Late Miocene Ostracoda from NW Libya

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ABSTRACT—Nine ostracod species from the Late Miocene A1 Khums Formation (exposed 2 km north of Qabilat ash Shurfah, NW Libya) are described and illustrated in this paper. Of these, four species, namely Cytherella libyaensis, Actinocythereis spinosa, Keijella africana and Neomonoceratina miocaenica, are new; one was established by Doruk (1980), one by Moyes (1965) and the other three species are left under open nomenclature. These species support the macrofossil, foraminiferal and other ostracod (Innocenti & Pertusati, 1984 and El-Waer, in press) evidence in suggesting a Late Miocene age.

INTRODUCTION
The present study deals with Ostracoda from the Late Miocene A1 Khums Formation exposed 2 km north of Qabilat ash Shurfah (see Fig. 1). The exposed section of the Formation measures approximately 14 m, and varies in composition between marlstone, calcareitic limestone and calcareous clay. Four samples were collected from the section (see Fig. 2) in 1983 by Mr. K. Sherif of the Industrial Research Centre, Tripoli, Libya. These beds are overlain by fluvo-aeolian deposits. The Miocene samples yielded a fairly rich and well preserved ostracod fauna (El-Waer, in press), containing Cytherella sp., Cytherella (Cytherella) vandenboldi Sissingh, 1972, Propontocypris sp., Loculicytheretta aff. miocaenica Szczecuha, 1978, Mutilus carinatus Doruk, 1973, Loxoconcha sp., Loxoconcha (Palmoconcha) sp., Paracytheridea gharianensis sp. nov., Paracytheridea sp., Pajienborelliina punctata sp. nov., Neomonoceratina mouliana Sissingh, 1972, Neomonoceratina conulata sp. nov., Actinocythereis libyaensis sp. nov., Chrysocythere alkhuma sp. nov., Chrysocythere cataphracta mucicata subsp. nov., Cistacythereis calamistrata Doruk, 1973, Cistacythereis qabilatashurfensis sp. nov., Falunia sicula Aruta, 1966, Ruggieria tetraptera tetraptera (Seguenza, 1897), Ruggieria miocaenica sp. nov., Keijella hodgii (Brady, 1866), Hermanites abundans sp. nov. and one genus left under open nomenclature.

The present work covers a number of important species which were discovered in examining further material. These are Cytherella libyaensis sp. nov., Propontocypris sp., Callistocythere sp., Actinocythereis spinosa sp. nov., Keijella africana sp. nov., Neomonoceratina miocaenica sp. nov., Loxoconcha sp., Paracytheridea inscita Doruk, 1980, and Carinovalva carinata (Moyes, 1965) from the same sequence. The occurrence at this stratigraphical level of two previously described species provides additional evidence for a Late Miocene age.

All figured specimens are deposited in the collections of the Geology Department, University of Hull, England.

Fig. 1. The study area.

SYSTEMATIC DESCRIPTIONS
Subclass Ostracoda Latreille, 1806
Order Podocopida Muller, 1894
Suborder Platycopina Sars 1866
Family Cytherellidae Sars, 1866
Genus Cytherella Jones, 1849
Cytherella libyaensis sp. nov.
(Pl. 1, figs. 1–3)

Derivation of name. From its occurrence in Libya.

Diagnosis. A species of the genus Cytherella characterised by its coarsely pitted surface. The location of the
El-Waer

muscle scar area is indicated by a small, shallow depression.

Holotype. Male left valve, HU.317.T.3; Pl. 1, fig. 3.

Paratypes. Two specimens, HU.317.T.1,2; Pl. 1, figs. 1, 2 and two right valves and one left valve (HU.317.T.24).

Type locality and horizon. 2 km north of Qabilat ash Shurfah, Late Miocene, sample 3.

Description. Carapace elongate to ovate in lateral view, with greatest height at the posterior margin. Dorsal margin straight, sloping gently to the anterior margin. Ventral margin slightly concave in the middle and curved upwards anteriorly. Posterior margin is rounded. The lateral surface is covered by coarse pits. The area of the muscle scar attachment is indicated by a small, shallow depression. The left valve is larger than the right. Sexual dimorphism is pronounced, the presumed males are more elongate and less high than the females. The internal features not visible.

