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PALAEOZOOLOGY AND TAXONOMY OF SOME AUSTRALIAN HOMALONOTID TRILOBITES

By Edmund D. Gill, B.A., B.D.

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Summary

Three new species are described (*Trimerus lilydalensis*, *T. kinglakensis*, and *T. zeehanensis*) and two re-described (*T. harrisoni* and *T. vomer*). The palaeoecology of these trilobites is discussed; also their palaeozoology, with special reference to eye migration and 'ornament'. Finally, the classification of these forms is treated.

Introduction

Homalonotid trilobites have been reported in Australia only from the states of Victoria and Tasmania. McCoy (1876) described *Homalonotus harrisoni* from Moonee Ponds Creek, Melbourne, a locality of Upper Silurian (Melbournian) age. Chapman (1912) described *Homalonotus vomer* from beds at Wandong, Victoria, which are either Upper Silurian or Lower Devonian in age. Chapman (p. 299) indicates that his species falls 'within the section *Trimerus* of Green.' Reed (1918) referred both the above species to the subgenus *Trimerus*, which has since been accorded generic standing. '*Homalonotus* sp.' has been recorded in Tasmania but no specimens figured. In the present paper, three new species are described from Lilydale (Victoria), Kinglake (Victoria) and Zeehan (Tasmania) respectively, all of which are considered to be Lower Devonian in age.

Palaeoecology

Homalonotid trilobites are usually found in facies of inshore types. they occur, but comparatively rarely, in facies of offshore types. This can be illustrated from the Lower Devonian deposits of Europe, where Homalonotid trilobites are varied in species and great in numbers in the Rhenish or inshore facies (for instance, see Koch's 1883 monograph on them), while they are quite rare in the Bohemian or offshore facies (for instance, see Barrande's volume on trilobites in his *Systême Silurien*). The same principle can be illustrated from the Lower Devonian deposits of Victoria. Homalonotid trilobites are a characteristic feature of beds of Rhenish facies at Kinglake, but rare in beds of Bohemian facies at Lilydale. All the species treated in this paper come from beds of inshore facies, except *Trimerus lilydalensis*, sp. nov.

From the rocks in which they occur, it is concluded that Homalonotid trilobites preferred a sea floor of fine sandy sediments. They were big enough and strong enough not to be troubled by the currents that went with that environment (inferred from the cross-bedding in the sandstones in which they are found). The great reduction of trilobation and segmentation in these animals resulted in a very streamlined carapace. The comparatively smooth cephalon made a good 'shovel' for digging in the sediments of the sea floor; sometimes this was specialized by being sharply pointed (as in *T. kinglakensis*) or turned up in front (*T. zeehanensis*).

Palaeozoology

1. Eye Migration.—It has been noted that in the four species herein described, of which complete cephala are known, a progressive migration of the eyes dorsally is observed if the species are placed in chronological order, i.e., in order of stratigraphical occurrence. The inward migration of the eyes meant that the free cheeks became wider. Eye migration is an important factor in a number of sections of the animal kingdom. It has been noted in other families of trilobites, e.g., the Phacopidae. Non-remote eyes are supposed to be one of the characteristics of the Homalonotidae, but *Trimerus lilydalensis* (the last in the series referred to) has eyes as remote as they can be. Measurements were made in each of the four species listed below, from the lateral margin of the cephalon, and parallel with its posterior margin, to the posterior inner edge of the eye. This measurement was chosen because the eyes vary in size from species to species, and because the width of the free cheek is an important morphological factor. Facial sutures are important for ecdysis, and trilobite taxonomy is based on them. The measurements were made following the contours of the carapace, and not in plan. They were made from the holotype in each case, except *T. vomer*, where the paratype was used, as the holotype is somewhat crushed. The following table sets out the data obtained:

	T. harrisoni	*T. vomer*	*T. kinglakensis*	*T. lilydalensis*
$\frac{\text{Cephalic margin to eye}}{\text{Width of cephalon}}$	$\frac{0 \cdot 6 \text{ cm.}}{3 \cdot 7 \text{ cm.}}$	$\frac{0 \cdot 65}{3 \cdot 7}$	$\frac{1 \cdot 4}{7 \cdot 3}$	$\frac{1}{3 \cdot 4}$
	$= \frac{16 \cdot 2}{100}$	$\frac{17 \cdot 5}{100}$	$\frac{19 \cdot 2}{100}$	$\frac{29 \cdot 4}{100}$
Age of the species	Up. Sil. (Melbournian)	Up. Sil. or Lr. Dev.	Lr. Dev. (Lower Yeringian*)	Lr. Dev. (Upper Yeringian*)

*For references to the division of the Yeringian Series, see Gill 1945, pp. 145-146, and 1947, p. 13.

