

AUSTRALIAN MUSEUM SCIENTIFIC PUBLICATIONS

Fletcher, Harold O., 1964. New linguloid shells from Lower Ordovician and Middle Palaeozoic rocks of New South Wales. *Records of the Australian Museum* 26(10): 283–294, plates 31–32. [17 July 1964].

doi:10.3853/j.0067-1975.26.1964.678

ISSN 0067-1975

Published by the Australian Museum, Sydney

nature culture **discover**

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NEW LINGULOID SHELLS FROM LOWER ORDOVICIAN AND MIDDLE PALAEOZOIC ROCKS OF NEW SOUTH WALES

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Plates 31 and 32

Manuscript received, 14-4-61

ABSTRACT

New species of linguloid shells, *Ectenoglossa brunnschweileri*, *Obolus mootwingeeensis* and *Lingulella (Leptembolon) gnaltaensis*, are described and figured from Lower Ordovician (Tremadoc) rocks of the Gnalta Stage in the West Darling District of New South Wales. Recent palaeontological evidence of the age of the Mulga Downs Formation, East Darling District, previously correlated with the Mootwingee Series, is also mentioned. New species of *Lingula* are also described and figured from various Upper Silurian and Devonian localities.

INTRODUCTION

Rocks of the Mootwingee Series are exposed west of the Darling River in the Mootwingee Ranges and contiguous slopes. The term Mootwingee Series was introduced for this group of rocks by Andrews (1922, p. 71) and although recognizing in general appearance a similarity to beds of Devonian age in the eastern portions of the State he was of the opinion they were much older than Devonian and were at least of very early Palaeozoic age.

The Mootwingee Series was subdivided into a lower or Gnalta Stage and an upper or Mootwingee Stage by Kenny (1934, p. 53), who stated that there was no evidence of the specific age of the Mootwingee Series beyond the fact they are post-Torrawangee and pre-Jurassic. It was pointed out by Kenny (1934, p. 53) and by Mulholland (1940, p. 16) that the rocks of the Mulga Downs Formation, which occur east of the Darling River, were lithologically and structurally very similar to those of the Mootwingee Stage. Fossil remains had not been found in either of the sequences but it was accepted by many that they were contemporaneous and were of Upper Devonian age.

The first fossils found in rocks of the Mootwingee Series were a series of linguloid shells which were collected by R. C. Sprigg, Geosurveys of Australia Pty. Ltd., from the upper part of the Gnalta Stage at a locality alongside the old White Cliffs-Mootwingee Road, about eight miles from Mootwingee Homestead. In an unpublished report on this material, R. O. Brunnschweiler in 1957 stated that, although it is not possible to obtain a specific age to the Mootwingee Series on the evidence of the Lingulacea, he considered it reasonable to assume an Upper Devonian or Lower Carboniferous age for the sequence when all the circumstantial evidence was considered.

During a geological reconnaissance of the Mootwingee area in 1957, J. Spence, Frome-Broken Hill Co. Pty. Ltd., collected similar linguloid shells from several localities, including two to three and a half miles between bearings 262° and 287° from Mount Wright Well (Tank 18 on Kenny's map). In 1959, the author accompanied Messrs. R. E. Relph and G. Rose, Geological Survey of New South Wales, to the Mootwingee Ranges and collected linguloid shells from various localities near the old mail road from White Cliffs to Mootwingee, at points from eight to ten miles from Mootwingee Homestead. These localities included that from which R. C. Sprigg collected the original linguloid material. The linguloid shells are very numerous at this locality and occur in a medium of fine-grained yellowish sandstone which outcrops alongside the road. In this bed *Ectenoglossa brunnschweileri* predominates with only occasional shells of *Lingulella (Leptembolon) gnaltaensis*, while in an overlying bed of a dark coloured coquinite type of rock the shells are mainly those of *Obolus mootwingeeensis*.

In September, 1960, Messrs. R. A. Warner and J. Harrison, Delhi Australian Petroleum Ltd., found an outcrop of limestone about two miles south of the Gnalta woolshed. Samples, forwarded to the author, were etched and proved to contain a crowded and comprehensive fauna of perfectly preserved brachiopods and trilobites of definite Middle Cambrian age (Warner, 1961, p. 268).