Dimensions of figured specimens (in μm)

| Length | Height |
|--------|--------|
| 650    | 358    |
| 613    | 373    |
| 653    | 360    |

Remarks. Cytherella libyaensis sp. nov. shows affinities with Cytherella (Cytherella) vandenboldi Sissingh, 1972, in its outline, but differs in having a straight, gently sloping dorsal margin, and a narrower anterior end.

Occurrence. Only at the type locality; sample 3 of the section 2 km north of Qabilat ash Shurfah.

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Suborder Podocopina Sars, 1866
Superfamily Cypridacea Baird, 1845
Family Pontocyprididae Muller, 1894
Subfamily Pontocypridinae Muller, 1894
Genus Propontocypris Sylvester-Bradley, 1948

Propontocypris sp. (Pl. 1, figs. 4–5)

Material. Three carapaces.

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Explanation of Plate 1

Figs. 1–3. Cytherella libyaensis sp. nov.: fig. 1, paratype, male right valve, HU.317.T.1 (x61); fig. 2, paratype, female internal view, right valve, HU.317.T.2 (x61); fig. 3, holotype, male left valve, HU.317.T.3 (x57).

Figs. 4, 5. Propontocypris sp.: fig. 4, female carapace from left, HU.317.T.4 (x75); fig. 5, male carapace from right, HU.317.T.5 (x75).

Fig. 6. Callistocythere sp., left valve, HU.317.T.6 (x57).

Figs. 7–9. Actinocythereis spinosa sp. nov.: fig. 7, holotype, left valve, HU.317.T.7 (x60); fig. 8, paratype, muscle scar pattern, HU.317.T.8; fig. 9, paratype, internal view, left valve, HU.317.T.8 (x61).

Figs. 10, 11. Keijella africana sp. nov.: fig. 10, paratype, female carapace from right, HU.317.T.9 (x70); fig. 11, holotype, male carapace from right, HU.317.T.10 (x68).

Fig. 12. Carinovalva carinata (Moyes, 1965), carapace, dorsal view, HU.317.T.11 (x82).
### Explanation of Plate 2

Figs 1, 2 Carinovalva carinata (Moyes, 1965); fig. 1, male carapace from right, HU.317.T.12 (×79); fig. 2, female carapace from left, HU.317.T.13 (×78).

Figs. 3–8 Neomonoceratina miocaenica sp. nov.: fig. 3, holotype, female left valve, HU.317.T.14 (×60); fig. 4, paratype, female right valve, HU.317.T.15 (×66); fig. 5, paratype, male carapace, dorsal view (specimen lost), HU.317.T.16 (×67); fig 6, paratype, male right valve, HU.317.T.17 (×65); fig. 7, paratype, male right valve, HU.317.T.18 (×65); fig. 8, paratype, male right valve, internal view, HU.317.T.19 (×65).

Figs. 9–11 Loxoconcha sp.: fig. 9, female, carapace from left, HU.317.T.20 (×70); fig. 10, female, carapace from right, HU.317.T.21 (×68); fig. 11, male, carapace from right, HU.317.T.22 (×69).

Fig. 12. Paracytheridea inscita Doruk, 1980, male right valve, HU.317.T.23 (×87).
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is a strong straight, horizontal median ridge which ends about one-fifth length from the posterior end. A strong ridge runs from the eye tubercle parallel to the anterior margin and about midway between the anterior and the sub-central tubercle. This rib curves round into an irregular ventral-lateral rib which ends in a rhombic tubercle again ends almost one-fifth length from the posterior marginal thickening, a rather irregular rib which runs near the anterior and roughly parallel to it an oblique rib parallel to the posterodorsal margin and midway between that margin and the posterior termination of the median rib. The ornamentation is completed by a series of transverse ribs and intervening fossae of variable shape and size.

**Dimensions of figured specimens (in μm).**

|                | Length | Height |
|----------------|--------|--------|
| Left valve, HU.317.T.6 | 933    | 466    |

**Remarks.** Callistocythere sp. shows some similarities to Callistocythere mediterranea (Muller, 1894) figured by Doruk (1980), but the latter differs in having marginal denticulations and different surface ornamentation.

