NEW TRILOBITES FROM THE TREMADOC SERIES OF SHROPSHIRE

by R. HUTCHISON and J. K. INGHAM

ABSTRACT. A new locality in the Shineton Shales of the Cardington district is referred to the *Clonograptus tenellus* Zone. The fossils are compared with related and similar forms previously known from the Wrekin district. The fauna includes three new species of trilobites—*Asaphoon pithogastron* gen. et sp. nov., *Dichelepyge phylax* sp. nov. and *Myindella crux* gen. et sp. nov. *D. phylax* represents the first recognition of *Dichelepyge* outside South America. *Myindella crux* suggests that the Family Myindidae is closely related to the Hapalopleuridae and should therefore be included in the Suborder Trinucleina.

THE SPECIMENS here described were collected by one of us (R. H.) from a greyish-green, nodular, micaceous siltstone seen in a small exposure of about 2 ft of Shineton Shales in Heath Brook, 1,100 yd. south-east of Cardington church (Grid Ref. 51259440) and 4 miles ENE. of Church Stretton. The beds are disturbed and their exact stratigraphical position is obscure but they most probably lie within the *Clonograptus tenellus* Zone (Stubblefield and Bulman 1927, p. 110) as they contain the zonal graptolite and an assemblage of trilobites which has its closest counterpart in the *C. tenellus* Zone of the Wrekin district (see table).

In a short description of the Cardington outcrops Stubblefield and Bulman (p. 116) suggested that the Transition Beds, which underlie the *C. tenellus* Zone, are also present in the area in view of the association of *C. tenellus* (Linnarsson), *Dictyonema flabelliforme* (Eichwald) and *Shumardia curta* Stubblefield on specimens in the Sedgwick Museum, Cambridge.

Neither of the two new genera—*Asaphoon* and *Myindella*—is as yet known outside the Cardington district but *Myinda* Stubblefield (*in* Stubblefield and Bulman, p. 130), a genus closely related to *Myindella*, was described from the *C. tenellus* Zone of the Wrekin district. The discovery of *Dichelepyge*, Harrington and Leanza, 1952, in the Shineton Shales provides a further link between the Tremadoc Series in Europe and Argentina. *D. phylax* sp. nov. is the only known European species referable to the genus. The specimen described as *Hysterolenus törnquisti* Moberg ?var. (Stubblefield *in* Stubblefield and Bulman, pp. 111, 118, 137; pl. 4, fig. 8) from the *C. tenellus* Zone of the Wrekin district is undoubtedly conspecific with the new form.

In Table 1 the fauna collected from the locality is compared with allied, identical, and possibly identical forms, together with their stratigraphical ranges in the Wrekin district, as listed by Stubblefield and Bulman.

SYSTEMATIC DESCRIPTIONS

The terminology used is that of Harrington and others (*in* Moore 1959, pp. **O**38–**O**126). Glabellar furrows are numbered forwards from the occipital furrow.

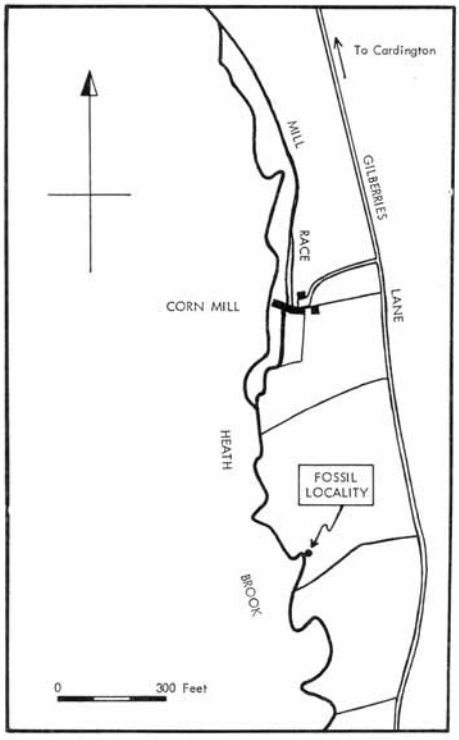
All specimens are deposited in the Hunterian Museum of the University of Glasgow.

[Palaeontology, Vol. 10, Part 1, 1967, pp. 47–59, pl. 8.

Suborder ASAPHINA Salter 1864
Superfamily ASAPHACEA Burmeister 1843
Family ASAPHIDAE Burmeister 1843
Genus ASAPHOON gen. nov.

Type species. Asaphoon pithogastron sp. nov.

Derivation of name. asaphes (Gr.) = indistinct, obscure+*oon* (Gr.) = egg.



TEXT-FIG. 1. Location of the fossil locality near Cardington.

Diagnosis. Small asaphid trilobite with highly convex glabella and long preglabellar field. ?Four pairs of short, indistinct lateral glabellar furrows and a posteriorly situated glabellar tubercle present. Occipital ring crescentic. Fixigenae possess small, convex, poorly defined paraglabellar areas. Palpebral lobes long. Pygidium with entire margin and concave border. Pygidial axis has seven annulations and pleural regions are crossed by seven pleural furrows which do not reach the margin. Faint interpleural furrows present.

