
Pl. IV, fig. 17

1946. *Xestoleberis dumblei* Stephenson, p. 320, pl. 43, fig. 16.

Material: 14 carapaces.
Occurrence and age: Middle Eocene of Texas (Stephenson, 1946) and Paleocene to Middle Eocene of the present material.

Xestoleberis tunisiensis Esker, 1968
Pl. IV, fig. 18

1968. *Xestoleberis tunisiensis* Esker, p. 332, pl. 2, figs 13-14; pl. 4, fig. 2.
1982. *Xestoleberis tunisiensis* Esker. - Donze *et al.,* p. 282, pl. 2, fig. 9.
1990. *Xestoleberis tunisiensis* Esker. - Bassiouni & Luger, p. 847, pl. 25, figs 1-7.
2000. *Xestoleberis tunisiensis* Esker. - Shahin, p. 307, figs 7. 29-30.

Material: 9 carapaces.
Occurrence and age: Maastrichtian to Early Paleocene of Tunisia (Esker, 1968 and Donze *et al.,* 1982) and the Paleocene to Early Eocene of Egypt (Bassiouni & Luger, 1990), Early-Late Eocene (Shahin, 2000). Here, it occurs in the Maastrichtian to Middle Eocene of the present material.

BIOSTRATIGRAPHY AND PALEOECOLOGY

As a sound stratigraphic position, it is possible to establish at least local biostratigraphic zonal scheme that based on ostracod content. Because of the discontinuous nature of the producing samples, any biostratigraphic and paleoenvironmental predictions by using ostracod populations should be regarded as tentative. The proposed ostracod biozones should be correlated with the planktonic foraminiferal zonation of the same interval to justify the age assessment. In the definition of these zones some characteristic association are recorded and the remainder can be seen in Figures 2-5. Based on the documented stratigraphic distribution of the identified ostracode assemblages in the studied sections, four local biostratigraphic zones are established covering an interval from the Early Maastrichtian to the Middle Eocene age (Figs 2-5) and correlated with their equivalents in and outside Egypt (Table 1). The associated planktonic foraminifera allow a rather good chronostratigraphic classification. Therefore, the proposed ostracode biozones should be correlated with the equivalent planktonic foraminiferal zones established by Shahin (1992) and El Bassiouni *et al.,* 2003) to justify the age assessment. The established biozones are arranged from the oldest to the youngest and briefly discussed as follows:

1. *Cristaeleberis fornicata* Zone

This zone is defined here as the interval from the base

Table 1 : Correlation chart of the proposed biozones with their equivalents in and outside Egypt.

AGE		Arabian Gulf ATHERSUCH, 1994	Tunisia OERTLI, 1976	Egypt				
				Shabrawet area, SHAMA & HELAL, 1993	Fayoum Divide ABDALLAH *et al.*, 2002	Souhwestern Sinai, SHAHIN, 2000	Eastcentral Sinai SHAHIN & EL NADY, 2001	Present study
Eocene	M		*Heptaloculites tunetana*	*Brachycythere (D.) ismaili*	*Costa crassieticulata-Costa ducassae*	*Asymmetricythere yousefi – Cytherella piacabucuensis*		*Martinicythereis samalutensis samalutemsis*
			H. minuta	*Bradleya oertlii*	*Brachycythere ismaeli – Bairdia tarabulusensis*	*Reticulina saitoi – Trachyleberis nodosus*		
			H. cavernosa	*Costa praetri. praetricostata*	*Xestoleberis kenawyi*			
	E					*Leguminocythereis bopaensis – Leguminocythereis bicostata*		*Reticulina proteros*
Paleocene	L	*Hornibrookella divergens*						*Mauritsina teiskotensis – Ordoniya ordoniya*
	M							
	E						*Trachyleberis teiskotensis*	
Maast.	L						*Cristaeleberis fornicata*	*Cristaeleberis fornicata*
	E	*Peleriops phumatoides*					*Rushdisaidina supracretacea*	

of the studied Ekma and Matulla sections to the last occurrence of the nominate taxon. Accordingly, the last occurrence datum (LOD) of the nominate species can be taken to mark the Cretaceous/Paleogene boundary. It occurs in the Sudr Chalk and the base of the Esna Shale and varies in thickness from 15 m in Gabal Dokh section, 21 m in Matulla section to about 23 m in Ekma section.

It is equivalent to the *Mauritsina supracretacea* Zone defined by Khalifa *et al*. (1984) in the Western Desert, Egypt. It is also equivalent to both *Rushdisaidina supracretacea* Zone and *Cristaeleberis fornicata* Zone described by Shahin & El Nady (2001) from the Maastrichtian of northeast Sinai. It is partially equivalent to *Peleriops phumatoides* Biozone and the lower part of *Hornibrookella divergense* Biozone described from the Maastrichtian of the Arabian Gulf area (Athersuch, 1994). It corresponds to the planktonic foraminiferal biozones of *Globotruncana aegyptiaca*, *Gansserina gansseri* and *Abathomphalus mayaroensis* Zone described by Shahin (1992).

Besides the nominate taxon, the characteristic Maastrichtian species recovered from the studied sections include *Brachycythere beerchevaensis, Cythereis mesa ventroreticulata, paracypris nigeriensis, Paracosta bensoni, Megommatocythere denticulata, Acanthocythereis meslei,* and *Bairdia ilaroensis*.

According to the previous documented age for the index and associated ostracode species as well as the documented age of the equivalent planktonic foraminiferal zones, an Early-Late Maastrichtian age is assigned to this biozone. In general, during the deposition of the Sudr Chalk, the scarcity of marine ostracodes is the dominant feature. The relative decrease in the diversity and abundance of the ostracod fauna reflects a middle neritic zone of normal marine salinity (Bassiouni & Luger, 1990). This zone is characterized by the occurrence of smooth genera of *Krithe, Parakrithe, Cytherella, Bairdia,* and *Paracypris* that are generally belonging to deep sea environment ranging from 400-500 m depth (Peypouquet *et al*., 1986). The associated, but rare, ornamented Cytheracea such as *Cristaeleberis fornicata, Megommatocythere denticulata, Acanthocythereis meslei,* and *Cythereis mesa ventroreticulata* have relatively noticeable eye tubercle. They are characteristic fauna for continental shelf and are typical of both infralittoral and inner circalittoral depth (0-150 m, Keen *et al*., 1994). This assemblage is similar to that described by Bassiouni & Luger (1990) as Southern Tethyan Type and Afro-Tethyan Type of middle to outer neritic environment. Based on the previous statements of ostracod content, middle to outer neritic environment is assigned to this zone. This result matches well with the previously deduced paleobathymetry of the Sudr Chalk deduced from the foraminiferal content (Shahin, 1992 and Shahin *et al*., 2003).

