STUDIES ON WESTERN AUSTRALIAN PERMIAN BRACHIOPODS 9. THE STERLITAMAKIAN BRACHIOPOD FAUNA OF THE CUNCUDGERIE SANDSTONE, CANNING BASIN

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The brachiopod fauna from isolated outcrops of the Early Permian Cuncudgerie Sandstone in the southern Canning Basin is reviewed and described. New species described are *Tornquistia subquadratus* and *Cyrtella koopi*. The fauna is a correlative of other brachiopod faunas of Early Permian (Sterlitamakian) stratigraphical units elsewhere in Western Australia (Perth, Carnarvon and northern Canning Basins).

THE ONSHORE Canning Basin of Western Australia measures some 800 km from north to south, 950 km from east to west and covers an area of 430,000 km^2 (Towner & Gibson 1983). Structural subdivisions of the basin are reviewed by Playford et al. (1975) and Towner & Gibson (1983). To date, most described Permian brachiopod faunas of the basin are from the thick sequences of the Fitzroy Trough in the north (e.g. see stratigraphy and faunal lists provided by Guppy et al. 1958). Thin Permian sequences with isolated outcrops occur in the south of the basin, in the region of the Anketell Shelf (Playford et al. 1975: 364, fig. 54). Limited brachiopod faunas from these outcrops have been recorded in numerous reports (Dickins & Thomas 1956, Dickins 1961, Dickins 1976; the last of these was published in 1983 as part of a microfiche appendix in Towner & Gibson 1983 who consolidated all previous reports). A few brachiopod specimens have been figured by Thomas (1971), Archbold (1983, 1986) and Archbold & Thomas (1984a).

Of the southern Canning Basin faunas, that of the Cuncudgerie Sandstone (Traves et al. 1956) is the most diverse and is the subject of the present study. The Cuncudgerie Sandstone has been correlated by previous workers with the Nura Nura Member of the Poole Sandstone and with the marine horizon at the base of the Poole Sandstone in the St George Range area (both northern Canning Basin). This correlation is supported by the present study although there is by no means a complete identity of faunas. This may be due to inadequate sampling of the units involved or differences in biofacies. Towner & Gibson (microfiche appendix number 5 in Towner & Gibson 1983) considered the "Cuncudgerie facies" to be a more clastic facies equivalent of the Nura Nura member.

AGE, PRESERVATION AND COLLECTIONS

The described assemblage exhibits significant links with the fauna of the Sterlitamakian (Late Sakmarian) Callytharra Formation of the Carnarvon Basin. The age of that formation is well constrained by ammonoids as indicated by Archbold (1982a).

Preservation of the material is of variable quality. Internal and external moulds, usually ferruginous, preserve sharp details of internal muscle scars and external ornament. Natural ferruginous casts of shells preserve less fine details but provide details of the gross form of the specimens. Many specimens are incomplete.

All specimens are registered with the Commonwealth Palaeontological Collections (CPC) of the Bureau of Mineral Resources, Geology and Geophysics, Canberra. Specimens were collected by W. J. Koop (West Australian Petroleum Pty Ltd) in 1963 (locality number (TK5A) and by field parties of the Bureau of Mineral Resources.

SYSTEMATIC PALAEONTOLOGY

Order STROPHOMENIDA Öpik, 1934
Suborder ORTHOTETIDINA Waagen, 1884
Superfamily ORTHOTETACEA Waagen, 1884
Family ORTHOTETIDAE Waagen, 1884
Subfamily ORTHOTETINAE Waagen, 1884

Genus **Permorthotetes** Thomas, 1958

Type species. Permorthotetes callytharrensis Thomas, 1958.

Comments. Permorthotetes was regarded by Manankov (1979) as a synonym of *Orthotetes* Fischer de Waldheim, 1829, but I agree with Manankov's (1973) earlier view that these genera are distinct.

Permorthotetes lindneri Thomas, 1958

Fig. 1A–C

Permorthotetes lindneri Thomas 1958: 92, pl. 1, figs 1–4, pl. 2, figs 1–3, pl. 3, figs 1–6.—Guppy et al. 1958: 54.—Thomas in Dickins 1976: 99.
Orthotetid.—Dickins 1976: 100.

Material. CPC 28024–28025, portion of a ventral valve external mould and portion of a dorsal valve external mould from locality TK5A, Scott Bluff, southern Canning Basin (collected by W.J. Koop).

Comments. The nature of the flat ventral valve, fine costellae and step-like lamellae permit assignment of the material to *P. lindneri* as identified by Thomas (in Dickins 1976). Thomas (1958: 92–96) fully described *P. lindneri* and compared it with other Western Australian representatives of *Permorthotetes.*

Order PRODUCTIDA Sarycheva & Sokolskaya, 1959
Suborder CHONETIDINA Muir-Wood, 1955
Superfamily CHONETACEA Bronn, 1862
Family ANOPLIIDAE Muir-Wood, 1962

Discussion. Since the reviews by Archbold (1980, 1981), this family has been investigated by Afanas'yeva (1984a, b). She stressed the appearance of heterochronous homeomorphs and considered it preferable to subdivide the family on the basis of dorsal internal features rather than on external ornament. The subfamily Tornquistiinae, possessing low radial lines of fused papillae in the dorsal interior, was separated by Afanas'yeva (1984a) from the Anopliinae, possessing paired radial ridges in the dorsal interior. Dorsal features do not appear to be a reliable criterion for subfamilial classification, however, as it is difficult to place in separate subfamilies the type species of *Anoplia* and *Tornquistia,* the dorsal interiors of which possess similar paired interior radial ridges (see Muir-Wood 1962, pl. 5, figs 16, 21).

Subfamily ANOPLIINAE Muir-Wood, 1962

Genus **Tornquistia** Paeckelmann, 1930

Type species. Leptaena (Chonetes) polita McCoy, 1852.

Diagnosis. Anopliinids with short lateral septa and prominent accessory septa in dorsal interior. Ventral interior with short, thin median septum. Shell exterior smooth.

Discussion. Tornquistia was reviewed by Archbold (1980, 1981) who substantially restricted the Permian palaeogeographical range of the genus to Western Australia, Thailand, the Salt Range in Pakistan, Eastern Siberia and Arctic North America. Many Permian species of the genus possess dorsal interior paired radial ridges that are less distinct than those of the type species (e.g. see Afanas'yeva 1977, Archbold 1980).

