FIRST RECORDS OF *MIRACYTHERE* HORNIBROOK, 1952 (CRUSTACEA, OSTRACODA) FROM THE TERTIARY OF AUSTRALIA

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A new species of the rare ostracode genus *Miracythere* Hornibrook, 1952, previously known only from New Zealand, is described from late Early or early Middle Miocene (Batesfordian) strata of the Muddy Creek Formation near Hamilton, southwestern Victoria. The new species is not formally named because the only complete adult valve amongst the limited material discovered has been lost. A specimen of another undescribed species possibly belonging to *Miracythere* is also figured from the Late Eocene of South Australia. The literature relating to this genus is reviewed, and the morphological parallels between *Miracythere* and some Palaeozoic genera are briefly discussed.

MIRACYTHERE is a rare and distinctive ostracode genus erected by Hornibrook (1952) for his new species *M. novaspecta* from dredgings off the northern tip of New Zealand. He indicated that the type species is widely distributed in New Zealand waters, though no locality data were given. No other species of the genus has been described, and the only other documented occurrence of *M. novaspecta* has been two valves recorded from the Otago Shelf by Swanson (1979a).

Hornibrook (1952, 1968) gave the stratigraphic range of *Miracythere* as Late Eocene (Runangan) to Recent and of *M. novaspecta* as Early Miocene (Hutchinsonian) to Recent, but he did not record any fossil occurrences. He has recently informed me (written communication 1985) that the Eocene occurrence cannot be confirmed, but that a specimen of *M. novaspecta* is known from the Wharekuri Greensand of Late Oligocene (Duntroonian) age, at a locality on the Waitaki River in the South Island now submerged by a hydroelectricity scheme reservoir. That occurrence, and a broken specimen (Fig. 1B) of ?*Miracythere* that I have recovered from the Tuketja Member of the Blanche Point Formation of South Australia (Late Eocene; Jenkins et al. 1982), predate the Victorian species described in the present paper. I have also picked a specimen of another undescribed species of ?*Miracythere* from a sample supplied by Dr B. Hayward from the Pleistocene (Castlecliffian Stage) Wanganui Series of New Zealand (Fig. 2C). No other occurrences of the genus are known at present.

SYSTEMATIC PALAEONTOLOGY

Family BYTHOCYTHERIDAE Sars, 1866

Remarks. Hornibrook (1952) placed *Miracythere* in the Bythocytherinae but noted that the hinge, with a posterior tooth in the left valve, is more complex than the characteristic bythocytherinid hinge. Schornikov (1981) regarded the genus as Bythocytherinae *incertae sedis*. Since I follow Hartmann & Puri (1974) in not recognising subfamilial groupings within the Bythocytheridae, the question of the placement of *Miracythere* at the subfamilial level does not arise. The hinge type as diagnosed by Hornibrook, and its variation in the Victorian species described here, fall within the range accepted as "normal" for bythocytherids.

Genus **Miracythere** Hornibrook, 1952

Type species. Miracythere novaspecta Hornibrook, 1952.

Diagnosis. See Hornibrook 1952: 61–62.

Remarks. A specimen from the Gulf of California and another of Cretaceous age from a deep sea drilling core in the Shatsky Rise, northwestern Pacific Ocean (DSDP 6-48.2) were tentatively assigned to *Miracythere* by Swain (1967; in Maddocks 1983). Both specimens differ from *M. novaspecta* in lacking a median sulcus, being longer, being caudate rather than subquadrate, and in having reticulate rather than smooth-surfaced valves. These differences

suggest that the specimens do not belong to *Miracythere*.

Miracythere sp. A

Figs 1A, C–D, 2A–B, 3A, C–F

Material. The specimens originally found consisted of one adult left valve (Figs 1A, D, 2A–B, 3A, C–F), one juvenile left valve, and fragments of two valves, all of which were lost in transit to the laboratory of the Geological Survey of Victoria. Subsequent repicking of the sample produced two broken juvenile valves, one left (NMV P123311, Fig. 1C) and one right (NMV P123312). The catalogue numbers refer to the invertebrate palaeontological collection of the Museum of Victoria, Melbourne.

