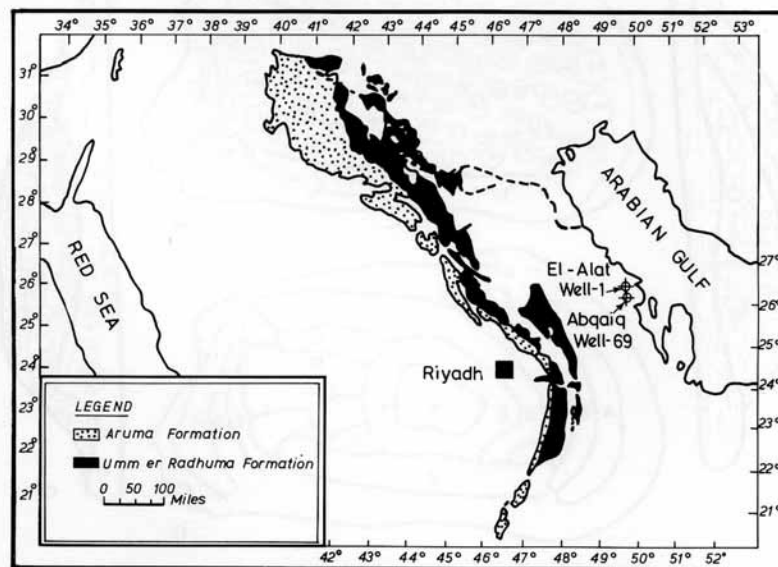


CRETACEOUS AND PALAEOCENE SPECIES OF THE OSTRACOD *HORNIBROOKELLA* FROM SAUDI ARABIA

by ALI A. F. AL-FURAIH

ABSTRACT. Seven new species of the ostracod genus *Hornibrookella* are described and illustrated from the uppermost Maastrichtian and Palaeocene of eastern Saudi Arabia: *Hornibrookella cyclifossata*, *H. cyclopea*, *H. cuspidata*, *H. divergens*, *H. episcelis*, *H. posterisella*, and *H. quinquecellulosa*. They occur at earlier horizons than species of the genus described from Europe and Pakistan. A modification of the Liebau diagram has been adopted for the analysis of the ornament.

THE uppermost Maastrichtian is represented in Saudi Arabia by the Lina Member of the Aruma Formation (text-fig. 1). The Lina Member is separated from the underlying Atj Member by a widespread disconformity, and is overlain by the Umm er Radhuma Formation of Palaeocene and lower Eocene age. The Lina Member consists, in the type locality, of yellow-brown dolomite and calcareous shale, olive shale, argillaceous dolomite, interbedded limestone, and dolomite.



TEXT-FIG. 1. Outcrop map of Aruma (upper Cretaceous) and Umm er Radhuma (Palaeocene and lower Eocene) Formations and locations. From El-Khayal 1974.

[*Palaentology*, Vol. 20, Part 3, 1977, pp. 483-502, pls. 53-58.]

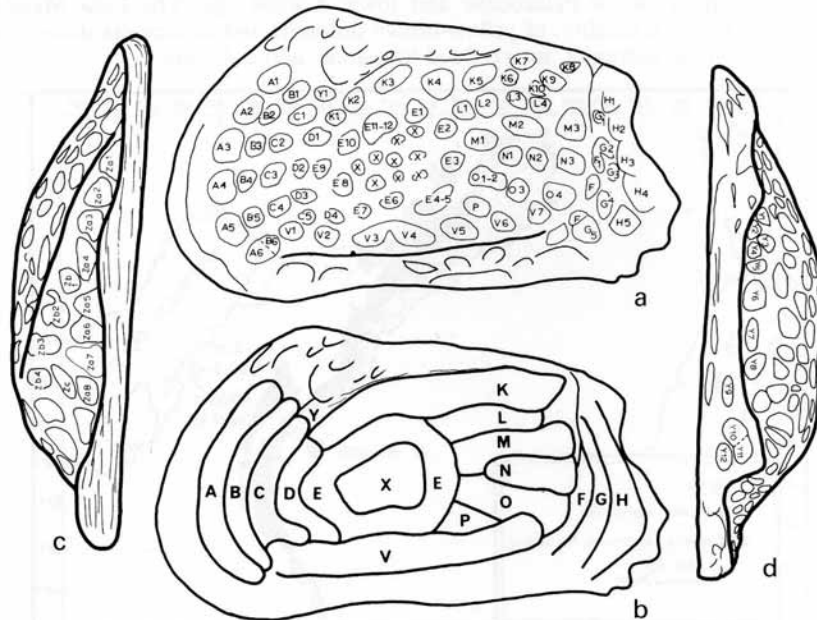
The Umm er Radhuma Formation in the reference section is divided into two units, the upper consisting of calcarenitic limestone, aphanitic limestone, and dolomite; the lower of aphanitic limestone (Powers *et al.* 1966).

Repository. All the figured material is deposited in the British Museum (Natural History), London.

SPECIFIC DISCRIMINATION

Liebau (1969, 1971, 1975*a*, 1975*b*) and Benson (1972) have suggested methods for the analysis of the ornament in genera of the Trachyleberididae based on fossal patterns and pore conuli. I have found this approach of great value in discriminating species of the Trachyleberididae, although the position and distinction of the pore conuli may vary within one species. Modifications were suggested by Neale (1975).

In the present study I have adopted Liebau's system but extended it to include ventral and dorsal views. The system as applied to the type-species of *Hornibrookella* (*H. anna* (Lienenklaus); see Al-Furaih 1975) is shown in text-fig. 2. The anterior fossae are analysed in four series (A-D) which run parallel to the anterior margin. E surrounds the subcentral tubercle. K and V lie above and below E and are parallel



TEXT-FIG. 2. Analysis of pattern of ornamentation in the type-species, *Hornibrookella anna* (Lienenklaus), *a, b*, left valve. *a*, lateral view. *b*, grouping of fossae. *c, d*, right valve. *c*, ventral view. *d*, dorsal view.

to the length of the shell; L, M, N, O, and P lie between K and V posterior to the subcentral tubercle; F, G, and H parallel the posterior margin. X covers the reticulation developed on the subcentral tubercle, and is particularly useful for specific discrimination. The ventral and dorsal development is indicated by Z and Y respectively. This analysis is applicable to all the new species described in the present paper.

SYSTEMATIC DESCRIPTIONS

Family TRACHYLEBERIDIDAE Sylvester-Bradley, 1948

Genus *HORNIBROOKELLA* Moos, 1965

Type species. *Cythere anna* Lienenklaus, 1894.

Diagnosis. A genus of Trachyleberididae, with subrectangular carapace. Shell surface strongly reticulate with no median ridges, although some species may have subordinate ribs. Dorsal and ventral ridges well marked. Eye and subcentral tubercles distinct. Hinge amphidont.

Remarks. Moos (1965) proposed *Hornibrookella* as a subgenus of *Quadracythere* to accommodate species in which the uppermost adductor muscle scar is divided into two spots. I noticed in my work on *H. anna* (Lienenklaus) that these features of the muscle-scar pattern may vary within a single species; so the pattern should not, in my opinion, be used as the main criterion to distinguish *Quadracythere* from *Hornibrookella* (see Al-Furaih 1975). *Quadracythere* differs from *Hornibrookella* in being quadrate in outline; both genera are reticulate, but *Hornibrookella* does not develop the median longitudinal ridges evident in *Quadracythere*.

Hornibrookella cyclifossata sp. nov.

Plate 53, figs. 1, 2; text-fig. 3

Derivation of name. Latin *cyclifossata*, with round holes.

Material. Three hundred and thirty carapaces from El-Alat W-1.

Type locality and horizon. El-Alat W-1, sample 1251—65 ft below the surface. Upper Palaeocene.

Diagnosis. Surface reticulate with rounded fossae, the fossae of the second anterior row (B) oval shaped. Height almost equal throughout the carapace.

