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NEW PLACODERM FISHES FROM THE EARLY DEVONIAN BUCHAN GROUP, EASTERN VICTORIA

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ABSTRACT: Three new placoderms are described from the McLarty Member of the Murrindal Limestone (Early Devonian, Buchan Group). *Murrindalaspis wallacei* gen. et sp. nov. is a palaeacanthaspidoid characterized by having a high median dorsal crest and lacking a median ventral keel. *M. bairdi* sp. nov. differs from the type species in having a low median dorsal crest and a median ventral groove. *Taemasosteus maclartiensis* sp. nov. differs from the type species *T. novaustrocambricus* White in the shape of the posterior region of the nuchal plate, the presence of canals between the infranuchal pits and the posterior face of the nuchal plate, the shape of the paranuchal plate, and the development of the apronic lamina of the anterior lateral plate.

The placoderms, *Arenipiscis westolli* Young, *Errolosteus* cf. *E. goodradigbeensis* Young, *Wijdeaspis warrooensis* Young, are recorded from the Buchan Group indicating close similarity to the ichthyofauna of the contemporaneous Murrumbidgee Group, New South Wales.

Few fossil fishes have been studied from the Early Devonian Buchan Group. McCoy (1876) described some placoderm plates from this region as *Asterolepis ornata* var. *australis*, which Chapman (1916) queried when presenting a description of a placoderm skull from Buchan. Chapman identified this specimen as a phlyctaenioid, *Phlyctaenaspis confertituberculatus*, but Hills (1936b) assigned the skull to *Coccosteus*. Stensiö (1945) recognized differences between the parasphenoid of *Coccosteus* and the Buchan specimen and erected *Buchanosteus* for the latter. Additional material of *Buchanosteus* has since been found from the Murrumbidgee Group, New South Wales, making this genus one of the best known Early Devonian euarthrodires (White 1952, White & Toombs 1972, Young 1979). The only other fish described from Buchan is a mandible of the dipnoan *Dipnorhynchus sussmilchi* (Hills 1936a, Thomson & Campbell 1971). This paper describes placoderm fish material recovered from the Buchan Group during Monash University third year geology field mapping trips as well as some found by geology honours students from both Melbourne and Monash Universities (Long 1983b).

The material was prepared using acetic acid with dilute polyvinylbuterol to strengthen the exposed bone. All specimens were found in the uppermost McLarty Member or the lowermost Rocky Camp Member of the Murrindal Limestone, with the richest concentration of vertebrates occurring near the contact of the McLarty and Rocky Camp Members on the eastern face of Rocky Camp Hill (Fig. 1). In addition to the macrovertebrate remains rich concentrations of microvertebrate fossils were recovered from the residues during preparation, and these have been forwarded to Dr. S. Turner (Queensland Museum) for detailed study. Amongst these are several types of acanthodian and elasmobranch scales similar to forms described from the Murrumbidgee Group by Giffin (1980). Recently a jaw of a new ischnacanthid acanthodian was found in residues from the Rocky Camp Member (under current study by the author). Lower Devonian macrovertebrates have also been described from the Murrumbidgee and Mulga Downs Groups in New South Wales and the Cravens Peak Beds in Queensland, with numerous sites yielding microvertebrate assemblages (Long 1982, 1983b, Turner *et al.* 1981, Long & Turner 1984).

Specimens are housed in the following institutions: CPC, Commonwealth Palaeontological Collections, Bureau of Mineral Resources, Canberra; MUGD, Geology Department, Melbourne University; and NMV, Museum of Victoria, Melbourne.

SYSTEMATIC PALAEONTOLOGY

Subclass PLACODERMI McCoy 1848
Superorder PETALICHTHYOMORPHA Miles & Young 1977
Order PETALICHTHYIDA Jaekel 1911

Wijdeaspis warrooensis Young 1978
Fig. 4C

MATERIAL: A piece of trunk shield comprising the right spinal plate and a small sliver of the anterior lateral plate. NMVP159825, collected Dr. R. E. Fordyce, February, 1981.

OCCURRENCE: The uppermost division of the McLarty Member of the Murrindal Limestone, immediately northeast of Rocky Camp Quarry, north of Buchan.

REMARKS: The specimen is identified as belonging to *Wijdeaspis* because the spinal shows a relatively high number of ornamental ridges (9-10) which are formed of closely packed tubercles arranged in rows. On this basis Young (1978, p. 112) distinguished *Wijdeaspis* spinal plates from those of *Lunaspis* species. The Buchan specimen is almost identical with that of *Wijdeaspis warrooensis* figured by Young (1978, figs 2E, 8B).

Order RHENANIDA Broili 1930
Suborder PALAEACANTHASPIDOIDEI Miles & Young 1977
Family WEEJASPERASPIDAE White 1978

DIAGNOSIS: Palaeacanthaspidoids having a well developed median dorsal crest on the median dorsal plate, which has a posterior face with a smooth medial

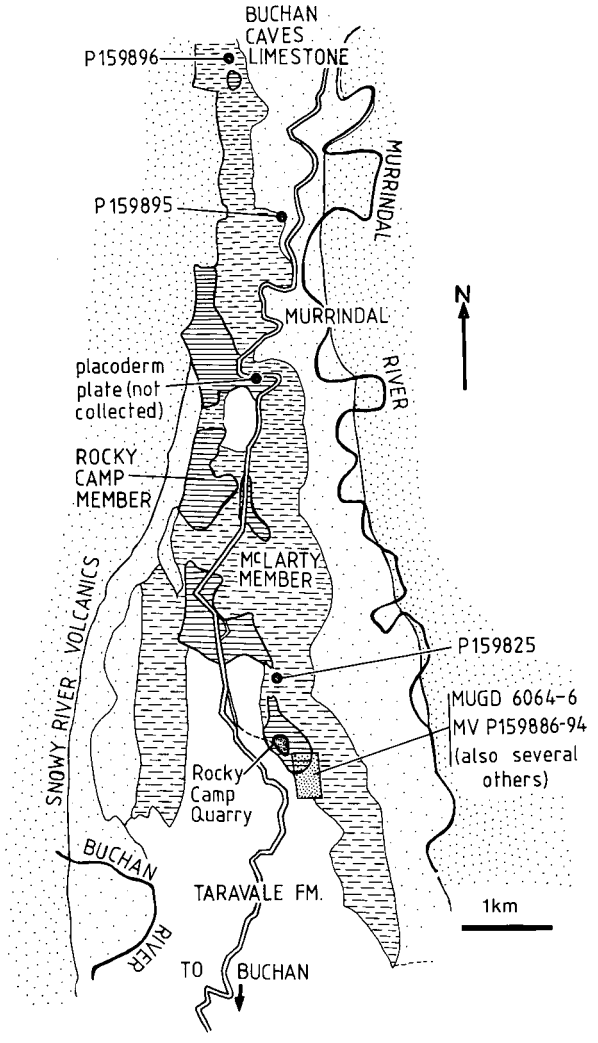


Fig. 1 – Locality map of placoderm fossils collected in the Buchan region. Geology from Teichert & Talent (1958).

prominence. Median dorsal plate with a B/L index approximately 80. Coarse ornamentation consisting of short ridges and pointed tubercles each with well defined grooves.

REMARKS: White's diagnosis (1978) has been modified to incorporate features of the new genus from Buchan. *Weejasperaspis* White 1978 and *Murrindalaspis* gen. nov. are similar in the proportions of the median dorsal plate, in their median dorsal crests and in the morphology of the dermal ornamentation; they differ chiefly in the well-developed median ventral ridge on *Weejasperaspis* only, and in the size of tubercles of the external ornament.