Tornquistia subquadratus sp. nov.

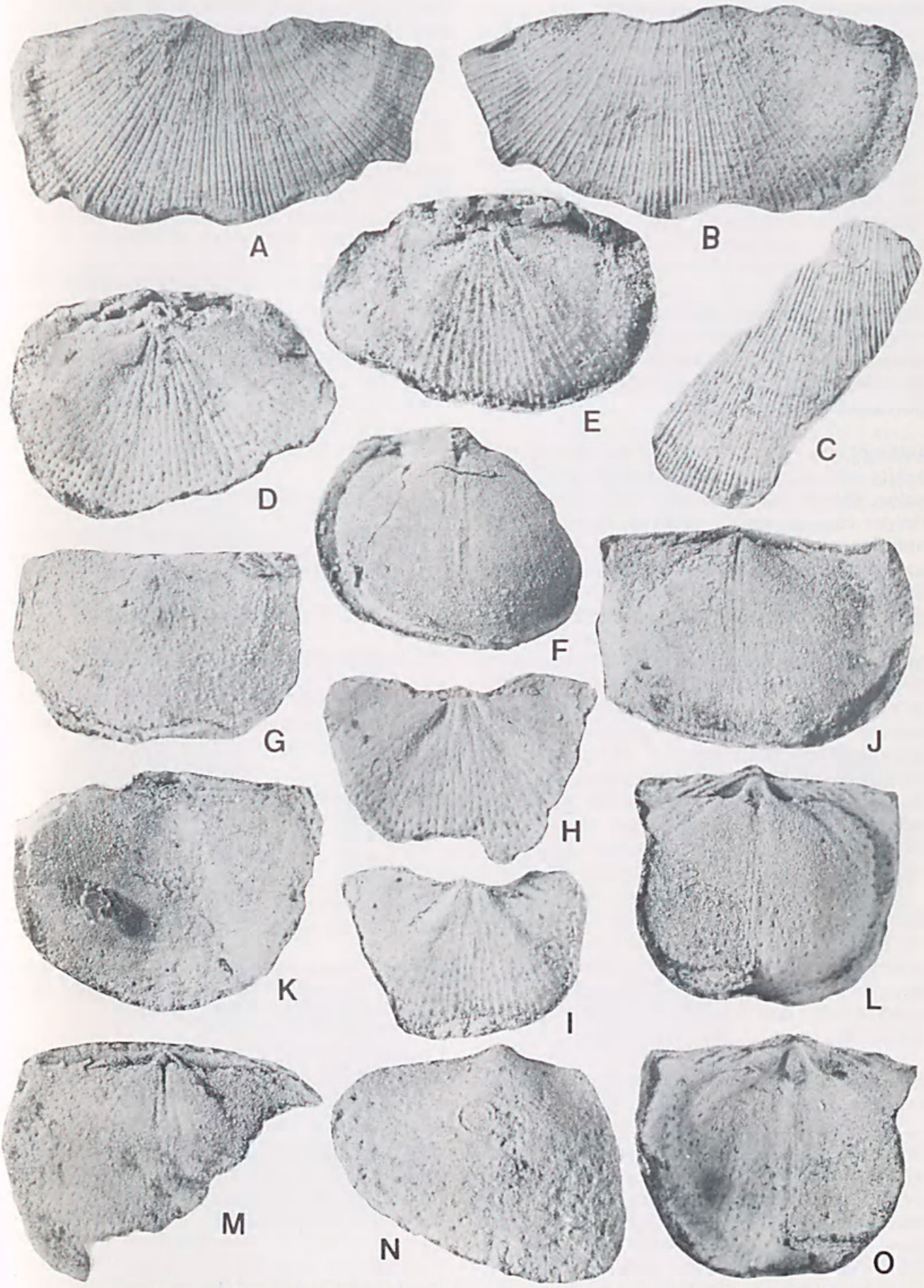
Fig. 1D–O

"*Chonetes*" sp.—Dickins 1976: 99.

Holotype. CPC 28026, an internal mould of a dorsal valve.

Other material and locality. CPC 28026–28034, 2 dorsal valve internal moulds, 2 dorsal valve external moulds, 4 ventral valve internal moulds and 1 incomplete ventral valve external mould as well as numerous fragments of moulds; all from locality TK5A, Scott Bluff, east side of Lake Blanche, southern Canning Basin; collected by W. J. Koop.

Fig. 1. A–C, *Permorthotetes lindneri* Thomas. A, B, CPC 28024, incomplete external mould of ventral valve and latex cast, × 1.5. C, CPC 28025, latex cast of incomplete external mould of dorsal valve, × 1.5. D–O, *Tornquistia subquadratus* sp. nov. D, E, CPC 28026, holotype, internal mould of dorsal valve and latex cast, × 5.0. F, CPC 28027, ventral valve internal mould, × 5. G, CPC 28029, dorsal valve internal mould and latex cast, × 5. J, CPC 28030, ventral valve internal mould, × 5. K, CPC 28031, latex cast of dorsal valve external mould, × 5. L, O, CPC 28032, internal mould of ventral valve and latex cast of mould, × 5. M, CPC 28033, internal mould of ventral valve, × 5. N, CPC 28034, latex cast of ventral valve external mould, × 5.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Measurements. In mm, e = estimate.

Specimen	Maximum width	Ventral height	Dorsal height	Hinge width
CPC 28026	12.6	—	7.9	—
CPC 28028	10.8	—	6.9	9.4
CPC 28029	12.8	—	8.8	11.2e
CPC 28030	11.0e	8.5	—	—
CPC 28031	14.0e	9.4	—	12.0e
CPC 28032	11.6e	8.8	—	11.6e
CPC 28033	11.5e	—	—	11.0e

Diagnosis. Medium sized *Tornquistia* with subquadrate shells at maturity. Maximum width often greater than hinge width at maturity. Dorsal septa weakly developed including centrally developed median septum.