Horizon and locality. Muddy Creek Formation, Clifton Bank, Muddy Creek near Hamilton, southwestern Victoria.

Age. All the specimens came from the oldest level at Clifton Bank (Sample 9), of late Early or early Middle Miocene (Batesfordian) age (N8 in the planktonic foraminiferal zones of Berggren et al. 1985; the revised correlation of magnetic anomalies by Berrgren et al. has shifted ages 1.5 to 2.0 my younger in the Middle Miocene, so that the position of the Early–Middle Miocene boundary in relation to the Australian Bairnsdalian and Balcombian stages is open to debate.)

Dimensions. Adult LV: L = 0.65 mm; H = 0.38 mm; W = 0.23 mm (figured specimen, now lost). The repicked specimens NMV P123311 and P 123312 are too fragmentary to measure.

Description. Valve medium-sized in adult; subelliptical in outline, hyaline and thinly calcified. Surface smooth. Normal pore canals simple and widely scattered. Dorsal margin straight. Ventral margin straight to slightly sinuous, subparallel to dorsal margin except posteriorly. Anterior and posterior gently rounded in outline, former more so than latter. Anterodorsal and posterodorsal angles broadly and evenly rounded. Shallow, vertical median sulcus. Prominent hollow tubercle developed anterodorsally (Figs 1A, 3A), ornamented with three spines on dorsal edge. Valve inflated, with well-developed and sharply-defined flattened ventral zone; less marked flattening anteriorly and posteriorly. Inflation of valve greatest in posterior third. Marginal zone of valve and inflated area ornamented with flat spatulate spines (Fig. 3E) that vary in orientation, from normal to plane of valve dorsally, to parallel with that plane ventrally. Ends of spines trilobate, bilobate or pointed (Figs 3E, F). Spines absent along dorsal margin. Ventrally, spines separated from basal plane of valve by slightly flanged rim. Approximately 30 spines in one row around inflated portion of carapace. Some spines probably missing through damage to valve. Spines 2 or 3 times more numerous on juvenile specimens than on adult. Ventral marginal zone of inflated area flat and normal to valve plane, forming broad basal platform 0.2 mm across (single valve).

Hinge-line marked in left valve by simple, smooth median bar with long, narrow grooves at anterodorsal and posterodorsal angles (Figs 2B, 3C, D). Muscle scar pattern consisting of 5 adductors in a compressed vertical row, with 2 small, subcircular frontal scars, one small ventral mandibular scar and 2 prominent dorsal scars (Fig. 2A). Inner margin moderately broad in anterior, narrow in posterior (Fig. 1D). Radial pore canals not detected. Line of concrescence deviates from inner margin; vestibule moderately broad anteriorly, narrow posteriorly. No eye tubercle. Sexual dimorphism not known.

Affinities. Miracythere sp. A differs from *M. novaspecta* (Figs 1E, 3B) in its more rounded ends and its spatulate rather than "peg-like" spines which occur in a single row marginal to the valve and the inflated area, rather than in 2 or 3 rows. The tubercle of the present species also carries spines rather than the pustules found on *M. novaspecta* (Fig. 3B). Additionally, there is no tooth in the hinge elements of the left valve. *Miracythere* sp. A resembles the type species in the median vertical sulcus, the ornamentation of spines, the muscle scar pattern and the shape and appearance of the carapace in lateral view. These features clearly establish the species as belonging to *Miracythere*.

Remarks. Miracythere sp. A is more closely allied morphologically to the Pleistocene specimen from New Zealand (Fig. 2C) than it is to *M. novaspecta* (Fig. 1E), having a similar arrangement of spines, a lophodont hinge structure and a similar subrounded quadrate shape. However, the Pleistocene specimen does not have a clearly differentiated, inflated inner lateral section of the valve as found in *Miracythere* sp. A. The fragmentary valve from the Late Eocene of the Blanche Point Formation, South Australia (Fig. 1B) may be conspecific with *Miracythere* sp. A.