The measurements in *T. harrisoni* are as accurate as its poor preservation will allow. However, the contrast with *T. lilydalensis* is obvious. The eye migration (and so widening of the free cheeks) may have had the following biological advantages:

(a) Better sight, as a result of higher placing of eyes.

(b) Clearer sight, as a result of being further removed from the mud stirred up by the trilobite's foraging on the sea floor.

(c) Easier ecdysis. Apparently at moulting the trilobite shed first its cephalic armour, then crawled out of the remainder of its carapace. Possibly the wider free cheeks assisted the shedding of the head-shield, in that it would break into three pieces of nearer equal size.

The first three species listed above approximate one another in the non-remote character of their eyes. It is the species from the off-shore environment which has the notably remote eyes, and this fact may well be significant.

2. Exoskeletal 'Ornament'.—The inadequacy of the term 'ornament' for certain exoskeletal organs has been referred to in a discussion on the palaeozoology of some Chonetid brachiopods (Gill, 1948a). The following sets out more precisely one's objection to the term:

(a) It has all the disadvantages of a word taken over from everyday speech, i.e., it lacks precision, is not definitive enough, has too many meanings, too wide a connotation.

(b) The term gives an erroneous impression of something merely decorative. But these structures are organs, genetically maintained, and of real biological significance. They are structures with functions.

(c) The term is scientifically inadequate, in that it collects into one category features of the exoskeleton which are homologous in neither structure nor function. For instance, some of these structures are on the external surface only, while others involve the whole thickness of the carapace or shell. Some are concerned with the relations of the animal to its environment (such as rugae on a brachiopod shell which help to hold it in place on the sea floor), while others are related to the internal economy of the animal (such as the thickenings on a eurypterid carapace which provide muscle attachments). The need is apparent for properly defined terms which will convey correct ideas of the structures and functions involved. Terms suggest themselves, but it is probably wiser in the present limited state of our knowledge of many of these structures to await the elucidation of their functions. It will be salutary if the unsatisfactory nature of the term 'ornament' is recognized, and thought directed to a more scientific comprehension and classification of the varying structures included in this omnibus term.

All the trilobites described in this paper possessed nearly smooth carapaces. In *T. harrisoni*, *T. vomer*, and *T. lilydalensis* the preservation is not good enough to show any fine ornament that may have been present. In both *T. kinglakensis* and *T. zeehanensis* the surfaces are covered with fine pittings. The steinkerns show that their inner surfaces were likewise pitted. It may be that fine punctae pierced the exoskeleton, and fulfilled an excretory function.

In the case of *T. zeehanensis* there were apparently spines on the thorax as well, judging by a fragment. This is reminiscent of the trilobite from New Zealand described by Allan (1935) as *Homalonotus* (*Burmeisteria*) *huttoni*, which possesses an ornament of fine pittings and tubercles. I agree with Reed (1918) that ornament should not be used very much for purposes of generic classification. The presence of the tubercles on Allan's species suggests its association with *Burmeisteria*, but it cannot be so placed because the facial sutures cut the genal angles. It is probably better accommodated in *Trimerus*. As the Reefton fossil is not a *Burmeisteria*, another apparent link with the Austral province is broken. Allan also redescribed *Homalonotus* (*Digonus*) *expansus* Hector. As only a pygidium is known, it cannot be determined whether the form belongs to *Digonus*. On the evidence available, it may equally well belong to *Trimerus*.

The presence in the steinkern of pits along the position of the thoracic axial furrows is a feature of three of the species herein described, viz., those in which the thorax is known. They occur on the posterior margins of the pleurae, and on the outer side of the axial furrow. On the dorsal surface of the dorsal carapace (as shown in the external mould), there are shallow indentations, and on the ventral surface there are prolongations represented by pits in the steinkern. As the dorsal indentations are shallow and the steinkern pits deep, the processes must have been solid, and so strong. Dr. Öpik (who has described similar structures in other trilobites—Öpik 1937) kindly examined these specimens and suggested that they are processes (Störmer's condyli) for the articulation of the pleura. With this I agree. It should be noted that these condyles are much deeper dorso-ventrally than is usually the case. Similar structures have been recorded in *Homalonotus major* (Whitfield, 1885).