2. *Mauritsina teiskotensis-Ordoniya ordoniya* Assemblage Zone

The base of this zone is located herein within the lower part of Esna Shale in the studied sections as the last appearance of *Cristaeleberis fornicata* and the first occurrence of the nominate taxa. It extends in the Paleocene to reach an interval of very rare ostracod fauna just below and above the P/E boundary.

Most of the Maastrichtian ostracod species range into the Paleocene. Besides the nominate species, there are some species firstly appeared in the Paleocene such as *Isohabrocythere teiskotensis, Martinicythereis praesamalutensis, Mauritsina coronata, Ordoniya hasaensis, O. maanensis, O. burmaensis, O. bulaqensis, Paracosta kefensis, P. pervinquieri,* and *Cytherelloidea melleguensis*.

This zone is partially equivalent to the upper part of *Hornibrookella divergens* Biozone described by Athersuch (1994) belonging to the Paleocene of the Arabian Gulf area. It is also equivalent to both *Cytheropteron lekefensis* Zone and *Hazelina ordoniya* Zone described by Khalifa *et al*. (1984) from the Paleocene of the Kharga Oasis. The lower half of this zone is equivalent to *Trachyleberis teiskotensis* Zone described by Shahin & El Nady (2001) from the Early Paleocene of northeastern Sinai. This zone seems to be equivalent to *Martinicythereis bassiounii* Assemblage Zone described by Honigstein & Rosenfeld (1995) from the Paleocene of Israel. It corresponds to the Paleocene planktonic foraminiferal biozones ranging from *Parvularugoglobigerina eugubina* Zone to *Morozovella velascoensis* Zone described by Shahin (1992) and El Bassiouni *et al*. (2003). The index ostracod species *Ordoniya ordoniya* is an important species ranging from the Late Maastrichtian to the Middle Paleocene but it is characteristic of the Paleocene rather than the Cretaceous (Keen *et al*., 1994). As stated before, all records of *Mauritsina teiskotensis* are of Paleocene age (see the systematic paleontology) and can be considered as characteristic Paleocene taxon. Based on the discussed age of the index species and the age of its planktonic foraminiferal biozones, a Paleocene age is assigned to this unit.

Most of the recorded Maastrichtian ostracod species survived across the K/P boundary supporting the idea of Honigstein & Rosenfeld (1995) that the ostracod assemblage not so much influenced by the Cretaceous-Paleogene event as other microfossil groups. These survived smooth ostracodes refers as stated previously to middle to outer neritic environment. The presence of *Krithe, parakrithe, Pontocyprella and Ordoniya* are characteristic fauna for the outer neritic environment (Morkhoven, 1963). The here occurrence of Southern Tethyan and assemblage including *Ordoniya ordoniya, Ordoniya bulaqensis, Mauritsina coronata, M. jordanica nodoreticulata, M. teiskotensis, Megommatocythere*

denticulata and *Oertliella delicata* refers to outer neritic to upper bathyal environment (BASSIOUNI & LUGER, 1990). Associated with these ornamented species, some genera such as *Cytherella, Cytherelloidea, Paracypris, Krithe, Parakrithe,* and *Paracosta* dominate some horizons of dark gray shale. *Cytherella* and *Cytherelloidea* may indicate low oxygen level (WHATLEY, 1991). Also, DONZE *et al*. (1982) stated that *Krithe* and *Parakrithe* suggest a zone of low level of dissolved oxygen at the top of the Tunisian Maastrichtian. *Krithe* and *Paracosta* were able to inhabit poorly oxygenated waters (PEYPOUQUET *et al*., 1986). In the limestone horizons within the Esna Shale of the studied sections, the ostracodes as well as foraminifera as a whole, were impoverished due to the shallowing of the sea to reach an inner neritic zone. From the previous statement, it is evident that the ostracod assemblage of this zone indicates generally an outer neritic to upper bathyal environment (100-400 m depth), except for the horizons of limestone in between, with some oxygen minimum zones. A similar bathymetry was previously deduced from the foraminifera content (SHAHIN, 1992 and SHAHIN *et al*., 2003).

3. *Reticulina proteros* Zone

This zone is define by the first occurrence of the nominate taxon just above a scarce interval around the P/E boundary. It extends upwards within the Early Eocene to be topped by another scarce interval including the upper part of the Early Eocene and the basal part of the Middle Eocene especially in Meshrak section. Several Paleocene species range into the Early Eocene and no distinctive Early Eocene ostracodes have been described referring to an opinion that the P/E boundary event had little or no effect on the ostracodes like on other micro organisms. Although ostracodes as well as foraminifera rarely occurred in the Lower Eocene Thebes Formation, some of the recorded ostracodes begin to appear within the Early Eocene such as *Clithrocytheridea kaufmani, Cytherura jacksoni, Doricythereis bireticulata, Soudanella laciniosa triangulata, Argilloecia faba,* and *Bairdia hiwanneensis*. The ostracod zone of *Leguminocythereis bopaensis-Leguminocythereis bicostata* Zone described from the Thebes Formation of southwestern Sinai, Egypt by SHAHIN (2000) is correlatable with the upper part of this zone. This zone is nearly equivalent to the Early Eocene foraminiferal zones ranging from *Morozovella subbotina* Zone to roughly the top of *Acarinina pentacamerata* Zone described by SHAHIN (1992) and EL BASSIOUNI *et al*. (2003).

Again, the scarcity of marine ostracodes in this zone is the dominant feature. The relative decrease in the diversity and abundance of the ostracod fauna reflects a middle neritic zone of normal marine salinity (BASSIOUNI & LUGER, 1990). The disappearance of deeper marine ostracodes and the continuation of the neritic cytheracea such as *Mauritsina teiskotensis, M. coronata, M. jordanica nodoreticulata, Ordoniya hasaensis, Paracosta kefensis* and *Soudanella laciniosa triangularis* also characterize this zone. PEYPOUQUET *et al*. (1986) proposed a water depth between 50 and 100 m for a similar assemblage characterizing the Late Thanetian-Early Ypresian Ecozone 8 in northern Tunisia. The paleobathymetry of this interval deduced from the foraminiferal content (SHAHIN, 1992 and SHAHIN *et al*., 2003) is restricted to the middle-outer neritic zone. Therefore, an assumption of middle neritic to outer neritic zone (50-200 m depth) is preferable for this zone.