Discussion. No other described asaphid trilobite has palpebral lobes as proportionally long or a glabella so convex as *Asaphoon*. The swollen nature of the glabella, however,

may be a feature of youth. *Ptychopyge* Angelin 1854 shows some similarities in possessing a long preglabellar field and in the presence, behind the palpebral lobes, of small nodes resembling the convex paraglabellar areas in *Asaphoon*. Although possessing such general asaphid characteristics as the course of the anterior branches of the facial suture and in having a glabellar tubercle near the occipital furrow, the new genus is so different in detail from other asaphid genera that it is impossible to place it in any of the recognized subfamilies within the Asaphidae.

TABLE 1

LIST OF SPECIES FROM THE NEW LOCALITY NEAR CARDINGTON INCLUDING NEW FORMS DESCRIBED IN THIS PAPER		RANGES OF ALLIED (A) OR IDENTICAL (I) FORMS PREVIOUSLY RECORDED FROM THE SHINETON SHALES OF THE WREKIN DISTRICT (after Stubblefield & Bulman, 1927)	*Dictyonema flabelliforme* Zone	Transition Beds	*C. tenellus* Zone	Brachiopod Beds	*Shumardia pusilla* Zone	Arenaceous Beds
Agnostid		3 agnostids recorded	X	X	X		X	
Asaphoon pithogastron gen. et sp. nov.								
?Beltella sp.								
Dichelepyge phylax sp. nov.	I	*Hysterolenus törnquisti* Moberg ?var.			X			
Lichapyge cf. *cuspidata* Callaway	?I	*L. cuspidata* Callaway					X	
Macropyge sp.	?I	*M. chermi* Stubblefield		X	X		?	
Myindella crux gen. et sp. nov.	A	*Myinda uriconii* Stubblefield			X			
Platypeltoides croftii (Callaway)	I	*Symphysurus croftii* (Callaway)		X	X		X	
Adelographus ? sp.	?I	*? Bryograptus* cf. *hunnebergensis* Moberg		X	X			
Clonograptus tenellus (Linnarsson)	I	*C. tenellus* (Linnarsson)		X	X			
C. tenellus callavei Elles & Wood	I	*C. tenellus* var. *callavei* Elles & Wood		X	X			
Lingulella cf. *nicholsoni* Callaway	?I	*L. nicholsoni* Callaway	X	X	X	X	X	X
Hyolithus sp.		3 hyolithids recorded	X	X			X	

Asaphoon pithogastron gen. et sp. nov.

Plate 8, figs. 11, 13, 14; text fig. 2.

Derivation of name. pithogastros (Gr.) = potbellied.

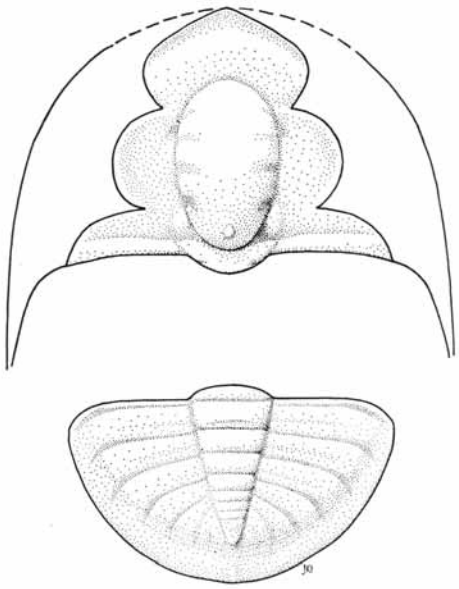
Holotype. Hunterian Museum A5807a, b (Pl. 8, fig. 11) internal and external moulds of a cranidium.

Paratypes. HM. A5809 (Pl. 8, fig. 14); HM. A5810a, b (Pl. 8, fig. 13).

Other material. One damaged pygidium HM. A5808.

Description. Holotype cranidium subtriangular in outline, a little broader than long (sag.) in the ratio 7:6. Glabella almost twice as long (sag.) as broad, inflated, egg-shaped with frontal lobe bluntly rounded and posterior margin slightly overhanging occipital furrow. Maximum width (tr.) a little in front of the middle of the glabella. At least three pairs of short, equally spaced lateral glabellar furrows present. The first pair are the deepest, situated at about one-third the length of the glabella from its posterior margin and directed slightly backwards. The second and third pairs of furrows are a little longer and more transverse than the first pair but they are very weakly impressed. There is an indication of a fourth, anterior pair of glabellar furrows represented only by faint indentations on the sides of the glabella about three-quarters the length of the glabella from its posterior margin. A large median tubercle is present near the posterior margin of the glabella. The axial and preglabellar furrows are not deeply impressed, the glabella

being defined primarily by the steepness of its sides. Occipital furrow arched backwards, sharply defined, its depth being exaggerated by the steepness of the glabellar margin. Occipital ring crescentic in outline, its sagittal length being about one-eighth the length of the glabella. It is slightly broader (tr.) than the maximum width of the glabella and is



TEXT-FIG. 2. Partial reconstruction of *Asaphoon pithogastron* gen. et sp. nov. Approx. ×18.