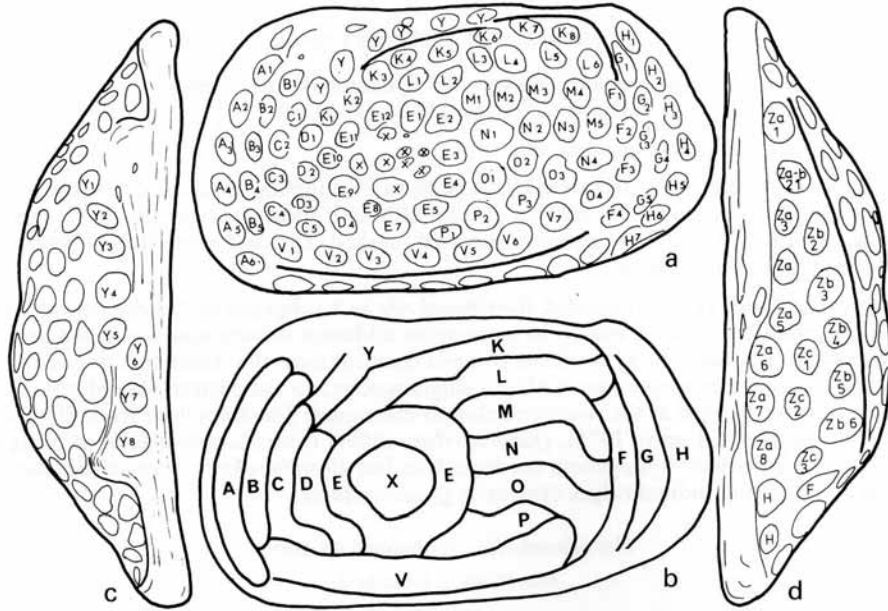
Description. Surface coarsely and deeply reticulate with rounded fossae. Subcentral tubercle weakly developed, eye tubercle distinct. There is a distinct ventrolateral ridge and a short curved horn-like ridge at the posterodorsal corner. Normal pores form domes, free-standing in the solum of each reticulum and presumably terminate in sieve-plates, but these are obscured by recrystallization. Internal details unknown. Sexual dimorphism strongly marked, the males are longer than the females.

Dimensions (μm).

	Length	Height	Width
Holotype, male carapace, OS 5244	732	415	427
Paratype, female carapace, OS 5245	634	415	415

Distribution. Known from Palaeocene of Saudi Arabia.

Affinities and differences. The present species shows some affinity to *H. quinque-cellulosa* sp. nov. but is longer, height almost equal throughout the carapace. *H. posterisella* sp. nov. has well-developed subcentral tubercle. *H. cyclifossata* differs from *H. episcelis* in details of ornamentation and the latter has a well-developed caudal process.



TEXT-FIG. 3. Analysis of pattern of ornamentation in *Hornibrookella cyclifossata* sp. nov. a-d, male left side of complete carapace. a, lateral view. b, grouping of fossae. c, dorsal view. d, ventral view.

Hornibrookella cyclopea sp. nov.

Plate 54, figs. 1-4; text-fig. 4

Derivation of name. Greek *cyclopea*, circle-eyed.

Material. Forty-eight carapaces, 6 right valves, and 10 left valves from El-Alat W-1. Six carapaces, 1 right valve, and 1 left valve from Abqaiq W-69.

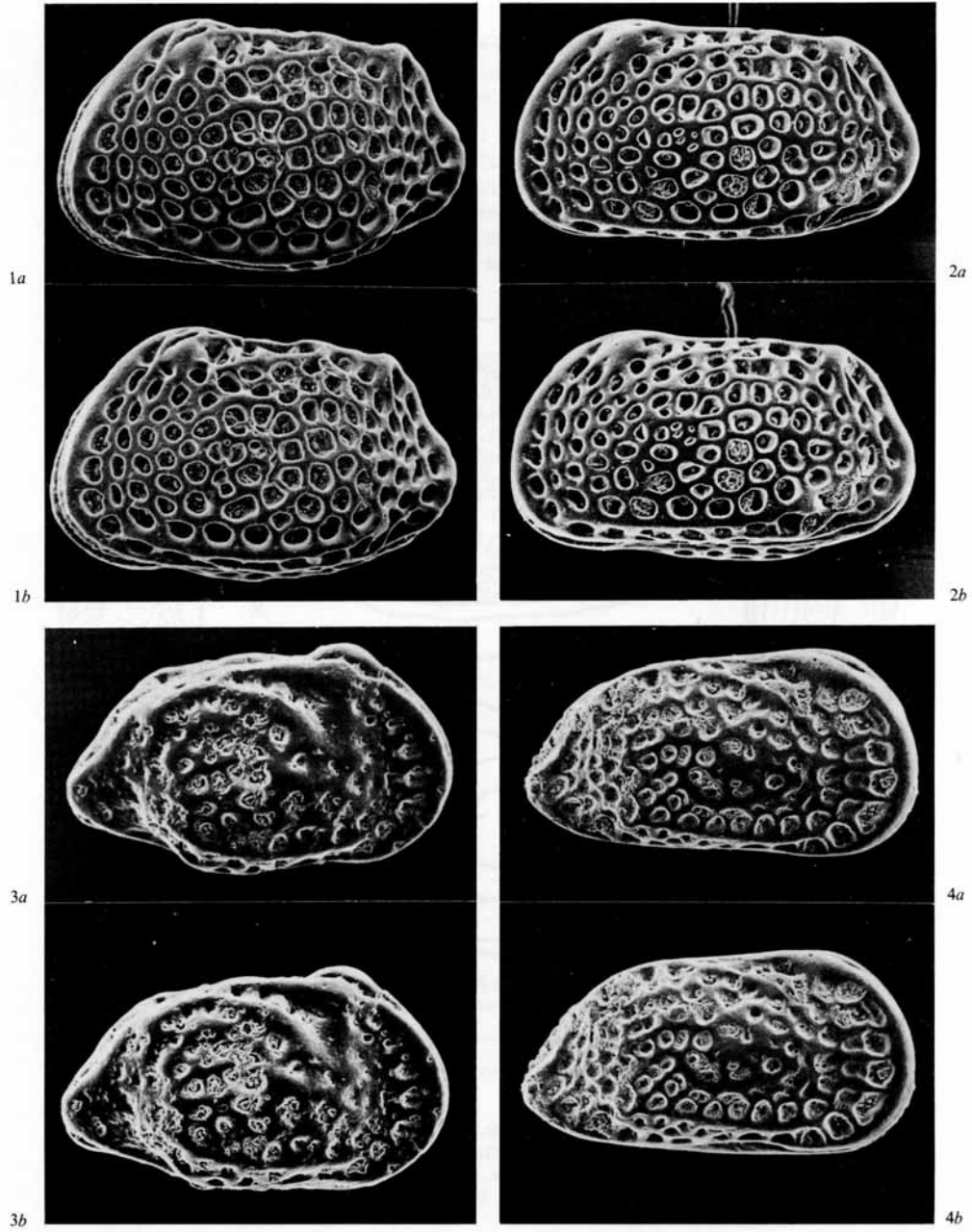
Type locality and horizon. El-Alat W-1, sample 1827-34 ft below the surface. Lower Palaeocene.

EXPLANATION OF PLATE 53

Stereoscopic paired photographs.

Figs. 1, 2. *Hornibrookella cyclifossata* sp. nov. El-Alat W-1, sample 1251-65 ft below the surface. 1, paratype, female carapace, OS 5245. External lateral view from left, $\times 104$. 2, holotype, male carapace, OS 5244. External lateral view from left, $\times 90$.