Following this discovery of the first Cambrian rocks in New South Wales, and because of work being carried out in the area by the Geological Survey of New South Wales, a party including Mr. L. Hall (Geological Survey of New South Wales), Dr. A. A. Öpik (Bureau of Mineral Resources, Canberra), and the author visited the area to carry out field investigations particularly in respect to the fossil fauna.

At this time Messrs. P. S. Lavers and W. H. Jones, of the Geological Survey of New South Wales, had established the following stratigraphic column, which is a modified version of that suggested by A. A. Öpik:—

Upper Cambrian—Lower Ordovician	Sequence IX Mootwingee Series	Shales, sandstones and conglomerates.
Upper Cambrian—Lower Ordovician	Sequence VIII	Shales and siltstone.
Upper Cambrian	Sequence VII	Greywackes, conglomerates calcareous and felspathic sandstone.
Middle Cambrian	Sequence VI	Shales and marls with limestones.
Lower Cambrian—Middle Cambrian	Sequence V	Shale and tuffs with glauconite.
Lower Cambrian	Sequence IV	Acid volcanics, tuffs, shales and cherts.
?	Sequence III	Greywackes, limestones and acid volcanics.
? Upper Proterozoic	Sequence II	Quartzites, red shales, quartz-felspar arenites and conglomerates.
Proterozoic—Archaean	Sequence I	Schists and phyllites.

During the field investigations collections of fossils were made from sequences IV to IX. Archaeocyathids were collected from lenticular limestones near the base of Sequence IV at a locality north-west of Mount Wright. From Sequences V to VIII numerous beautifully preserved trilobites and brachiopods (not linguloids) were collected and the trilobite fauna is now in the course of being described by A. A. Öpik. The Middle Cambrian fauna, including an abundance of *Pagetia*, recorded by Warner (1961, p. 268) occurs in Sequence VI. The linguloid shells from the top of the Gnalta Stage of Kenny, Mootwingee Ranges, have been determined as Lower Ordovician forms and the beds have been referred to Sequence IX. Specimens of *Lingulella* (*Leptembolon*) *gnaltaensis*, rare in the beds at that locality, also occur in rocks outcropping near the woolshed of Gnalta Station (Nucha 1 mile sheet, 1.4 miles at bearing of 295° from Gnalta Well), where they are unassociated with other linguloid species. These beds have been assigned to Sequence IX. This species appears to be congeneric with a linguloid collected at about 12 miles south-west of Alice Springs in beds of the Pacoota Sandstone Formation which is within the limits of late Upper Cambrian and early Lower Ordovician.

In a personal communication I have been informed by Dr. Öpik that in Sequence VIII the lower trilobite horizon is certainly Lower Ordovician (Tremadoc) while the orthoids below could be the top of the Upper Cambrian; in Sequence VII trilobites of the Richardsonellidae have an upper Upper Cambrian aspect by central Australian standards.

The Age of the Mulga Downs Formation

The rocks of the Mulga Downs Formation which occur east of the Darling River have in the past been considered to be contemporaneous with those of the Mootwingee Stage because of a strong lithological and structural similarity. Fossil remains were unknown from the Mulga Downs Formation but it was generally accepted they were of Upper Devonian age.

Several years ago, J. Spence collected well-preserved fish-plates and spines from the Mulga Downs Formation at a locality about six miles from the Wittagoona Homestead. A more comprehensive suite of specimens was later collected from the same locality by E. O. Rayner, Geological Survey of New South Wales, and the author. The fish remains occur in a thin bed of quartz sandstone near the basal beds of the formation and current-bedding, rain-prints and mud-flow casts indicate a shallow water environment.

A second occurrence of fish-remains was located by R. Russell, Cobar Mines Pty. Ltd., at the site of a new tank on Mt. Grenfell Station near its boundary with Tambua Station. A visit to this locality, which, in a direct line, is about 25 miles south of the Wittagoona locality, resulted in a collection of fish-plates very similar to those from Wittagoona and there appears little doubt that both occurrences belong to the same horizon. Further discoveries of fish-plates within the Mulga Downs Formation have recently been made by G. Rose and G. R. Wallis, Geological Survey of New South Wales, and L. Hall, Planet Oil Company.