**Occurrence.** Only at the type locality: sample 3 of the section 2 km north of Qabilat ash Shurfah.

**Genus Keijella** Ruggieri, 1967

**Keijella africana** sp. nov.

(Pl. 1, figs. 10–11)

**Derivation of name.** From its occurrence in north Africa.

**Diagnosis.** The lateral surface is ornamented by slit-like pits which are distributed longitudinally in the muscle area.

**Holotype.** Male carapace, HU.317.T.10; Pl. 1, fig. 11.

**Paratype.** Female carapace, HU.317.T.9; Pl. 1, fig. 10.

**Other material.** Three carapaces (HU.317.T.26.) from samples 1b and 2.

**Type locality and horizon.** 2 km north of Qabilat ash Shurfah, Late Miocene, sample 3.

**Description.** Carapace ovate in lateral view, with greatest height at the anterior cardinal angle. Ventral margin straight, curving upwards at the posterior end. Dorsal margin straight but sloping gently posteriorly in the posterior third of its length. Anterior margin symmetrically rounded, decorated by 12 denticles which all lie below two-thirds height. Posterior margin subtriangular, smooth in the upper part and decorated with one pointed spine in the lower part. The lateral surface is ornamented by slit-like pits which are distributed longitudinally in the muscle scar area. The ventral longitudinal slits run from the posterior margin backwards in the posteroventral area. Another series run in a single line just behind the posterior margin. Sexual dimorphism is pronounced, the males being elongate and narrower than the females. No internal details were seen as no single valves were obtained.

**Dimensions of figured specimens (in μm).**

|                | Length | Height |
|----------------|--------|--------|
| Paratype, female carapace, HU.317.T.9 | 706    | 373    |
| Holotype, male carapace, HU.317.T.10 | 733    | 346    |
Remarks. The present species has some similarities to *Keijella hodgii* (Brady, 1866) as figured by Ruggieri (1967), Doruk (1973) and El-Waer (in press), but the latter differs in that the anterior series of pits run in a single line just behind the anterior margin and the males are less high. *K. africana* is also somewhat similar to *Keijella clauda* Doruk, 1973, but the latter differs in lacking the pits on the lateral surface and the sloping dorsal margin.

**Occurrence.** In samples 1b, 2 and 3 of the section 2 km north of Qabilat ash Shurfah.

**Genus Carinovalva** Sissingh, 1973

*Carinovalva carinata* (Moyes, 1965)

(Pl. 1, fig. 12; Pl. 2, figs. 1–2)

1965 *Ruggieria carinata* n. sp. Moyes; 91–93, pl. XI, figs. 10–12.

1969 *Ruggieria (Keija) carinata carinata* (Moyes); Carbonnel; 128–129, pl. 16, figs. 5–8.

1985 *Carinovalva carinata* (Moyes); Carbonel; pl. 95, figs. 6, 7.

**Material.** Five carapaces.

**Dimensions of figured specimens** (in μm).

|                | Length | Height |
|----------------|--------|--------|
| Male carapace, HU.317.T.11. | 511    | 244    |
| Male carapace, HU.317.T.12. | 517    | 250    |
| Female carapace, HU.317.T.13. | 482    | 282    |

**Remarks.** *Carinovalva carinata* (Moyes, 1965) was originally described from the Upper Miocene of the Bay of Biscay and recorded by Carbonnel (1969) from the Rhone Basin. The species is also recorded from the Upper Miocene (Tortonian) of Portugal by Nascimento (1983).

**Occurrence.** 2 km north of Qabilat ash Shurfah, Late Miocene, samples 1b and 3.

**Family Cytheridae** Baird, 1850

Subfamily Cytherinae Baird, 1850

Tribe: *Paijenborchellini* Deroo, 1960

Genus *Neomonoceratina* Kingma, 1948

*Neomonoceratina miocaenica* sp. nov.

(Pl. 2, figs. 3–8)

**Derivation of name.** From its stratigraphic occurrence in the Miocene.

**Diagnosis.** A species of *Neomonoceratina* characterised by its coarsely punctate to reticulate surface and deep, subcentral vertical sulcus.

**Holotype.** Female left valve, HU.317.T.14; Pl. 2, fig. 3.

**Paratypes.** Five specimens, HU.317.T.15–19; Pl. 2, figs. 4–8 and 11 right valves, 12 left valves and five carapaces (HU.317.T.27).