The dimensions of the lost adult specimen of *Miracythere* sp. A were the same as those of the holotype *M. novaspecta*, allowing for the fact that the former specimen was a single valve whereas the latter is a carapace. It was not possible to determine whether this adult valve be-

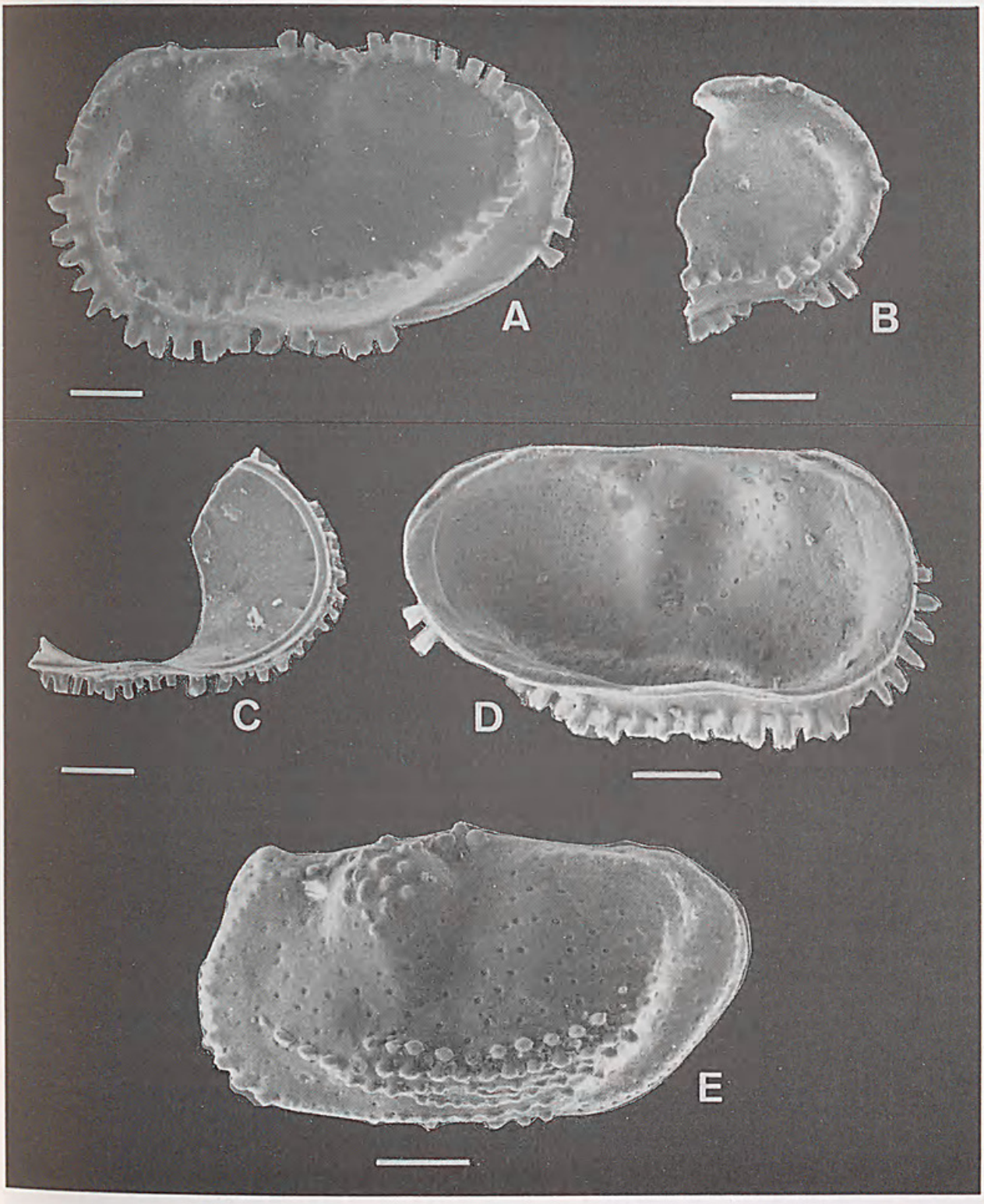

Fig. 1. A, C, D, *Miracythere* sp. A, Muddy Creek Marl (early Middle Miocene), Clifton Bank, Muddy Creek, southwestern Victoria. A, D, LV exterior and interior (specimen lost). C, LV interior (fragmentary juvenile), NMV P123311. B, ?*Miracythere* sp., LV exterior (fragment), Tuketja Member, Blanche Point Formation (Late Eocene), Port Willunga, South Australia. E, *Miracythere novaspecta* Hornibrook, 1952, LV exterior, New Zealand Geological Survey fossil locality F201012, Station 18 of Hornibrook (1952), off Big King Island at 98 fathoms. Scale bars = 0.1 mm.

