

THE SILURIAN TRILOBITES OF NEW SOUTH WALES,
WITH REFERENCES TO THOSE OF OTHER
PARTS OF AUSTRALIA.

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PART II.—THE GENERA PROETUS AND CYPHASPIS.

(Plates VI.-VII.)

Genus PROETUS (*continued*).

Since the appearance of our first paper* on the Silurian Trilobites of N. S. Wales, certain disjointed pygidia, glabellæ, and other portions of cephalic-shields have attracted attention in the Australian Museum Collection. These are from the black Cave Limestone, of Cave Flat, Murrumbidgee, and were collected by Mr. Charles Jenkins, L.S. Although not sufficiently complete to enable us to give a detailed description, or to warrant the proposal of a specific name, they yet appear distinct from either of those characteristic of the Bowring Series, and are of interest as showing the existence of *Proetus* at a higher stratigraphical horizon than previously surmised.

The fossils in question consist of portions of glabellæ, pygidia, and a free cheek or two. On the glabella the edge of the limb is very finely concentrically lined, and the surface of the glabella itself minutely granular. The pygidium has a pronounced axis of seven rings, each bearing a row of tubercles. The pleuræ consist of four or five coalesced segments.

* P.L.S.N.S.W. 1892, vi. (2), pt. iii. p. 311, t. 25.

Genus CYPHASPIS, Burmeister, 1843.

(Organ. der Trilob. p. 103.)

CYPHASPIS BOWNINGENSIS, Mitchell (Pl. vi. figs. 3, 3a-h ; Pl. vii. figs. 3i-k).

Cyphaspis bowningensis, Mitchell, P.L.S.N.S.W. 1888, ii. pt. iii. p. 418, t. 16, f. 3.

Sp. Char.—Body oval. *Cephalic-shield* subsemicircular, strongly inflated ; limb wide with thickened margin, usually abruptly deflected ; glabella pyriform or including the circumscribed lobes suboblong, tumid, granulated distinctly ; glabellar furrows in many specimens not visible, but in some the two anterior ones are present, and are short and faint ; axial furrows distinct and continuous anteriorly round the front of the glabella ; circumscribed lobes separated from the glabella by deeply incised furrows, ovate or obpyriform, prominent, inflated ; fixed cheeks tumid, granulated ; eye lobes in flattened specimens large ; free cheeks moderately large, strongly inflated towards the eye, no granulation observed ; genal angles produced into spines reaching to and including the sixth segment of the thorax, and curving out from the body ; facial sutures anteriorly weakly directed outwards till reaching the thickened edge, then sharply incurved, passing out in a line with the inner side of the eyes, posteriorly sharply curving outwards, cutting the posterior margin of the side lobes at their extremities ; eyes subcrescentic or subreniform, large, facets not observed ; neck furrow distinct, continuous across side lobes ; neck ring robust, arched, posterior facet strongly granulated ; central granule most robust. *Thorax* consisting of twelve segments ; axis strongly arched, width equal to that of pleuræ ; posterior facet of each segment carrying a row of granules similar to that of the neck ring, gradually diminishing distally, sixth segment bearing a large dorsal spine extending to the extremity of the pygidium ; pleuræ grooved, grooves terminating just short of their extremities, abruptly depressed from fulcra, posterior facets carrying a row of granules, distal ends of pleuræ rounded,

sutures straight. *Pygidium* subtriangular, small, anterior margin straight and twice as long as axial length of the pygidium; axis prominent, reaching to the posterior margin, subtruncate, divided into three segments; pleuræ composed of two coalesced segments, moderately inflated, margin narrow and thickened, no striation visible.

Obs.—Since the description of this species by one of us, a large addition has been made to our material, which enables us to give fuller specific details. One important feature possessed by some of the specimens, and not present on the original example, is the presence of a large dorsal spine. Different specimens of the head shield show variations in the width of the limb, size of the eye lobe, distinctness and presence of glabellar furrows, and apparent shape of the eye; but all these differences we conclude to be insufficient to establish more than one species. Most of the variations may arise from compression, and the oval impression left in some cases where the eye has been broken off are treated as accidental. As we are unable to observe any marked differences between the cephalic shields of those specimens with dorsal spines, and those without that appendage, it has struck us that this feature may be no more than a sexual characteristic.

C. bowningensis is closely allied to *C. Burmeisteri*, Barr.,* but is longer in proportion to its width, and seems to have a much more attenuated pygidium and thoracic axis. In addition there is the possibility of glabellar furrows. In dealing with small and often ill-preserved remains such as these, it is sometimes difficult to be certain what is pure structure or what may be the result of pressure. If the apparent glabellar grooves sometimes observable in *C. bowningensis*, such as are shown in Pl. VI. fig. 3*f-g*, be truly of that nature, they would tend to place the species near the genus *Phætonides*, Angelin.† The ovate character of the entire test is one in which notably the present species and also our *C. Horani*, agree with several American species of the Hamilton Group.