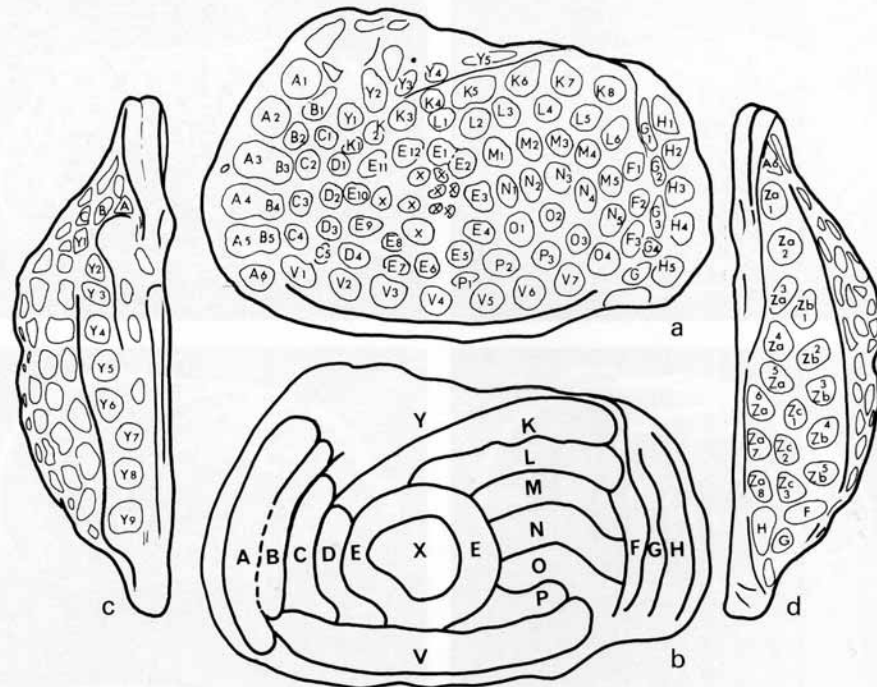
Figs. 3, 4. *Hornibrookella cuspidata* sp. nov. El-Alat W-1, sample 1251-65 ft below the surface. 3, paratype, female carapace, OS 5266. External lateral view from right, $\times 99$. 4, holotype, male carapace, OS 5265. External view from right, $\times 82$.



AL-FURAIH, *Hornibrookella cyclifossata* and *H. cuspidata*

Diagnosis. A species of the genus *Hornibrookella* with subrectangular carapace, moderately elongate. Dorsal and ventral margins converging slightly towards the posterior. Highest point of carapace in region of eye tubercle.

Description. Surface strongly reticulate. Domed normal pore canals quite distinct, rather large, one in each reticule. Radial pore canals not very well preserved but appear to be simple. Duplicature of moderate width. Selvage prominent submarginal in the left valve. The muscle scars are hard to distinguish, due to preservation, but appear to be typical for the genus. Hinge holamphidont. Sexual dimorphism rather marked; the females are shorter than the males.

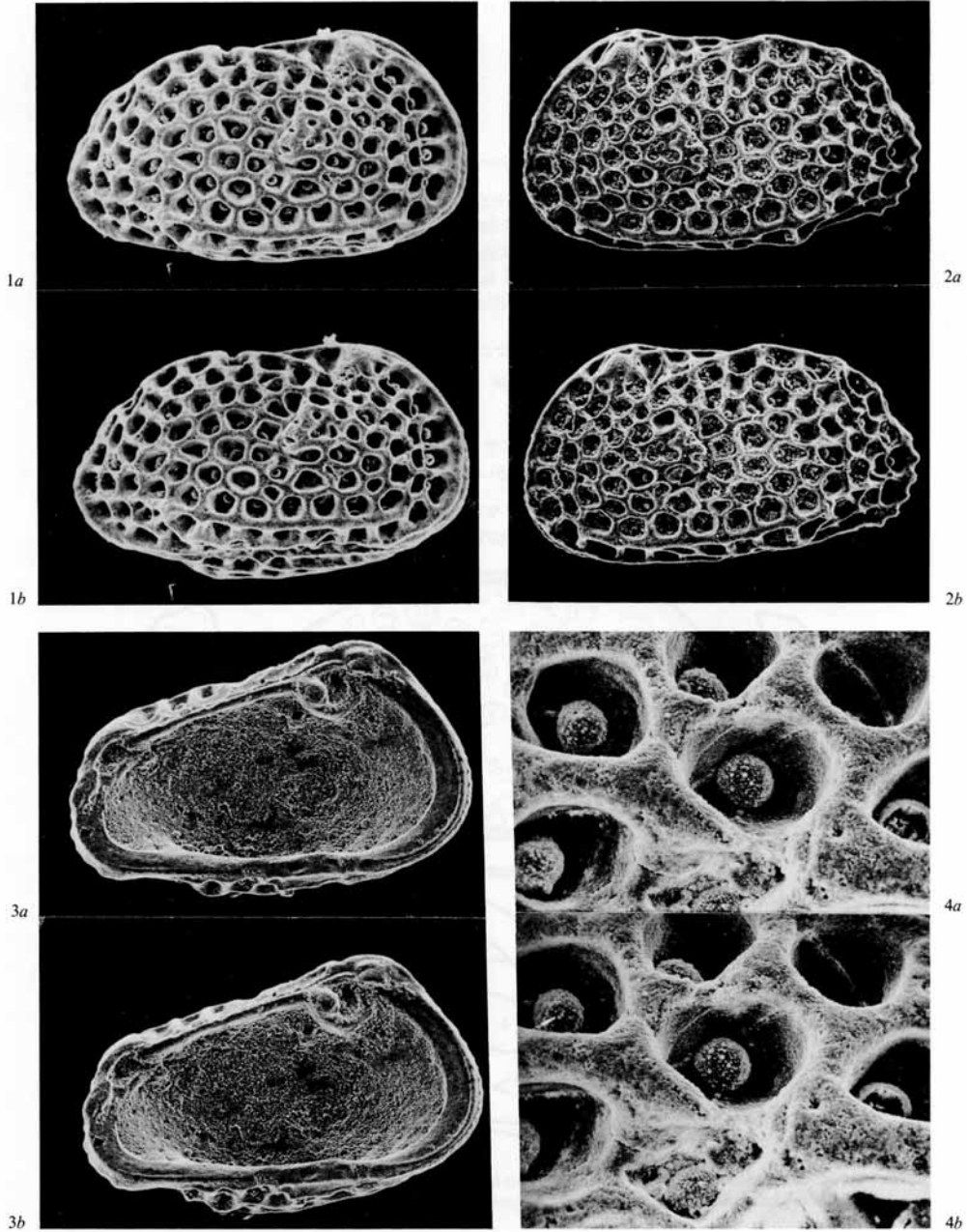


TEXT-FIG. 4. Analysis of pattern of ornamentation in *Hornibrookella cyclopea* sp. nov. a-d, female left valve. a, lateral view. b, grouping of fossae. c, dorsal view. d, ventral view.

EXPLANATION OF PLATE 54

Stereoscopic paired photographs.

Figs. 1-4. *Hornibrookella cyclopea* sp. nov. El-Alat W-1, sample 1827-34 ft below the surface. 1, 4, holotype, male carapace, OS 5246. 1, external lateral view from right, $\times 76$; 4, details of ornament showing domed pore canals $\times 532$. 2, paratype, male left valve, OS 5248. External lateral view, $\times 75$. 3, paratype, female left valve, OS 5247. Internal lateral view, $\times 83$.



AL-FURAIH, *Hornibrookella cyclopea*

Dimensions (μm).

	Length	Height	Width
Holotype, male carapace, OS 5246	854	488	463
Paratype, female left valve, OS 5247	780	488	
Paratype, male left valve, OS 5248	866	512	

Distribution. Known from the uppermost Cretaceous and lower Palaeocene of Saudi Arabia.

Affinities and differences. The reticular pattern somewhat resembles *H. quinquecellulosa* but shape is very different, with greatest height in different position, and *H. quinquecellulosa* is more quadrate in lateral outline. *H. episcelis* sp. nov. is also similar but differs in details of the ornament, and has a better-developed ventrolateral ridge, which expands posteriorly into an ala-like extension.

Hornibrookella cuspidata sp. nov.