Systematic Descriptions

Order PROPARIA Beecher

Family HOMALONOTIDAE

Genus **Trimerus** Green

Trimerus harrisoni (McCoy)

Text fig. 1A.

Homalonotus harrisoni McCoy, 1876, Decade III, pp. 19-20, Pl. XXIII, figure 11.

TYPE MATERIAL

Holotype consisting of steinkern of an almost complete carapace in greyish micaceous (muscovite) sandstone. The locality is given as 'Royal Park, near Melbourne' by McCoy, and in the National Museum register (Reg. No. 7503) a note is added that this is 'Moonee Ponds Creek, near Flemington.' The locality is a cliff on the east bank of the creek below Union Street and just north of Brunswick Road West.

DESCRIPTION

Measurements

Whole carapace, as preserved	6·3 cm.
If complete, it would approach	7 cm. in length
Length of cephalon	1·9 cm.
Width of cephalon	3 cm. approx.
Length of thorax	3 cm.
Width of thorax posteriorly	2·1 cm.

Cephalon sub-triangular, with well rounded anterior margin. The glabella is considerably damaged, but the wide flat pre-glabellar field is preserved. The median longitudinal profile is as in fig. 1A. The axial furrows are but ill-defined. The facial sutures are indicated for little of their course, those shown on McCoy's figure being largely reconstructions. Where the left side of the cephalon is broken away at the margin, a deep furrow in the doublure about 1 mm. wide is revealed. There is a slight rim round the edge of the cephalon, or slight upturning.

Thorax. Trilobation is almost absent, but rows of pits (impressions of condyles) show where the axial furrows would normally be. There is no change in the degree of arching of the pleura to mark the normal position of the furrows as in *Trimerus vomer.* The pleura are gently arched until the margins, where the ends are deflected ventrally at approximately right angles. The pleura have fine furrows running centrally along their length; they contrast with the other species described herein (where the thorax is known), for in them the furrows divide the pleura unevenly.

Pygidium. Trilobation is clearly shown in the pygidium, as figured by McCoy.

COMMENT. This species is distinguished by the median furrows in the pleura, the almost complete absence of trilobation in the thorax, and the narrow free cheeks.

Trimerus vomer (Chapman)

Text fig. 1B, C.

Homalonotus vomer Chapman, 1912, pp. 298-299, Pl. LXII, figs. 2-3, Pl. LXIII, figs. 1-2.

TYPE MATERIAL

1. *Holotype* consisting of steinkern of a cephalon and part of a thorax in close proximity on one slab, assumed by Chapman to belong to the same individual or at least the same species. Preserved in bluish indurated fine-grained sandstone from 'Wandong, Victoria'. The holotype is the specimen figured by Chapman, Pl. LXII, figs. 2-3. Nat. Mus. Vic., Reg. No. 12301. Presented by Dr. J. T. Jutson.
2. *Paratype* consisting of steinkern of a thorax and part of a pygidium together (Chapman's Pl. LXIII, fig. 2) in a matrix similar to that of the holotype, and from the same locality. Nat. Mus. Vic., Reg. No. 12302. Presented by Geo. Sweet, Esq.
3. *Paratype* consisting of steinkern of a cephalon preserved in yellowish brown fine-grained sandstone from the same locality as the other specimens. This specimen is figured by Chapman, Pl. LXIII, fig. 1. Nat. Mus. Vic., Reg. No. 12303. Presented by F. P. Spry, Esq.

DESCRIPTIONS

Holotype. The right side of the cephalon is broken away, and part of the left is hidden by matrix, but the following measurements can be made:

Length of cephalon	3·3 cm.
Width from eye to median line	1·5 cm.
Length of glabella	1·7 cm.
Width of glabella anteriorly	1·25 cm.
Width of glabella posteriorly	1·85 cm.
Length of pre-glabellar field	1·1 cm.

The thoracic measurements are:

Width of thorax	About 4 cm.
Width of axis	About 3·7 cm.
Width of pleura	4 to 4·5 mm.
Width of anterior part of each pleuron (i.e., the part showing when they are together) ..	1 mm. approx.
Width of pleural furrow	0·5 mm. approx.
Width of posterior part of pleura	2·5 mm. approx.