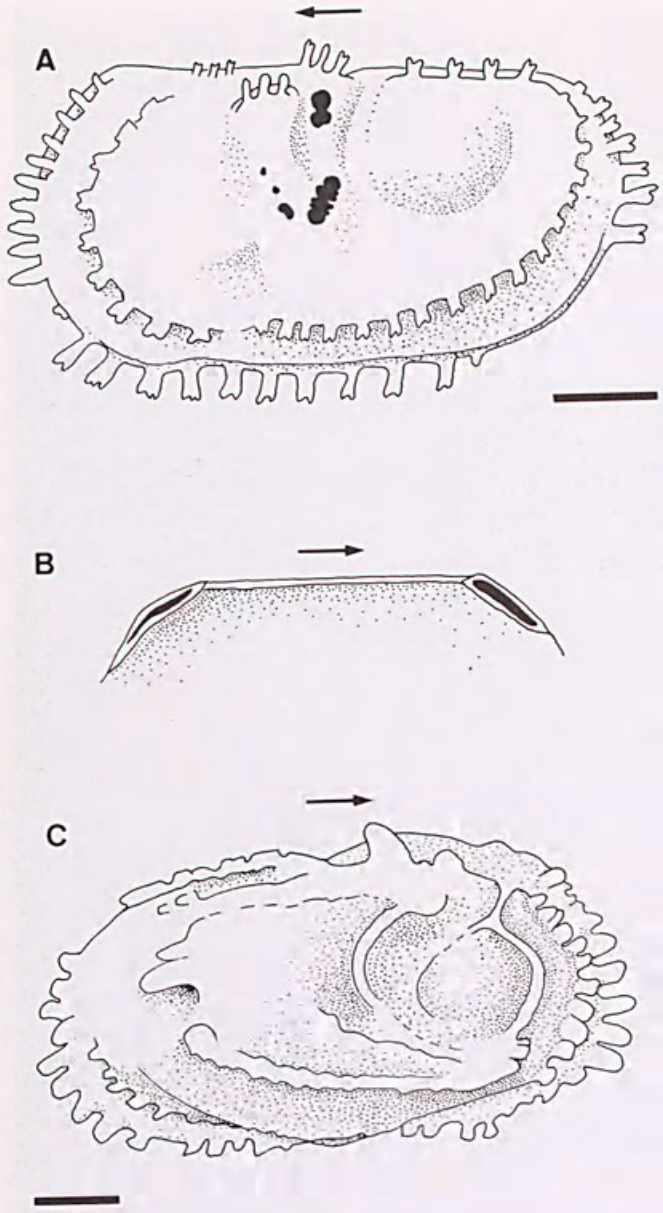

Fig. 2. A–B, *Miracythere* sp. A. A, drawing of LV interior showing muscle scars. B, drawing of LV hinge line (not to scale). C, ?*Miracythere* sp., drawing of RV exterior, from Wanganui Series (Castlecliffian, Pleistocene), Wanganui, New Zealand. Scale bars = 0.1 mm.

longed to a male or to a female. The juvenile specimen (now lost) was close to the adult in lateral dimensions but was much less inflated, suggesting that in the final growth stage or stages there was little change in length or height but an increase in width. However, Swanson (1979a) figured a specimen of *M. novaspecta* that he considered to be a juvenile, though its length and height are virtually the same as those of the holotype and its width is actually greater.