In Meshrak section, the Early Eocene rare ostracodes have decreased later and then disappeared during the rest of the Early Eocene and the basal part of the Middle Eocene (E/M Eocene boundary). This interval with flint bands is also poor in foraminifera and an inner to middle neritic zone was assigned to it (SHAHIN *et al*., 2003). It is well known that the ostracodes are facies controlled organisms and the facies here are changed from shale to restricted environment limestone facies with frequent flint bands. It is logic here to consider that this facies and environmental changes were the cause of the ostracod disappearance within this barren interval.

4. *Martinicythereis samalutensis samalutensis* Zone

It is defined in Meshrak section as the interval from the first occurrence of the nominate taxon to the top of the studied section just above the barren interval around the E/M Eocene interval. Several Paleocene and Early Eocene species reoccur after an interval of ostracod disappearance and others firstly occur. Among the firstly occurred species there are *Paracythereidea tuberosa, Xestoleberis cunteri, X. dumblei, Schizocythere stesselata, Buntonia livida* and *Buntonia tatteuliensis*.

This zone is partially equivalent to *Costa praetricostata praetricostata* Zone, *Bradleya oertlii* and *Brachycythere (Digmocythere) ismaili* Zone described by SHAMA & HELAL (1993) from the Middle Eocene Mokattam Formation of Shabrawet area, Egypt. It nearly coincides with *Reticulina saitoi-Trachyleberis nodosus, Asymmetricythere yousefi-Cytherella piacabucuensis* Assemblage Zones described by SHAHIN (2000) from the Middle Eocene of southwestern Sinai. This zone is partially coeval with *Xestoleberis kenawyi* Zone, *Brachycyhere ismaili-Bairdia trabulusensis* Zone and *Costa crassireticulata-Costa ducassae* Zone that described by ABDALLAH *et al*. (2002) from the Fayoum Divide. As stated by KEEN *et al*. (1994), the Tunisian Eocene rocks were biostratigraphically subdivided into ostracod biozones by OERTLI (1976). It seems that this Egyptian biozone is coeval with Tunisian middle and upper part of Lutetian biozones ranging from *Heptaloculites cavernosa* Zone to *Heptaloculites tunetana* Zone. This zone is also equivalent to the foraminiferal biozones ranging from *Globigerinatheka subconglobata-*

Turborotalia cerroazulensis possagnoensis Zone to *Turborotalia cerroazulensis pomeroli/Truncorotaloides rohri* Zone described by EL BASSIOUNI *et al*. (2003) in Meskrak section. The above mentioned characteristic ostracodes are nearly restricted to the Middle Eocene as stated before. Accordingly, and based on this association and the age of equivalent ostracod biozones and foraminiferal biozones, the Middle Eocene is assigned to this biozone. This biozone is included in the Mokattam Formation that contains bands rich in *Nummulites* and other larger foraminifera associated with some algal remains referring to a reefal, shoal carbonate within the inner neritic zone and other bands rich in smaller foraminifera of deeper neritic zones (SHAHIN *et al*., 2003). The reefal facies here were inhabited by the shallower marine ostracodes such as the cytheraceans with eye tubercles that are commonly associated with relatively deeper marine ostracodes in the smaller foraminifera rich bands. This combination between the shallower and deeper ostracodes reflects a middle-outer neritic habitat. In conclusion, this interval was deposited in a rapid oscillation between shallow facies in inner neritic environment and deeper ones of middle-outer neritic pulses as a result of rhythmic oscillatory movements.

PALEOBIOGEOGRAPHY

Many Late Cretaceous and Paleogene ostracode genera and species have relatively long stratigraphic range. Because of their generally narrow ecological adaptation and wide geographic distribution, they are very useful for regional paleobiogeographic reconstruction.

During the Maastrichtian and the Paleogene, North Africa was considered as the southern shore of the Tethys. Most of the ostracod species occurring in many localities of North African countries as well as the western and eastern extremities of the present Mediterranean Sea characterize the Southern Tethyan Province. Generally, there is no similarity between the southern Mediterranean Maastrichtian-Paleocene ostracod assemblage and the northern mediterranean one. Whatever the reason, the Tethys may be considered as a barrier to North-South migration of ostracodes. The great similarities of the Egyptian ostracod assemblages during that time to those of different countries in the Middle East and North Africa is attributed to the geography of the southern Tethyan Realm that facilitated the East-West migration. Also some similarities are expected between the Egyptian assemblages and that of the western side of the Atlantic Ocean. The ostracod similarity in the area extending from the Middle East, North Africa, West Africa suggests the presence of marine link between the southern Tethys province and the basins of West Africa during the Late Maastrichtian and Paleocene with free exchange of benthic fauna.

Many ostracod species were widely distributed in the Tethyan realm and therefore can be used as paleogeographic indicators (Fig. 6, Table 2). Among the investigated Egyptian Maastrichtian ostracodes (also recorded from many other Egyptian regions by various authors as stated before in the systematic paleontology section) there are *Cristaeleberis fornicata, Cristaeleberis reticulta, Cristaeleberis thomasi, Paracosta bensoni, Paracosta pervinquieri* and *Phacrohabdotus inaquicostata, Megommatocythere denticulata, Mauritsina jordanica nodoreticulata*, *Ordoniya ordoniya, Bythocypris adunca, Pontocyprella recurva* and *Xestoleberis tunisiensis*. This assemblage is very similar to that recorded from Jordan (BASSIOUNI, 1970), Israel (HONIGSTEIN, 1984), Libya (BARSOTTI, 1963; SALAHI, 1966, EL WAER, 1992 and EL