Following an examination of the fish-plates and spines, Professor E. S. Hills stated that there was no doubt of their Upper Devonian age. I am also indebted to Dr. Thor Örvig, Swedish Museum of Natural History, for the following information, which was submitted to me after an examination of enlarged photographs of the fish material: "Typical *Phyllolepis* plates are present and other fish remains including

antiarchs and various arthrodires, some of which appear to be new. Two specimens show a circular orbital opening, sensory line canals, and an ornamentation in all probability belonging to a new arthrodire. Another interesting specimen is part of the ventral side of the dermal shoulder girdle of an arthrodire, either belonging to a late representative of the Dolichothoraci (Arctolepida), or to a Coccosteomorph Brachythoracid". Dr. Ørvig concluded that there can be no doubt at all of an Upper Devonian (Famennian) age for the fish fauna.

In this paper the linguloid shells from the Mootwingee Ranges are described and figured, together with other new species from various localities in New South Wales. *Lingula gregaria* Etheridge is redescribed and refigured. The new species are:—

- Ectenoglossa brunnschweileri*. Lower Ordovician.
Obolus mootwingeeensis. Lower Ordovician.
Lingulella (Leptembolon) gnaltaensis. Lower Ordovician.
Lingula merrimbulensis. Upper Devonian.
Lingula adamsoni. Upper Silurian.
Lingula murrumbidgeensis. Middle Devonian.

Acknowledgments: The author wishes to express his thanks to Professor W. C. Bell, University of Texas, U.S.A., and Dr. G. A. Cooper, United States National Museum, for many helpful suggestions concerning the identification of the Mootwingee linguloids; to Dr. A. A. Öpik, Bureau of Mineral Resources, Canberra, and also to Mr. R. C. Sprigg, Geosurveys of Australia Ltd., for a series of linguloids from the Gnalta Formation and also for permission to use information in an unpublished report on the Gnalta fossils by R. Brunnschweiler.

SYSTEMATIC DESCRIPTIONS

Order **Atremata** Beecher, 1891

Superfamily **Obolacea** Schuchert, 1896

Family **Obolidae** King, 1846

Subfamily **Obolinae** Dall, 1870

Genus **Obolus** Eichwald, 1829

Obolus mootwingeeensis, sp. nov.

(Pl. 31, figs. 1-3, 8; pl. 32, figs. 13, 14)

Holotype F.47427; paratypes F.49056, F.47422. Australian Museum collection.

Description: Shell large, rounded-subtriangular in outline, apical angle about 80°, greatest width slightly anterior to the middle; postero-lateral margins gently curved, almost straight, then broadly curving anteriorly to gradually merge into the slightly curved anterior margin; surface ornamentation consists of fine radiating striae and concentric growth lines with more distant undulations; valves moderately convex posteriorly with fairly steep, rounded lateral slopes in the posterior one-third, convexity gradually but perceptibly flattening towards the anterior margin; umbonal region more acuminate and convexly rounded in the pedicle valve; a fine median ridge extends from the beak to less than half the length of the valve.

Measurements:—

	Holotype	Paratypes	
	F.47427	F.49056	F.47422
Length	29 mm.	32 mm.	26 mm.
Width	22 mm.	29 mm.	21 mm.

Remarks: This species is based on a comparatively large series of both brachial and pedicle valves which vary in size from about 16 mm. to 32 mm. In no instance, however, has it been possible to determine any definite or diagnostic internal features. Several immature specimens indicate that *O. mootwingeensis* is more rounded in outline in younger shells but with growth becomes progressively more acuminate and subtriangular.

In general appearance, like most linguloids, this species is suggestive of several genera but it has been referred to the genus *Obolus* because of its marked resemblance, and apparent agreement in characters, to *O. feistmanteli* (Barrande) from rocks of Lower Ordovician age in Europe. Walcott (1912, p. 391), in a description of this species, mentions the presence of minute terminal vessels which cross the inner surface of the valves near the antero-lateral margins. This pattern of marginal sinuses, figured by Walcott (1912, pl. 12, figs. 9, 9a), is visible on three partly exfoliated specimens of *O. mootwingeensis* (specimens F.48963, F.48974 and F.47424). This feature, pointed out to me by Professor Bell, has not been illustrated elsewhere in regard to species of linguloids.

The presence of fine radiating striae on the inner lamellae, revealed on exfoliated shells, is common to both species but this feature is common in many linguloid shells. Most of the specimens of *O. mootwingeensis* are in various stages of exfoliation and the lamellae appear as imbricating layers which are thickened on the postero-lateral slopes. When completely exfoliated a narrow, well-defined, marginal rim is found to extend along the lateral margins of the valve diminishing in strength towards and around the lateral margins. This is a feature which appears to be similar to that recorded by Walcott (1912, p. 391), and illustrated (1912, pl. 12, figs. 1b and 1e).