The hinge structure of *Miracythere* sp. A is closer to the typical bythocytherid form than to that of the type species. In the latter, the left valve anterior groove or socket of the hinge elements extends above the dorsal line established by the median bar, and marks the anterodorsal angle in pronounced fashion (Fig. 3D). *Miracythere* sp. A has a narrow anterior groove which continues the line of the median bar, parallelling the broadly rounded anterodorsal angle (Fig. 3C). The left valve posterior hinge element of *M. novaspecta* consists of a narrow tooth below, with a groove or socket above at the posterodorsal angle. *Miracythere* sp. A has a groove (in a more elongate form), no tooth and a less marked posterodorsal angle (Fig. 3C). The Victorian and Late Eocene South Australian specimens have a lophodont hinge structure. Given that the variation in hinge structure is a relatively minor one, the specimens should be retained in *Miracythere*.

As with the genera *Puncia* and *Manawa* erected by Hornibrook (1949), morphological parallels may be drawn between *Miracythere* and some Palaeozoic genera. Ruggieri & Siveter (1975) figured a species of *Kelletina, K. carnica*, in which there is ventrally a broad flat platform or flange with marginal spines, some of which are linked to form a perforated ridge. *Kelletina carnica* also has a lophodont hinge structure very similar to that of *Miracythere* sp. A. The right valve of *K. carnica* has a simple tooth at each of the anterodorsal and posterodorsal angles to match the grooves in the left valve. The unknown right valve of *Miracythere* sp. A is likely also to have such teeth. A further similarity with Palaeozoic genera lies in the muscle scar pattern, which in both *Miracythere* and *Promanawa* McKenzie & Neil, 1983 includes prominent dorsal antennal/mandibular scars.

Morphological similarities with Palaeozoic forms gave rise to speculation about the phylogeny of the Punciidae by Hornibrook (1949, 1963), even though at that time no Mesozoic representatives of the family were known. Herrig (1988), however, has recently discovered species of all three punciid genera, *Puncia, Manawa* and *Promanawa*, in silicified chalky limestone of late Maastrichtian age. Swanson (1991) made an intensive study of the soft part anatomy of punciids, as well as their carapace morphology, and concluded that "On the basis of a detailed comparison of a number of key carapace characters ... punciid ostracods are the only living representatives of the predominantly