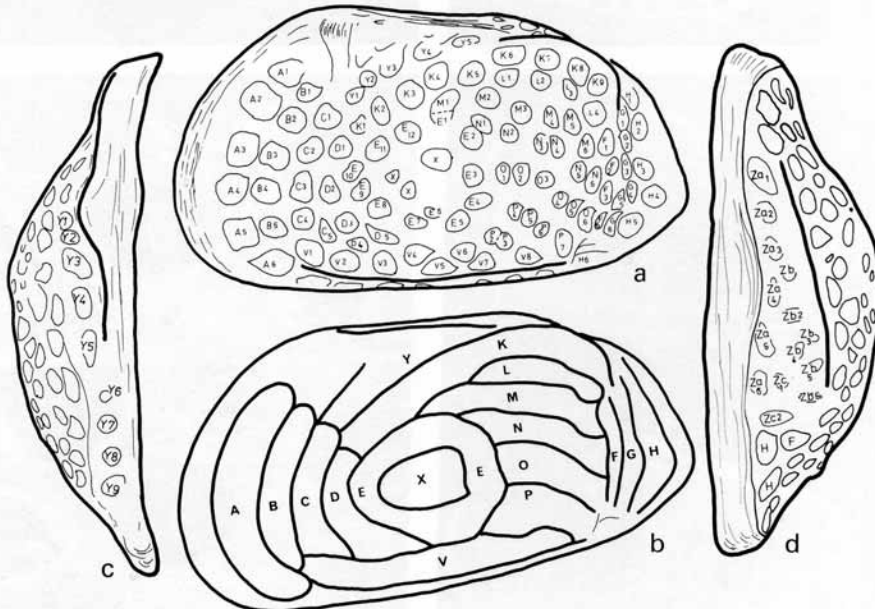
Plate 53, figs. 3, 4; text-fig. 5

Derivation of name. Latin, pointed.

Material. Two carapaces from El-Alat W-1, sample 1251—65 ft.

Type locality and horizon. El-Alat W-1, sample 1251—65 ft below the surface. Upper Palaeocene.

Diagnosis. A species of *Hornibrookella* with carapace thick-shelled, distinct caudal process. Surface reticulate with thick muri.



TEXT-FIG. 5. Analysis of pattern of ornamentation in *Hornibrookella cuspidata* sp. nov. a-d, male left side of complete carapace. a, lateral view. b, grouping of fossae. c, dorsal view. d, ventral view.

Dimensions (μm).

	Length	Height	Width
Holotype, male carapace, OS 5265	781	432	415
Paratype, female carapace, OS 5266	634	366	366

Distribution. Known from the upper Palaeocene of Saudi Arabia.

Affinities and differences. This species bears some resemblance to *H. arcana* (Lubimova and Guha) (see Siddiqui 1971) from the Eocene of Kutch, India but differs in details of ornamentation, further, dorsal margin in *H. arcana* has a well-marked concavity behind the anterior cardinal angle.

Remarks. Only two specimens of this species have been found in El-Alat W-1, sample 1251—65 ft.

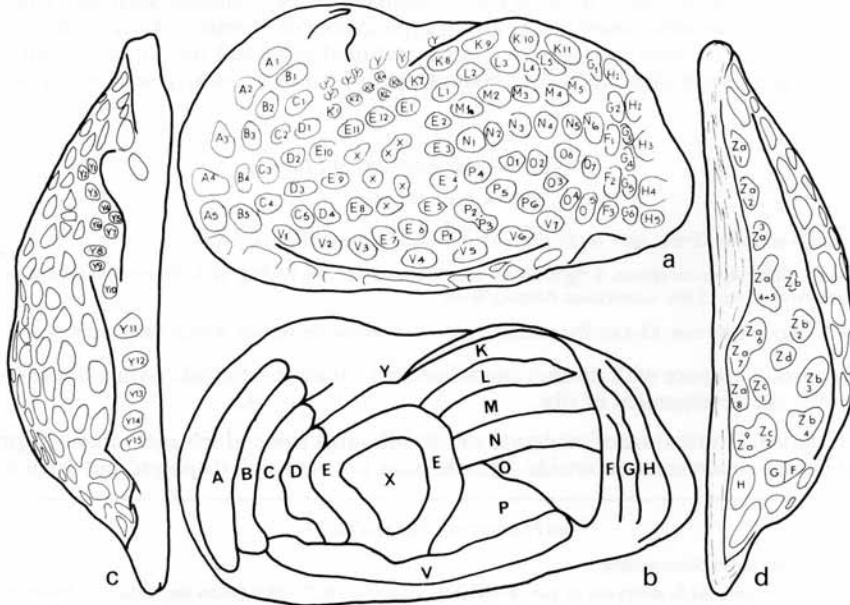
Hornibrookella divergens sp. nov.

Plate 55, figs. 1-4; text-fig. 6

Derivation of name. Latin, *divergens*, divergent, with reference to the ornament in the posterior half.

Material. Fifty-three carapaces, 5 right valves, and 5 left valves from El-Alat W-1. Two carapaces from Abqaiq W-69.

Type locality and horizon. El-Alat W-1, sample 1827—34 ft below the surface. Lower Palaeocene.



TEXT-FIG. 6. Analysis of pattern of ornamentation in *Hornibrookella divergens* sp. nov. a-d, male left valve. a, lateral view. b, grouping of fossae. c, dorsal view. d, ventral view.

Diagnosis. Shell surface reticulate with subordinate ribs arranged in radial pattern, clearly seen in posterior half. Carapace subrectangular with a gently convex dorsal margin. The ventral ridge is weaker in the posterior part.

Description. Sexual dimorphism rather marked, the females are shorter and higher than the males. Small marginal denticles often apparent on posterior and anterior margins. Denticles may be absent, depending on state of preservation. Eye tubercle distinct but low. Ventrolateral ridge well developed but weak in the posterior part. Duplicature of moderate width with subperipheral selvage. Inner margin and line of concrescence coincide. Radial pore canals simple, more or less straight. Muscle scars consist of subvertical row of four adductors, situated on the posterior margin of the muscle-scar pit, with two frontal scars. The upper frontal scar circular, the lower one reniform. Hinge holamphidont.

Dimensions (μm).

	Length	Height	Width
Holotype, female right valve, OS 5249	756	427	
Paratype, male left valve, OS 5250	829	463	
Paratype, female carapace, OS 5251	793	451	463
Paratype, male left valve, OS 5252	805	439	

Distribution. Known from the uppermost Cretaceous and lower Palaeocene of Saudi Arabia.

Affinities and differences. *H. divergens* is unlikely to be confused with any other species. It shows some resemblance to the type species of *Hornibrookella* in the outline; although *H. anna* has a sharp posterior cardinal angle and the dorsal margin in *H. divergens* has a clear concavity behind the eye tubercle, clearly seen in the left valve.

Hornibrookella episcelis sp. nov.

Plate 56, figs. 1-4, text-fig. 7

Derivation of name. Greek, *epi*+*scelis*, rib, with reference to the rudimentary ribs.

Material. Thirty-four carapaces, 9 right valves, and 5 left valves from El-Alat W-1. Thirty-nine carapaces, 9 right valves, and 15 left valves from Abqaiq W-69.

Type locality and horizon. El-Alat W-1, sample 1816—22 ft below the surface. Lower Palaeocene.