Description. Ventral valve of pronounced convexity with distinctly inflated mesial portion of valve. Dorsal valve concave with demarcated deeper central region. Greatest width of shell anterior of hinge line at about one-third to one-half shell length. Exterior of shell smooth with faint growth lines. Interareas low, cardinal spines apparently short. Ventral umbo low.

Ventral interior with blunt, relatively large teeth. Delthyrium distinct with pronounced thickening of shell beneath it. Minute pseudodeltidium in apex of delthyrium. Median septum sharp posteriorly, extending weakly anteriorly for about one-half of valve length. Muscle scars usually weakly impressed. Valve floor, except for smooth muscle scars, marked by weakly developed radial rows of pustules. Weakly impressed parallel vascular trunks form low ridges adjacent to median septum.

Cardinal process poorly known. Socket plates short but distinct. Lateral and accessory septa relatively weakly developed and separated by several rows of radial pustules which continue to anterior of valve. Short median septum developed in valve centre with radial row of pustules anteriorly.

Discussion. Tornquistia subquadratus is distinguished from other Western Australian Permian members of the genus by its more subquadrate outline with a maximum width anterior of the hinge line. *T. gregoryi* Archbold, 1981 from the Late Artinskian Wandagee Formation rarely exhibits a subquadrate outline but that species is distinguished from *T. subquadratus* by its incipient ventral fold. *T. occidentalis* Archbold, 1980 from the Sterlitamakian Callytharra Formation of the Carnarvon Basin is smaller and has a more trigonal shell but its internal structures appear similar to those of *T. subquadratus.*

Tornquistia gibbera Afanas'yeva, 1977 from the Late Carboniferous Paren Horizon of the Kolyma-Omolon Massif is slightly less subquadrate than *T. subquadratus* and possesses less well defined rows of dorsal internal radial papillae. The younger *T. tropicalis* Grant, 1976 from the Late Artinskian of Thailand is a triangular species unlikely to be confused with the new species, and is stated to have a short dorsal median septum. The Sakmarian *Tornquistia* sp. (Bamber & Waterhouse 1971, pl. 15, figs 16, 17) from northern Yukon Territory, Canada, is larger than *T. subquadratus* and possesses finer rows of dorsal interior radial papillae.

Suborder STROPHALOSIIDINA Waterhouse, 1975

Superfamily STROPHALOSIACEA Schuchert, 1913

Family STROPHALOSIIDAE Schuchert, 1913

Subfamily STROPHALOSIINAE Schuchert, 1913

Genus **Strophalosia** King, 1844

Type species. Strophalosia gerardi King, 1846

Discussion. The morphology, type species and palaeogeographical distribution of the genus were reviewed by Archbold (1986).

Strophalosia irwinensis Coleman, 1957

Fig. 2A–E

Strophalosia cf. *irwinensis.*—Dickins 1976: 99.

Strophalosia irwinensis.—Archbold 1986: 99–102, figs 1A–Z, 4A–I (with synonymy).

Material. Three internal moulds of ventral valves (CPC 24429–24430, CPC 28035) from locality TK5A, Scott Bluff, collected by W. J. Koop.

Comments. Two of these specimens were figured by me previously (Archbold 1986, fig. 1Y,Z) but they are refigured herein in magnified format to show the internal valve details including the muscle scars. The size and outline of the specimens and the nature of the muscle scars leave little doubt as to the assignment of the specimens to Coleman's species, despite the absence of dorsal valve details. *S. irwinensis* is well known from Sterlitamakian units in the Perth and Carnarvon Basins (Archbold 1986).

Superfamily AULOSTEGACEA Muir-Wood & Cooper, 1960
Family AULOSTEGIDAE Muir-Wood & Cooper, 1960
Subfamily AULOSTEGINAE Muir-Wood & Cooper, 1960
Genus **Aulosteges** von Helmersen, 1847

Type species. Orthis wangenheimi de Verneuil, 1845 (= *Aulosteges variabilis* von Helmersen, 1847).

Aulosteges cf. **baracoodensis** Etheridge, 1903

Fig. 3A–C

cf. *Aulosteges baracoodensis* Etheridge 1903: 22, pl. 2, figs 1–2a.—Hosking 1933: 32, pl. 1, figs 1a–c, pl. 2, figs a, b.—Coleman 1957: 36, pl. 1, figs 1, 3, 4, 6.
cf. *Aulosteges lyndonensis* Coleman 1957 (partim.), pl. 4, figs 9, 10 (*non cet.*).
Aulosteges. —Dickins 1976: 100.

Material. One natural cast of a ventral valve with attached ear of dorsal valve and one external mould of the anterior of a dorsal valve (CPC 28036–28037) from BMR locality T127, Scott Bluff, Lake Blanche (22°31′06″S, 123°14′06″E), collected by BMR field parties in 1975.

Comments. The Aulosteginae is represented in the Scott Bluff collections by some nine specimens, two of them belonging to *Aulosteges* itself. On the basis of shell shape, the low convexity of the ventral valve, the apparently relatively low ventral interarea and the fine to medium sized, relatively closely spaced spine bases on the ventral valve, comparison with *A. baracoodensis* is indicated. A natural cast of a ventral valve (CPC 28036) possesses a clearly demarcated small ear and recalls a specimen from the Callytharra Formation assigned to *A. lyndonensis* by Coleman (1957, pl. 4, figs 9, 10). Coleman's specimen is herein assigned to *A. baracoodensis* on the basis of its relatively closely spaced ventral spine bases. An incomplete external mould of a dorsal valve is also compared with *A. baracoodensis* on the basis of a low dorsal median fold. Other incomplete external moulds of dorsal valves from Scott Bluff show very minor development of a similar feature and are discussed under *Taeniothaerus* cf. *irwinensis*. *A. baracoodensis* is known from the Sterlitamakian Callytharra Formation (Carnarvon Basin) and the Fossil Cliff Member of the Holmwood Shale (Perth Basin).

Genus **Taeniothaerus** Whitehouse, 1928

Type species. Productus subquadratus Morris, 1845.