No linguloid shells in any way similar to *O. mootwingeensis* have previously been recorded from Australian rocks. It differs from *O. feistmanteli* (Barrande) in its generally larger size, its more acuminate and subtriangular outline and the presence of a posterior median sinus.

Localities and geological horizon: Creek on side of old Mootwingee-White Cliffs Road, via Mount Wright, about eight miles from Mootwingee Homestead; northern side of Mootwingee Range, one mile north of old Mootwingee-White Cliffs Road, about eight miles from Mootwingee Homestead. Upper part of Gnalta Stage, Mootwingee Series, Lower Ordovician.

Subfamily **Linguellinae** Schuchert, 1893

Leptembolon Mickwitz, subgenus of **Lingulella**

Lingulella (Leptembolon) gnaltaensis sp. nov.

(Pl. 31, figs. 7, 9)

Holotype F.49383; paratype F.49344. Australian Museum collection.

Description: Shell of comparatively small size, slightly longer than wide, pointedly ovate to subtriangular in outline and the greatest width located anterior to the middle; apical angle of the pedicle valve about 100°; lateral margins very

gently curved, almost straight, posteriorly, rather narrowly rounded at the antero-lateral extremities and passing into a gently curved, almost straight, anterior margin; two slightly pronounced roundish edges diverge from the beak to the antero-lateral extremities separating the somewhat flattened surface of the valve from short, steeply sloping lateral and anterior slopes; lateral profile gently convex, beak blunt and rounded; surface sculpture consists of concentric lines of growth with strong undulations anteriorly; exfoliated shells reveal strong and widely separated radial striae with occasional apparent pustules. Details of the interior unknown.

Measurements:—

	Holotype	Paratype
	F.49383	F.49384
Length	16 mm.	18 mm.
Width	15 mm.	17 mm.

Remarks: This species is characterized by its somewhat subtriangular outline, relatively deep and even convexity and short, steeply sloping margins. The figured specimens are brachial valves and are shorter and more rounded at the apex than the pedicle valves.

It has not been possible to determine any definite generic characters of this species but it has a very close resemblance to shells of *Lingulella* (*Leptembolon*) *linguliformis* (Mickwitz) discussed by Walcott (1912, p. 542), from Upper Cambrian and passage beds between the Upper Cambrian and Lower Ordovician of Esthonia. Walcott refers to the characteristic subtriangular outline of the shells, the flat arching, the presence of two roundish edges which converge into the tip of the beak and the lateral and anterior vertical flattening of the borders. These features are also characteristic of *L. (Leptembolon) gnaltaensis* and it is considered there are close affinities between the two species. The Australian shells are larger in size and generally more truncate anteriorly.

Shells of this species occur in the Gnalta Stage (upper beds), in the Mootwingee Ranges and also in beds of Sequence IX, which outcrop near the Gnalta Station woolshed (Nucha 1 ml. sheet, 1.4 mls. at bearing of 295° from Gnalta Well), where they are unassociated with other linguloid species. The species appears to be congeneric with linguloid shells collected by A. A. Öpik and A. D. M. Bell, Bureau of Mineral Resources, from a locality about 12 miles south-west of Alice Springs, Northern Territory. These shells are abundant in the Pacoota Sandstone, the age of which is within the limits of late Cambrian and late Tremadocian (early lower Ordovician).

Localities and geological horizon: Mootwingee Ranges Creek alongside old Mootwingee-White Cliffs, via Mount Wright, mail road, about eight miles from Mootwingee Homestead; near woolshed of Gnalta Station. Lower Ordovician.

Subfamily **Glossellinae** Cooper, 1956

Genus **Ectenoglossa** Sinclair, 1945

Ectenoglossa brunnschweileri sh. nov.

(Pl. 31, figs. 4-6; pl. 2, fig. 15)

Holotype F.49027, paratypes F.48995, F.49014. Australian Museum collection.