* Syst. Sil. Bohême, 1852, i. p. 484, t. 18, f. 61-71.

† See Hall, Pal. New York, 1888, vii. p. xlv.

We have not noticed any trace of fimbriate pygidia in any Australian *Cyphaspis*.

Loc. and Horizon.—Bowning, Co. Harden—Upper and Middle Trilobite beds; Limestone Creek, near Bowning, Co. Harden—Middle Trilobite bed, Bowning Series (? Wenlock) (*Coll. Mitchell*).

The majority of the specimens figured are from the Upper Trilobite bed, but many cephalic-shields, two of which are figured, were obtained from the Middle Trilobite bed (Pl. VI. fig. 3*h*, 3*j*). The latter we are not able to separate from those of the former; and therefore, like *Proetus bowningensis* and *Acidaspis longispinis*, this species was one of the most persistent Trilobites of that geological age.

CYPHASPIS YASSENSIS, *sp. nov.* (Pl. VI. figs. 1, 1*a-d*).

Sp. Char.—Entire body unknown. *Cephalic-shield* semicircular, with a wide somewhat concave limb, the edge reflected upwards and thickened; glabella pyriform, arched in the middle line, narrowing rapidly towards the posterior, with a wide anterior border, axial furrows very marked towards the front, less so in the middle of their course and behind; first pair of glabellar furrows somewhat indicated by a slight lateral compression on each side of the glabella; circumscribed lobes small, oval; facial sutures anterior to the eyes gently directed outwards, curving inwards along the limb and cutting it nearly in lines opposite the original point of departure from the eyes, posterior to the eyes very short, cutting the hinder margin of the cephalic-shield close to the glabella; neck furrow moderately distinct, depressed on each side; fixed cheeks small; eyes large, reniform, and faceted; eye lobes moderately large, semicircular; free cheeks large, very tumid towards the eyes; genal angles produced into comparatively large and gently incurved spines, their limbs striated; supposed auditory organs situated between the front margin of the glabella and the facial sutures. *Thorax* only known by disjointed segments, but with a very prominent axis; pleuræ distinctly furrowed, the

furrows terminating just short of the distal ends, which are rounded. *Pygidium* semielliptical; axis distinct, terminating below in a tolerably sharp apex; first three segments distinct, others less so, the last two or three becoming very faint; pleuræ of five coalesced segments, the anterior pair perceptibly furrowed, the second and third pairs faintly so; they terminate at the margin; limb striate.

Obs.—*Cyphaspis yassensis* is remarkable in possessing features that distinguish several genera of Proetidæ. Its wide limb, and particularly the wide anterior glabellar border, relate it to *Arethusina*; its pyriform and tumid glabella allies it as strongly to *Cyphaspis*; whilst, on the other hand, the proximity of the eyes to the glabella and the small fixed cheeks are characteristic of *Proetus*. The pygidium also approaches the latter type; but even the glabella is narrower and more pyriform than is generally seen in *Cyphaspis*.

The glabellar furrows are as a rule not observable, but in one fairly well preserved head-shield all three pairs are faintly visible.

Amongst Australian Trilobites this species is the only one in which the supposed auditory organs have been observed, and on that account is of more than ordinary interest. The occurrence of these pores, usually one on each side of the glabella, either in the axial grooves or at any rate close to them, has been noticed in several genera by various writers. The question has been summed up by Dr. H. Woodward,* who after instituting a comparison with the living genus *Serolis*, believes that the pores in question may represent either a simple eye, a tympanum, or an olfactory organ; but it is still an open question which of the three is the most probable. Such pores have been seen in the genera *Trinucleus*, *Ampyx*, *Griffithides*, *Phillipsia*, *Acidaspis*, *Calymene*, *Cheirurus*, and to these we can now add *Cyphaspis*. In our Trilobite the pores, or, from our specimens being denuded of the test, papillæ, are not situated in the facial sutures, but between them and the front rounded border of the glabella.

* Mon. Brit. Carb. Trilobites (Pal. Soc.), 1884, pt. 2.

Cyphaspis yassensis is also remarkable for the great lateral expansion of the cephalic-shield, as compared with the central portion or glabella. This, with the general contour and the wide anterior glabellar border (limb), strongly reminds us of the genus *Arethusina*.

Loc. and Horizon.—Belle Vale, between Bowning and Yass, and at Bowning, Co. Harden—Lower Trilobite bed, Bowning Series (? Wenlock) (*Coll. Mitchell*).

CYPHASPIS HORANI, *sp. nov.* (Pl. VII. figs. 4, 4a-c).