Comments. The type species has been redescribed by Parfrey (1983). Reports of the species

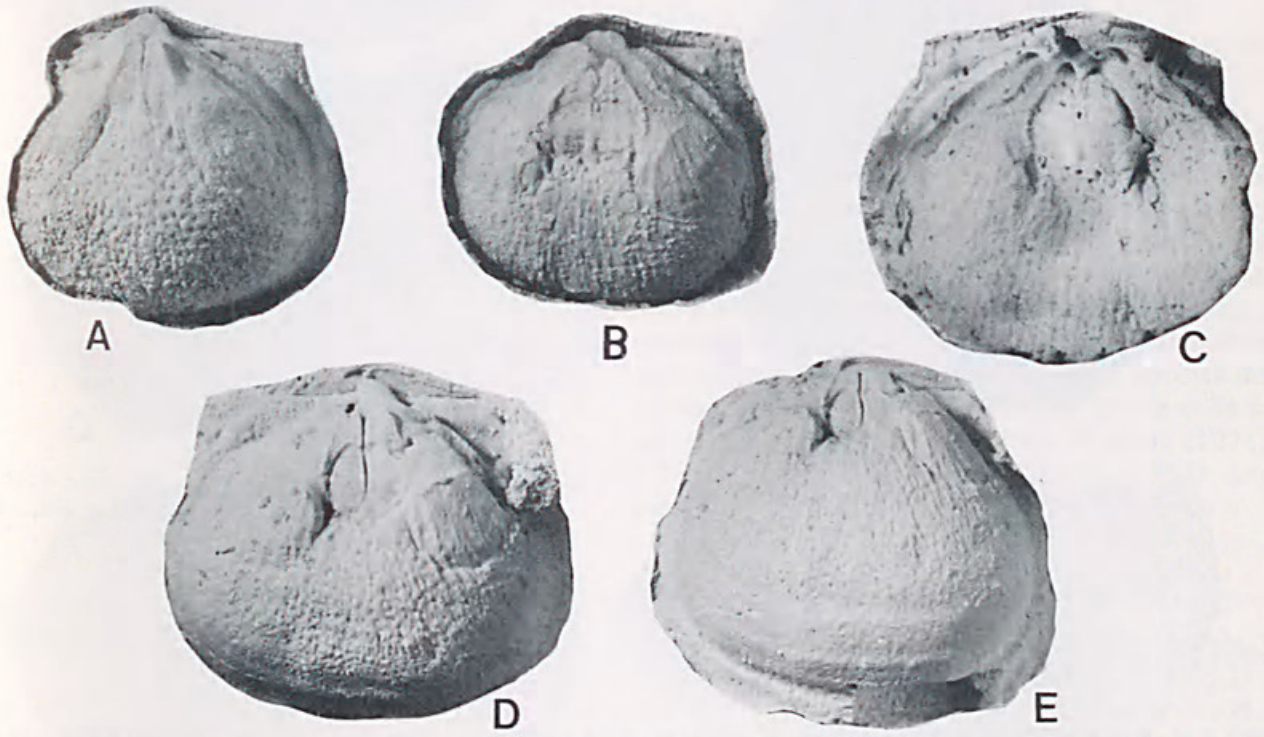
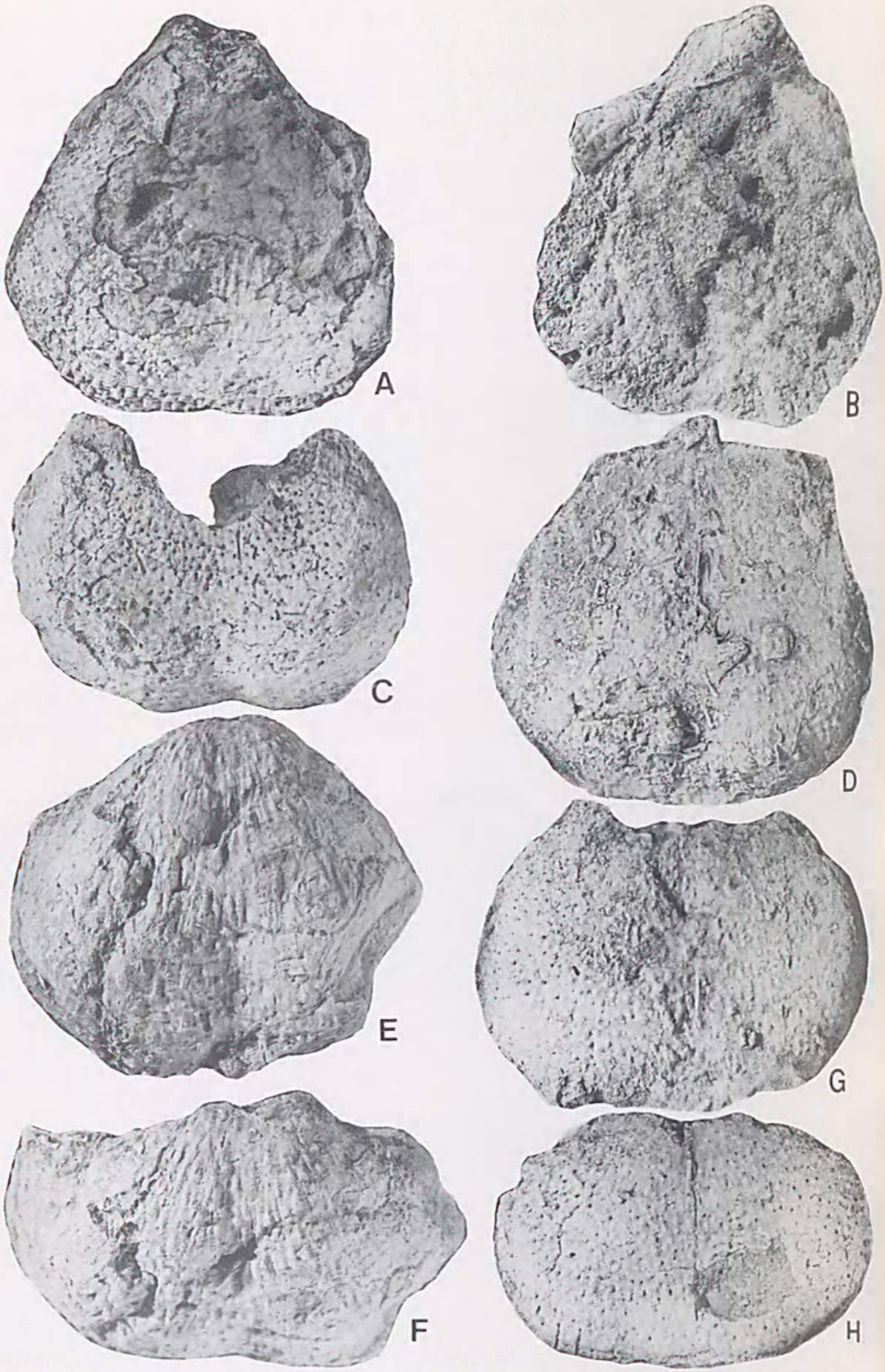