Description: Shell large, elongate, narrowly rectangular, gradually tapering posteriorly to form a sharp and pointed beak in the pedicle valve; brachial valve shorter and rounded at the apex; length more than twice the width with the greatest

width located at about the anterior one-third of the shell; lateral margins gently curved, subparallel, on the anterior half then gradually tapering posteriorly to the apex; anterior margin nearly straight with almost right angle antero-lateral extremities; shell surface smooth, marked by fine concentric lines with occasional ill-defined undulations of growth; inner shell layers marked by distinct and relatively well-separated radiating striae; shell material thin. Valves gently and evenly convex in profile with a slight flattening towards the anterior margin; lateral slopes very slight; a narrow prominent ridge, developed on the interior of each valve, extends along the median line in the anterior half to two-thirds, increasing gradually in width towards the anterior margin.

Measurements:—

	Holotype	Paratypes	
	F.49027	F.48995	F.49014
Length	27 mm.	29 mm.	23 mm.
Width	12 mm.	13 mm.	12 mm.

Remarks: This is a most characteristic species, the shells of which in general appearance look more like the living *Lingula* and *Glottidia* than most fossil linguloids. The genus *Ectenoglossa* (genotype) *Ectenoglossa lesueuri* (Rouault, 1850), was proposed by Sinclair (1945, p. 63) for "shells of elongate linguloid form, thick heavy valves, and with two 'teeth' in the posterior part of the shell". Three shells of *E. lesueuri*, figured by Davidson (1866, pl. i, figs. 1-3) bear a very close resemblance in general outline with the Australian shells of *E. brunnschweileri*. Hall and Clarke (1892, p. 63) mentioned the presence in internal casts of "*Lingula* ? *Lesueuri* Rouault" of two deep pits close to the beak, a feature which is present in *E. brunnschweileri*.

In a description of these shells from the Mootwingee Range, R. O. Brunnschweiler (1957, unpublished report), recorded that "the pedicle opening is shared by both valves; it is deeply counter-sunk into the apical part of the umbos and there is a slight thickening of the shell at the anterior end of the pedicle openings". This feature was suggestive of the genus *Barroisella*, restricted to rocks of Upper Devonian and Lower Carboniferous age, and Brunnschweiler identified the material as *Barroisella* sp. nov. aff. *Lingula squamiformis* Phillips. He recorded the surface ornamentation as follows: "Externally the valves are smooth except for their anterior parts, where strong growth lines from centrally overlapping shell layers become visible. All larger specimens also show a very distinct radial ornament of very fine lines and riblets and of radial wrinkling between the various layers of the shell".

This species also has a superficial resemblance to *Ectenoglossa nymphoidea* Cooper (1912, pl. 2, figs. 12-20), but differs from that species in being more progressively pointed posteriorly, its smaller size, and in the presence of a median ridge in both valves. It differs from *E. lesueuri* (Rouault) in general outline, the posterior two-thirds of the shell being considerably narrower and pointed.

Locality and geological horizon: Alongside creek on side of old Mootwingee-White Cliffs mail road, via Mount Wright, about eight miles from Mootwingee Homestead. Near top of Gnalta Stage, Mootwingee Series, Lower Ordovician.

SPECIES FROM OTHER LOCALITIES IN NEW SOUTH WALES

Genus **Lingula** Bruguière**Lingula merrimbulensis** sp. nov.

(Pl. 32, figs. 9-12)

Holotype F.46149, paratypes F.46150, F.46155; Australian Museum collection.

Description: Shell of medium size, rectangular in outline and about twice as long as wide; sides parallel for the greater length of the shell, bluntly pointed posteriorly, strongly truncated anteriorly; beak small and only slightly projecting; valves moderately convex posteriorly, flatly ridged, wide gently concave sloping lateral slopes, considerably flattened anteriorly. Surface marked by distinct concentric lines with more conspicuous growth lines near the margins.

Measurements:—

	Holotype	Paratypes	
	F.46149	F.46155	F.46150
Length	13.5 mm.	10 mm. (x)	8 mm. (x)
Width	6 mm.	6 mm.	6.5 mm.

(x) incomplete measurement.

Remarks: This species is known by a series of only 10 specimens, mostly incomplete, from the type locality. It is found in a fine ferruginous sandstone in which, apart from a few isolated crinoid stem segments, no other fossils occur. The shell is very thin and fragile and in most specimens the anterior one-third of the valve has broken away. The holotype, a pedicle valve, shows the anterior portion detached but still in position; another incomplete specimen, F.46153 (pl. 32, fig. 9), also has the anterior portion of the valve preserved. It is difficult to determine between ventral and dorsal valves, but it appears that the former has a more defined beak and a greater convexity in the posterior median position.