Cephalon sub-triangular, and slightly inflated as shown by the median longitudinal profile (fig. 1C). Axial furrows weakly developed. Nuchal furrow a little more strongly developed. The nuchal segment is 2·5 mm. wide. However, this specimen is a little crushed, and so the profile of the paratype is also given (fig. 1B). The glabella is sub-quadrate, but tapering anteriorly more strongly than is usual in this genus. Three glabellar furrows are faintly impressed on each side of the glabella.

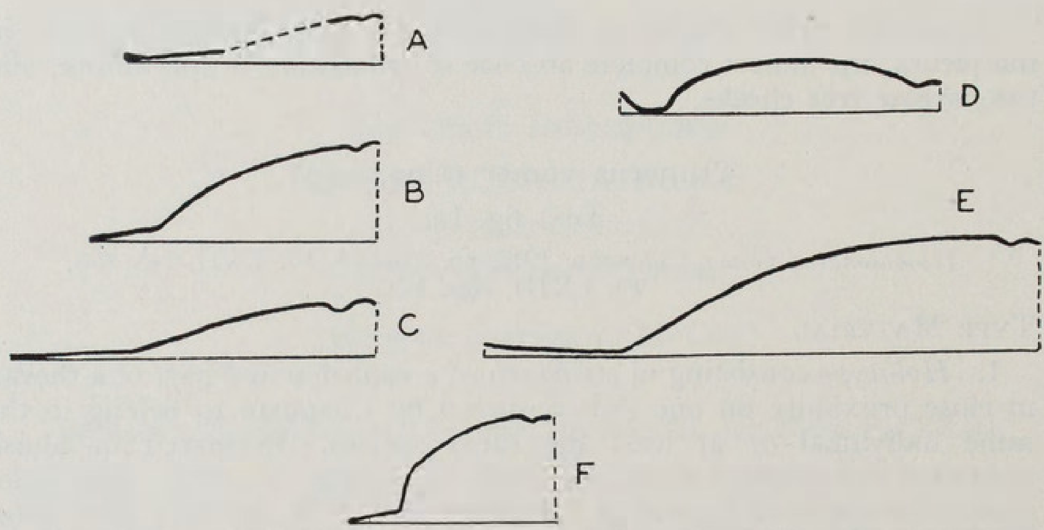

FIG. 1.—Longitudinal median profiles of cephala of trilobites described in this paper.

A. *Trimerus harrisoni* (McCoy), holotype. Part of the profile is dotted because in that area the specimen is damaged.
B. *Trimerus vomer* (Chapman), paratype.
C. *Trimerus vomer* (Chapman), holoytpe. Somewhat flattened.
D. *Trimerus zeehanensis*, sp. nov., holoytpe. This specimen is sheared somewhat, and the posterior part of the profile probably does not represent what the cephalon was like originally.
E. *Trimerus kinglakensis*, sp. nov., holotype.
Both D and E are drawn from plasticine squeezes of external moulds.
F. *Trimerus lilydalensis*, sp. nov., holotype.

Each is deflected a little so that the inner end is posterior to the axial furrow end; each glabellar furrow makes an angle of the order of 75° with the axial furrow. Eyes prominent. Very little of the course of the facial sutures is determinable, but it is noted that anterior to the eye the suture is not parallel with the axial furrow as in other species described in this paper. Part of the pre-glabellar field is broken away, revealing a doublure 4 mm. wide.

Thorax has trilobation almost absent, but there is a marked change in the arching of the thorax and rows of faintly developed pits (impressions of articulating condyles) to indicate the place of the axial furrows. These show the axis to be about 3·7 cm. wide—very wide indeed. On the outer margins of the thorax, the pleura are strongly deflected ventrally. The pleura are furrowed as given in measurements. All these features of the thorax can be seen well in paratype No. 12302.

Pygidium. Paratype 12302 provides the only evidence of the nature of the pygidium. From the small part preserved, it can be seen that the trilobation is better marked in the pygidium than in the thorax.

Paratype 12303 gives no additional information about the cephalon except its tumidity (fig. 1B), and the placing of the eyes. In plan, the cephalon is 2·7 cm. wide and 2·2 cm. long, and the eyes are situated approximately half a centimetre from the lateral margin of the cephalon.

COMMENT. Another specimen in the Museum collection from the same locality, and also collected by Mr. Geo. Sweet, shows that the genal angles were broadly rounded.

Trimerus vomer is distinguished by the tapered glabella, the presence of glabella furrows (as in *T. vanuxemi*), facial suture anterior to the eye not being parallel with the axial furrow.