Murrindalaspis gen. nov.

ETYMOLOGY: After the settlement of Murrindal, north of Buchan.

DIAGNOSIS: A weejasperaspid of moderate size having a median dorsal plate with a smooth ventral surface which may have a median ventral groove developed; dermal ornamentation of short ridges, approximately one-third as long as broad, on the dorsal surfaces with pointed stellate tubercles densely concentrated near the anterior and posterior margins; median dorsal crest developed; a short dorsal transverse sensory line canal situated at the anterior base of the median dorsal crest; the posterior face of the median dorsal crest with a smooth median prominence throughout.

TYPE SPECIES: *Murrindalaspis wallacei* sp. nov.

REMARKS: This palaeacanthaspid is similar to *Weejasperaspis gavini* White (1978) but differs in the absence of the median ventral keel on the median dorsal plate. *Palaeacanthaspis* Stensiö 1944 also possesses a median dorsal crest but differs from both *Murrindalaspis* and *Weejasperaspis* in possessing a large nutritive foramen for the crest on the ventral surface of the median dorsal plate, and by its simple tubercular ornamentation. Of the remaining described palaeacanthaspids none has a well developed median crest; where the median dorsal plate is unknown (*Brindabellaspis* Young 1980, *Romundina* Ørvig 1975, *Kimaspis* Mark-Kurik 1973a, *Kolymaspis* in Denison 1978) *Murrindalaspis* is distinguished by the characteristic dermal ornamentation.

Murrindalaspis wallacei sp. nov.
Figs 2A, D, E, G, 3, 8C, D

ETYMOLOGY: After Mr. M. Wallace, Dept. Geology, University of Tasmania, who discovered several fishes from the Buchan area in 1982, including the type specimen of *Murrindalaspis* gen. nov., and kindly allowed me to study the material.

DIAGNOSIS: A member of *Murrindalaspis* with a median dorsal plate having a high median dorsal crest which is strongly curved posteriorly and tapers narrowly at its apex. Ventral surface of median dorsal plate smooth, and there are paired prominences developed at the posterior end of the ventral surface near the base of the crest. Ratio of median dorsal crest height/plate length approximately 64.

HOLOTYPE: MUGD6066 (Figs 2A, D, E, G, 3), an almost complete median dorsal plate from the top of the McLarty Member of the Murrindal Limestone from the vicinity of Rocky Camp Quarry, north of Buchan (Fig. 1).

DESCRIPTION: The holotype is almost complete, missing only the top of the crest and a small part of the left anterolateral corner. It bears a high, slender median dorsal crest (cr.d) which starts approximately 28% of the plate length from the anterior margin, and extends backwards beyond the level of the posterior margin (Fig. 3). In profile the crest is strongly curved, being proportionately much narrower than the broad crest of *Weejasperaspis* (Fig. 8). The anterior margin of the plate has a short median convexity and lateral to this region the anterior margin extends forward at an angle of about

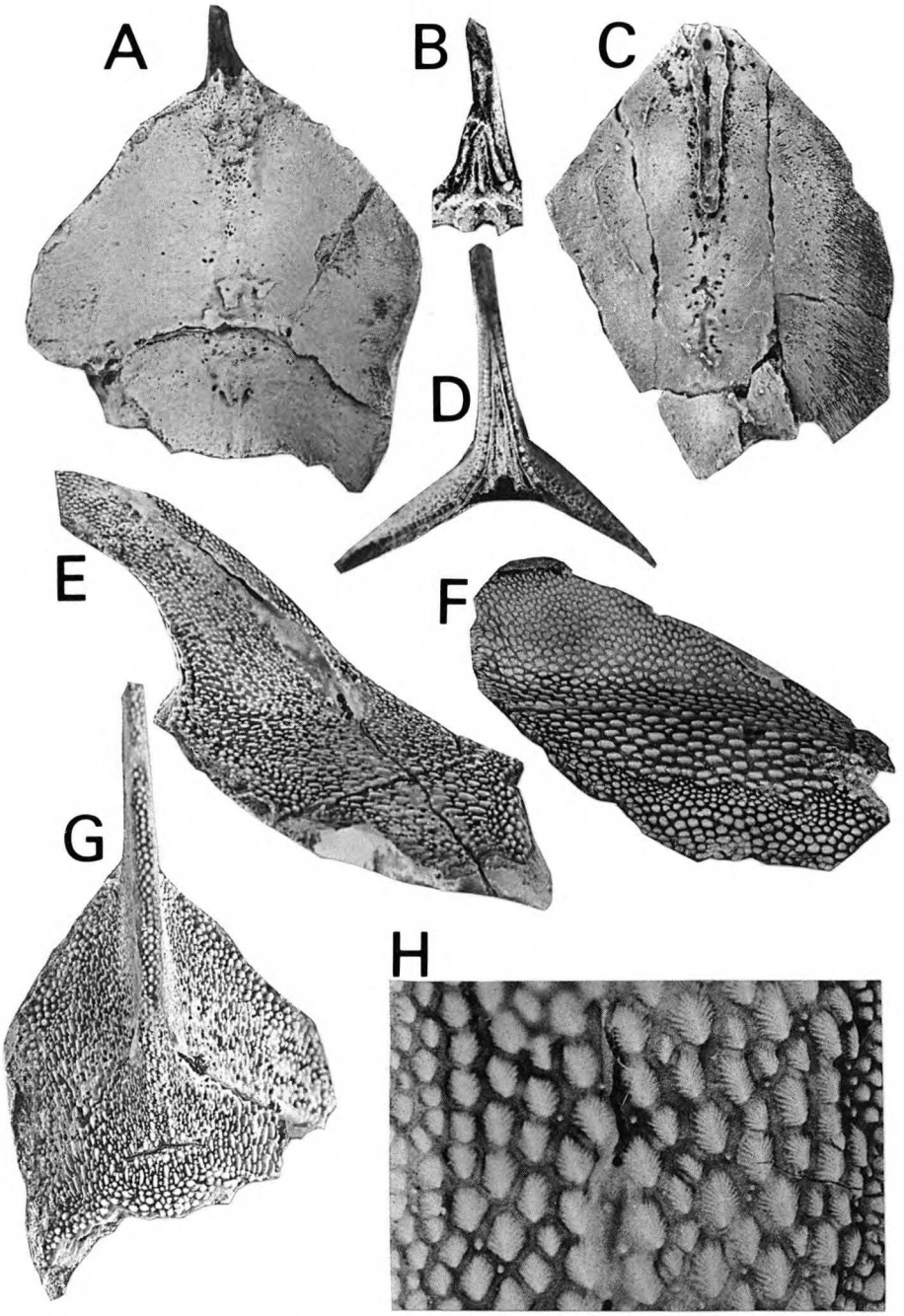


Fig. 2—*Murrindalaspis* gen. nov., Emsian, Buchan. A, D, E, G, *M. wallacei* sp. nov., MUGD6066. Holotype median dorsal plate in A, ventral, D, posterior, E, right lateral and G, dorsal views, ×1. B, C, F, H. *M. bairdi* sp. nov., NMVP59892. Holotype median dorsal plate in B, posterior, C, ventral, and F, right lateral views. H, detail of dermal ornamentation. B, ×2; C, F, ×1; H, ×4. All specimens whitened with ammonium chloride.