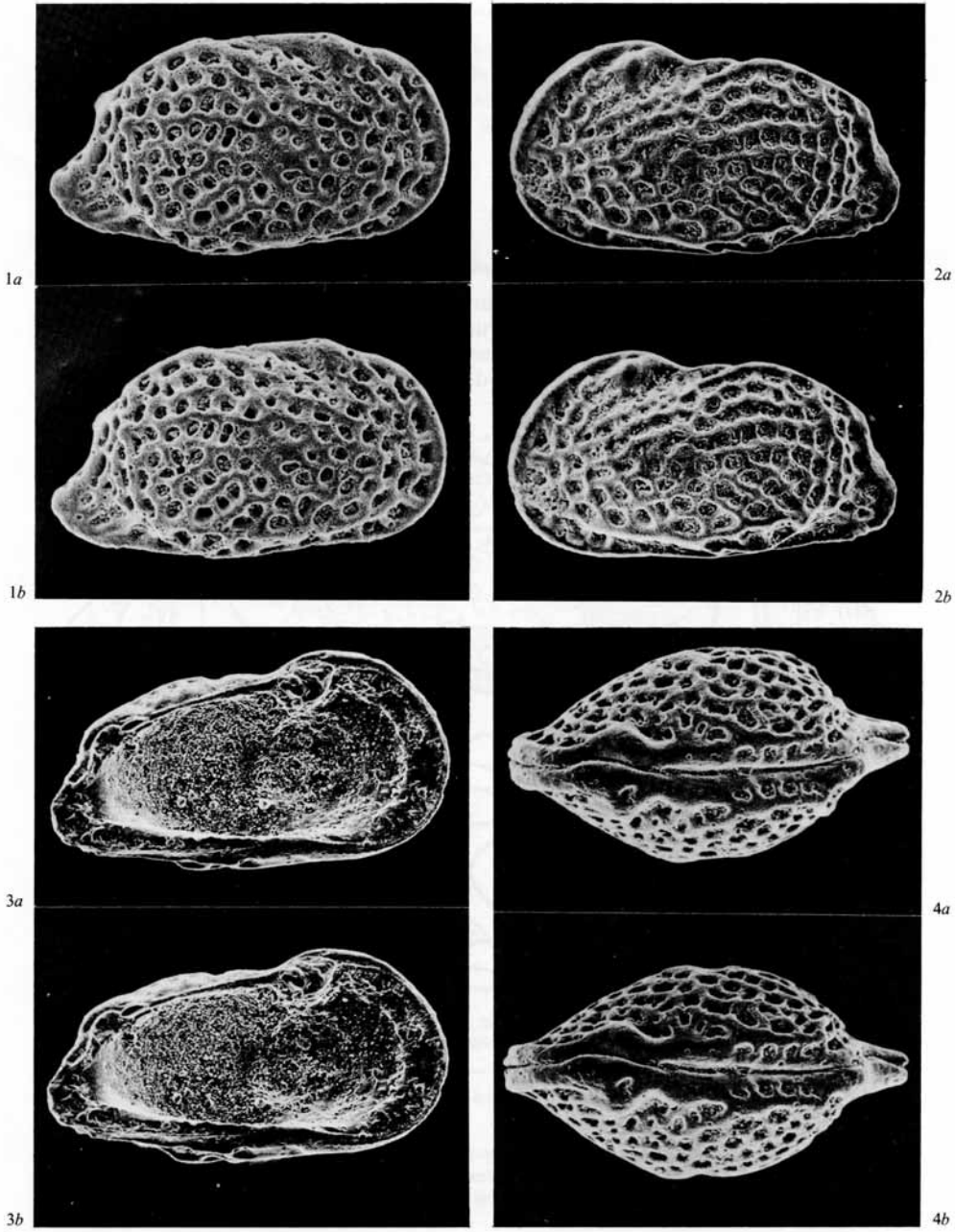
Diagnosis. Carapace with distinct caudal process. Surface reticulate with a tendency towards the development of ribs.

Description. Duplicature of moderate width with subperipheral selvage. Inner margin and line of concrescence coincide. Muscle scars not very well displayed but seem to

EXPLANATION OF PLATE 55

Stereoscopic paired photographs.

Figs. 1-4. *Hornibrookella divergens* sp. nov. El-Alat W-1, sample 1827—34 ft below the surface. 1, holotype, female right valve, OS 5249. External lateral view, $\times 86$. 2, 3, paratype, male left valve, OS 5250; 2, external lateral view, $\times 78$; 3, internal lateral view, $\times 80$. 4, paratype, female carapace, OS 5251. Dorsal view, $\times 85$.



AL-FURAIH, *Hornibrookella divergens*

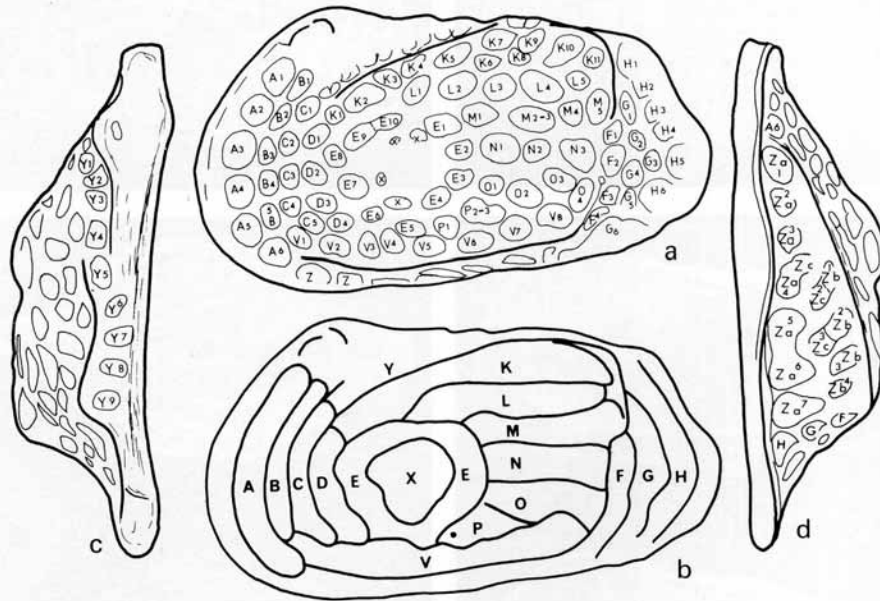
be four adductors and two frontal scars. Normal pore canals simple. Hinge holamphidont. Right valve hinge with highly projecting tooth, anteromedian socket opening into posteromedian groove, posterior reniform tooth, the left valve complementary. Sexual dimorphism distinct, the females wider and higher than the males.

Dimensions (μm).

	Length	Height	Width
Holotype, female carapace, OS 5253	805	500	451
Paratype, female right valve, OS 5254	780	439	
Paratype, male carapace, OS 5255	768	415	341

Distribution. Known so far from the uppermost Cretaceous and lower Palaeocene of Saudi Arabia.

Affinities and differences. This species is similar to *H. posterisella* but differs in having a more pronounced caudal process, the rudiments of longitudinal ribs and in details of the reticulation. Internally, it has wider duplicature. *H. quinquecellulosa* sp. nov. has a different lateral outline, less well developed subcentral tubercle, and deeper reticulation.