Trimerus kinglakensis, sp. nov.

Pl. VIII, figs. 1-3; Pl. IX, figs. 3, 5-6.

TYPE MATERIAL

1. *Holotype** consisting of steinkern and external mould of the same cephalon preserved in mottled greyish fine-grained sandstone from Davies' Quarry, on the western branch of Stony Creek, about a mile north of the Kinglake West State School, Victoria. This is the locality from which *Dicranurus kinglakensis* (Gill 1947) was recently described. Nat. Mus. Vic., Reg. Nos. 14580 and 14581.

2. *Paratype* consisting of steinkern and external mould of a thorax and pygidium together in mottled blue-grey and greyish fine-grained sandstone from the same locality as the holotype (Nat. Mus. Vic., Reg. Nos. 14582 and 14583). All the above specimens were collected by Mr. F. S. Colliver and presented to the National Museum. I wish to thank Mr. Colliver for the opportunity of describing the specimens.

DESCRIPTIONS

1. *Cephalon*. Sub-triangular in outline, tumid, of longitudinal median profile as shown in fig. 1E. Length in plan (i.e., not following the contours of the carapace) is 4·2 cm., and width 5·5 cm. The right genal angle has been fractured and turned ventrally a little; the normal width of the cephalon would be about 6·4 cm. If the profile is followed, the

*Following local practice, the author has previously called the steinkern and external mould of a new species *syntypes*. This point was discussed with Dr. C. Teichert and Dr. A. Öpik and the opinion reached that as there is only one biological specimen concerned, the two palaeontological specimens should be regarded as but two parts of a single holotype. The same principle has been applied to the naming of secondary types.

maximum width is 7·3 cm. Glabella sub-quadrate, slightly narrower in front; length 2·7 cm., anterior width 2·1 cm., and posterior width 2·6 cm. Axial furrows definite, but not well developed. Eyes elevated on raised areas. Neck ring flat, and about 3·5 mm. wide. Neck furrow comparatively deep and narrow (about 1 mm.), continuous with posterior marginal furrow, which is wider. Genal angles well rounded; facial suture cuts genal angle, then curves so as to be parallel for a short distance with the posterior margin of the cephalon. It thereupon curves anteriorly again to the eye, and after skirting the eye it continues anteriorly almost parallel with the axial furrow. When near the anterior end of the glabella, it curves round to form an obtuse angle with the suture from the other side, 2·5 mm. behind the apex of the pre-glabellar field (this seen in counterpart). Epistomal sutures have not been recognized with certainty. Pre-glabellar field wide (1 cm.), but pre-sutural area narrow (2·5 mm.). Pre-glabellar field flat (not upturned as in *Trimerus zeehanensis*) and pointed.

The external mould counterpart shows the dorsal surface of the cephalon to have been comparatively smooth, but covered with numerous very fine pittings (minute mounds on the mould).

Thorax of ten segments preserved; it is presumed that there were 13 segments present as is usual in these forms. Trilobation almost lost. Five and a half centimetres of each pleuron is gently arched, and then on each side steeply deflected ventrally. Each pleuron has a narrow anterior articulating portion two to three millimetres wide, then a deep furrow about a millimetre wide, followed by the main part of the pleuron $3\frac{1}{4}$ to 4 mm. wide. A row of large pits (impressions of articulating condyles) on each side of the thorax marks where the axial furrows would normally be. The axis is extremely wide, being 4·3 cm. anteriorly, and tapering back to the width of the pygidial axis (2·3 cm.).

The external mould counterpart shows that the fine pittings observed on the cephalon occur similarly on the thorax and pygidium.

Pygidium sub-triangular, strongly arched, trilobation moderately defined, acuminate. Fourteen pygorachial segments, the last being poorly defined; seven pygopleural segments, the most posterior being very poorly developed. Axis about one-third of width of pygidium; width anteriorly 2·3 cm.

COMMENT. The specimens described (with addition of missing thoracic segments) would constitute a complete carapace of 14·5 cm. In the collection of Mr. F. S. Colliver is a cephalon from the same locality which is 6·5 cm. long. Proportionately to the type specimens, this cephalon would belong to a carapace 22·4 cm. long. Koch (1883) has described homalonotid trilobites of this magnitude, and one pygidium he figures, which is 12 cm. long, must have belonged to a remarkably big trilobite.