40° to the lateral margin of the plate. There is a narrow overlap platform (ant.oa) along the extent of the anterior margin. In dorsal view the plate has constant breadth in its anterior half and tapers posteriorly towards the posterior processes (ppr). The posterolateral margin is straight, without the irregular notches seen on *Weejasperaspis*. There is a short transverse sensory line canal (dg) situated just anterior to the base of the crest and extending for a short distance laterally (Fig. 3D). The ventral surface of the plate is smooth with slightly striated lateral margins where there is overlap with the anterior and presumably posterior dorsolateral plates (oa.ADL). In the midline of the ventral surface there is a concentration of small vascular pores (vas). Two larger foramina occur at the anterior end, below the position of the transverse dorsal sensory canal, probably for innervation of this sensory line. Posteriorly a median process (mpr) is developed, behind which are paired protruberances (ppr) marking the base of the crest. In lateral view, these paired processes extend behind the ornamented external surface. White (1978, p. 159) noted the presence of a process on the posterior face of the median dorsal of *Weejasperaspis* suggesting an articulation for either a posterior median dorsal plate or body scute. As posterior median dorsal plates are only known in antiarchs, and body scutes tend to lie flat on the dorsal ridge of the trunk it is more probable that this region was an attachment area for a dorsal fin support. The posterior margin of the median dorsal spines of some ptyctodontids are grooved for attachment of the dorsal fin support in a similar fashion (e.g. *Rhamphodopsis* Miles 1967). In posterior view (Fig. 3B) the base of the median dorsal crest of *M. wallacei* shows a smooth median vertical thickening (mth) flanked on each side by well defined grooves, which deepen towards the base of the crest. A short distance above the paired processes there is a central foramen (for). As the plate was broken in two halves when collected it can be noted that there is a large canal inside the plate running along the base of the crest.

The ornamentation of *Murrindalaspis* (Fig. 2H), is quite distinctive as is this feature on many palaeacanthaspids. In the development of small ridges and tubercles with distinctive ridges it is superficially similar to *Weejasperaspis*. It differs from this genus in that the ridges are shorter (average approximately one-third as long as broad) and predominate on the dorsal surface of the plate with high, pointed stellate tubercles in dense concentrations at the anterior and posterior margins. The crest has closely packed tubercles which grade into short, small ridges on its flanks. All ridges of ornament on the plate have a rostrocaudal alignment, although on the lower part of the crest these form an angled pattern pointed towards the anterior end of the base of the crest.

Murrindalaspis bairdi sp. nov.
Fig. 2B, C, F, H

ETYMOLOGY: After Mr. Robert Baird, Earth Sciences Dept., Monash University, who found the holotype specimen in July, 1983.

DIAGNOSIS: A *Murrindalaspis* having a median dorsal plate which bears a low median dorsal crest. The ventral surface of the median dorsal plate has a well defined median ventral groove in the posterior half of the plate.

HOLOTYPE: An almost complete median dorsal plate, NMVP159893 from the base of the Rocky Camp Member of the Murrindal Limestone, on the southeastern face of Rocky Camp quarry hill, north of Buchan (Fig. 1).

REMARKS: The two species of *Murrindalaspis* are known only from median dorsal plates, yet as they both bear the same distinctive type of dermal ornamentation it is assumed that they are congeneric. The differences seen in the two species are not intraspecifically variable characters. In the antiarch *Bothriolepis* there are interspecific variations in the heights of median dorsal crests and in the presence or absence of median ventral grooves (Miles 1968, Long 1983a). It is unfortunate that palaeacanthaspidoids are too rare as fossils to test the variability of the median dorsal plate morphology within and between species. The two median dorsal plates of *Murrindalaspis* are of about the same size which indicates that the differences seen between the two forms are not attributable to growth changes. As the two species occur in different lithofacies, *M. bairdi* in clean biosparite and *M. wallacei* in interlayered micritic packstones and mudstones, it is possible that the differences in crest height could relate to the degree of turbulence or current activity which predominated in the differing palaeoenvironments.

DESCRIPTION: The holotype median dorsal plate is missing the anterior margin and left anterolateral corner. Although the left side of the crest is slightly damaged the full extent of the crest is shown on the right side of its dorsal margin.

The plate (Fig. 2F) has a slender, broad median dorsal crest which runs along the entire preserved length of the plate. The dorsal margin is gently curved with the crest height being approximately 51% of the overall height of the plate. The ratio of crest height to plate length (as preserved) is 31. The form of the plate in dorsal view is the same as for *M. wallacei* (compare Fig. 2A, C). The posterior face of the plate has a short median thickening which is bordered by a narrow ridge (Fig. 2B). The median thickening extends ventrally to meet the lateral sides of the ventral median groove. The ventral aspect (Fig. 2C) shows this groove extending for 40% of the plate length from its posterior extent. Anterior to the median ventral groove are numerous vascular foramina, as on the ventral surface of *M. wallacei* (Fig. 2A). The dermal ornamentation of *M. bairdi* is slightly coarser than that of *M. wallacei* just lateral to the base of the crest, and on the lateral sides of the crest (Fig. 2E, F) but is otherwise virtually indistinguishable on the two species.

Order EUARTHRODIRA Gross 1932
Suborder PHLYCTAENIOIDEI Miles 1973
Infraorder BRACHYTHORACI Gross 1932