EXPLANATION OF PLATE 8

Figs. 1–5, 7. *Myindella crux* gen. et sp. nov. 1, HM. A5802, ×12. Latex cast of holotype cranidium, an external mould. 2, 3, HM. A5805a and b, ×8. Internal mould and latex cast of external mould of paratype thorax/pygidium. 4, HM. A5803b, ×8. Latex cast of external mould of cranidium. Paratype. 5, As for fig. 1. Oblique frontal view ×8. 7, HM. A5804, ×8. Latex cast of external mould of poorly preserved incomplete individual showing the nature of the marginal suture and a suggestion of the presence of a lower lamella. Paratype.

Figs. 6, 8–10, 12, 15, 16. *Dichelepyge phylax* sp. nov. 6, HM. A5772b, ×9. Latex cast of external mould of holotype cranidium. 8, HM. A5781a, ×6. Internal mould of incomplete pygidium associated with damaged thoracic segments, showing two pairs of marginal spines. Paratype. 9. HM. A5784, ×9. Internal mould of pygidium with four thoracic segments. Paratype. 10, HM. A5776, ×6. Internal mould of almost complete individual. Paratype. 12, HM. A5785, ×6. Internal mould of hypostome. Paratype. 15, HM. A5779a, ×9. Internal mould of left librigena showing long genal spine. 16, HM. A5770, ×9. Latex cast of external mould of incomplete cephalon and thorax showing the course of the facial suture. Paratype.

Figs. 11, 13, 14. *Asaphoon pithogastron* gen. et sp. nov. 11, HM. A5807b, ×12. Latex cast of external mould of holotype cranidium. 13, HM. A5810a, ×8. Internal mould of badly damaged incomplete individual showing shape of librigena and traces of anterior thoracic segments. Paratype.14, HM. A5809, ×8. Internal mould of pygidium. Paratype.

defined laterally by shallow furrows which continue the curve of its posterior margin and run obliquely forward to meet the posterior border furrows of the fixigenae. The posterior margin is interrupted laterally by a pair of short, shallow, transverse furrows which have the effect of giving a slight independent convexity to the outer portions of the predominantly flat occipital ring. Preglabellar field long (sag.), almost half the length of the glabella, slightly concave with a narrow, upturned anterior border defined by a shallow border furrow. Palpebral portions of fixigenae of moderate width (tr.); posterior portions wide (tr.), curving backwards a little distally. Posterior borders defined by weak border furrows which die out laterally. Small, convex paraglabellar areas lie close to the posterior part of the glabella in the angles formed by the axial furrows and the posterior border furrows. They are ill-defined both laterally and frontally. Palpebral lobes are long, narrow, slightly elevated, and crescentic in shape. Anteriorly they begin opposite the ?fourth pair of glabellar furrows and extend backwards to a level a little to the rear of the preoccipital glabellar furrows. Their length (exsag.) is a little more than half the length of the glabella. Palpebral furrows shallow. Palpebral lobes continue anteriorly into short, gently convex eye ridges which are terminated by the axial furrows a little in front of the ?fourth pair of lateral glabellar furrows. Anterior branches of facial suture diverge at first at about 40°, then curve gradually inwards to meet dorsally at an angle of 135°. Posterior branches of facial suture curve gently outwards and backwards.

Librigenae, known only from a poorly preserved individual (HM. A5810a, b, Pl. 8, fig. 13), are broad, flat and produced into rather stout genal spines which are at least as long as the palpebral lobes. Hypostome unknown.

Thorax also known only from the fragmentary evidence of HM. A5810a, b. Number of segments unknown. Axis occupies about one-quarter the total thoracic width. Pleurae very poorly preserved but each pleura ends in a short, backwardly directed point and is apparently crossed obliquely by a moderately deep pleural furrow.

Pygidium semicircular to paraboloid in outline. Axis convex, narrow, occupying a little less than one-quarter the maximum pygidial width anteriorly. Axial furrows converge posteriorly at 30°. The axis does not quite reach the posterior border which, however, is crossed by a narrow post-axial ridge. Seven well-defined axial rings and terminal piece present. Pleural fields with a gently convex inner portion and a concave border. Anterior margins straight proximally but curving backwards distally. Six pairs of distinct, and one posterior pair of faint pleural furrows curve gently outwards and backwards from the axis, not reaching pygidial margin but dying out on the concave border. Faint interpleural furrows discernible on the three anterior pairs of pleural ribs. Doublure not seen. The flattened and incomplete pygidium in HM. A5810a, b (Pl. 8, fig. 13) differs from HM. A5809 (Pl. 8, fig. 14) in that a seventh pair of faint, backwardly directed pleural furrows is visible. This is probably not a significant difference.

Surface of cranidium and pygidium smooth.

Measurements (in mm.).

HM. A5807b (external mould)

Length of cranidium	2·30
Max. width of cranidium	3·00
Width of cranidium at palpebral lobes	1·95
Length of glabella	1·40

Measurements (in mm.).

Max. width of glabella	0·80
Length of preglabellar field and anterior border	0·65
Length (exsag.) of palpebral lobes	0·75

HM. A5809 (internal mould)

Length of pygidium	1·55
Max. width of pygidium	2·45
Anterior width of axis	0·60
Length of axis (including articulating half-ring)	1·20

Superfamily CERATOPYGACEA Linnarsson 1869
Family CERATOPYGIDAE Linnarsson 1869
Genus DICHELEPYGE Harrington and Leanza 1952

Type species. Dichelepyge pasquali Harrington and Leanza 1952, p. 203, by original designation.

Dichelepyge phylax sp. nov.