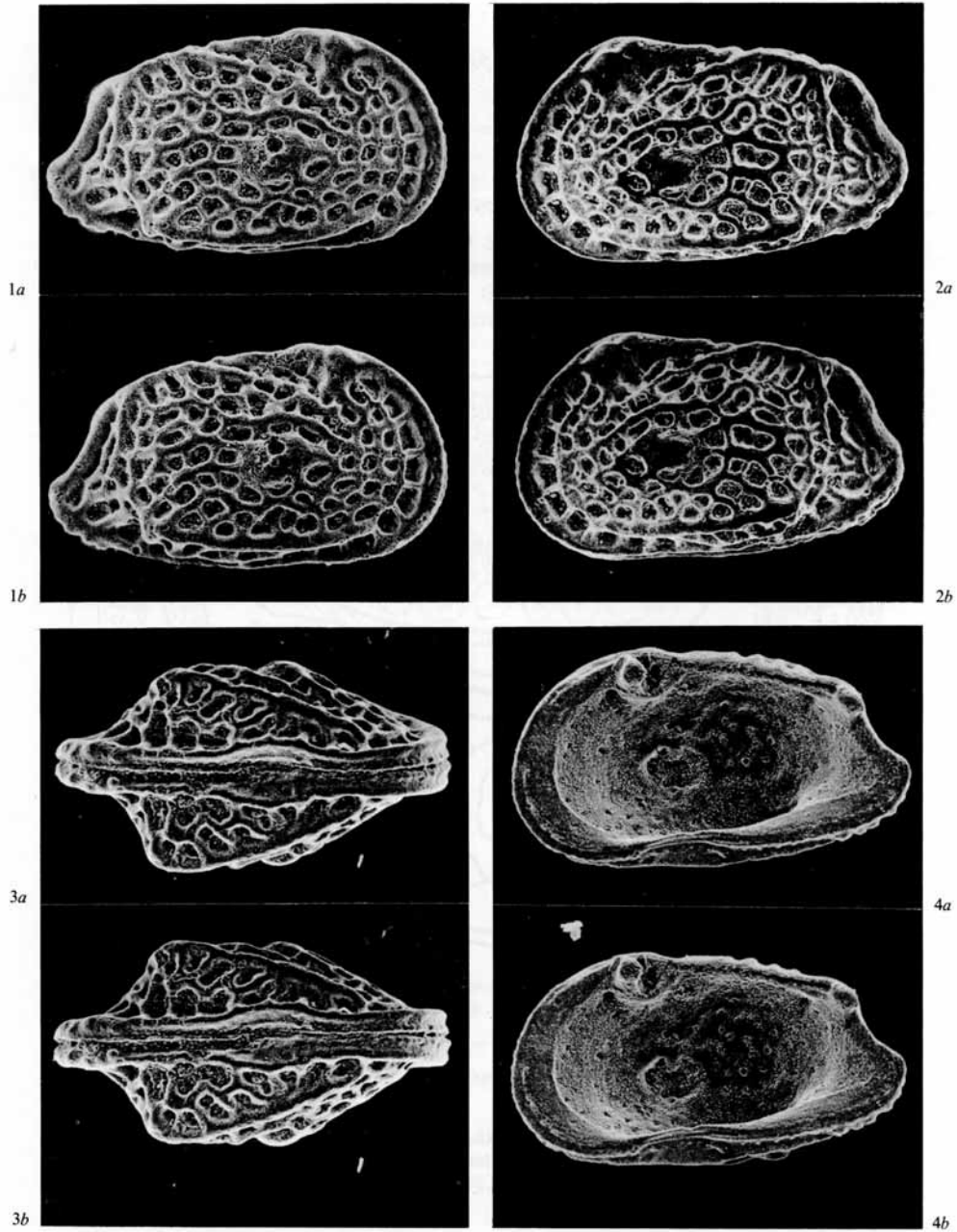


TEXT-FIG. 7. Analysis of pattern of ornamentation in *Hornibrookella episcelis* sp. nov. *a-d*, male left valve. *a*, lateral view. *b*, grouping of fossae. *c*, dorsal view. *d*, ventral view.

EXPLANATION OF PLATE 56

Stereoscopic paired photographs.

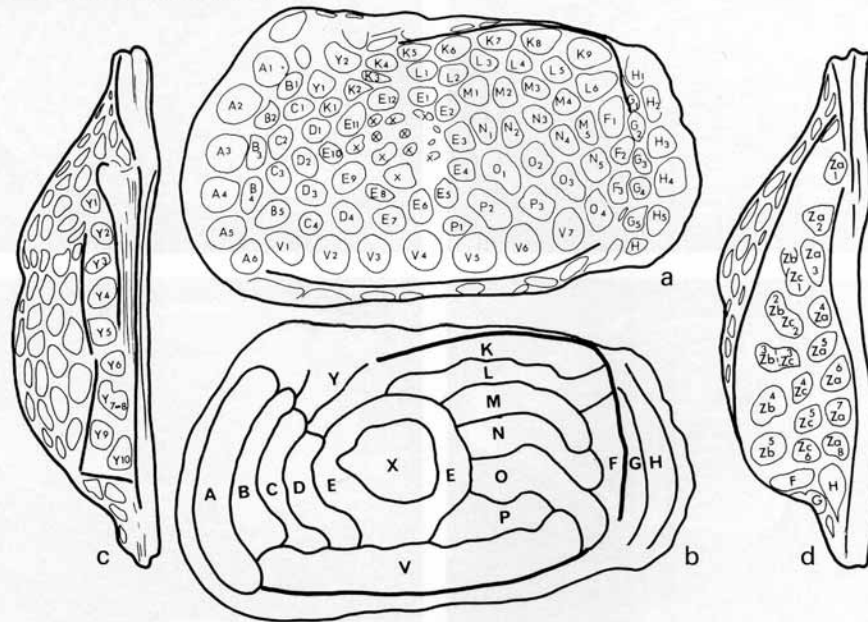
Figs. 1-4. *Hornibrookella episcelis* sp. nov. El-Alat W-1, sample 1816—22 ft below the surface. 1, 4, paratype, female right valve, OS 5254. 1, external lateral view, $\times 83$; 4, internal lateral view, $\times 83$. 2, 3, holotype, female carapace, OS 5253; 2, external lateral view from left, $\times 80$; 3, ventral view, $\times 81$.



AL-FURAIH, *Hornibrookella episcelis*

Hornibrookella posterisella sp. nov.

Plate 57, figs. 1-4; text-fig. 8

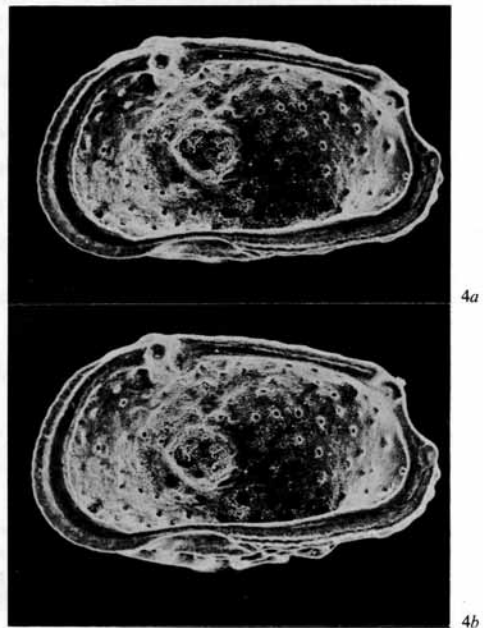
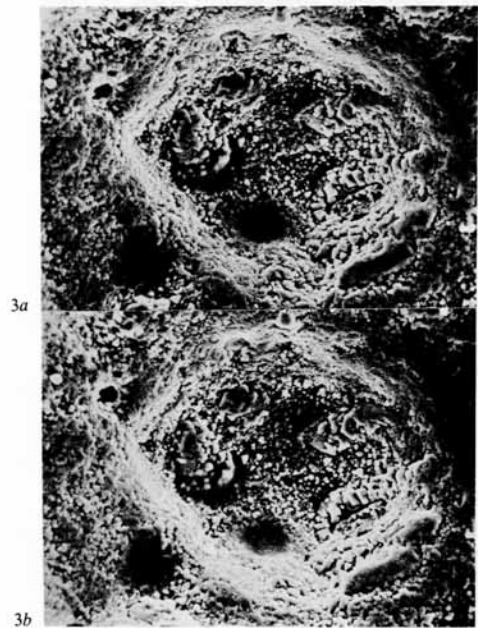
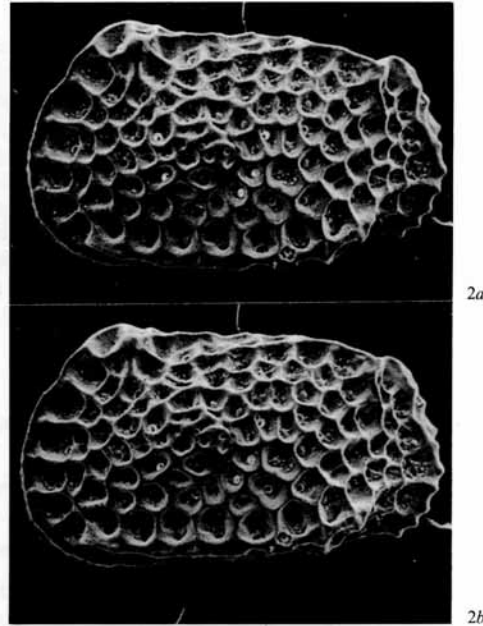
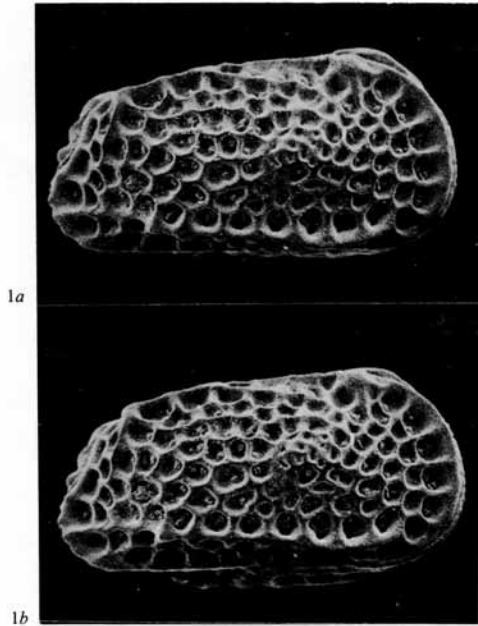
Derivation of name. Latin, *sella*, saddle, with reference to the posterior saddle.*Material.* Three hundred and sixty carapaces, 95 right valves, and 114 left valves from Abqaiq W-69. Ninety-nine carapaces, 20 right valves, and 15 left valves from El-Alat W-1.*Type locality and horizon.* Abqaiq W-69, sample 1780-90 ft below the surface. Lower Palaeocene.*Diagnosis.* A strongly reticulate species of *Hornibrookella* in which the posterior cardinal process joins with the posterodorsal ridge to form a triangular and horizontal posterior saddle. Anterior and posterior cardinal angles distinct. Anterior margin rounded with a slight anterodorsal concavity particularly in the left valve. Sexual dimorphism pronounced.