Fig. 2. A–E, *Strophalosia irwinensis* Coleman. A, CPC 28035, internal mould of ventral valve, × 2. B, C, CPC 24430, internal mould of ventral valve and latex cast of mould, × 2.3 and × 2.6. D, E, CPC 24429, internal mould of ventral valve in ventral and anterior views, × 2.5.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from Western Australia require critical examination.

Taeniothaerus cf. **irwinensis** Coleman, 1957

Figs 3D–H, 4A–E

cf. *Taeniothaerus irwinensis* Coleman 1957: 93, pl. 11, figs 13, 14, pl. 12, figs 1–6.
Taeniothaerus.—Dickins 1976: 99, 100.

Material. Two incomplete internal moulds of ventral valves and 4 incomplete external moulds of dorsal valves (CPC 28038–28041, 28043, 28044) from BMR locality T127, Scott Bluff, Lake Blanche, collected from BMR field parties in 1975. One external mould of the anterior of a dorsal valve (CPC 28042) from locality TK5A, collected by W. J. Koop.

Comments. The rounded shell outline, short hinge line and the external ornament of spine bases indicate a close comparison of the material with *T. irwinensis* from the Sterlitamakian Fossil Cliff Member of the Holmwood Shale (Perth Basin). Other Western Australian species assigned to *Taeniothaerus* by Coleman (1957) possess wider hinge lines and a more subquadrate or elongate shell outline. Some species such as *T. miniliensis* Coleman possess much finer ornament that *T. irwinensis.*

Suborder PRODUCTIDINA Waagen, 1883
Superfamily LINOPRODUCTACEA Stehli, 1954
Family LINOPRODUCTIDAE Stehli, 1954
Subfamily LINOPRODUCTINAE Stehli, 1954

Genus **Cancrinella** Fredericks, 1928

Type species. Productus cancrini de Verneuil, 1842.

Discussion. Archbold (1983) discussed the type species and its date of authorship.

Cancrinella irwinensis Archbold, 1983

Fig 4F–G

Linoproductus sp.—Thomas in Dickins 1961: 288.—Thomas in Dickins 1976: 98.
Cancrinella sp.—Dickins 1976: 100.
Cancrinella irwinensis Archbold 1983: 240, fig. 1C–P (with synonymy).

Material. Two natural casts of ventral valves, one submature (CPC 19918) and one juvenile (CPC 28045), from BMR locality T127, Scott Bluff, collected by BMR field parties in 1975.

Comments. The specimens belong to the *C. cancriniformis* species group characterised by distinct, relatively fine rugae across the venter of the shell and distinct elongate ventral spine bases (see Archbold 1983: 240). Such species are restricted to Early Permian faunas of Western Australia where the best known species is *C. irwinensis* Archbold from the Sterlitamakian Fossil Cliff Member and Callytharra Formation. The spacing of the spine bases on the present material is particularly close to that of *C. irwinensis* and so the material is referred to that species.

Order SPIRIFERIDA Waagen, 1883
Suborder SPIRIFERIDINA Waagen, 1883
Superfamily SYRINGOTHYRIDACEA Fredericks, 1926
Family SYRINGOTHYRIDIDAE Fredericks, 1926
Subfamily PERMOSYRINXINAE Waterhouse, 1986

Genus **Cyrtella** Fredericks, 1924

Type species. Cyrtella kulikiana Fredericks, 1916.

Discussion. Punctocyrtella Plodowski, 1968 is clearly closely related to *Cyrtella* and may be synonymous with it (Thomas 1971, Waterhouse 1987). Thomas (1971) and Archbold & Barkham (1989) stressed the presence of a grooved fold in *Cyrtella* (or *Punctocyrtella*) but this may be a variable feature (Waterhouse 1987) and does not appear to be present in the new species described below. The relationship of *Cyrtella* to other genera was discussed by Thomas (1971), Grigor'yeva (1977), Waterhouse (1987) and Solomina (1988).

Fig. 3. A–C, *Aulosteges* cf. *baracoodensis* Coleman. A, B, CPC 28036, natural cast of shell in ventral and dorsal views, × 1. C, CPC 28037, incomplete external mould of dorsal valve, × 1. D–H, *Taeniothaerus* cf. *irwinensis* Coleman. D, CPC 28038, natural cast of dorsal valve in internal view, × 1. E, F, CPC 28039, internal mould of ventral valve in ventral and posterior views, × 1. G, CPC 28028, external mould of dorsal valve, × 5. H,I, CPC 28040, incomplete natural cast of dorsal valve, × 1. H, CPC 28041, incomplete natural cast of dorsal valve, × 1.