**Type locality and horizon.** 2 km north of Qabilat ash Shurfah, Late Miocene, sample 3.

**Description.** Carapace subrectangular to subrhomboidal in lateral view, with greatest height at the anterior cardinal angle. Anterior margin broadly and obliquely rounded. Ventral margin fairly straight, slightly convex in the middle, curving upwards posteriorly. Lateral surface with a vertical sulcus which is widest dorsally and dies out above the ventral lateral ridge. The lateral surface is characterised by ridges. The ventrolateral ridge runs parallel to the ventral margin, is slightly alate posteriorly and joins the ventral rib anteriorly. The posterodorsal ridge commences behind the sulcus at one-third height below the dorsal margin, curves upwards posterodorsally and ends behind the posterior cardinal angle. The median ridge starts from the middle of the ridge parallel to the anterior margin, runs across the median sulcus, and continues to join the inner posterodorsal rib posteriorly. The ventral rib originates from the anterior end of the median ridge, curves down parallel to the ventral margin to the posteroventral corner where it runs into the posterior rib. A small eye tubercle is present. The muscle scar pattern and the hinge are typical of the genus. Sexual dimorphism is marked, the presumed males being more elongate and narrower than the females.

**Dimensions of figured specimens** (in μm).

|                | Length | Height |
|----------------|--------|--------|
| Holotype, female left valve, HU.317.T.14. | 650    | 370    |
| Paratype, female right valve, HU.317.T.15. | 570    | 335    |
| Paratype, male carapace, HU.317.T.16. | 680    | 300    |
| Paratype, male right valve, HU.317.T.17. | 660    | 300    |
| Paratype, male right valve, HU.317.T.18. | 700    | 350    |
| Paratype, male, HU.317.T.19. | 660    | 320    |

**Remarks.** The new species is closely comparable with *Neomonoceratina delicata* Ishizaki & Kato, 1976, but the latter has a more smoothly rounded anterior margin and posteroventral spines. *N. miocaenica* is also distinguished from *N. delicata* by its more reticulate surface.

**Occurrence.** Only at the type locality: sample 3 of the section 2 km north of Qabilat ash Shurfah.

**Family Loxoconchidae** Sars, 1925

Genus *Loxoconcha* Sars, 1866

*Loxoconcha* sp.

(Pl. 2, figs. 9–11)

**Material.** Five carapaces.

**Description.** Carapace elongate to subovate in lateral view with greatest height at one-third the length. Anterior margin obliquely rounded, posterior margin more narrowly slightly rounded. Dorsal margin nearly straight, sloping gently backwards posteriorly. Ventral margin straight, curved upwards posteriorly. The lateral surface is finely pitted, the pits being arranged in a
concentric pattern around the margins. Sexual dimorphism present, the presumed males being more elongate than the females. No internal details were seen as no single valves were obtained.

Dimensions of figured specimens (in pm)

|                | Length | Height |
|----------------|--------|--------|
| Female carapace, HU.317.T.20. | 586    | 333    |
| Female carapace, HU.317.T.21. | 600    | 333    |
| Male carapace, HU.317.T.22.   | 625    | 326    |

Remarks. The present species is compared with *Loxoconcha punctatella* (Reuss, 1850) as figured by Oertli (1956) and El-Waer (in press); the latter differs in having the ventral margin slightly concave in the middle and narrower posterior end.

Occurrence. 2 km north of Qabilat ash Shurfah, Late Miocene, sample 3.

### Family Paracytherideidea Puri, 1957

### Genus *Paracytheridea* Muller, 1894

*Paracytheridea inscita* Doruk, 1980

(Pl. 2, fig. 12)

1980 *Paracytheridea inscita* Doruk: 7(25), 143–146.

**Material.** One right valve.

Dimensions of figured specimens (in μm)

|                | Length | Height |
|----------------|--------|--------|
| Male right valve, HU.317.T.23. | 536    | 273    |

Remarks. *Paracytheridea inscita* Doruk was originally described from the Upper Miocene, Antakya region of Turkey.

Occurrence. 2 km north of Qabilat ash Shurfah, Late Miocene, sample 3.

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