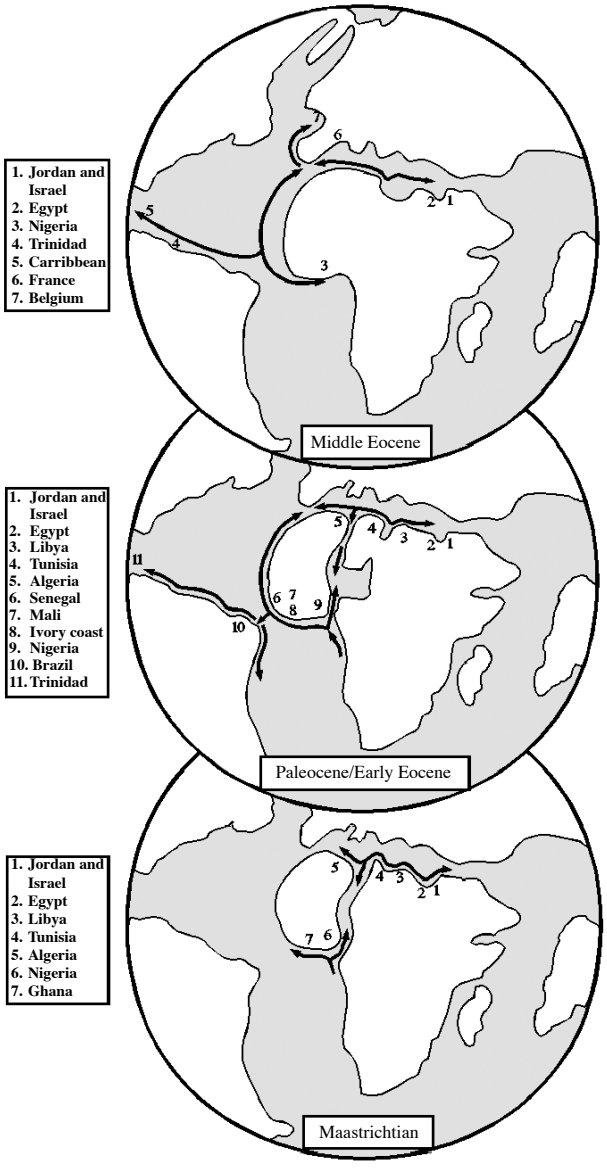

Fig. 6: Paleobiogeographic distribution of the most important ostracodes and the migration routes.

Table 2: Paleogeographic distribution and stratigraphic range of the important recorded ostracodes.

A: Algeria
Be: Belgium
Br: Brazil
C: Cuba
Ca: Carribbean
E: Egypt
F: France
G: Ghana
I: Ivory Coast
J: Jordan and Israel
L: Libya
M: Mali
Mu: Mauritania
N: Nigeria
S: Senegal
To: Togo
Tu: Tunisia
Tr: Trinidad

AGE						Characteristic ostracodes
Eocene		Paleocene			Maast.	
Middle	Early	Late	Middle	Early		
CaE	E	ETrT	ETrT	ETrT	CE	*Bairdia cespedecensis*
	E	NE	NE	NE	GE	*Bairdia ilaroensis*
					EJ	*Brachycythere beershevaensis*
E	EJ	EJ	EJT	EJT	ET	*Krithe echolsae*
					EJL	*Cristaeleberis fornicata*
		E	EJ	E	EJ	*Cristaeleberis reticulata*
		AET	AET	AET	AELT	*Cristaeleberis thomasi*
E	E	ENL	EL	EL	L	*Parakrithe kalambainensis*
E	E	EJLN	EJLN	EJLN	EN	*Paracypris nigeriensis*
	E	ET		EL	EL	*Paracypris bensoni*
E	E	E	AE	AET	ET	*Paracosta pervinquieri*
		EJ	EJ	EJ	JT	*Phacrohabdotus inaequicostata*
	EJ	AEJ	AEJT	AEJT	AELT	*Mauritsina coronata*
J	EJ	EJT	EJT	EJT	EJT	*Megommatocythere denticulata*
	E	E	EJT	EJT	EJT	*Ordoniya ordoniya*
E	E	AE	AE	AET	ELT	*Pontocyprella recurva*
E	EJT	BrENST	BrNS	BrNS	A	*Soudanella lacin. triangulata*
E	EBr	E	E	ETr	E	*Bairdia dolicha*
E	E	ELMN	L	L	L	*Buntonia tatteuliensis*
EJ	E	E	E	BrEL	L	*Cytherella piacabucuensis*
	E	EJT	EJT	EJT	T	*Mauritsina jord. nodoreticulata*
ETr				Br		*Bairdia hiwanneensis*
N	ANTo	NE	N	N		*Buntonia attitogonensis*
	EJT	AEJST	AES	AES		*Reticulina proteros*
		ELMN	ELMN	ELMN		*Mauritsina teiskotensis*
E	E	EILNM	ELN	ELN		*Isohabrocythere teiskotensis*
E	E	E	EJ	EJ		*Ordoniya burmaensis*
	F	EN	E	E		*Paracypris trosliensis*
	EMu	E	ET			*Paracosta kefensis*
EJ	J					*Reticulina praescitula*
BeEF	BeF					*Schizocythere tessellata*

Sogher, 1996) and Tunisia (Benson, 1977; Said, 1978 and Donze *et al.*, 1982), in addition to the localized eastward co-occurrence of *Brachycythere beerchevaensis* and *Cythereis mesa ventroreticulata* in the Maastrichtian of Israel (Honigstein, 1984). This wide distribution of these fauna is attributed to the free migration through the directly connected Southern Tethyan bioprovince and proved that Egypt was a part of the North African-Middle East bioprovince during the Maastrichtian recognized by Babinot & Colin (1992) and Damotte (1995). Other assemblages include *Paracypris nigeriensis* (Maastrichtian-Paleocene of Nigeria, Reyment, 1960),

Bairdia ilaroensis (Maastrichtian of Ghana, REYMENT, 1981 and the Paleocene of Nigeria, FOSTER *et al.,* 1983) and *Cytherella gabonensis* (Late Cretaceous of Gabon, NEUFVILLE, 1973). This similarity between the North African assemblage and that of West Africa is considered as a further document for the existance of trans-Saharan seaway during the Maastrichtian (Fig. 6).