TEXT-FIG. 8. Analysis of pattern of ornamentation in *Hornibrookella posterisella* sp. nov. a-c, female left valve. a, lateral view. b, grouping of fossae. c, dorsal view. d, female ventral view of right valve.

EXPLANATION OF PLATE 57

Stereoscopic paired photographs.

Figs. 1-4. *Hornibrookella posterisella* sp. nov. Abqaiq W-69, sample 1780-90 ft below the surface. 1, paratype, male carapace, OS 5260. External lateral view from right, $\times 71$. 2, holotype, female left valve, OS 5256. External lateral view, $\times 77$. 3, 4, paratype, female right valve, OS 5259. 3, muscle scars, $\times 410$; 4, internal lateral view, $\times 82$.



AL-FURAIH, *Hornibrookella posterisella*

Description. Strongly dimorphic, the males are longer than the females. Anterior margin finely denticulate, posterior margin with larger denticles. Normal pore canals of two kinds: intramural, badly preserved and difficult to determine and domed pores, free-standing in the solum of each reticulum, and presumably terminating in sieve-plates as in *Mutilus retiformis* Ruggieri and Sylvester-Bradley, 1973, but now obscured by recrystallization. Radial pore canals not well displayed due to the form of preservation and calcification, but appear to be simple. Duplicature of moderate width, selvage peripheral in left valve but bordered by flange in right valve. Right valve with well-developed flange groove, particularly on the venter. Muscle scars are in a vertical row of four elongate adductor and two frontal scars. The upper frontal scar more or less circular in outline, the lower one reniform. Hinge holamphidont.

Dimensions (μm).

	Length	Height	Width
Holotype, female left valve, OS 5256	854	512	
Paratype, male carapace, OS 5257	951	519	537
Paratype, female carapace, OS 5258	878	537	488
Paratype, female right valve, OS 5259	781	476	
Paratype, male carapace, OS 5260	915	488	463

Distribution. Known from the uppermost Cretaceous and lower Palaeocene of Saudi Arabia.

Affinities and differences. This species differs from *H. quinquecellulosa* sp. nov. and *H. cyclopea* sp. nov. in shape and having well-marked anterior and posterior cardinal angles. *H. posterisella* closely resembles *H. bilamellosa* (Marlière) (*Bradleya bilamellosa* Marlière, 1958), but differs in having a distinct hinge-ear in the left valve, a straight ventral margin and the anterior margin, in lateral view with a slight anterodorsal concavity in front of the hinge-ear.

Hornibrookella quinquecellulosa sp. nov.

Plate 58, figs. 1-4; text-fig. 9

Derivation of name. Latin, *quinquecellulosa*, 'with five-fold cells'; with reference to shape of fossae.

Material. One hundred and thirty-four carapaces, 40 right valves, and 31 left valves from El-Alat W-1. Seven carapaces from Abqaiq W-69.

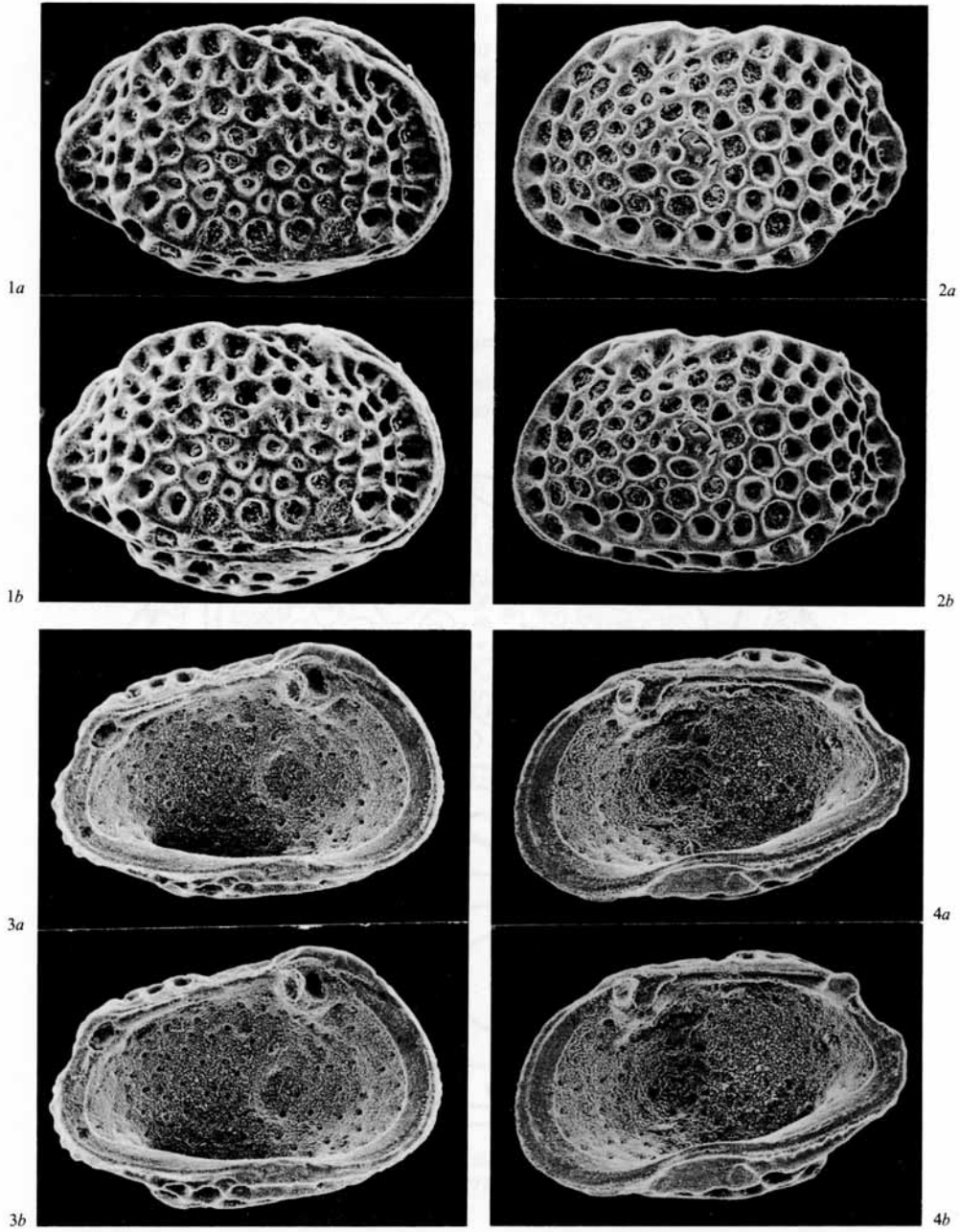
Type locality and horizon. El-Alat W-1, sample 1865-75 ft below the surface. Lower Palaeocene.

Diagnosis. Carapace subquadrate, with coarse reticulation, with pentagonal fossae. Dorsal margin convex due to the arched posterodorsal ridge. Greatest height passes just behind the subcentral tubercle.

EXPLANATION OF PLATE 58

Stereoscopic paired photographs.

Figs. 1-4. *Hornibrookella quinquecellulosa* sp. nov. El-Alat W-1, sample 1865-75 ft below the surface. 1, paratype, female carapace, OS 5263. External lateral view from right, $\times 99$. 2, holotype, male left valve, OS 5261. External lateral view, $\times 77$. 3, paratype, male left valve, OS 5264. Internal lateral view, $\times 82$. 4, paratype, male right valve, OS 5262. Internal view, $\times 78$.