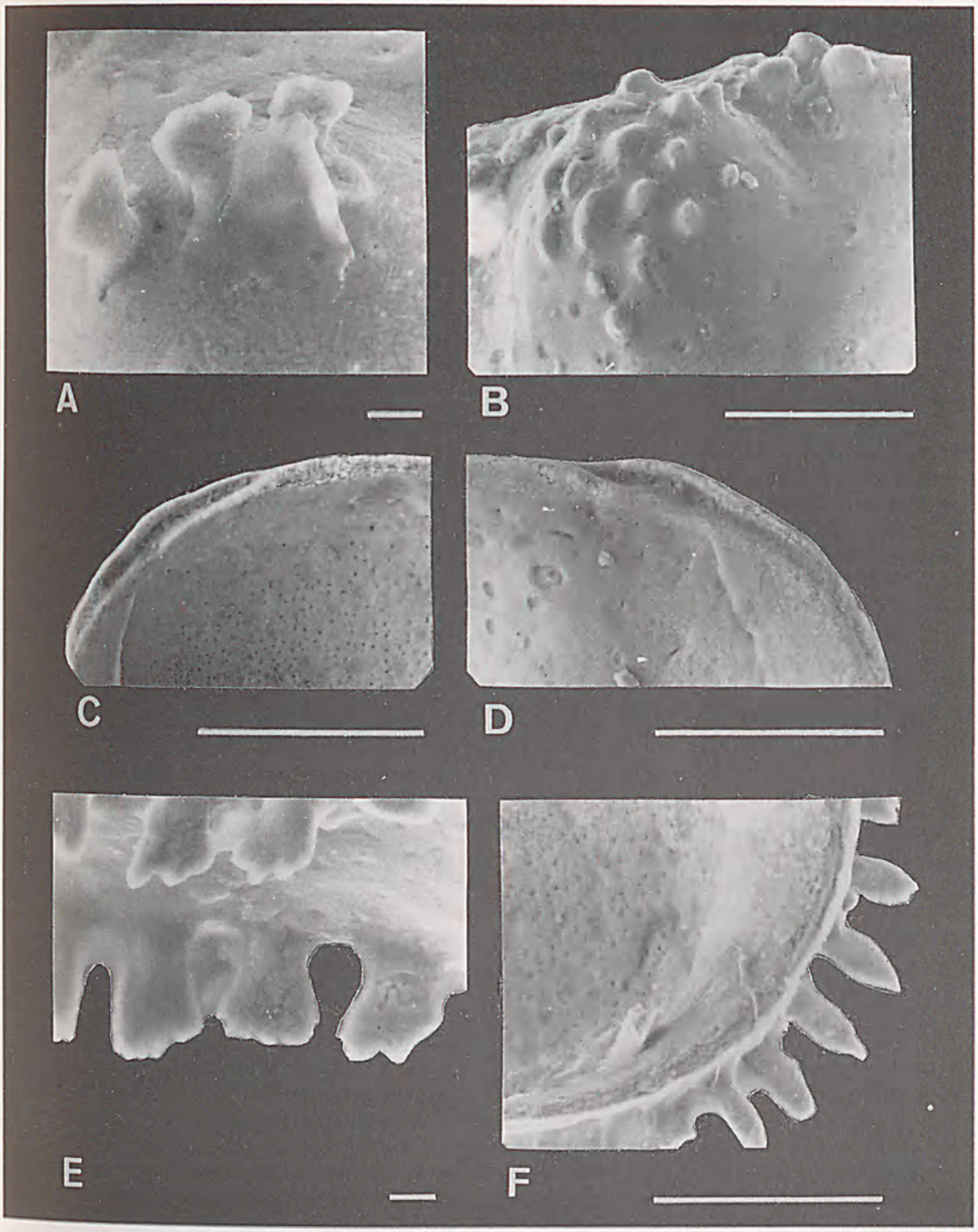

Fig. 3. A, C–F, *Miracythere* sp. A. A, spines on tubercle. C, posterior hinge line. D, anterior hinge line. E, spatulate spines on ventral margin. F, pointed spines on anteroventral margin. B, *Miracythere novaspecta* Hornibrook, 1952, pustules on tubercle. Scale bars = 0.01 mm in A and E, 0.1 mm in remainder.

Palaeozoic Kirkbyacea." Morphological similarities between *Miracythere* and Palaeozoic forms are less suggestive of phylogenetic links, since the homologies are shared with a number of Recent genera. Since *Miracythere* occurs only in Recent and Tertiary sediments, as was believed to be the case for the punciids (Swanson, 1979b, 1985), the absence of Mesozoic records of it or of *Kelletina* at present nullifies any hypothetical phylogeny of *Miracythere* linking it with the latter genus. The discovery of *Miracythere* in Late Eocene sediments in a form possibly conspecific with *Miracythere* sp. A gives an age range in southeastern Australia greater than that for *M. novaspecta* in New Zealand. This suggests that the Mesozoic *Miracythere* gap might also be filled in the course of further intensive collecting, so that the possibility of an evolutionary origin in a Palaeozoic kirkbyacean is not ruled out. A more plausible view, however, is that the basic morphology of *Miracythere* is the result of convergent evolution of bythocytherids. The occurrence of ?*Miracythere* sp. in the Pleistocene of New Zealand in a form which reflects some of the characteristics of *Miracythere* sp. A whilst differing markedly from *M. novaspecta* suggests that a plexus of species of this genus may eventually be discovered.

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