The Paleocene-Early Eocene ostracodes of Egypt exhibit a great similarity to those found in different areas in the Middle East, North and West Africa. The characteristic, widely distributed Early Paleogene ostracodes that recovered from the studied sections include *Mauritsina coronata, M. jordanica nodoreticulata, Megommatocythere denticulata, Reticulina proteros, Paracosta kefensis, P. pervinquieri, Ordoniya burmaensis, O. hasaensis, O. maanensis, O. ordoniya, Pontocyprella recurva Krithe echolsea, Phacrohabdotus inaequicostata* and *Soudanella laciniosa triangulata*. This assemblage exhibits a great similarity to those recorded from Jordan (BASSIOUNI, 1969a, 1971), from Israel (HONIGSTEIN *et al.,* 1991 ; HONIGSTEIN & ROSENFELD, 1995), Libya (BARSOTTI, 1963 ; SALAHI, 1966, EL WAER, 1992 and EL SOGHER, 1996), Tunisia (BENSON, 1977 ; SAID, 1978 and DONZE *et al.,* 1982) and Algeria (DAMOTTE & FLEURY, 1987). Other recorded ostracod species including *Cristeleberis thomasi, Acanthocythereis meslei, Cytheropteron lekefensis* and *Bythocypris adunca* are of westward common co-occurrence in Tunisia (BENSON, 1977 ; Said, 1978 and DONZE *et al.,* 1982) and Algeria (DAMOTTE & FLEURY, 1987). It is worth to mention that the *Martinicythereis samalutensis samalutensis* and its allies are of common co-occurrence eastward in Jodan (BASSIOUNI, 1969) reveals that there was E-W direct connection between these Tethyan localities. This wide distribution indicate that the Maastrichtian South Tethyan province still in E-W direct connection during the Paleocene and Early Eocene. On the other hand, *Mauritsina teiskotensis, Isohabrocythere teiskotensis, Paracypris nigeriensis, Bairdia ilaroensis, Mauritsina sangalkamensis, Soudanella laciniosa triangulata, Reticulina proteros, Buntonia attitogonensis* and *Buntonia tatteuliensis* commonly occur in Nigeria and Niger (REYMENT, 1960, 1963, 1966, 1981 ; REYMENT & REYMENT, 1980 ; FOSTER *et al.,* 1983), Mali, Togo, Ivory Coast, Senegal (APOSTOLESCU, 1961) in addition to their co-occurrence in the North African province.

This wide distribution of Early Paleocene ostracod species demonstrates a direct connection with faunal exchange between North and West Africa (Fig. 6) wherever the connection was through the trans Saharan (in case of shallower marine ostracodes) or around the western coast of Africa (especially the deeper marine dwellings) during that time (APOSTOLESCU, 1961 ; REYMENT, 1980 and BASSIOUNI & LUGER, 1990).

In addition, there is some similarity between the Egyptian, as well as North African assemblages, and that reported from Brazil (NEUFVILLE, 1979), Trinidad and Panama (BOLD, 1957, 1960, 1967). From the recorded species in common between these areas there are *Cytherella piacabucuensis*, *Bairdia dolicha*, *B. hiwanneenssis*, *Soudanella laciniosa triangulata* and others (Table 2). This common occurrence supports the direct connection between North Africa, Brazil and the Caribbean region during the Paleocene and the Early Eocene. By the Middle Eocene, the scarcity of ostracodes in the studied section in addition to the scarcity of the published researches on this interval in western Africa and other countries do not allow to complete the paleogeographic picture during that time. However, some Egyptian ostracodes are similar to that recorded from France and Belgium (Fig. 6, Table 2). This is attributed to an ostracod exchange throughout a direct connection between the southern Tethys and western Eyrope during the Middle Eocene.

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Plate I

Fig. 1 : *Cytherella coryelli* BENSON & TATRA, left view, X75, Ekma section.
Fig. 2 : *Cytherella gabonensis* NEUFVILLE, left view, X75, Meshrak section.
Fig. 3 : *Cytherella lagenalis* MARLIERE, left view, X50, Dokh section.
Fig. 4 : *Cytherella piacabucuensis* NEUFVILLE, right view, X75, Meshrak section.
Fig. 5 : *Cytherella sergipensis* NEUFVILLE, left view, X75, Matulla section.
Figs 6-8 : *Cytherelloidea melleguensis* DAMOTTE & SAID, left, right, left views respectively, X100, Matulla section.
Fig. 9 : *Isohabrocythere teiskotensis* APOSTOLESCU, right view, X100, Meshrak section.
Fig. 10 : *Bairdia cespedecensis* BOLD, right view, X100, Meshrak section.
Figs 11-12 : *Bairdia dolicha* BOLD right views, X75, Ekma section.
Fig. 13 : *Bairdia hiwanneensis* HOWE & LEA, right view, X100, Matulla section.
Figs 14-15 : *Bairdia ilaroensis* REYMENT & REYMENT, right view, X50, Meshrak section.
Figs 16- 17 : *Bythocypris adunca* ESKER, right view, X75, 100, Meshrak section.
Fig. 18 : *Bythocypris eskeri* BASSIOUNI & LUGER, right view, X100, Dokh section.
Fig. 19 : *Bythocypris ghorbandti* ESKER, right view, X75, Meshrak section.
Fig. 20 : *Paracypris jonesi* BONNEMA, right view, X100, Meshrak section.
Fig. 21 : *Paracypris nigeriensis* REYMENT, right view, X100, Meshrak section.