AL-FURAIH, *Hornibrookella quinquecellulosa*

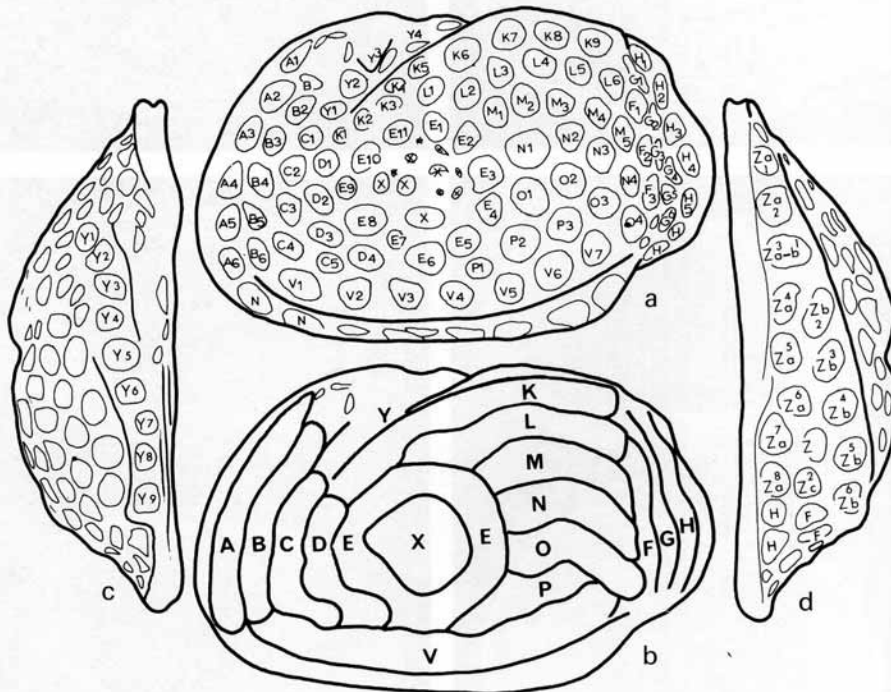
Description. Sexual dimorphism rather marked, presumed females shorter, higher, and wider than presumed males. Normal pore canals domed. Duplicature of moderate width. Selvage prominent in both valves, submarginal in left valve, in outer third of duplicature in right valve. Vestibule narrow. Muscle scars not very well displayed due to preservation but appear to be typical for the genus. Hinge holamphidont.

Dimensions (μm).

	Length	Height	Width
Holotype, male left valve, OS 5261	829	561	
Paratype, male right valve, OS 5262	829	561	
Paratype, female carapace, OS 5263	659	439	415
Paratype, male left valve, OS 5264	780	512	

Distribution. Known from the uppermost Cretaceous and lower Palaeocene of Saudi Arabia.

Affinities and differences. This species differs from other species in this paper in being more quadrate and having pentagonal fossae.



TEXT-FIG. 9. Analysis of pattern of ornamentation in *Hornibrookella quinquecellulosa* sp. nov. a-d, female left valve. a, lateral view. b, grouping of fossae. c, dorsal view. d, ventral view.

DISCUSSION

Moos originally established *Hornibrookella* as a subgenus for *Quadracythere*. It has since been raised to generic status (Al-Furaih 1975). The following species are believed to be European representatives of the genus:

<i>Hornibrookella anna</i> (Lienenklaus):	Lower Oligocene
<i>H. bilamellosa</i> (Marlière):	Danian–Montian
<i>H. confluens</i> (Reuss):	Upper Oligocene
<i>H. macropora</i> (Bosquet):	Oligocene–Pliocene
<i>H. partimglabra</i> (Moos):	Lower Oligocene
<i>H. vahrenkampii</i> (Moos):	Lower Oligocene

The following have been described from Pakistan and India:

<i>H. arcana</i> (Lubimova and Guha):	Middle Eocene
<i>H. directa</i> (Siddiqui):	Lower Eocene
<i>H. platybomus</i> (Siddiqui):	Upper Palaeocene
<i>H. subquadra</i> (Siddiqui):	Upper Eocene
<i>H. sp. A.</i> (Siddiqui):	Lower Eocene

The Arabian species here described show close similarity with these forms, but occur at earlier horizons. This would indicate that the origin of the genus *Hornibrookella* occurred in the Arabian area.

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REFERENCES

- AL-FURAIH, ALI A. F. 1975. On *Hornibrookella anna* (Lienenklaus). *A Stereo-Atlas of Ostracod Shells*, 2 (3), 211–214.
- BENSON, R. H. 1972. The *Bradleya* problem, with descriptions of two new psychrospheric ostracode genera, *Agrenocythere* and *Poseidonamicus* (Ostracoda: Crustacea). *Smithson. Contr. Paleobiol.* 12, 138 pp., 38 pls., 67 figs., 4 tables.
- EL-KHAYAL, A. A. 1974. Foraminiferal biostratigraphy of the Umm er Radhuma Formation (Palaeocene–Lower Eocene) of Eastern Saudi Arabia. *Bull. Fac. Sci. Riyadh Univ.* 6, 195–214, 5 figs.
- HORNIBROOK, N. DE B. 1952. Tertiary and Recent Marine Ostracoda of New Zealand. Their origin, affinities, and distribution. *Palaeont. Bull. Wellington*, 18, 1–82, pls. 1–18, 4 text-figs.
- LIEBAU, A. 1969. Homologisierende Korrelationen von Trachyleberididen-Ornamenten (Ostracoda, Cytheracea). *Neues Jb. Geol. Paläont. Mh.* 7, 390–402, 4 figs.
- 1971. Homologe Skulpturmuster bei Trachyleberididen und verwandten Ostrakoden. *Diss. Techn. Univ. Berlin*, 118 pp., 32 figs.
- 1975a. Comment on suprageneric taxa of the Trachyleberididae. S.n. (Ostracoda, Cytheracea). *Neues Jb. Geol. Paläont. Abh.* 148, 3, 353–379, 3 figs.
- 1975b. The left–right variation of the Ostracode ornament. *Bull. Am. Paleont.*, 65, pp. 78–86, 1 pl., 5 text-figs.

- LIENENKLAUS, E. 1894. Monographie der Ostrakoden des nordwestdeutschen Tertiärs. *Z. dt. geol. Ges.* **46**, 158-268, pls. 13-18.
- LUBIMOVA, P. S., GUHA, D. K. and MOHAN, H. 1960. Ostracoda of Jurassic and Tertiary deposits from Kutch and Rajasthan (Jaisalmer), India. *Bull. geol. Min. Metall. Soc. India*, **22**, 1-60, pls. 1-4.
- MARLIÈRE, R. 1958. Ostracodes du Monfien de Mons et résultats de leur étude. *Mém. soc. belge Géol.* no. 5, 53 pp., pls. 1-6.
- MOOS, B. 1965. Die Ostracoden-Fauna des Unteroligozäns von Bunde (Bl. Herford-west, 3817) und einige verwandte jüngere Arten (Ostr., Crust.) 1. *Quadracythere* (*Hornibrookella*) n. subg., *Pokornyella*, *Hemicythere*, *Hermanites*. *Geol. Jber.* **82**, 593-630, pls. 34-39.
- NEALE, J. W. 1975. The Ostracod fauna from the Santonian Chalk (Upper Cretaceous) of Gingin, Western Australia. *Spec. Pap. Palaeontol.* **16**, 1-81, 17 text-figs., pls. 1-22.
- POWERS, R. W. et al. 1966. Geology of the Arabian Peninsula (Sedimentary Geology of Saudi Arabia). *Prof. Pap. U.S. geol. Surv.* 560-D, pp. 1-147.
- RUGGIERI, G. and SYLVESTER-BRADLEY, P. C. 1973. On *Mutilus retiformis* (Terquem). *A Stereo-Atlas of Ostracod Shells*, **1** (2), 109-116.
- SIDDQUI, Q. A. 1971. Early Tertiary Ostracoda of the Family Trachyleberididae from West Pakistan. *Bull. Br. Mus. Nat. hist. (Geol.) Suppl.* **9**, 1-98, pls. 42.
- SYLVESTER-BRADLEY, P. C. 1948. The Ostracode genus *Cythereis*. *J. Paleont.* **22**, 792-797.
- and BENSON, R. H. 1971. Terminology for surface features in ornate Ostracodes. *Lethaia*, **4**, 249-286, 48 figs.

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