Plate 8, figs. 6, 8–10, 12, 15, 16; text-fig. 3.

1927 *Hysterolenus törnquisti* Moberg ?var.; Stubblefield *in* Stubblefield and Bulman, p. 137, pl. 4, fig. 8.

non 1898 *Hysterolenus törnquisti* Moberg, pp. 318–23, pl. 17, figs. 1–9.

Derivation of name. phylax (Gr.) = jester, referring to the impression given of a grinning face on the cranidium.

Holotype. HM. A5772a, b (Pl. 8, fig. 6) internal and external moulds of a cranidium.

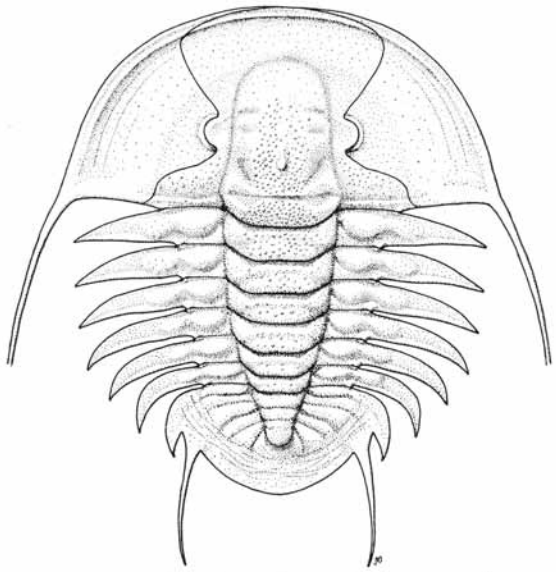
Paratypes. HM A5781a, b (Pl. 8, fig. 8); HM. A5784 (Pl. 8, fig. 9); HM. A5776 (Pl. 8, fig. 10); HM. A5785 (Pl. 8, fig. 12); H.M. A5770 (Pl. 8, fig. 16).

Other material. Two incomplete individuals, three cranidia, three librigenae, one hypostome, one thoracic fragment HM. A5773a, b to HM. A5775a, b, HM. A5777a, b, HM. A5778a, b, HM. A5779a, b (Pl. 8, fig. 15), HM. A5780a, b, HM. A5782, HM. A5783, HM. A5786a, b.

Diagnosis. Dichelepyge with anterior branches of facial suture diverging. Glabella with median tubercle. Pygidium with a rounded posterior margin and axis consisting of only three rings and a terminal piece. Pleural portions of thoracic segments relatively short (tr.).

Description. Cephalon only weakly convex, broadly semicircular in outline, with long genal spines. Glabella, in holotype cranidium, weakly convex, raised a little above level of fixigenae and defined by broad, shallow, axial furrows gradually converging forwards. Length (sag.) of glabella about two-thirds median length of cephalon; basal width almost one-quarter the maximum width of the cephalon between the genal angles. Anteriorly the glabella is broadly rounded and laterally it is slightly constricted at the level of the first pair of glabellar furrows. Three pairs of lateral glabellar furrows present. First pair bifurcated, the posterior branches being very deep adaxially and directed obliquely backwards but not reaching occipital furrow. Anterior branches very short and indistinct. Second pair of lateral glabellar furrows consist of shallow, transverse pits situated at half the glabellar length, not reaching axial furrows. Anterior pair of furrows are rather longer and although reaching the axial furrows are extremely shallow at this point. A large median glabellar tubercle is situated at the level of the first glabellar furrows. Occipital furrow broad (tr.), deepest distally. Occipital ring gently convex transversely and gently

arched backwards, its posterior margin slightly flattened mesially. Median length (sag). about one-sixth the glabellar length, becoming narrower (exsag.) laterally. Length (sag.) of preglabellar field equal to about one-quarter the length of the glabella, gently convex (sag., exsag.), passing forwards insensibly into a broad, shallow, border furrow whose anterior margin ends abruptly. Narrow anterior border with slightly raised posterior ridge and anterior portion declined forwards. Palpebral areas of fixigenae narrow (tr.), with palpebral lobes near to glabella. Posterior portions wide, roughly quadrilateral



TEXT-FIG. 3. Reconstruction of *Dichelepyge phylax* sp. nov. Approx. ×8.

in shape, extending laterally for a distance equal to two-thirds of the basal glabellar width. Palpebral lobes short and narrow, strongly crescentic, beginning at a level just to the rear of the anterior pair of glabellar furrows and extending backwards almost to the level of the first glabellar furrows. Palpebral furrows shallow. Short eye ridges run obliquely forwards in continuation of the lobes. Posterior border furrows shallow, well-defined but dying out laterally. Posterior borders narrow proximally, expanding a little distally where, on its posterior margin, each bears a small socket for the articulation of the first thoracic pleura. Facial suture seen most clearly in HM. A5770 (Pl. 8, fig. 16). Anterior branches diverge at first at about 90°, then curve gradually forwards and inwards to cross the anterior border very obliquely, becoming confluent on the dorsal surface a very short distance from the anterior margin. Posterior branches of facial suture curve gently backwards and outwards from the palpebral lobes, then turn sharply backwards and finally curve outwards again to cut the posterior margin of the cephalon a short distance beyond the articulating sockets on the posterior borders. Librigenae large and almost flat, produced into long, narrow, slightly outwardly directed genal