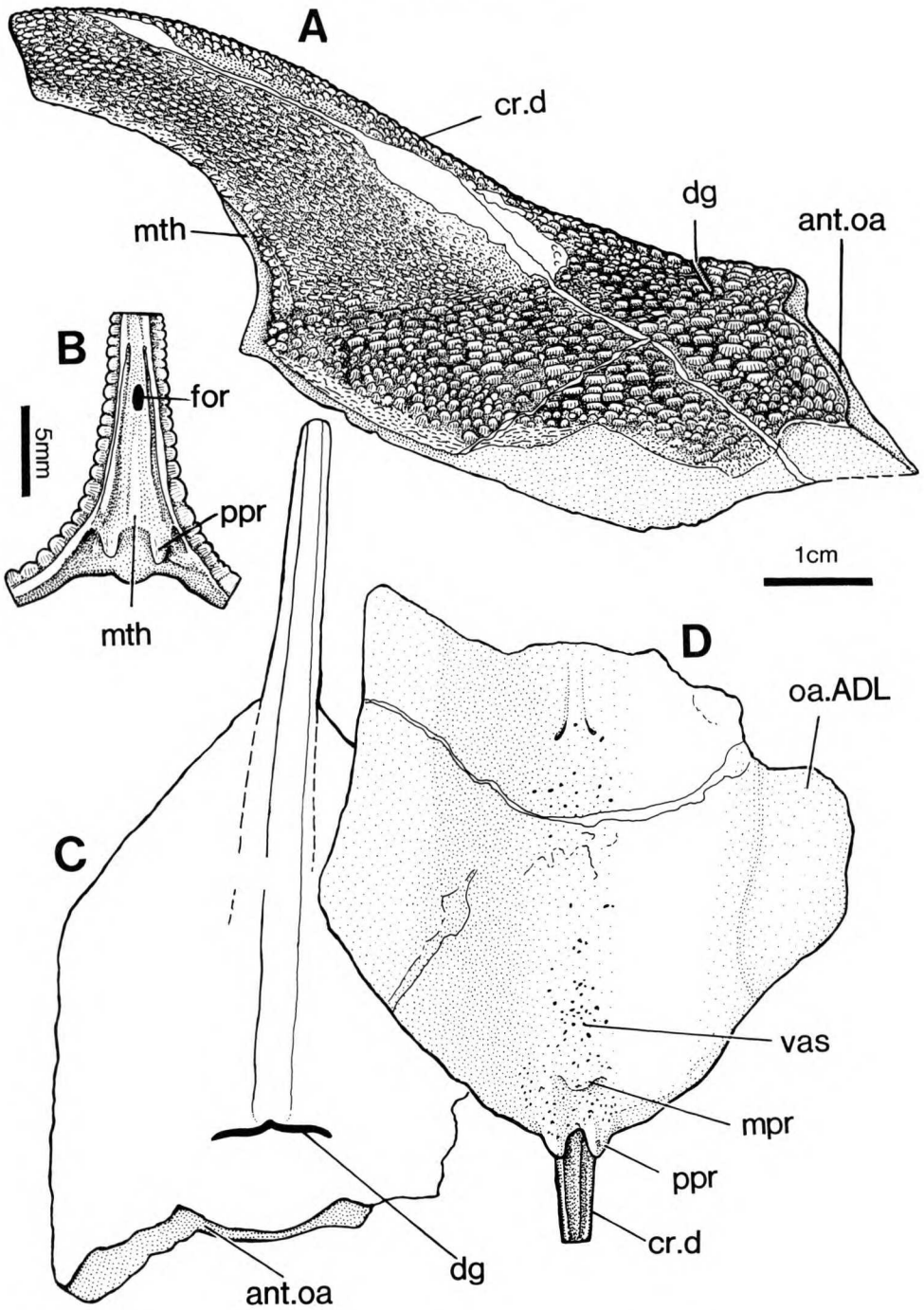


Fig. 3—*Murrindalaspis wallacei* gen. et sp. nov., Emsian, Buchan. Holotype median dorsal plate in A, right lateral, C, dorsal, and D, ventral views. B, detail of posterior face of median dorsal crest. MUGD 6066. ant.oa, anterior overlap surface; oa.ADL, overlap area for anterior and possibly posterior dorsolateral plates; cr.d, median dorsal crest; dg, dorsal transverse sensory-line groove; for, posterior foramen of crest; mpr, median ventral process; mth, median thickening; ppr, paired posterior processes at base of crest; vas, vascular foramina.

REMARKS: These taxa were defined by Young (1979, p. 344, 345) and Long (in press) has amended this definition of the Euarthrodira to include phyllolepids. The following section records taxa from the Buchan Group not previously reported, except for *Buchanosteus confertituberculatus* (Hills 1936b, White 1952, Young 1979).

Arenipiscis westolli Young 1981b
Fig. 4F

MATERIAL: An almost complete nuchal plate, NMVP159885, collected by Mr. Ken Simpson, 1975 from a road cutting near Murrindal, north of Buchan. Although the stratigraphic horizon was not indicated on the label, the lithology suggests that the specimen came from the thinly bedded, fossiliferous McLarty Member of the Murrindal Limestone. Other fish fragments have been found in this region on the road outcrop immediately north of Henham Homestead.

REMARKS: The nuchal plate is referred to *Arenipiscis westolli* on the basis of relative proportions, the presence of a conspicuous median ventral depression and by the fine grained tubercular ornamentation.

DESCRIPTION: The posterior median region of the plate is not preserved, although the shape of the lateral posterior margins is apparent. Other features characteristic of *Arenipiscis* seen on the Buchan specimen are the narrow anterior region of the plate, numerous nutritive foramina along the median ventral depression, well defined infranuchal pits (only partly preserved) and the broad overlap areas for the paranuchal plates. The Buchan specimen has an estimated B/L index of 88 (the anterior margin and broadest lateral extremities are not complete). As the New South Wales type material does not include a complete nuchal plate, proportions can only be estimated from Young's restoration (1981b, figs 5, 6), where the nuchal is slightly broader than long.

Errolosteus cf. **E. goodradigbeensis** Young 1981b
Fig. 4A

MATERIAL: Almost complete anterior dorsolateral plate, NMVP159894 from the upper part of the McLarty Member of the Murrindal Limestone in the vicinity of Rocky Camp Quarry, north of Buchan.

REMARKS: This genus is easily recognized by the characteristic dermal ornamentation of concentric ridges bearing small tubercles. Young (1981b) described the type species from an imperfect headshield, an anterior lateral plate and a posterior ventrolateral plate. The anterior dorsolateral plate from Buchan has a shape compatible with that of the dorsal margin of the anterior lateral of *E. goodradigbeensis*, and for this reason it is provisionally referred to this species until more material is recovered.

DESCRIPTION: The anterior dorsolateral plate is higher than long, as in *Buchanosteus* and most phlyctaenioids (Denison 1978). The plate has an overall H/L index of 153. The anterior margin of the plate is longer than the rounded posterior margin. The overlap area for the median dorsal plate extends for just under half of the plate length with the ventral overlap area for the anterior lateral plate extending for 80% of plate length. The external ornamented area of the plate is broadest anteriorly, then narrows before becoming broader at the posterior margin. The articular condyle is a short, rounded process as in other primitive brachythoracids.

Taemasosteus White 1952

DIAGNOSIS: As in White, 1978, p. 184.

TYPE SPECIES: *Taemasosteus novaustrocambricus* White 1952.

REMARKS: White (1952) established this genus upon a single left paranuchal plate and recently redescribed the taxon from over eighty plates (White 1978). *Taemasosteus novaustrocambricus* is a common element in the Taemas-Wee Jasper fauna, and has been reported at Buchan (Young 1979, p. 311) although details were not given. This report was based on NMVP41829, a left paranuchal attached to part of the nuchal (Fig. 6A), collected by a Mr. Goodwin from the Rocky Camp member in the early 1970s and prepared by Dr. G. C. Young. In the recently collected material from Buchan *Taemasosteus* is common, although differences in proportion and morphology indicate that some of the material constitutes a new species, whereas other plates are indistinguishable from the type species. All the Buchan specimens resemble *Taemasosteus novaustrocambricus* in their large size, thickness, dermal ornamentation and approximate shape, and are referred to the genus on these characters.

The following plates of *Taemasosteus*, collected near Buchan, are indistinguishable from the type species, *T. novaustrocambricus*: NMVP159889, an imperfect left central plate (Fig. 4E); NMVP159886, imperfect left paranuchal plate (Fig. 6B); NMVP161865, an imperfect right interolateral plate (Fig. 7d); and NMVP159888, a posterior region of the median dorsal plate (Fig. 7B, C). These may turn out to belong to the new species described below but this cannot be shown unless articulated material is found. For the present these specimens are referred to *T. novaustrocambricus*.

Taemasosteus maclartiensis sp. nov.
Figs 4B, D, 5, 6A, 7A, E, 8A

ETYMOLOGY: After the McLarty Member of the Rocky Camp quarry where most of the specimens were found.

DIAGNOSIS: A member of *Taemasosteus* having a nuchal plate which is not strongly raised at the occipital end, and with short, deep grooves connecting the posterior face of the nuchal plate to the large infranuchal pits. Posterior margin of the nuchal plate slightly concave, much straighter than for *T. novaustrocambricus*. Paranuchal plate with straight posterior margin forming an angle of 50° with the suture to the nuchal plate. Anterior lateral plate with 4 toothed ridges on the apronic lamina which is inturned at an angle of 65° to the lateral lamina of the trunkshield.