Plate I

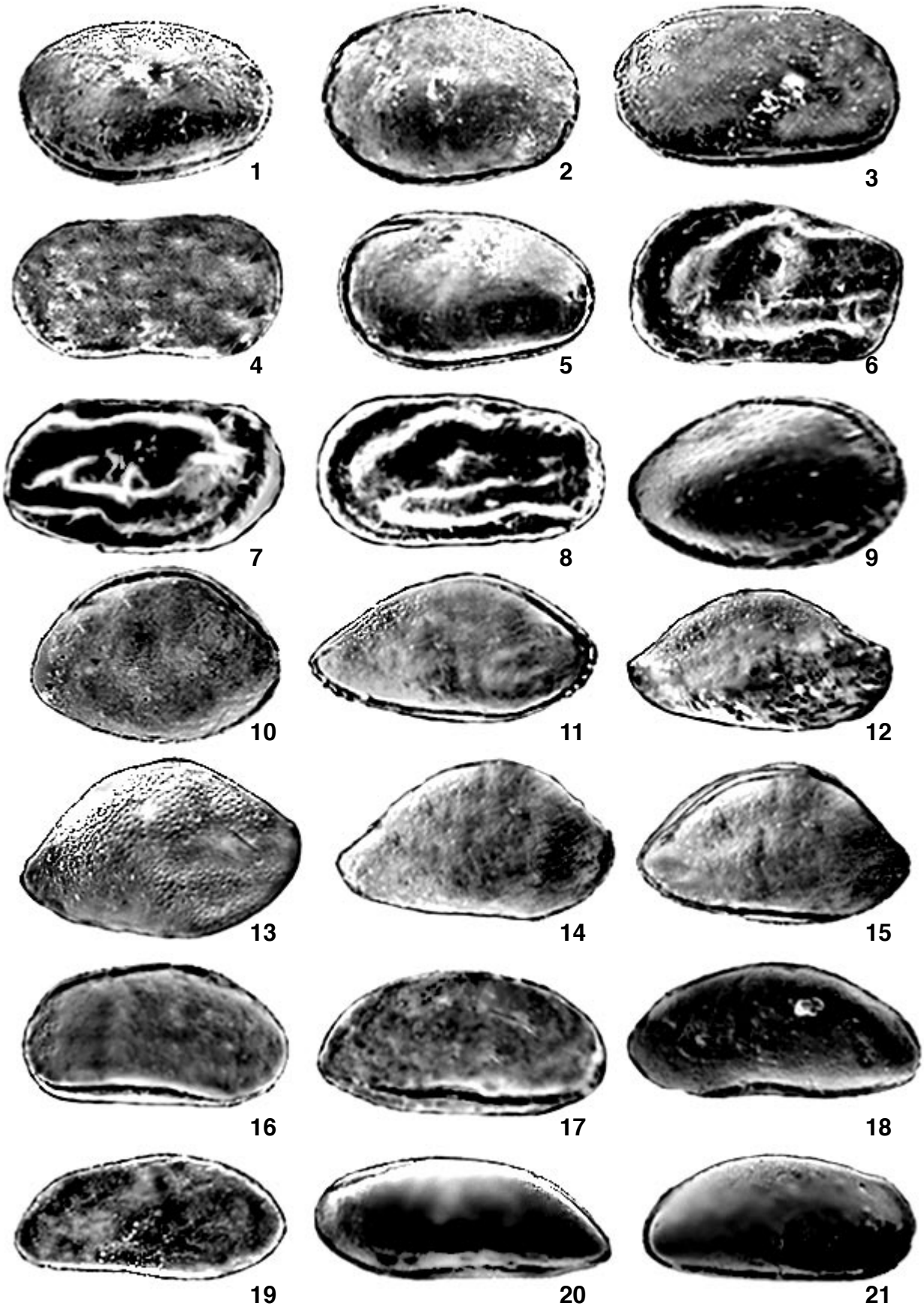

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Plate II

Fig. 1 : *Paracypris trosliensis* APOSTOLESCU, left view, X150, Matulla section.
Fig. 2 : *Argilloecia faba* ALEXANDER, left view, X100, Meshrak section.
Fig. 3 : *Pontocyprella recurva* ESKER, right view, X100, Ekma section.
Fig. 4 : *Propontocypris saharaensis* BASSIOUNI & MORSI, right view, X150, Dokh section.
Fig. 5 : *Brachycythere beershevaensis* HONIGSTEIN, right view, X100, Ekma section.
Figs 6-7 : *Bythoceratina umbonatoides* (KAY), left views, X200, 125, Matulla and Dokh sections.
Fig. 8 : *Cytheropteron lekefensis* ESKER, left view, X150, Dokh section.
Figs 9-10 : *Cytherura jacksoneni* HUFF, left views, X175, Ekma section.
Fig. 11 : *Eucytherura hassanieni* BASSIOUNI & LUGER, right view, X200, Dokh section.
Fig. 12 : *Schizocythere tessellata* (BOSQUET), right view, X150, Meshrak section.
Fig. 13 : *Clithrocytheridea kaufmani* HAZEL, right view, X175, Ekma section.
Fig. 14 : *Clithrocytheridea malkinae* SCHMIDT, left view, X300, Dokh section.
Fig. 15 : *Clithrocytheridea marylandica* HAZEL, right view, X150, Ekma section.
Fig. 16 : *Krithe echolsae* ESKER, left view, X100, Dokh section.
Fig. 17 : *Parakrithe crolifa* BASSIOUNI & LUGER, right view, X50, Meshrak section.
Fig. 18 : *Parakrithe kalambainaensis* (REYMENT), right view, X125, Dokh section.
Fig. 19 : *Paracytheridea tuberosa* LIENENKLAUS, left view, X150, Meshrak section.
Fig. 20 : *Anticythereis arcana* BERTELS, right view, X150, Meshrak section.
Fig. 21 : *Acanthocythereis meslei* DONZE & OERTLI, right view, Ekma section.

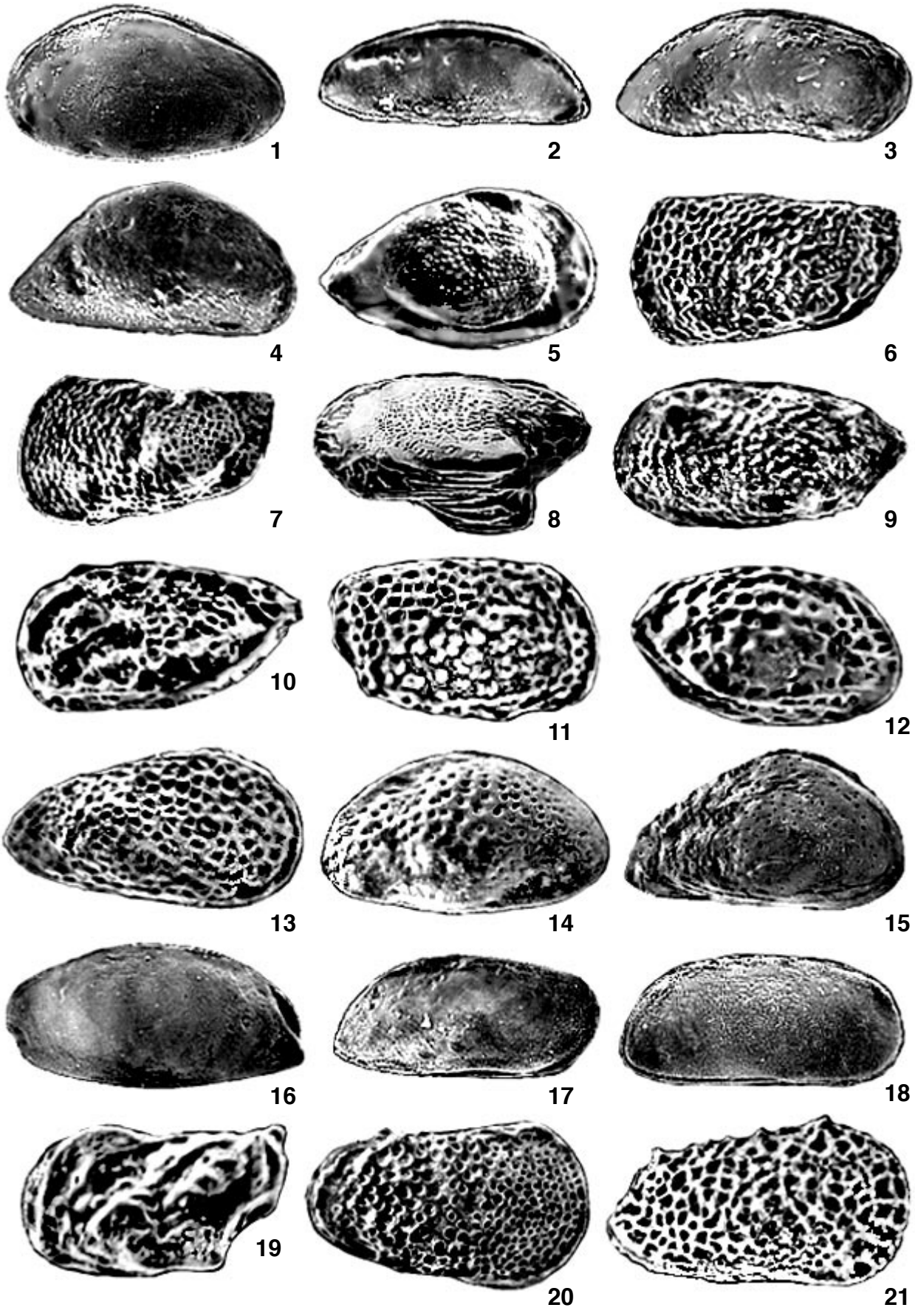
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Plate III