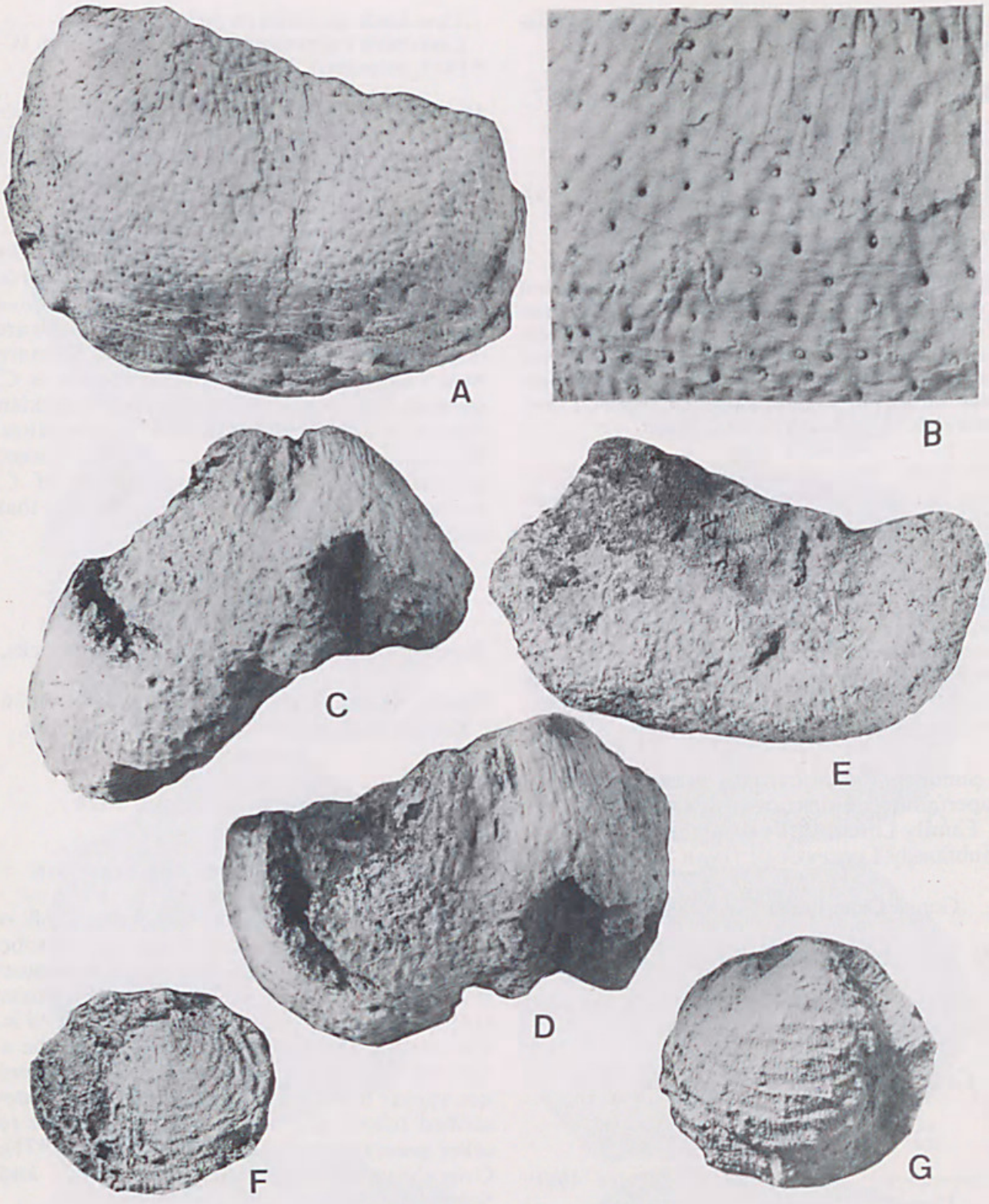

Fig. 4. A–E, *Taeniothaerus* cf. *irwinensis* Coleman. A, B, CPC 28042, incomplete external mould of dorsal valve, × 1, portion enlarged, × 3.5. C, D, CPC 28043, incomplete ventral valve in ventral and posterior views, × 1. E, CPC 28044, incomplete external mould of dorsal valve, × 1. F, G, *Cancrinella irwinensis* Archbold. F, CPC 28045, incomplete natural cast of juvenile ventral valve, × 2.5. G, CPC 19918, natural cast of ventral valve, × 2.

Cyrtella koopi sp. nov.

Fig. 5A–E

Pseudosyrinx sp. aff. *nagmargensis* (Bion).—Thomas in Dickins 1976: 99.

Etymology. Named after W. J. Koop, collector of the holotype.
Holotype. CPC 28046, an internal mould of a conjoined shell from locality TK5A, Scott Bluff.

Diagnosis. Large, wide species with wide, relatively deep sulcus; dorsal fastigium apparently grooved posteriorly but flat anteriorly; ventral adminicula short; 9 to 10 broadly rounded, coarse costae on each flank.

Description. Internal mould large, transverse (estimated 100 mm wide). Anterior commissure sinuous with prominent fold. Ventral valve massively thickened posteriorly (ventral interarea of unknown height). Dorsal valve not thickened greatly; external ornament clearly defined on interior. Sulcus deeply rounded, extended into prominent ventral tongue. Ventral external ornament poorly impressed on anterior of valve interior. Costae apparently coarse, low and gently rounded; number not clear.

Dental plates stout with blunt thick teeth and short thickened adminicula. Ventral muscle field prominent (20 mm wide, 25 mm long); diductor muscle scars longitudinally striate anteriorly, radially striate posteriorly; adductor muscle scar essentially smooth. Posterior part of muscle field bisected by apical callus. Interior of ventral valve either side of muscle field deeply pitted; remainder of valve interior smooth.

Dorsal interior with prominent fastigium, flattened anteriorly but possibly with groove posteriorly. Flanks of valve with up to 10 broad, flattened costae (up to 3 mm wide at anterior of valve). Cardinal process relatively small (5 mm wide); socket plates stout. Thin dorsal septum arises 3 mm anteriorly of cardinal process, extends approximately two-thirds of valve length (25 mm). Minute pustules scattered on mould surface indicate punctate shell.

Discussion. Although based on only one internal mould, the new species is named in view of the distinctive nature of the fastigium and the relatively coarse costae. *Cyrtella australis* Thomas (1971) from the Lyons Group and Callytharra Formation has finer, more numerous costae than the new species and a distinct dorsal groove on the fastigium. *Cyrtella nagmargensis* (Bion, 1928; see also Reed, 1932) is characterised by 10 to 15 internal costae and a distinct furrow on the fastigium. Specimens of *C. nagmargensis* from the Sakmarian of Afghanistan (Termier et al. 1974) are comparable with those from Kashmir, but specimens attributed to this species from the Sakmarian of Tibet (Yang & Fan 1983, pl. 3, figs 2–5; Hu 1983, pl. 3, figs 17–23; Jin 1985, pl. 1, fig. 23) possess finer, sharper and more numerous costae than *C. koopi.*

Cyrtella kulikiana (Fredericks, 1916; see also Ifanova 1972) is a large species from the Artinskian and Kungurian of Northern European Russia and possesses more numerous costae than the new species.