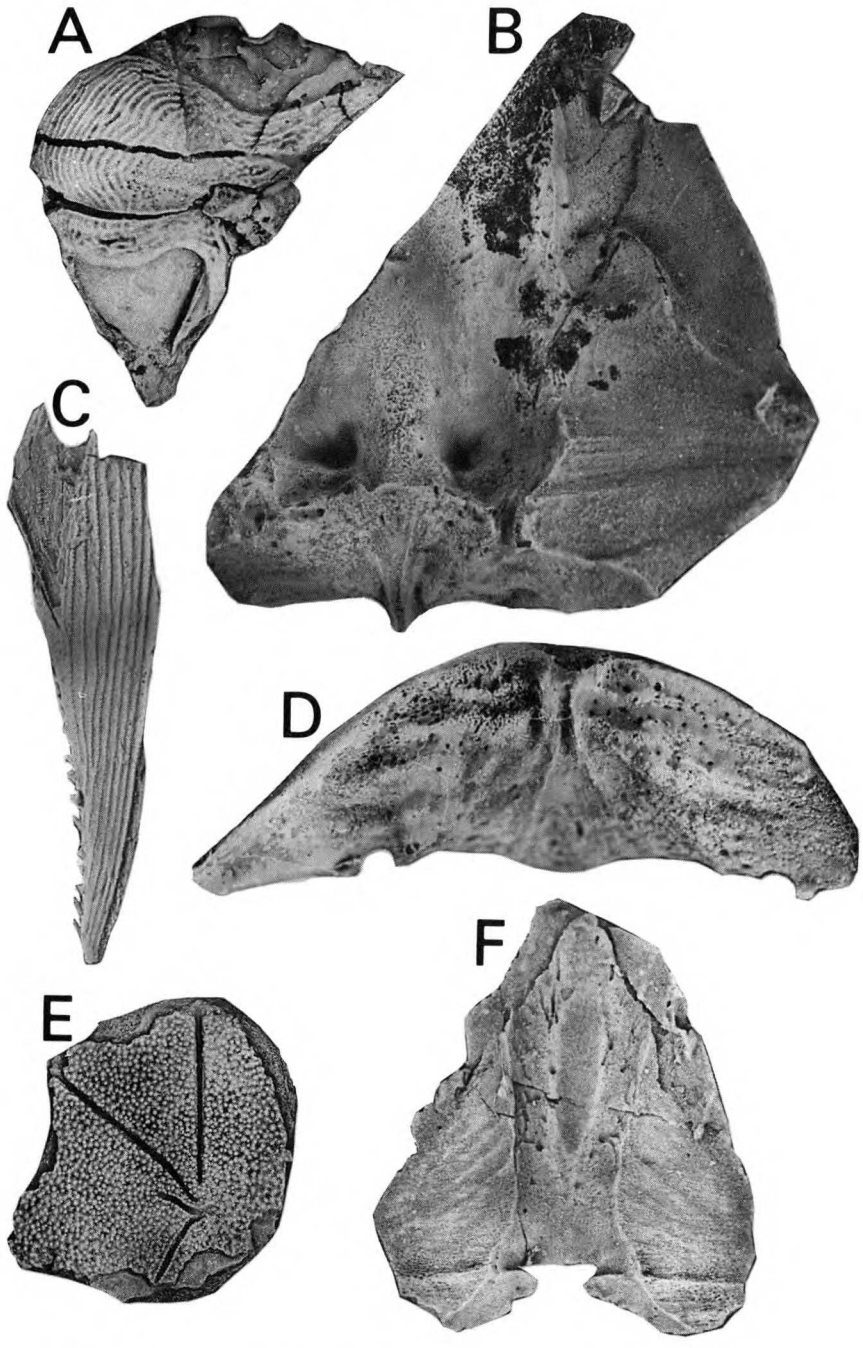


Fig. 4—A, *Errolosteus* cf. *E. goodradigbeensis* Young. Right anterior dorsolateral plate in lateral view, NMVP159894, ×1. B, D, *Taemasosteus maclartiensis* sp. nov., holotype nuchal plate in B, ventral, and D, posterior views, NMVP159887. B, ×1; D, ×1.5. C, *Wijdeaspis warooensis* Young. Left spinal plate in ventral view, NMVP159825, ×2. E, *Taemasosteus* cf. *T. novaustrocambricus*, left central plate in dorsal view, NMVP159889, ×1. F, *Arenipiscis westolli* Young, nuchal plate in ventral view, NMVP159885, ×2. All whitened with ammonium chloride.

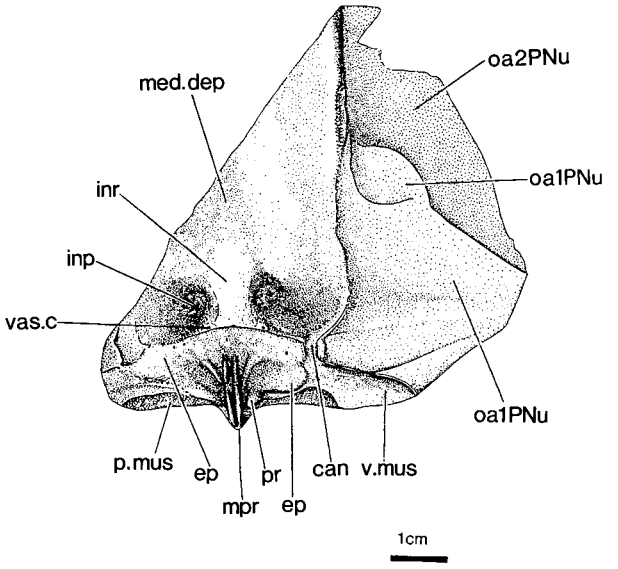


Fig. 5 – *Taemasosteus maclartiensis* sp. nov., Emsian, Buchan. Holotype nuchal plate in ventral view, NMVP159887. can, deep grooves between infranuchal pits and ventral muscle area; ep, epiotic prominence; inp, infranuchal pit; inr, infranuchal ridge; med. dep, median depression; mpr, median process or supraoccipital spine; oa1PNu, oa2PNu, overlap areas for paranuchal plate; p.mus, posterior muscle attachment area; vas.c, vascular canals; v.mus, ventral muscle attachment area.

MATERIAL: Holotype NMVP159887 (Figs 4B, D, 5), a large portion of the nuchal plate, showing all of the characteristic features; MUGD6064, an almost complete nuchal plate, more worn than the holotype; NMVP41829, almost complete left paranuchal plate with part of left side of nuchal attached (Fig. 6A); NMVP159891, complete right anterior lateral plate (Fig. 7A, E).

OCCURRENCE: All specimens were collected from the vicinity of the Rocky Camp quarry, on the eastern slope of the hill, in the topmost section of the McLarty Member and lowermost Rocky Camp Member (Fig. 1). Most of the material was collected by the author and friends during 1980-1983.

REMARKS: The material is believed to be conspecific because all these plates show differences from the type species, and were collected from the same stratigraphic horizon. The new species is distinctive in the morphology of the nuchal, paranuchal and anterior lateral plates, and as there are two specimens of the nuchal plate which exhibit distinctive features compared to *T. novaustrocambricus* of the same size, the differences between the type species and *T. maclartiensis* sp. nov. are unlikely to be due to abnormality or changes during growth.