Besides the type specimens described above, two other specimens of this species are figured. Plate IX, fig. 5, is of a thorax and pygidium with a cephalon on the opposite side (Nat. Mus. Vic., Reg. No. 14584). This specimen shows the thoracic pits (impressions of condyles) distinctly, and also the nature of the pleural furrows. A shallow and narrow furrow divides each pleuron into a wide posterior part and a narrow anterior part (the articulating half ring), as seen clearly in the most anterior segment of the paratype.

The holotype cephalon is broken away on the anterior of the right side, revealing a flat doublure (5 mm. wide, although full width not showing) under the front of the pre-glabellar field. Laterally, the doublure has a deep marginal furrow, 2 mm. wide and about 1·5 mm. deep. It begins opposite the axial furrow and rapidly deepens and widens to the dimensions given. The cephalon No. 14584 shows that this furrow flattens out towards the genal angle, becoming a more or less flat doublure 3 mm. wide.

Plate IX, fig. 6, is a pygidium preserved as a steinkern, which is figured (Reg. No. 14585), and an external mould (Reg. No. 14586). The latter shows that the pygidium tapered to a fine point, as seen in the paratype thorax and pygidium. The steinkern is broken away on the left side, and reveals a doublure about 4·5 mm. wide and slightly convex. Under the posterior margin of the pygidium it can be seen that the doublure continues to the end at this same width and with a similar convexity. Fourteen pygorachial segments can be distinguished, and seven pygopleural segments. The above two figured specimens are topotypes (coming also from Davis' Quarry), and may also be regarded as hypotypes.

The most distinguishing structures of *Trimerus kinglakensis* are the large pointed pre-glabellar field with its tiny boomerang-shaped epistoma, the absence of glabellar furrows, the strongly developed articulating condyles in the thorax, and its large size.

Trimerus lilydalensis, sp. nov.

Plate VIII, figs. 4, 5; Pl. IX, fig. 7. Text fig. 1F.

Type Material

1. *Holotype* consisting of steinkern and external mould of the same individual preserved in reddish shale. Hull Road, Lilydale. For locality, see Gill 1940. (Nat. Mus. Vic., Reg. Nos. 14587 and 14588.)

2. *Paratype* consisting of steinkern of a pygidium in yellow shale. Same locality. (Nat. Mus. Vic., Reg. No. 14589.)

Descriptions

1. *Cephalon.* Measurements in plan (i.e., not following the contours of the carapace):

Length of cephalon	1·55 cm.
Width of cephalon	2·55 cm.
Length of glabella	1 cm.
Width of glabella anteriorly	8·5 mm.
Width of glabella posteriorly	1 cm.
Distance of eye from lateral margin (along suture) ..	1 cm.

Distance of eye from lateral margin (along suture) 1 cm. Cephalon sub-triangular in outline, with fairly pointed pre-glabellar field, but well rounded genal angles. Exceedingly tumid; median longitudinal profile as shown in fig. 1F. Eyes prominent, elevated on protuberances, and much more remote than in the other new species described in this paper.

Glabella sub-quadrate, but narrowing anteriorly, and anterior margin slightly rounded. Axial furrows almost absent.

The facial sutures cut the genal angles, then arch forward to run parallel to the posterior margin of the cephalon (and about 4 mm. from it) until the eyes are reached. Having skirted the eyes, the sutures run forward parallel to the lateral margins of the glabella, as far forward as its anterior margin, then they curve across the pre-glabellar field to meet about 1·5 mm. from the tip of the cephalon. The epistome is thus small.

The nuchal segment is not conspicuous or well-defined. The external mould of the cephalon shows the left facial suture, and indicates that the surface of the carapace was smooth.

2. *Pygidium* about 2·8 cm. long. Segmentation distinct, but trilobation indistinct. Eleven pygorachial segments can be distinguished, but there may well have been twelve. Nine pygopleural segments can be counted; there were possibly ten.

COMMENT. This is a small trilobite compared with the other new species here described. The whole carapace was probably only 8 or 9 cm. long. A fragment of a pleural segment suggests that the pleural furrows ran along the middle of the pleura, i.e., along the middle of the elevated part of the pleurae showing when they are in place, as in *T. harrisoni*. This species also contrasts with the other new forms in that it has a more transverse cephalon, the eyes are more remote, and the trilobation of the pygidium is much less distinct.

Trimerus zeehanensis, sp. nov.

Pl. IX, figs. 1, 2, 4. Text fig. 1D.