This species is readily distinguished from other Australian species of Devonian age by its almost rectangular outline, straight anterior margin, and gently arched posterior margin.

Locality and geological horizon: Road cutting, 200 yards north of Bellbird Creek on the Prince's Highway, three miles north of Eden, N.S.W. Lower part of the Merrimula Formation, Upper Devonian.

Lingula adamsoni sp. nov.

(Pl. 2, figs. 4-7)

Lingula sp. Gill, E., 1940, p. 106.

Holotype F.47400, paratypes F.32965, F.47401; Australian Museum collection.

Description: Shell of medium size, slightly longer than wide, sub-oval in outline; lateral margins sub-parallel narrowly curving anteriorly and passing into an almost straight, gently curved, anterior margin; posteriorly the sides converge to form an obtuse posterior margin; valve profile gently convex with a flattening towards the lateral and anterior margins; surface of shell marked by concentric lines more defined near the margins. Shell material thin.

Measurements:—

	Holotype
	F.47400
Length	16 mm.
Width	11 mm.

Remarks: This species is represented by a series of about 20 specimens, all of which have been subjected to pressure and are somewhat crushed and distorted. The holotype, except for a slight buckling of the valve, is practically unaltered and has retained its original shape. One specimen, F.31890 (pl. 32, fig. 6), shows a crumpling of the test due to pressure and appears oval in outline, while another valve, F.32965 (pl. 32, fig. 4), shows distortion due to lateral pressure. This species is very common in the sediments at Oak's Creek, near Cootamundra, the type locality, and there seems little doubt that *Lingula* sp., recorded by Gill (1940, p. 106), from Oak's Creek, belongs to this species.

The species is readily recognized by its somewhat ovate outline and relatively wide valves. The species is named after Mr. C. Adamson, Geological Survey of New South Wales.

Locality and geological horizon: Oak's Creek, near Cootamundra, N.S.W. Upper Silurian.

***Lingula murrumbidgeensis* sp. nov.**

(Pl. 32, figs. 1-3)

Holotype F.29897, paratypes F.46150, F.46155. Australian Museum collection.

Description: Shell of medium size, more than twice as long as wide, narrowly elongate oval in outline; lateral margins slightly curved, almost subparallel, with narrowly rounded posterior and somewhat deeply curved anterior margins; pedicle valve deepest at a point about one-third the length from the beak, sloping to the beak and with relatively steep postero-lateral slopes; swelling continues to the anterior margin along the median area but gradually sloping towards the margin and the antero-lateral margins; brachial valve less swollen than the pedicle valve; surface marked by distinct elevated concentric lines somewhat crowded and more prominent on the lateral and postero-lateral regions; median area relatively smooth.

Measurements:—

	Holotype	Paratypes	
	F.29897	F.49393	F.49395
Length	21 mm.	26 mm.	17 mm.
Width	9 mm.	11 mm.	7 mm.

Remarks: This species was recorded by Benson (1922, p. 169) as occurring in Middle Devonian rocks at Goodradigbee and Wolgarlo as *Lingula* sp. indet. The specimens he listed, F.2382 and F.2506, belong to a fairly large series which is recorded in the official registers of the Australian Museum as having been collected from Cave Flat, Murrumbidgee, a locality now covered by water of the Murrumbidgee Irrigation System. It is almost certain that *Lingula* sp., mentioned by Browne (1958, p. 119), is conspecific with *L. murrumbidgeensis*, that author recording it as being not uncommon at many localities in the Murrumbidgee area in a few calcareous bands of the Majurgong beds.

This species is represented by about 40 specimens, all of which have suffered a certain amount of distortion. There is a considerable variation in the size of the specimens and in most cases the shells are complete with both valves.

The elongate-ovate outline of this species, together with the relatively deeply curved anterior margin and the strong convexity of the median area in the posterior half of the shells, distinguishes it from other Devonian species of the genus.

Localities and geological horizon: Cave Flat; beyond woolshed on Bloomfield Station, Murrumbidgee River, N.S.W. Majurgong Stage, Murrumbidgee Series, Middle Devonian.

***Lingula gregaria* Etheridge**

(Pl. 32, fig. 8)

Lingula gregaria Etheridge, R., 1901, p. 120, text fig. 14.

Lingula gregaria Benson, W. N., 1922, p. 169.

Holotype F.7502, Australian Museum collection.