Genus **Myodelthyrium** Thomas, 1986

Type species. Pseudosyringothyris dickinsi Thomas, 1971

Myodelthyrium dickinsi (Thomas, 1971)

cf. *Pseudosyrinx* sp. nov.—Dickins & Thomas 1956: 52.
Pseudosyrinx sp. nov.—Thomas in Dickins 1961: 288.
Pseudosyringothyris dickinsi Thomas 1971: 140, pl. 10, figs 1–5, pl. 11, figs 1, 2, pl. 12, figs 1–4, pl. 13, fig. 3, pl. 29, fig. 7.

Comments. Thomas (1971, pl. 13, fig. 3a, b) figured an external mould of a ventral interarea (CPC 1643) from the Cuncudgerie Sandstone in Well 27, in the southern central part of the Canning Basin (22°49′S, 123°40′E). No new material of this species is available from the Cuncudgerie Sandstone.

Superfamily SPIRIFERACEA King, 1846
Family SPIRIFERIDAE King, 1846
Subfamily TRIGONOTRETINAE Schuchert, 1893

Genus **Trigonotreta** Koenig, 1825

Type species. Trigonotreta stokesii Koenig, 1825

Discussion. The relationship of *Trigonotreta* to *Neospirifer* and the reasons for assigning various Western Australian spiriferid species to *Trigonotreta* have been discussed by Archbold & Thomas (1984b, 1986).

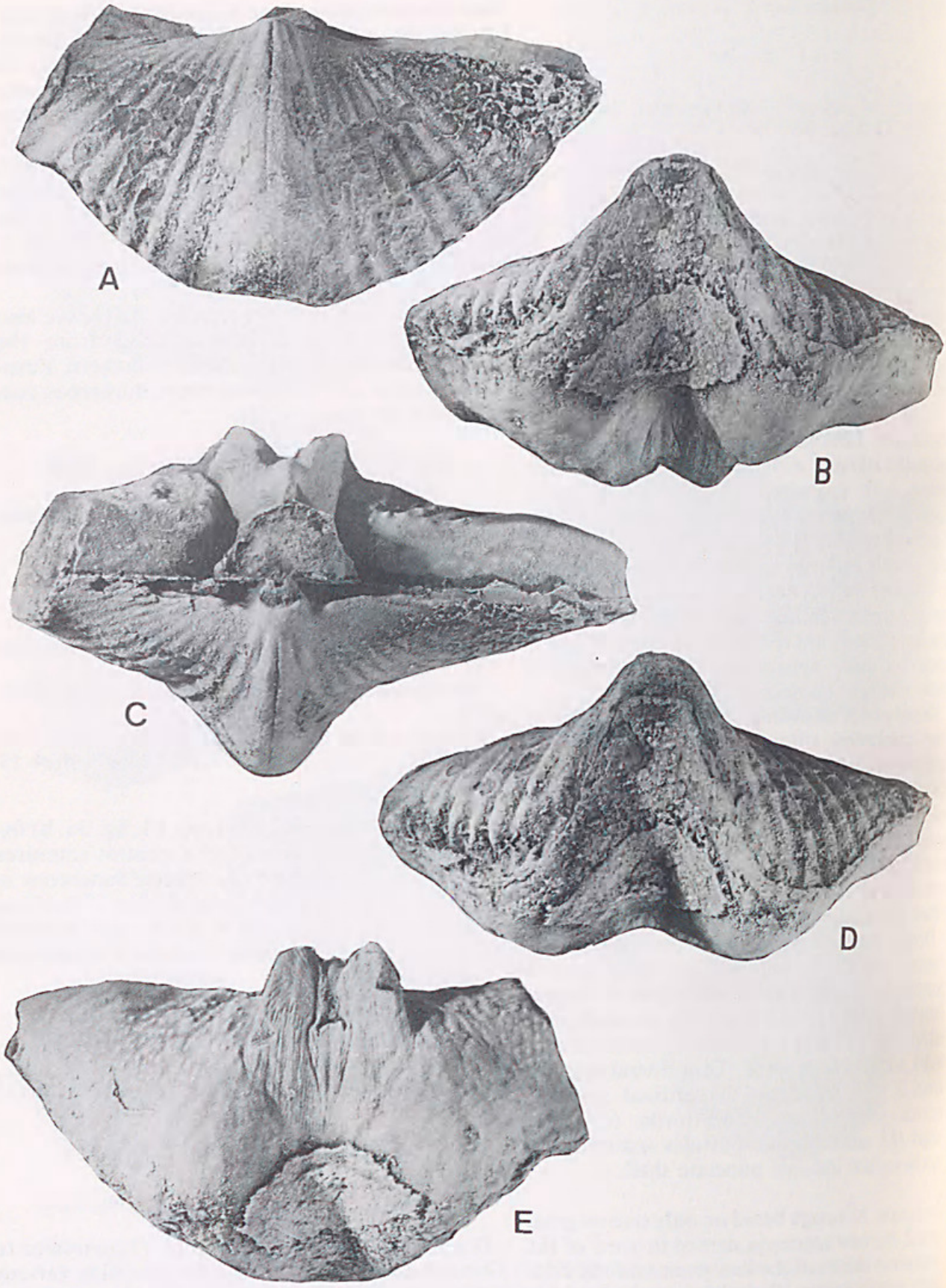

Fig. 5. A–E, *Cyrtella koopi* sp. nov., CPC 28046, holotype, internal mould in dorsal, antero-ventral, posterior, anterior and ventral views, × 1.

Trigonotreta neoaustralis Archbold & Thomas, 1986

Fig. 6A–I

Neospiriferid.—Dickins 1976: 100.
Trigonotreta neoaustralis Archbold & Thomas 1986: 152, figs 16A–J, 17A–L (with synonymy).

Material. CPC 28047–28049, a natural cast of an immature conjoined shell and two incomplete casts of juvenile dorsal valves from locality T127; and CPC 28050, a ventral valve internal mould from locality TK5A.