spines which extend backwards for a distance at least equivalent to the median length of the cranidium. Lateral borders narrow, slightly elevated and gently concave in cross-section. Posterior borders ill-defined. Three very narrow, concentric grooves cross the librigenae parallel to the lateral borders. Innermost groove very faint. In addition, a broad, shallow groove set further from the border (Pl. 8, figs. 15, 16) may be an impression of the inner margin of the cephalic doublure. Eyes narrow, crescentic, convex in cross-section, bounded below by a shallow furrow. Hypostome almost as wide as long, with strongly convex median body. Anterior border flat, short (sag.), crescentic in shape, becoming a little longer (exsag.) laterally where it is continued into prominent, backwardly truncated anterior wings. Anterior margin of hypostome strongly curved. Lateral notches right-angled. Lateral and posterior borders narrow except postero-laterally where the borders expand into small, rounded projections. Border furrow deepest opposite this pair of structures. Lateral margins straight, subparallel. Posterior margin curved backwards.

Thorax of six segments, rather shorter than the median length of the cranidium. Axis occupies a little more than one-quarter of the total thoracic width anteriorly. Narrow axial furrows converge gradually backwards as far as the fourth segment, beyond which they curve inwards more strongly. Axial rings decrease in length (sag.) progressively from front to back, moderately arched (tr.), strongly curved forwards distally, less so mesially. A faint transverse groove on each ring (Pl. 8, fig. 16 (external mould)) is probably an impression of the anterior margin of the articulating half-ring belonging to the segment behind. Small slit-like apodemal pits are situated in the lateral portions of the ring-furrows. Proximal portion of each pleura swollen anteriorly. A sigmoidal furrow crosses from the antero-proximal corner of the pleura behind the swelling to separate off a narrow (exsag.) posterior portion which itself expands a little distally, and even less so proximally, to form two small articulating sockets. The proximal socket, which is less obvious than the distal one, is situated adjacent to the axial furrow. It is clearly visible on the first thoracic segment of HM. A5770 (Pl. 8, fig. 16). A shallow furrow in front of the pleural swelling defines a small anterior process which fits into the outer articulating socket of the segment in front. Another small process, not seen, is presumably present proximally. Each pleura is produced distally into a fairly flat, pointed, blade-like pleural tip, not in contact with adjacent segments. On the anterior segments the pleural tips are curved gently backwards but on successive segments the curvature is progressively more marked so that on the sixth segment the points are directed posteriorly. A shallow furrow on each pleural tip runs close to the posterior margin.

Pygidium, excluding spines, paraboloid in outline. Maximum width equal to about twice the median length. Convex axis occupies about one-quarter the width of the pygidium anteriorly and extends backwards for half its median length. Axial furrows deep, converging posteriorly at about 45° at first, then becoming subparallel. Axis ends bluntly but faint continuations of the axial furrows continue on to border. Three axial rings, similar to those of the thorax, and a terminal piece present. Pleural regions gently convex proximally, with a broad concave border which is longest (sag.) posteriorly. Two pairs of narrow interpleural furrows extending faintly on to the concave border alternate with three pairs of shorter, but deeper, pleural furrows. A number of very fine, concentric, but sinuous, grooves are present on the pygidial border. Two pairs of lateral border spines present. Anterior pair short, blade-like, similar to the spines of the

last thoracic segment, but recurved. Posterior pair long and slender, gently curved, reaching backwards for a distance equivalent to a little more than the median length of the pygidium.

Surface of test fairly smooth except for the postero-mesial part of the glabella, the posterior portions of the fixigenae, the occipital ring and the axial rings, all of which are finely granular.

Measurements of type specimens (in mm.). EM. = external mould, IM. = internal mould.

	HM. A5772b EM.	HM. A5770 EM.	HM. A5776 IM.	HM. A5781a IM.	HM. A5784 IM.
Width of cephalon at genal angles		5·80 (est.)			
Length of cranidium	4·40	3·00	3·50 (est.)		
Max. width of cranidium (est.)	5·55	3·60			
Width of cranidium at palpebral lobes	3·15	2·20 (est.)			
Width of cranidium across preglabellar field	3·80	2·80 (est.)			
Length of glabella with occipital ring	3·30	2·15	2·65		
Basal width of glabella	2·25	1·40 (est.)	1·80		
Length of palpebral lobes	0·65	0·50			
Median length of thorax			2·70		
Max. width of thorax (est.)		5·40	5·70		
Anterior width of thoracic axis			1·80		
Median length of pygidium excluding articulating half-ring			1·65	2·60	1·80
Max. width of pygidium			3·50 (est.)	4·60	3·55
Anterior width of pygidial axis			0·85	1·20 (est.)	0·75

Length of hypostome HM. A5785 (IM.) 3·00; max. width 3·15 (est.)