DESCRIPTION: Nuchal plate. NMVP159887 shows the posterior half of the plate perfectly preserved whereas MUGD6064 gives an overall estimation of proportions of the entire plate. Proportions are similar to *T. novaustrocambricus* but the posterior margin is straight and the posterior profile of the plate is lower. White (1978, p. 186) noted that in *T. novaustrocambricus* the occipital region of the nuchal plate is raised strongly, more so in larger plates. Examination of the British Museum specimens confirmed that this is a feature of all specimens, and as the occipital region of the nuchal is not strongly elevated in the two specimens from Buchan it is assumed to be a specific characteristic of *T. novaustrocambricus*. The middle part of the posterior margin of the nuchal in *T. maclartiensis* (Fig. 5) is only slightly concave, whereas in all specimens of *T. novaustrocambricus* this margin is strongly concave medially (bordering the posterior face, giving the whole of the posterior margin a W-shape seen in Fig. 8A, B). As in the type species the infranuchal pits (inp) are also large and deep in *T. maclartiensis*, being stepped in NMVP159887 with the deepest excavation in the anterior half and the infranuchal ridge (inr) giving way anteriorly to a median depression (med. dep). The posterolateral corner of each infranuchal pit has a clearly marked deep groove (can) leading to the ventromesial corner of the ventral muscle attachment region (v. mus) on the posterior face of the plate. MUGD6064 is very worn in this region but still shows vestiges of the canals. The epiotic prominences (ep) are clearly seen immediately posterior to these canals in the holotype (Fig. 5). The supraoccipital spine (mpr) is a bifid structure with smaller pointed protuberances (pr) flanking each side close to the dorsal margin. Below the supraoccipital spine is a broad concave area, presumably for attachment of the medial division of the levator capituli muscles. Lateral to the epiotic prominences is an extensive, smooth region for other muscle attachment (v. mus), and dorsal to this field on the posterior face of the plate is a posterior muscle attachment area (p. mus). White (1978) noted the presence of foramina for the posterior cerebral veins around the supraoccipital spine on the nuchal plate of *T. novaustrocambricus*. In the holotype of *T. maclartiensis* there are numerous small pores in this region (vas. c), presumably for vascular supply, but large conspicuous foramina are not present. The dorsal smooth overlap flange for the extrascapular plates appears to be more extensive for the holotype of *T. maclartiensis* than for any of the figured specimens of *T. novaustrocambricus*, but such differences are difficult to define as specific characters. As in the type species there are two-tiered overlap areas for the paranuchal plates (oa1PNu, oa2PNu). At the junction of the thin anterior overlap lamina with the thicker posterior overlap area on the holotype there is a semicircular median thickening intermediate in height between the two levels (Fig. 8A, oaPNu).

The paranuchal plate is well preserved on NMVP41829 (Fig. 6A), where it is articulated to part of the nuchal plate, missing only the posteromesial corner. This specimen differs from the paranuchal plates of *T. novaustrocambricus* in having a straight posterior margin (pm) which forms an angle of 50°from the suture with the nuchal plate. All the figured paranuchal

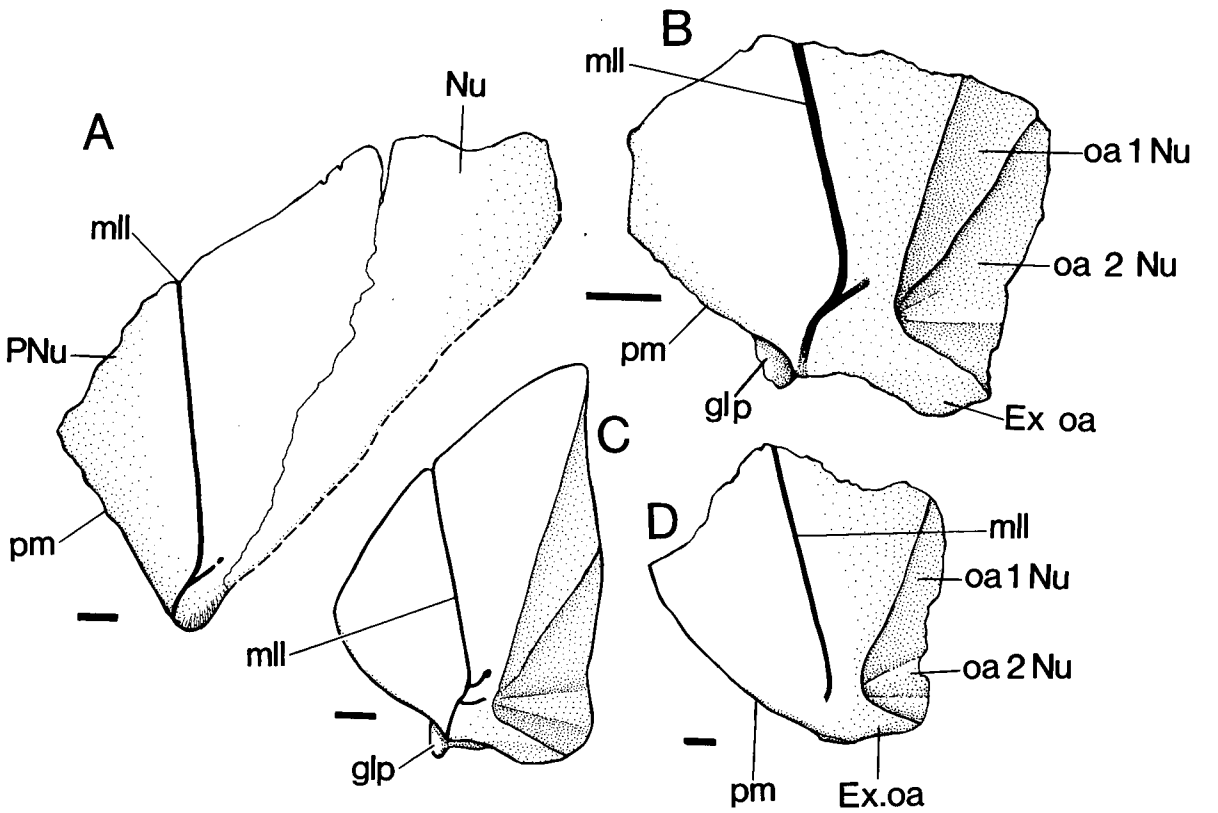


Fig. 6 – *Taemasosteus* paranuchal plates in dorsal view. A, *T. maclartiensis* NMVP41829, Buchan. B-D, *T. novaustrocambricus*. B, NMVP159886, Buchan. C, restoration of paranuchal plate by White (1978, fig. 77, reversed to match other plates figured here). D, British Museum specimen P33712, Taemas, from White (1978, pl. 9C). Bar scale equals one centimetre. Ex.oa, area overlain by extrascapular plates; glp, glenoid process; mll, main lateral line canal groove; Nu, nuchal plate; oa1Nu, oa2Nu, areas overlapped by nuchal plate; pm, posterior margin of paranuchal plate; PNu, paranuchal plate.

plates of *T. novaustrocambricus* have convex posterior margins and make an angle close to 65°with the external contact margin of the nuchal plate (White 1978, pl. 9A, C, D; Fig. 6 B, C, D). The course of the main lateral line-canal (mll) is essentially as in the type species.

The anterior lateral plate of *T. maclartiensis* (Fig. 7A, E) differs from that of the type species in having a smaller number of toothed ridges on the apronic lamina. In the figured specimens of *T. novaustrocambricus* (White 1978) and in CPC25337 there are 7-10 toothed ridges on the apron, whereas the Buchan specimen shows only 4. As the best preserved specimen of this plate of *T. novaustrocambricus* (White 1978, pl. 12A) is approximately the same size as the Buchan specimen these differences cannot be attributed to growth changes and are here regarded as specific features. Another difference between the species is that the apronic lamina is strongly inturned on *T. maclartiensis*, forming an angle of 65° to the lateral lamina of the trunkshield, compared to 44° for that of the type species, as measured on CPC25337.

EUARTHRODIRA gen. indet.

MATERIAL: NMVP159890, an almost complete left suborbital plate (Fig. 7F) from the base of the Rocky Camp Member, Murrindal Limestone, Buchan Group, on the eastern slope of Rocky Camp Hill (Fig. 1).