Sp. Char.—Body oval. *Cephalic-shield* subsemicircular, highly inflated; limb wide, divided into two almost equal parts, of which that immediately in front of the glabella is subtumid and conspicuously granulated, anterior part concave, edge thickened and bearing a row of granules, subcrenated; glabella ovoid or elliptical, very tumid, highly granulated, glabellar grooves not present, axial furrows deep and continuous in front; circumscribed lobes small, narrow and elongate, close to and somewhat under the sides of the glabella; fixed cheeks fairly large, very tumid centrally, granulated, the posterior granule largest; eye lobes large, suboblong-semicircular; free cheeks very inflated, the inflated portion ornamented with several rows of slightly oblique granules, and subcrenulated, margin thickened; genal angles continued into long slender falcate spines embracing and apparently reaching to or near the extremity of the thorax; eyes small, suboval or sub-circular, in some specimens very prominent, facets not observed; facial sutures anteriorly comparatively straight, incurving on edge of limb a short distance before passing out, posteriorly sharply curved outwards and cutting the posterior margin of the shield at the extremities of the side lobes; neck furrow deep, wide, strongly arched backward, interrupted by circumscribed lobes and continuing much less conspicuously across lateral lobes; neck ring prominent, intensely arched backward, bearing a row of granules of which the central one is most conspicuous. *Thorax* consisting of ten segments, length equal to width, apparently highly granulate; axis prominent, proximal portion for six seg-

ments equal in width to side lobes, from sixth segment diminishing gradually, well preserved specimens with a row of three or more granules on each segment, no dorsal spine observed; pleuræ straight and flat to fulcrum, distal ends sharply deflected and slightly separated, deeply grooved, grooves terminating short of the extremities, the posterior facets of each pleura with a row of granules, of which that on the fulcrum is most prominent and persistent, appearing on the pleuræ of the pygidium also, axial furrows conspicuous. *Pygidium* small, strongly granulated; axis small, consisting apparently of three segments, divisions of the pleuræ the same, axial furrows distinct; margin thickened.

Obs.—This is rather a minute Trilobite, the largest of our specimens not exceeding three-eighths of an inch, and it is difficult to determine the exact number of thoracic segments; but we believe ten to be correct.

The distinctive features of this species are its ovoid and tumid glabella, very tumid cheeks, granulated ornamentation of the whole test and particularly of the glabella and free cheeks, small eyes, flatness of the pleuræ between their proximal ends and the fulcrum, and their shortness from the fulcrum to the distal ends. It differs so widely from the other species described in the present paper that comparison is unnecessary.

In some specimens the granules of the glabella are arranged in tolerably regular longitudinal rows, in others this is not so conspicuous. The normal shape of the eyes we believe to be round or subconical; but our specimens show them of various shapes. In the larval form the eye is very small, and the specimens are almost invariably in a rolled state.

This very peculiar form of *Cyphaspis* is allied to *C. cerberus*, Barr.,* and *C. Davidsoni*, Barr.,† by reason of its subcrenate anterior cephalic border, but in both the species named the border becomes absolutely serrate, while our best preserved specimens are only faintly so. Still more closely resembling our

* Syst. Sil. Bohême, 1852, I. p. 489, t. 18, f. 49-51.

† Syst. Sil. Bohême, 1852, I. p. 489, t. 18, f. 54-56.

species is *C. ornata*, Hall,* from the Hamilton Group of New York State, in which the thickened edge of the pustulose anterior border is granular-crenate without being fimbriate.

We have named the species after Mr. Joseph Horan, who has been the companion of one of us on many pleasant excursions.

Loc. & Horizon.—Bowning Creek, Bowning, Co. Harden—Lower Trilobite bed; Belle Vale, near Bowning, in the Lower Trilobite bed; and on Great Southern Road near cemetery, Bowning—Middle Trilobite bed, Bowning Series (? Wenlock).

All the specimens figured are from the Lower Trilobite Bed, Bowning Creek (*Coll. Mitchell*).

CYPHASPIS ROTUNDA, *sp. nov.* (Pl. VI. figs. 2, *a* and *b*).

Sp. Char.—Body oval. *Cephalic-shield* subsemielliptical, proportionately large, the axial measurement equal to that of the thorax and pygidium combined, whilst the width is equal to its own axial measurement and that of the thorax combined; limb wide, and concave in front of the glabella, margin thickened. Glabella ovate, short, a pair of glabellar furrows (probably the median) faintly indicated; circumscribed lobes small, oval, oblique in position, very slightly truncate behind; axial furrows moderately defined in front, and continuous round the glabella; facial sutures anterior to the eyes tolerably straight, or slightly inclined outwards, thence incurving along the thickened edge of the limb, and cutting the latter in a line with the sides of the glabella, whilst posterior to the eyes the sutures curve outwards, cutting the posterior margin of the shield at about one-third the distance between the axial furrows and the lateral margins; fixed cheeks small; free cheeks large, tumid, with a wide limb, flat and striate; genal angles produced into strong spines, which embrace the first three thoracic segments; neck furrow wide; neck ring narrow, moderately arched backwards. *Thorax* of eight segments, the transverse measurement being about twice the axial length; axis prominent, width nearly equal to that of the pleuræ, segments