Fig. 1 : *Cristaeleberis fornicata* BASSIOUNI, left view, X75, Matulla section.
Fig. 2 : *Cristaeleberis reticulata* BASSIOUNI, right view, X75, Ekma section.
Fig. 3 : *Cristaeleberis thomasi* DONZE & SAID, left view, X75, Dokh section.
Fig. 4 : *Cythereis mesa ventroreticulata* HONIGSTEIN, right view, X50, Matulla section.
Fig. 5 : *Doricythereis bireticulata* COLIN & DAMOTTE, right view, X75, Matulla section.
Fig. 6 : *Martinicythereis praesamalutensis* BASSIOUNI & LUGER, left view, X100, Ekma section.
Figs 7-8 : *Martinicythereis samalutensis dorsocosta* BASSIOUNI, left and right views, X100, Matulla section.
Fig. 9 : *Martinicythereis samalutensis samalutensis* BASSIOUNI, right view, X75, Ekma section.
Fig. 10 : *Mauritsina coronata* (ESKER), right view, X50, Ekma section.
Fig. 11 : *Mauritsina jordanica nodoreticulata* BASSIOUNI, left view, X50, Matulla section.
Fig. 12 : *Mauritsina teiskotensis* (APOSTOLESCU), right view, X50, Matulla section.
Fig. 13 : *Megommatocythere denticulata* (ESKER), right view, X50, Matulla section.
Figs 14-15 : *Megommatocythere praecursor* COLIN & OERTLI, right views, X75, 175, Meshrak and Dokh sections.
Fig. 16 : *Oertliella delicata* BASSIOUNI & LUGER, right view, X50, Ekma section.
Fig. 17 : *Ordoniya bulaqensis* BASSIOUNI & LUGER, right view, X75, Ekma section.
Fig. 18 : *Ordoniya burmaensis* (BASSIOUNI), right view, X50, Meshrak section.
Fig. 19 : *Ordoniya hasaensis* (BASSIOUNI), right view, X75, Ekma section.
Fig. 20 : *Ordoniya maanensis* (BASSIOUNI), right view, X50, Ekma section.
Fig. 21 : *Ordoniya ordoniya* (BASSIOUNI), right view, X75, Matulla section.