REMARKS: This large specimen bears very little dermal ornament which is concentrated close to the centre of radiation of the plate, and these are of low rounded tubercles.There is no orbital notch present, but there is a well developed linguiform process for attachment of the autopalatine. This feature is characteristic of higher brachythoracids (Dennis & Miles 1983, Young 1981b), being absent on forms such as *Holonema* (Miles 1971), *Buchanosteus* and *Goodradigbeeon* (Young 1979, White 1978). The figured suborbital plates of *Taemasosteus novaustrocambricus* (White 1978) differ in having an orbital notch, but are otherwise similar to this specimen (except that the presence of a linguiform process is not known). In the absence of features linking this plate to any of the recorded brachythoracids from Buchan or

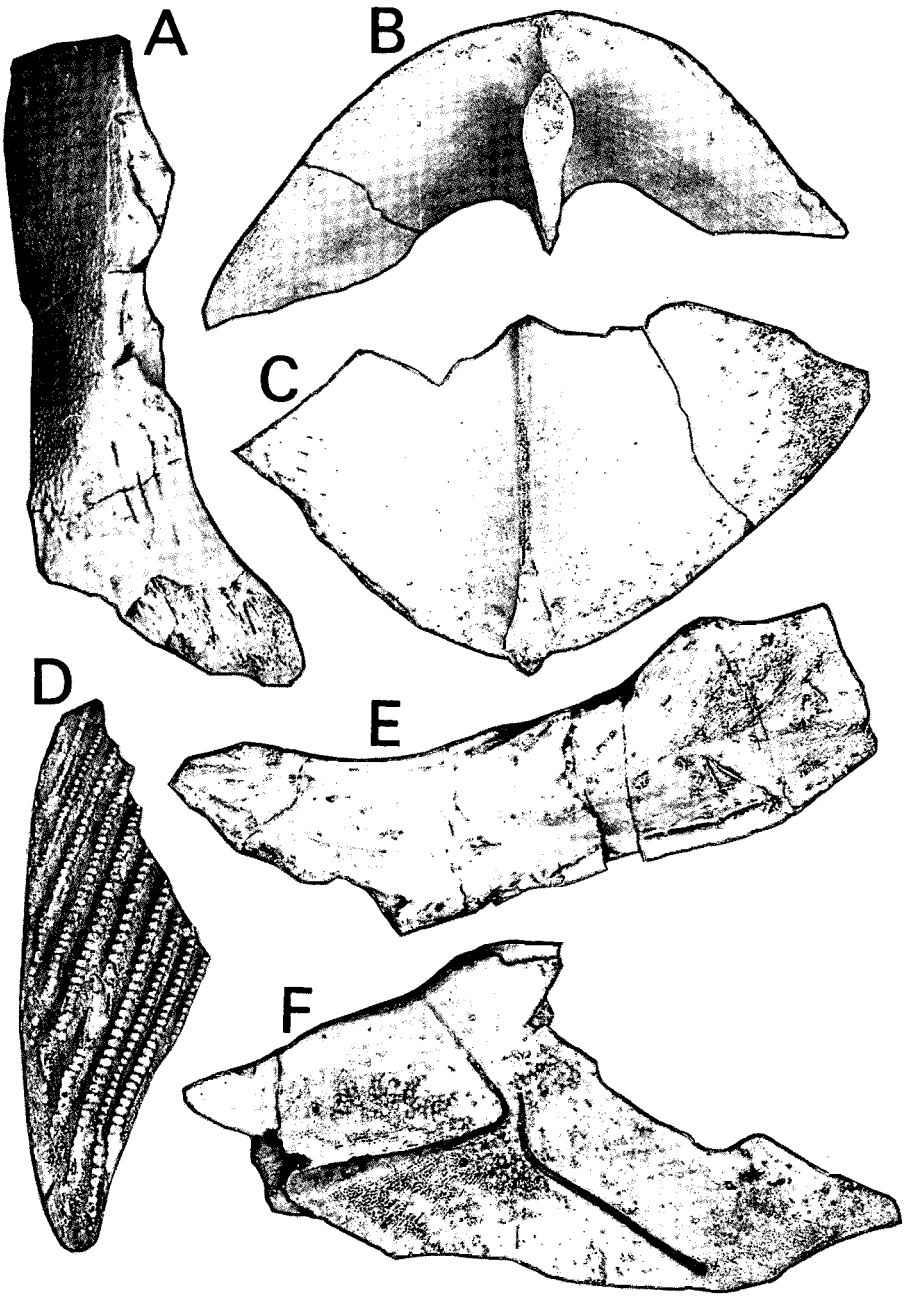
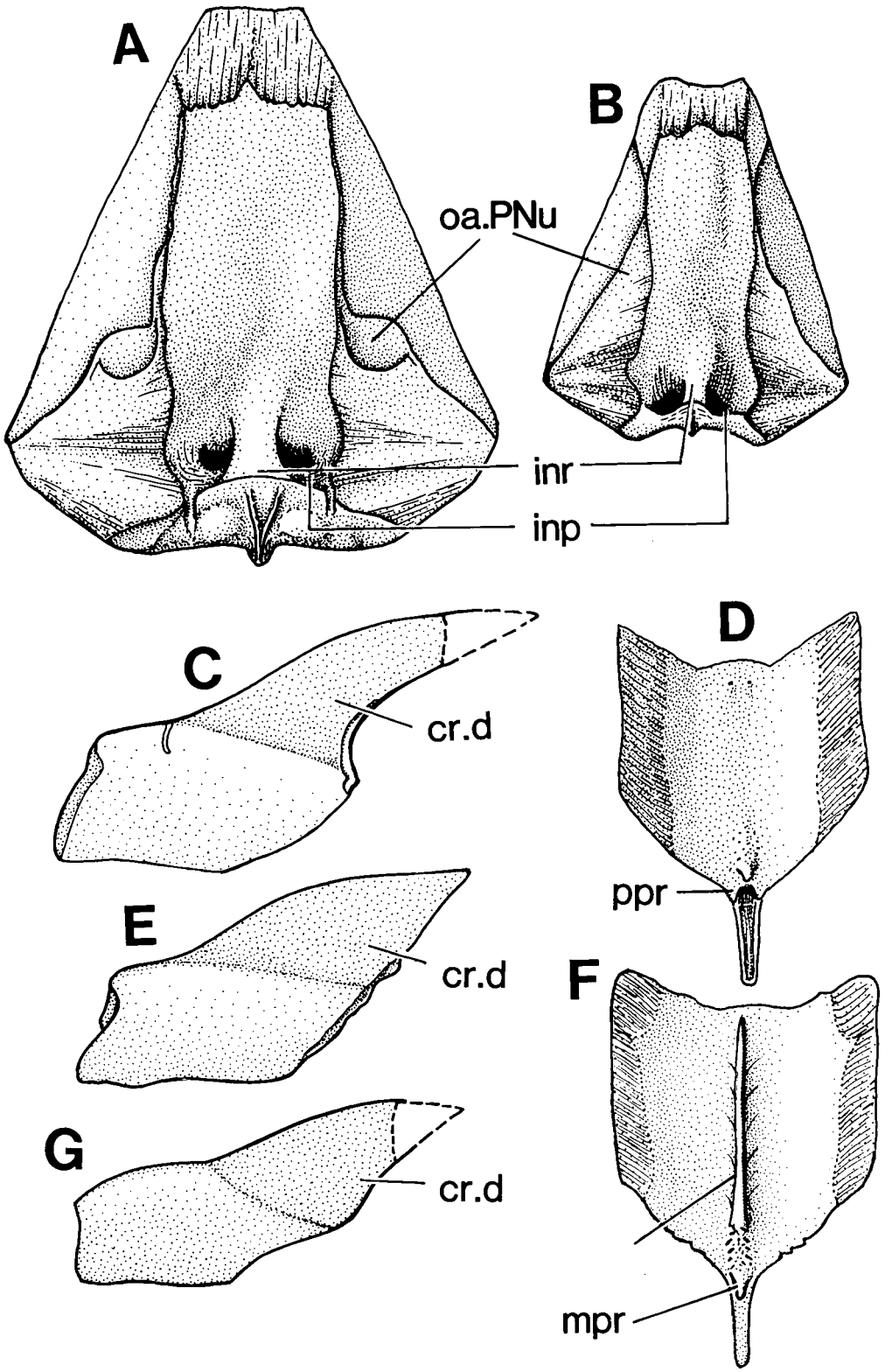