TYPE MATERIAL

1. *Holotype* consisting of steinkern and external mould of cranidium. (Nat. Mus. Vic., Reg. Nos. 14590 and 14591.)

2. *Paratype* consisting of steinkern and external mould of pygidium. (Nat. Mus. Vic., Reg. Nos. 14592 and 14593.)

A free cheek and part of a pleural segment are also described, but are given no typical standing.

All specimens from the right bank of Little Henty River, 1 mile S.E. from Zeehan.

DESCRIPTIONS

Cranidium comparatively tumid, smooth except for very fine and moderately dispersed 'granulation', 2·2 cm. long in plan (i.e, not following the contours of the carapace), and 2·7 cm. wide from eye to eye. Median longitudinal profile as fig. 1D. Glabella sub-quadrate, slightly narrower in front. Approximately 1·7 cm. long, 1·3 cm. wide anteriorly and 1·6 cm. posteriorly. No glabellar furrows present. Axial furrows poorly defined. Nuchal segment and furrow clearly defined. Pre-glabellar field markedly concave, the anterior rim being upturned. The part of the facial suture alongside the glabella runs to the eye more or less in a straight line, and parallel to the side of the glabella. The suture is 6 mm. from the lateral margin of the glabella. From the eye, the suture turns away towards the genal angle so as to form an angle of the order of 130°.

External mould of cranidium shows strongly the upturned front margin, and that the surface was smooth except for the fine 'granulation', which is so minute that it is not noticed until a lens is employed. It appears in our specimens as minute papillae on both steinkerns and external moulds, so must have consisted of pittings on both the external surface and internal surface. The mould also shows that the front margin of the cranidium is nearly straight, being indented slightly.

Pygidium triangular, strongly arched, with well-defined pygorachial and pygopleural segments. Margin entire. Axis a third of width of pygidium. Axis well marked, but axial furrows not deep. Pygorachial and pygopleural segments in cross-section are streamlined like a sand dune, i.e., with a long slope anteriorly and a short one posteriorly. There are twelve pygorachial segments, not counting the rounded terminal segment; eight pygopleural segments.

Dimensions in plan:	Length	3·0 cm.
	Width	3·6 cm.
Dimensions following contours of pygidium:	Length	3·5 cm.
	Width	5·7 cm.

These figures indicate the high degree of tumidity.

External mould of pygidium shows the carapace to have possessed an 'ornament' similar to that of the cephalon.

Free cheek shows facial suture curves anteriorly so as to form one side of an arch. From the position of the eye, the suture swings outwards, then posteriorwards, then outwards again to the genal angle. A line from the eye to where the suture cuts the genal angle, makes an angle of about 120° with the straight part of the suture which is parallel to the lateral margin of the glabella. The free cheek is tumid, more so posteriorly than anteriorly. Opposite the eye, the margin of the cheek is deflected sharply so as to be almost at right angles to the general dorsal surface. Anteriorly, the cheek preserves part of a furrowed doublure. The cheek is 'granulated' like the cephalon, but the granulations appear to be closer; this is probably due to better preservation.

A fragment of a pleuron shows a deep furrow which divides the segment unevenly, thus:

Wide part	3 mm.
Furrow	1·5 mm.
Narrow part	2 mm.
Total width	6·5 mm.

A terminal fragment of a pleural segment shows that the furrow almost reaches the end of the segment, which is deflected posteriorly.

COMMENT. The complete carapace of trilobites of this type is from 3·5 to 4·5 times as long as the pygidium, the variation being due largely to the presence or absence of extensions on the cephalon and pygidium. The thorax is usually twice the length of the pygidium if any pygidial spine present is left out of account. On this basis, we may infer that the type specimens represent a trilobite about 12 cm. long. A much larger pygidium was collected from the locality, which suggests a form about 18 cm. long. The upturned pre-glabellar field readily marks off this species from the others described. It has been suggested to me that the upturned anterior margin would act like that of a toboggan.

Genetic Relationships

In the National Museum there is a complete but poorly preserved *Trimerus* carapace from 'Section XII, Parish of Yering' collected by Mr. Geo. Sweet, which apparently belongs to *T. lilydalensis*. The thorax is the best preserved part, and it is particularly like that of *T. harrisoni*, with similar profile in cross-section, and similar median pleural furrows. This suggests that *T. lilydalensis* is the Lower Devonian descendant of the Silurian *T. harrisoni*.