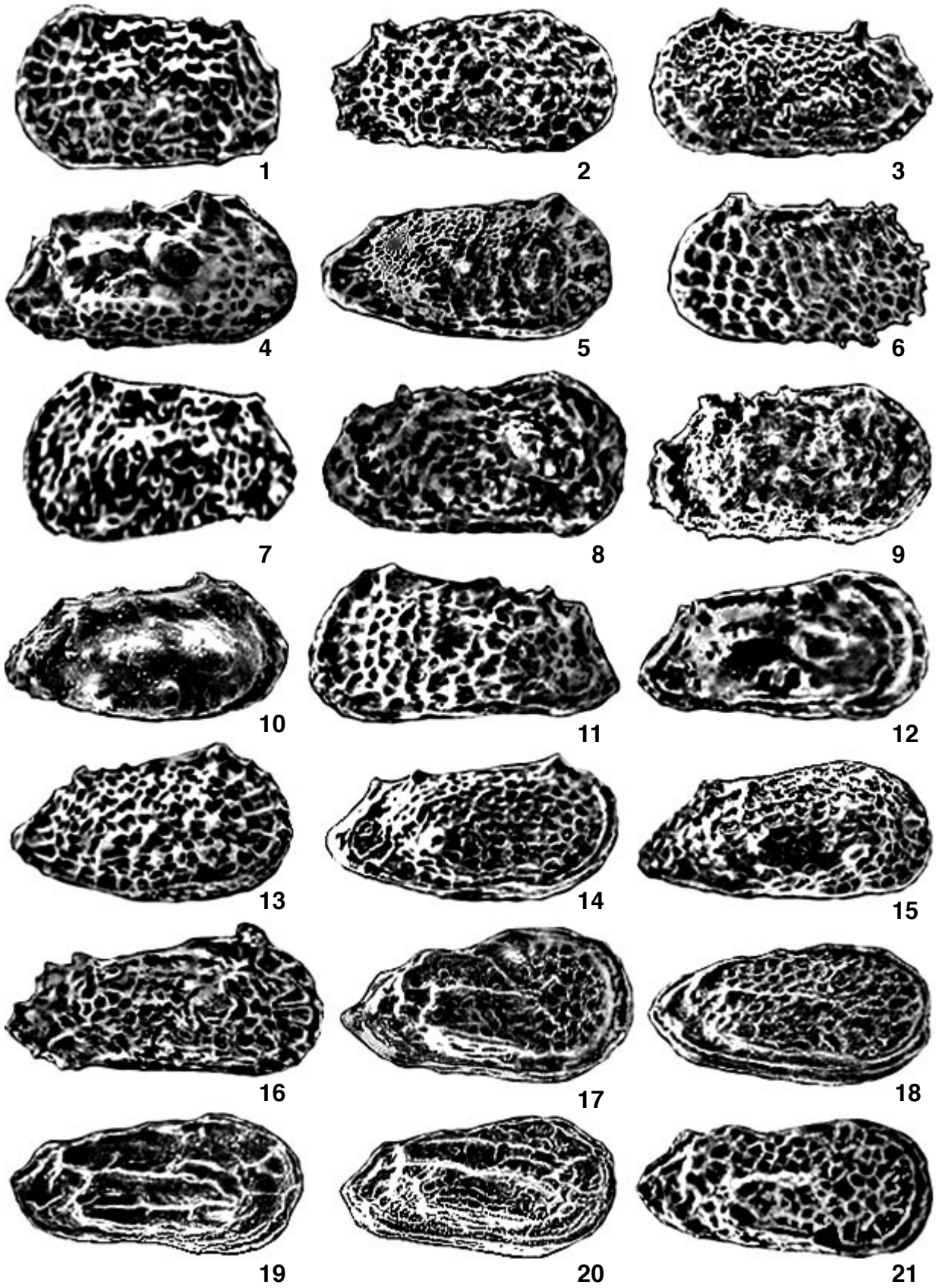
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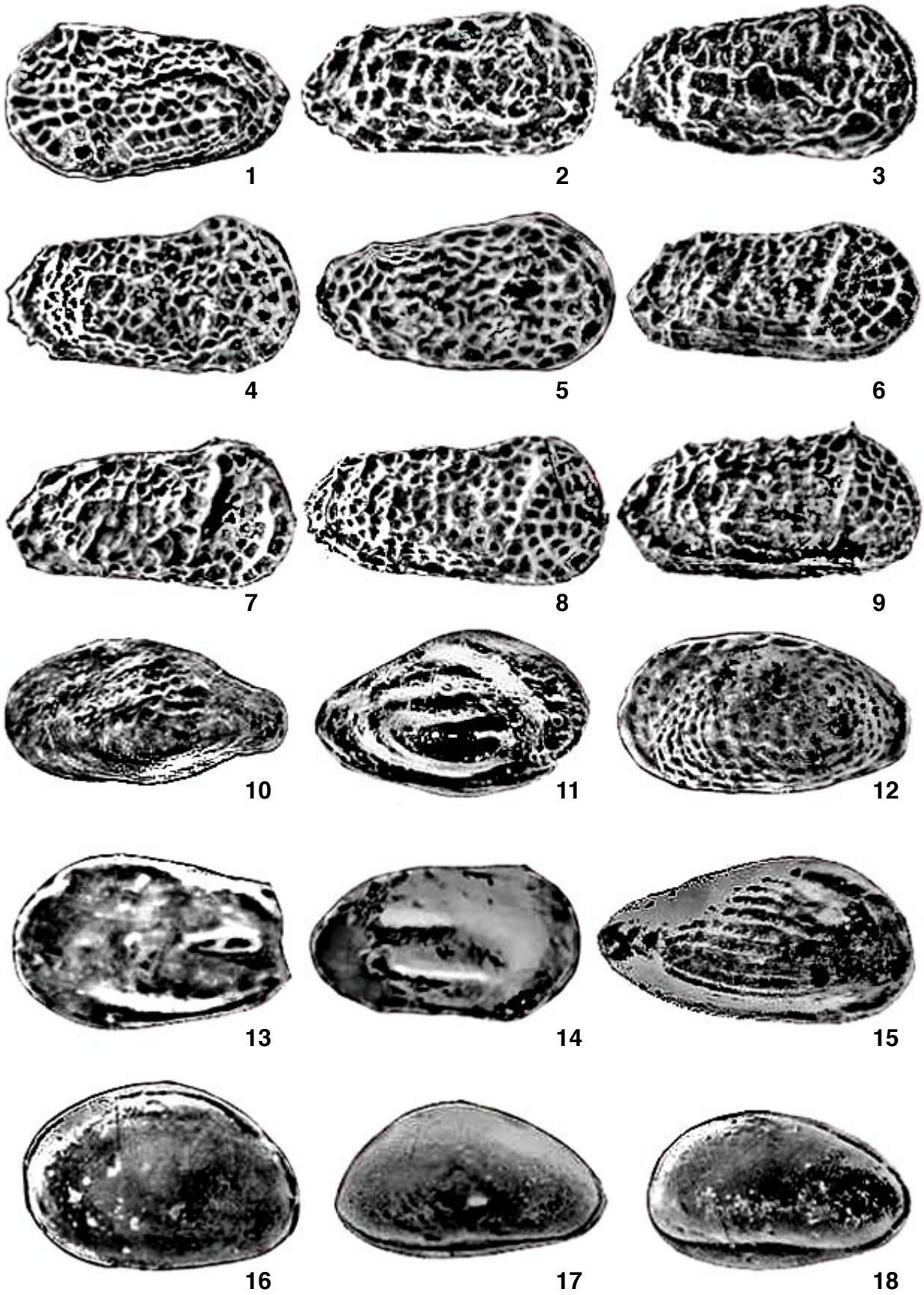
Plate IV

Fig. 1 : *Paracosta bensoni (*Damotte & Donze), left view, X75, Ekma section.
Figs 2-3 : *Paracosta kefensis* (Benson), right views, X50, 75, Ekma section.
Fig. 4 : *Paracosta pervinquieri* (Donze & Said), right view, X75, Matulla section.
Fig. 5 : *Reticulina praescitula* Bassiouni, right view, X125, Meshrak section.
Figs 6-7 : *Reticulina proteros* Bassiouni, right views, X50, Meshrak section.
Figs 8-9 : *Reticulina sangalkamensis* (Apostolescu), right views, X75, Ekma and Matulla sections.
Fig. 10 : *Buntonia attitogonensis* Apostolescu, left view, X75, Ekma section.
Fig. 11 : *Buntonia livida* Apostolescu, right view, X100, Meshrak section.
Fig. 12 : *Buntonia tatteuliensis* (Apostolescu), left view, X150, Meshrak section.
Figs 13-14 : *Phacrohabdotus inaequicostata* Colin & Donze, left and right views, X100, Matulla and Ekma sections.
Fig. 15 : *Soudanella laciniosa triangulata* Apostolescu, right view, X75, Ekma section.
Fig. 16 : *Xestoleberis cunteri* Howe, left view, X125, Ekma section.
Fig. 17 : *Xestoleberis dumblei* Stephenson, left view, X150, Matulla section.
Fig. 18 : *Xetoleberis tunisiensis* Esker, left view, X75, Meshrak section.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