Discussion. Dichelepyge pasquali Harrington and Leanza (1952, p. 203, pl. 1, figs. 3–6; 1957, p. 184, figs. 97, 98, 1*a–d*), from the *Kainella meridionalis* Zone of the Lower Tremadoc of Salta Province in the Eastern Cordilleras of Argentina, is the only other species in the genus. It is of approximately the same age as the Shropshire specimens of *D. phylax* sp. nov. and is very similar to the new form. Both species possess two pairs of marginal pygidial spines (a generic character) but there are several striking differences in proportion, the most noticeable of which is in the size of the pygidium. In *D. pasquali* the median lengths of pygidium and cranidium are approximately equal, whereas in *D. phylax* the median length of the pygidium is only about half that of the cranidium. The pygidial axis is longer, narrower, has more axial rings in the South American

species (seven, compared with three in *D. phylax*), and the pygidial margin is flattened mesially, that of *D. phylax* being rounded. The holotype of *D. pasquali*, a cranidium, seems to have suffered slight crushing which may account for the more forward position of the eyes and the transverse fold in front of the glabella. Nevertheless, the anterior branches of the facial suture are less divergent than in *D. phylax* and there is no median glabellar tubercle. Also, the posterior portions of the fixigenae are much wider (tr.) in *D. pasquali* and as it is this part of the cephalon which articulates with the thoracic pleurae, the proximal, articulating portions of the latter are also much wider (tr.) than in the Shropshire form. Finally, in *D. pasquali*, the free, blade-like extremities of the pleurae are proportionally longer, particularly on the four posterior segments.

Suborder TRINUCLEINA Swinnerton 1915
Family MYINDIDAE Hupé 1955
Genus MYINDELLA gen. nov.

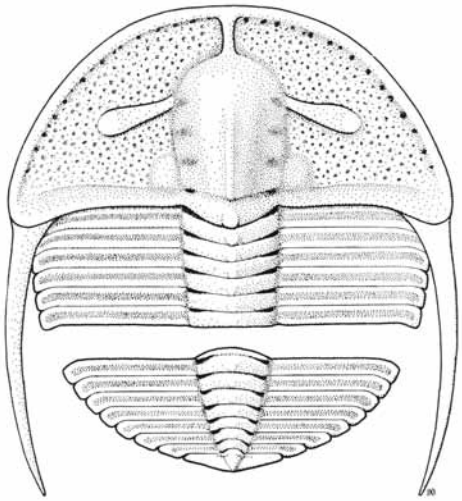
Type species. Myindella crux sp. nov.

Diagnosis. Myindid with carinate glabella and three pairs of short lateral glabellar furrows. Distinct paraglabellar areas present. Preglabellar field short, with transfrontal ridge. Cephalon with marginal suture has narrow elevated border surrounding pitted genal region and long genal spines. Border furrow with single row of larger pits. Eye ridges club-like. Occipital and axial rings with large median tubercle or spine. Thorax/pygidium with narrow axis, narrow (exsag.), transverse, furrowed pleurae and small, triangular terminal piece. Number of segments unknown.

Discussion. Myindella agrees with *Myinda* Stubblefield (*in* Stubblefield and Bulman 1927, p. 130) in the general plan of the cranidium, similar eye ridges and transfrontal ridge and the number of glabellar furrows. Also, the occipital ring in *Myinda uriconii* (op. cit., p. 131, pl. 4, fig. 3) may possess a median tubercle. The two genera differ in that *Myindella* has a more transverse cephalon and much shorter (sag.) preglabellar field and transfrontal ridge, a carinate glabella with depressed lateral portions, and paraglabellar areas. In addition, the genal region internal to the border is pitted in *Myindella* and the row of large pits in the border furrow is not present in *Myinda*.

Hupé (1955, pp. 149, 155) included the Myindidae in his Utioidae because of the [quite different] preglabellar structures shown by *Inouyia* Walcott and allied genera, but Whittington (*in* Moore 1959, pp. **O**167, **O**512) listed the family under 'Order Uncertain'. Harrington and Leanza (1957, p. 209) noted that *Araiopleura* Harrington and Leanza displays certain similarities to *Myinda* and that *Myinda* may belong to the Hapalopleuridae. The new myindid material described here strengthens the view that the Hapalopleuridae and the Myindidae are related but there are sufficient differences between them to warrant the retention of the Myindidae as a separate family within the Trinucleina. Major differences between the two families include the presence of opisthoparian facial sutures and lack of a transfrontal ridge and distinct cephalic border in hapalopleurid genera. Similarities are seen in the general shape of the cephalon, glabella, and eye ridges. Also, the multisegmented post-cephalic exoskeleton with no obvious distinction between thorax and pygidium, so characteristic of the Hapalopleuridae and Alsataspididae, is also found in *Myindella* and therefore presumably in *Myinda*. The presence of a row of large pits in the cephalic border furrow of *Myindella*, together with the

marginal suture and an indication of a lower lamella (see below), suggests a relationship with the Dionididae and the Trinucleidae. The carinate glabella and axial tubercles or spine bases of *Myindella* may also be important in this respect as both are seen in some trinucleid genera (e.g. *Reedolithus* and some species of *Tretaspis*). The post-cephalic segments in general configuration also recall those of *Lloydolithus* as figured by Whittard (1958, pl. 11).



TEXT-FIG. 4. Reconstruction of *Myindella crux* gen. et sp. nov. Approx. ×15.

Myindella crux gen. et sp. nov.

Plate 8, figs. 1–5, 7; text-fig. 4.

Derivation of name. crux (Gr.) = cross, referring to the cross-shaped arrangement of ridges on the cephalon.

Holotype. HM. A5802 (Pl. 8, figs. 1, 5) external mould of incomplete cranidium.