Fig. 7—A, E, *Taemasosteus maclartiensis* sp. nov., right anterior lateral plate in A, anterior, and E, mesial views. NMVP159891, ×1. B, C, D, *Taemasosteus* cf. *T. novaustrocambricus*. B, C, median dorsal plate in B, posterior and C, ventral views, NMVP159888, ×0.8. D, right interolateral plate, NMVP161865 in anterior view, ×1.5. F, Brachythoracid euarthrodire, genus indeterminate, left suborbital plate in lateral view, NMVP159890, ×1. All whitened with ammonium chloride.

Fig. 8—Comparison between A, *Taemasosteus maclartiensis* and B, *T. novaustrocambricus* nuchal plates in ventral view. A, restoration based on holotype, NMVP159887, B, from White (1978, fig. 78). C-F, comparison between palaeacanthaspidoid median dorsal plates in left lateral (C, E, G) and ventral (D, F) views. C, D, *Murrindalaspis wallacei* gen. et sp. nov. E, F, *Weejasperaspis gavini*. G, *Palaeacanthaspis vasta*. E, F, G from White (1978, figs 12, 15, 19). cr.d, medial dorsal crest; inp, infranuchal pit; inr infranuchal ridge; mpr, median ventral process; oa. PNu, area overlapped by paranuchal plate; ppr, paved posterior processes at base of crest; vk, median ventral keel.


A
B
oa.PNu
inr
inp
C
cr.d
D
ppr
E
cr.d
F
G
cr.d
mpr

Taemas I refer this suborbital plate to indeterminate Euarthrodira.

DISCUSSION

Some Comments on Phylogenetic Positions of Placoderms from Buchan

The phylogenetic position of the placoderms *Buchanosteus*, *Arenipiscis*, *Errolosteus* and *Taemasosteus* has been thoroughly discussed by Young (1979, 1981b, with further comments on *Buchanosteus* by Denison (1978), Dennis-Bryan & Miles (1983), and White (1978), and on *Taemasosteus* by White (1978) and Denison (1978). Young concluded that these euarthrodires are primitive phlyctaenaspidoids relative to the well known coccosteomorphs and higher groups such as pachyosteomorphs. *Taemasosteus* is regarded as the most specialized of the Buchan/Taemas euarthrodires by virtue of the shortened trunkshield, and may be the sister taxon to *Tityosteus* from the Lower Devonian Rhineland fauna of Germany (Gross 1960). *T. maclartiensis* is undoubtedly a sister species to *T. novaustrocambricus* and does not share any extra features with *Tityosteus* to indicate otherwise.

Murrindalaspis is a palaeacanthaspidoid (*sensu* Miles & Young 1977) known only from the median dorsal plate. Of the palaeacanthaspidoids in which this plate is known (*Dowbrowlania*, *Kimaspis*, *Kosoraspis*, *Palaeacanthaspis* & *Radotina* Denison 1978, *Weejasperaspis* White 1978) only *Palaeacanthaspis* and *Weejasperaspis* possess a well-developed high median dorsal crest comparable to that in *M. wallacei*, although both *Kosoraspis* and *Radotina* possess small median crests similar to *M. bairdi* (Stensiö 1969, Westoll 1967). Three characters can be utilized in an hypothesis of relationships based upon the median dorsal plate of palaeacanthaspidoids: development of the median dorsal crest, development of a median ventral ridge, and the complexity of the ornamentation. All placoderms primitively possess a simple tubercular ornamentation (Denison 1978, Janvier & Pan 1982), which may develop into complex linear ridges, reticulate networks or complex ridged tubercles in different lineages. The presence of a complex ornament pattern, of similar organization, between *Murrindalaspis* and *Weejasperaspis*, taken with their overall similar shape and proportions suggests a close relationship between these genera. Although median dorsal crests have been independently developed in different lineages of placoderms (*Wuttagoonaspis* Ritchie 1973, groenlandaspids Ritchie 1975, *Byssacanthus* Denison 1978, *Bothriolepis cullodenensis* Long 1983a) and may generally be attributed to similar function (homoplasy), the ornament patterns are rarely very similar in different groups, except for primitive groups which share a plesiomorphic dermal ornament (e.g. actinolepidoids and yunnanolepidoid antiarchs) or broadly similar patterns (e.g. phyllolepids, *Wuttagoonaspis*, *Holonema*). The ventral keel of *Weejasperaspis* is interpreted as a specialization, presumably for articulation of an intermyotomal submedian dorsal plate, as in higher euarthrodires. The ventral keel is primitively absent in placoderms (Miles & Dennis 1979, Young 1981b, Denison 1978). I conclude that on the similar development of a complex ornament *Murrindalaspis* is the sister taxon of *Weejasperaspis*. Young (1980) has noted the close similarity between the trunkshield of *Weejasperaspis* to *Brindabellaspis*, commenting that they are probably closely related. Until more remains of *Murrindalaspis* are found it will be unknown whether this genus is more closely related to *Brindabellaspis* than to *Weejasperaspis*.

Comparison of the Ichthyofauna from Buchan

The ichthyofauna from the Buchan Group closely resembles that of the contemporaneous Murrumbidgee Group, New South Wales. Both faunas contain the following taxa, most being endemic to southeastern Australia:

PLACODERMI
Euarthrodira
Brachythoracid phlyctaenaspidoids
Buchanosteus confertituberculatus, *Arenipiscis westolli*, *Errolosteus goodradigbeensis*, *Taemasosteus novaustrocambricus*.
Petalichthyomorpha
Wijdeaspis warrooensis

In addition the palaeacanthaspidoids from both faunas are closely related forms (*Murrindalaspis* and *Weejasperaspis*), and appear to represent the youngest members of this group worldwide (with *Brindabellaspis* Young 1980) as almost all other palaeacanthaspids are described from Gedinnian or Siegenian deposits (Denison 1978). The petalichthyid *Wijdeaspis* is also known from the Middle Devonian of Spitsbergen and Severnaya Zemlya (Young 1978), so its Australian occurrence appears to be slightly older (Emsian). The lungfish *Dipnorhynchus* occurs at Buchan and in the Taemas/Wee Jasper faunas, as well as in the Lick Hole Limestone near Kiandra (Campbell & Barwick 1982). The German occurrence of *Dipnorhynchus lehmanni* (Lehman & Westoll 1952) from the Rhineland faunas has been commented on by Campbell & Barwick (1983) as probably referrable to the Australian genus *Speonesydrion*, making *Dipnorhynchus* an endemic Australian genus. The fish faunas from the Lower Devonian of Australia contain mostly endemic genera which has led Young (1981a) to suggest that East Gondwana formed an endemic province in the Early Devonian. More systematic description of Australian Early Devonian fish fossils is necessary before detailed comparisons with Northern Hemisphere fish faunas can be evaluated fully.

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