Remarks: Etheridge (1901, p. 119) recorded that "the remains of this *Lingula* are pressed and matted together in enormous numbers, forming a bed of some thickness and extending over a considerable area, so forming an excellent horizon". He was uncertain, however, whether the geological age of the horizon was Upper Devonian or Lower Carboniferous.

Benson (1922, p. 169) in listing this species recorded its occurrence at Canowindra, Orange and incorrectly at Condobolin. The specimen (F.16513), listed by him as from that locality, is from the type locality at Nyrang Creek. David (1950, p. 249) recorded the zone of *L. gregaria* from Gap Creek, where a layer of impure limestone is composed almost entirely of shells of the species. Sussmilch (1906, pp. 135-136) also recorded the *Lingula* limestone in Gap Creek (portion 276, Parish of Barton), in an unnamed creek on portion 277, and also stated that the species had been obtained from Mount Lambie.

Shells of *L. gregaria* are small, length 7 mm., width 3 mm., elongate subelliptical in outline, with slightly curving almost subparallel sides, gently curving posteriorly to a small projecting beak; antero-lateral margins and anterior margin fairly broadly and similarly curved. Valve surface moderately convex, elevated along a central flattened and triangular area, bounded by two ill-defined ridges which extend from the beak to the extreme antero-lateral margins; shell substance thin and lustrous. Sculpture consists of very fine, almost microscopic striae, which tend to thicken over the marginal parts. At regular and more distant intervals slightly heavy thickenings of the valves mark growth stages.

There is no known species of *Lingula* from Australian rocks with which this species can be compared. Etheridge (1901, p. 119), remarked on its similarity to shells of *L. mytiloides* Sowerby and *L. credneri* Geinitz from the Carboniferous of Britain. This is particularly the case with a specimen of *L. credneri* figured by Davidson (1861, pl. 48, fig. 38) but as usually recognized with linguloid shells most resemblances are entirely superficial.

Localities and geological horizon: Nyrang Creek, five miles from Canowindra (type locality); Gap Creek, Bowan Creek, and Quarry Creek, western flank of Canobolas Mountains, near Orange; Mount Lambie. Upper Devonian.

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EXPLANATION OF PLATE 31

Obolus mootwingensis sp. nov.

1. Holotype F.47427. Mould of a brachial valve.
2. Paratype F.47422. Mould showing the median internal sinus.
3. A steinkern of the holotype F.47439.

Ectenoglossa brunnschweileri sp. nov.

4. Holotype F.49027. A pedicle valve showing the median sinus.
5. Paratype F.48995. Another pedicle valve.
6. F.49014. A brachial valve.

Lingulella (Leptembolon) gnaltaensis sp. nov.

7. Holotype F.49383. A pedicle valve.

Obolus mootwingensis sp. nov.

8. F.48974. An immature valve with preserved shell material showing ornamentation.

Lingulella (Leptembolon) gnaltaensis sp. nov.

9. Paratype F.49344. A pedicle valve showing coarse marginal undulations of growth.

EXPLANATION OF PLATE 32

Lingula murrumbidgeensis sp. nov.

1. Holotype F.29897. A pedicle valve.
2. Paratype. F.49395. A slightly crushed pedicle valve of a complete shell showing general outline.
3. Paratype F.49393. An incomplete valve showing surface markings.

Lingula adamsoni sp. nov.

4. Paratype F.32965. A small and crushed pedicle valve.
5. Holotype F.47400. A supposed brachial valve showing only slight distortion.
6. F.31890. Overlapping of the valve surface due to crushing.
7. F.47401. A steinkern of the holotype.

Lingula gregaria Etheridge.

8. Holotype F.7502.

Lingula merrimbulensis sp. nov.

9. F.46158. An incomplete valve showing the anterior portion.
10. Holotype F.46149. A brachial valve showing the anterior portion detached but still in position.
11. Paratype F.46150. A small pedicle valve with the fragile anterior portion missing.
12. Paratype F.46155. A similar specimen to fig. 11.

Obolus mootwingensis sp. nov.

13. F.47428. A pedicle valve showing convexity of umbonal area.
14. F.48963. An incomplete valve, partly exfoliated, showing radial striae on inner laminae.

Ectenoglossa brunnschweileri sp. nov.

15. F.49044. A complete shell showing the brachial valve slightly skewed to reveal the more acuminate pedicle valve.