* Pal. New York, 1888, p. 490, vii, t. 21, f. 1.

arched backwards laterally and forwards in the middle line; thoracic spine absent; axial grooves well marked; pleuræ straight, flat above, distal ends sharply bent downwards, furrows wide and barely reaching the outer margin. *Pygidium* small, transversely elongated, widely triangular, its transverse measurement three times that of the axial length; coalesced segments of the pleuræ invisible; axis prominent, short, truncated posteriorly, of seven or eight segments, the terminal ones very close together; limb very abruptly depressed, flat.

Obs.—This little Trilobite, in its short pyriform glabella and circumscribed lobes, assumes the habit of *Cyphaspis*; the shape of the thorax generally approaches more closely that of the genus *Proetus*, whilst the pygidium in its diminutive size is again of a *Cyphaspis* type. Its rotund appearance at once separates it from the preceding species and the European *C. megalops*, and this separation is further increased by the presence of comparatively short genal spines. From the other Australian species it is distinguished by possessing eight instead of eleven or twelve thoracic segments, the rotund outline, and in the length of the cephalic-shield equalling that of the combined thorax and pygidium. From *Cyphaspis depressa*, Barr.,* *C. Halli*, Barr.,† and *C. Burmeisteri*, Barr.,‡ it is distinguished by having no trace of a thoracic spine, but if there is a possibility of this point of differentiation being of a sexual nature, as previously suggested, the characters mentioned above will serve for the purpose in view, particularly the almost oval shape and closely adpressed genal spines.

Loc. and Horizon.—Bowning, Co. Harden—Lower Trilobite bed, Bowning Series (? Wenlock) (*Coll. Mitchell*).

* Syst. Sil. Bohême, 1852, i. Atlas, t. 16, f. 38, 39.

† Syst. Sil. Bohême, 1852, i. Atlas, t. 18, f. 35.

‡ Syst. Sil. Bohême, 1852, i. Atlas, t. 18, f. 61.

EXPLANATION OF PLATES.

PLATE VI.

CYPHASPIS YASSENSIS, *Eth., fil., and Mitchell.*

- Fig. 1. —Cephalic-shield; a large specimen showing auditory organs ($\times 3$).
 Fig. 1a.—Pygidium, a large specimen ($\times 3$).
 Fig. 1b.—Pygidium and two segments of thorax attached ($\times 3$).
 Fig. 1c.—Cephalic-shield without free cheeks; a well preserved specimen showing no signs of glabellar furrows.
 Fig. 1d.—Free cheek (nat. size).

CYPHASPIS ROTUNDA, *Eth., fil., and Mitchell.*

- Fig. 2. —An almost complete specimen slightly contorted and completely decorticated ($\times 6$).
 Fig. 2a.—The same restored ($\times 6$).
 Fig. 2b.—Side view of same ($\times 6$).

CYPHASPIS BOWNINGENSIS, *Mitchell.*

- Fig. 3. —Young specimen somewhat contorted and one free cheek missing ($\times 3$).
 Fig. 3a.—Cephalic-shield and six segments of the thorax, with dorsal spine on the sixth segment, and showing the granular ornamentation distinctly ($\times 2$).
 Fig. 3b.—Side view of same.
 Fig. 3c.—Side view of Fig. 3.
 Fig. 3d.—Portion of thorax, with pygidium and dorsal spine complete.
 Fig. 3e.—Portion of thorax and spine ($\times 3$).
 Fig. 3f-h.—Cephalic-shields showing variations; 3h-j are from the Middle Trilobite bed and are decorticated and contorted; 3g shows a very wide border, and like 3h-j indicative of glabellar furrows ($\times 3$).

PLATE VII.

- Fig. 3i-k.—(*Vide* explanation of 3f-h.)

CYPHASPIS HORANI, *Eth., fil., and Mitchell.*

- Fig. 4. —Cephalic-shield with one free cheek missing, showing genal spine and very faint serration of anterior edge ($\times 3$).
 Fig. 4a.—Thorax and pygidium complete and posterior portion of cephalic-shield inverted, decorticated ($\times 4$).
 Fig. 4b.—Portion of a thorax and pygidium of a smaller specimen than 4a ($\times 6$).
 Fig. 4c.—A very well preserved cephalic-shield without the free cheeks, showing the ornamentation ($\times 6$).



Etheridge, Robert, Melo-Costa, Wanessa de, and Mitchell, J. 1894. "The Silurian trilobites of New South Wales, with references to those of other parts of Australia. Part II." *Proceedings of the Linnean Society of New South Wales* 8, 169–178.

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