Paratypes. HM. A5805a, b (Pl. 8, figs. 2, 3); HM. A5803a, b (Pl. 8, fig. 4); HM. A5804 (Pl. 8, fig. 7).

Other material. Isolated thoracic segments HM. A5806a, b.

Description. Cephalon twice as wide (tr.) as long, roughly semicircular in outline, sometimes a little flattened frontally and antero-laterally, as in the holotype. Genal angles produced into long, stout, and slightly curved genal spines having a triangular cross-section. In the holotype, the glabella, occupying about two-thirds the median length of the cephalon and one-fifth its maximum width, is roughly parallel-sided, a little convex laterally and bluntly rounded in front. A high median crest runs forwards from the occipital furrow, but becomes reduced and finally disappears about two-thirds the length of the glabella from its posterior margin. Laterally the glabella is somewhat depressed where it bears three pairs of short, transverse, weakly impressed, and equidistant lateral glabellar furrows. Axial and preglabellar furrows shallow. Occipital furrow shallow

mesially but deep abaxially where it contains a pair of deep apodemal pits. Occipital ring strongly convex (tr.), arched backwards and narrow (exsag.) abaxially, bearing a prominent median tubercle or spine base. Preglabellar field flat, extending forwards for a distance equal to about one-third the length of the glabella, crossed sagittally by a narrow, sharply defined, and convex (tr.) transfrontal ridge which links the frontal lobe of the glabella wth the narrow anterior border. Genal areas quadrant-shaped, flat, with narrow lateral borders. Shallow border furrows contain a row of relatively large, rather irregularly distributed pits, there being fifteen to twenty pits between the transfrontal ridge and the genal angles on each side of the cephalon. Posterior borders broad (exsag.), expanding abaxially, highest along the posterior margin and declined forwards. Posterior border furrows shallow but sharply defined frontally. No dorsal facial suture. Marginal suture present, becoming dorsal only at the genal angles, the genal spines thus belonging to a ventral lamella. Specimen HM. A5804 (Pl. 8, fig. 7), although poorly preserved, shows evidence of the existence of a lower lamella as in trinucleids and dionidids. The cranidium and lower lamella have parted along the marginal suture and the former has moved forwards a little relative to the latter, clearly showing the separation between the genal spines and the postero-lateral corners of the cranidium. The row of pits in the marginal furrow of the cranidium is discernible but close behind is a ridge which seems to be an impression on to the cranidium of a ventral structure, possibly a row of pits similar to those on the dorsal surface and originally having been opposed to them. Convex eye ridges extend outwards and a little backwards from the postero-lateral corners of the frontal glabellar lobe to the centre of the genal areas. They are very sharply defined and expand somewhat abaxially. There is no indication of a lens-bearing surface. Small, gently convex paraglabellar areas present opposite the preoccipital glabellar lobes. Genal areas, internal to border furrows and with the exception of the eye ridges and paraglabellar areas, are covered with small, shallow pits. Eye ridges have small granules adaxially. Hypostome unknown.

Post-cephalic exoskeleton not known in its entirety and proportions belonging to thorax and pygidium impossible to ascertain due to the similarity of the segments throughout its length. Specimen HM. A5805a, b (Pl. 8, figs. 2, 3) may represent a pygidium but the margin is not entire and each segment is very similar to others associated with a cephalon (HM. A5804, Pl. 8, fig. 7). Pygidium may, therefore, be represented by the small, triangular terminal piece. Total number of segments unknown. Axis convex, occupying a little more than one-fifth the width of the thorax frontally. Each axial ring bears a median tubercle or spine base smaller than that borne by the occipital ring. Each pleura is narrow (exsag.) and straight for most of its length and has a very distal fulcrum and a rounded termination. A deep pleural furrow runs from the axis parallel to the anterior and posterior margins of the pleura, maintaining its depth almost to the termination of the segment. Posteriorly the segments become progressively shorter (tr.). The postcephalic exoskeleton is terminated by a small, transverse, triangular plate on to which the axis continues to the posterior margin; an indication of segmentation is present on the pleural portions.

Measurements (in mm.) (all external moulds).

	HM. A5802	HM. A5803b	HM. A5804
Max. width of cephalon	5·00 (est.)	5·00	4·50 (est.)
Median length of cephalon	2·50	2·20	2·15

Basal width of glabella	1·00	1·00 (est.)	
Median length of glabella	1·55	1·35	
Length of preglabellar field	0·45	0·50 (est.)	
Anterior width of thorax			3·65
Anterior width of axis			0·75

Dimensions of specimen HM. A5805b (Pl. 8, fig. 3)

Median length 1·15 Maximum width 3·05

Acknowledgements. The authors would like to thank Sir James Stubblefield and Professor T. Neville George for kindly reading the manuscript and offering much useful advice and helpful criticism.

REFERENCES

ANGELIN, N. P. 1854. Palaeontologica Scandinavica. *Academia Regia Scientarium Suecanae* (*Holmiae*), **2,** i–ix, 21–92, pls. 25–41.

HARRINGTON, H. J. and LEANZA, A. F. 1952. La classificación de los 'Olenidae' y de los 'Ceratopygidae'. *Revta. Asoc. Geol. Argent.* **7,** (3), 190–205, 1 pl.