Comments. The distinctive transverse shell outlines, nature and bundling of the costae and prominent growth lamellae permit ready assignment of the specimens to *Trigonotreta neoaustralis,* a species from the Sterlitamakian Fossil Cliff Member and the Callytharra Formation, and the Aktastinian Jimba Jimba Calcarenite. The specimens from locality T127 are juvenile and immature representatives of the species and hence exhibit the transverse shell outline characteristic of these ontogenetic stages (Archbold & Thomas 1986). The ventral valve internal mould represents a sub-mature specimen and possesses the characteristic bulbous apical callosity of the genus.

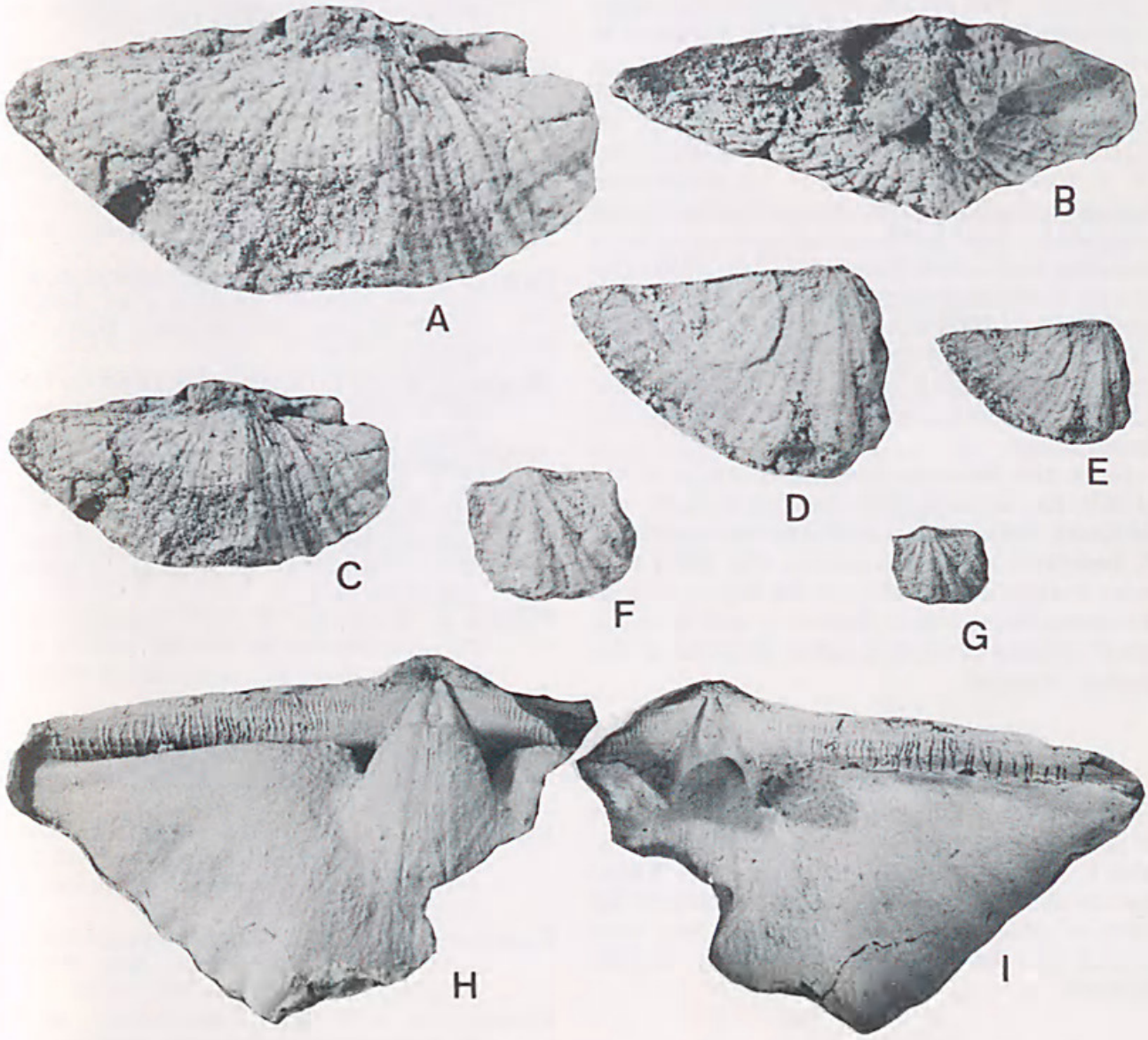

Fig. 6. A–I, *Trigonotreta neoaustralis* Archbold & Thomas. A–C, CPC 28047, natural cast of shell in dorsal, posterior and dorsal views, × 1.8, × 1.6, × 1. D, E, CPC 28048, natural cast of dorsal valve, × 2 and × 1. F, G, CPC 28049, natural cast of dorsal valve, × 2 and × 1. H, I, CPC 28050, internal mould of ventral valve and latex cast of mould, × 1.8.

Superfamily RETICULARIACEA Waagen, 1883
Family ELYTHIDAE Fredericks, 1924
Subfamily ELYTHINAE Fredericks, 1924

Genus **Spirelytha** Fredericks, 1924

Type species. Spirelytha pavlovae Archbold & Thomas, 1984.

Spirelytha cf. **fredericksi** Archbold & Thomas, 1984.

Phricodothyris sp. nov.—Dickins 1976: 99.
Spirelytha sp. cf. *S. fredericksi* Archbold & Thomas 1984: 322, fig. 4S–W.

Comments. The review of Western Australian representatives of the Elythidae by Archbold & Thomas (1984a) re-established *Spirelytha* in modern terms. Two specimens from Scott Bluff were figured in that study (CPC 24225, an internal mould of a complete shell collected by W. J. Koop, and CPC 24227, an incomplete natural cast of a ventral valve collected by the 1975 BMR field parties). The specimens were noted by Archbold & Thomas (1984a: 323) to be closest in morphological details to their *S. fredericksi* but to differ from that species in possessing a more strongly developed sulcus and fold, and in the presence of minute dorsal adminicula (the latter considered to be of infraspecific importance).

Since the Western Australian study, Klets (1987) has investigated *Spirelytha* from the Southern Verkhoyan, USSR and has identified *S. fredericksi* among his species. The Early Permian Verkhoyan species from the Sigskaya Suite is comparable to true *S. fredericksi* and lacks the more strongly developed sulcus and fold of the present material.

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