Secondly, the similarities between *T. vomer* and *T. kinglakensis* are striking. The latter is really a *T. vomer*, in which the obsolescence of the glabellar furrows has been completed, i.e., they have disappeared, and the form in general has become more developed. The only other important difference is that the glabellar is more tapered in *T. vomer*, and the facial suture follows that lineation. We may conclude that *T. kinglakensis* is genetically related to, and probably a little later in time than, *T. vomer*.

Thirdly, *T. zeehanensis* provides a distinct species. However, as so little is known of Tasmanian palaeontology, it is not surprising that no ancestor can be indicated.

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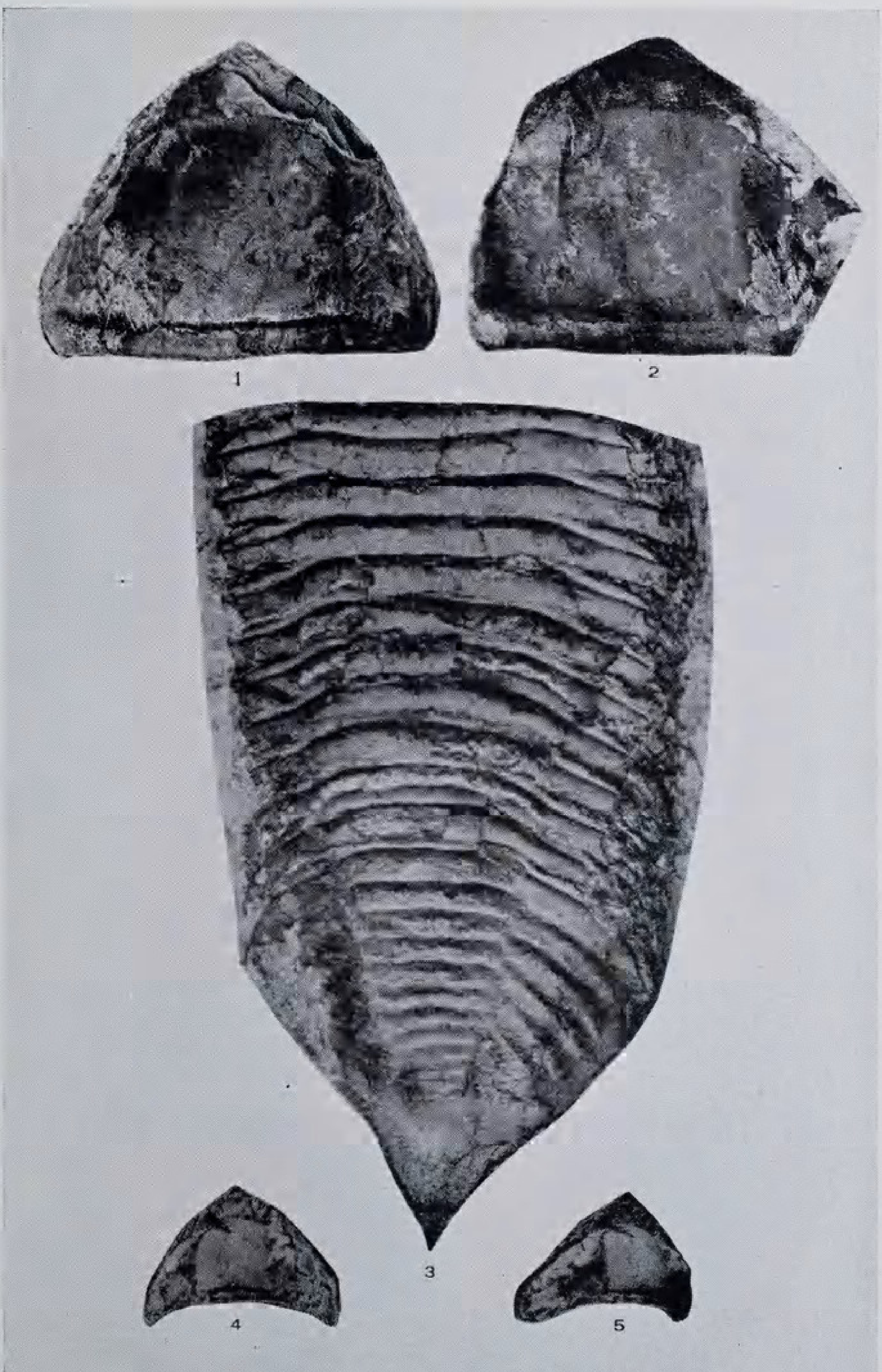
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