—— 1957. Ordovician trilobites of Argentina. *Univ. Kansas* (*Lawrence*), *Dept. Geol. Spec. Pub.* **1,** 1–276, 240 figs.

HUPÉ, P. 1955. Classification des trilobites. *Annls. Paléont.* (*Paris*), **41,** 91–235, figs. 93–247.

MOBERG, J. C. 1898. En trilobit från Skånes Dictyograptusskiffer. *Geol. För. Stockh. Förh.* **20,** 317–24, pl. 17.

MOORE, R. 1959. *Treatise on Invertebrate Paleontology*, Part **O** *Arthropoda* **1**, i–xix, **O**1–**O**560.

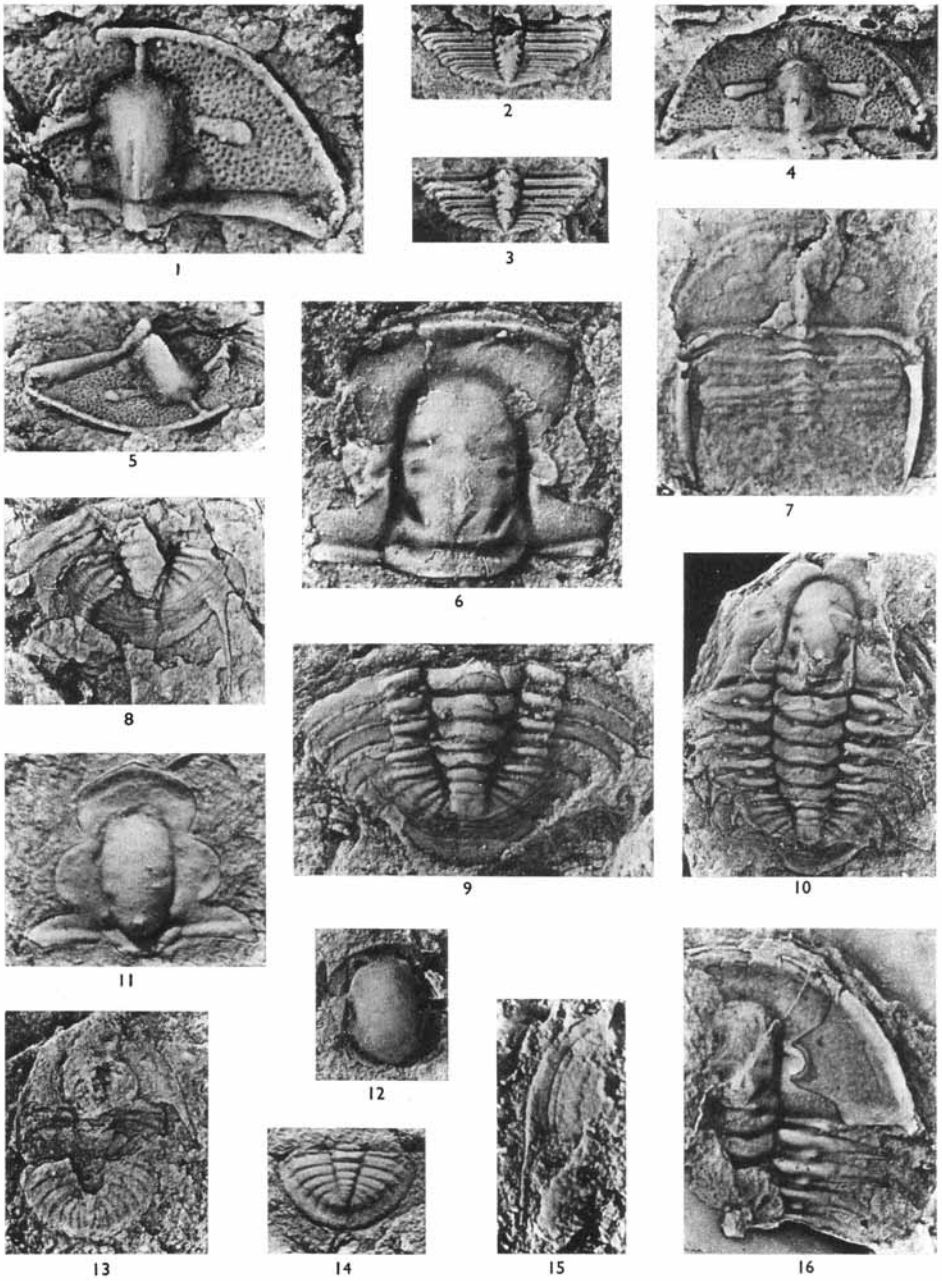
STUBBLEFIELD, C. J. and BULMAN, O. M. B. 1927. The Shineton Shales of the Wrekin district. *Q. Jl geol. Soc. Lond.* **83,** 96–146, pl. 3–5.

WHITTARD, W. F. 1958. The Ordovician trilobites of the Shelve Inlier, west Shropshire, Part 3. *Palaeontogr. Soc.* [*Monogr.*]

R. HUTCHISON
Ministry of Mines and Power,
Geological Survey Division,
P.M.B. 2007, Kaduna South,
Nigeria

J. K. INGHAM
Hunterian Museum,
University of Glasgow,
Glasgow, W.2

Manuscript received 24 November 1965



HUTCHINSON and INGHAM, Tremadocian trilobites