

THE AFFINITIES OF THE TRILOBITE GENUS *SCHARYIA*, WITH A DESCRIPTION OF TWO NEW SPECIES

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ABSTRACT. New discoveries of the trilobite *Scharyia* have led to a critical reappraisal of the genus, in particular the nature of the cedariiform facial suture. *Scharyia* has been considered by a number of authors to belong to the Proetidae, but it is argued here that it has closer affinities with the Otarionidae. Two new species are described, *S. siceripotrix* from the Silurian (Ludlow) of the British Isles and *S. heothina* from the Ordovician (Ashgill) of Sweden, the latter being the first record of the genus in the Ordovician.

DURING the course of work on proetid trilobites from Britain and Scandinavia specimens were examined of the genus *Scharyia*, which has commonly been classified with proetids. In 1967 Dr. J. S. W. Penn and Miss J. Vinnicombe kindly put at the author's disposal proetid and otarionid trilobites which they had collected from the Silurian of the Malvern Hills, England. Among these, from one locality in the Lower Elton Beds (Ludlow Series), were numerous well-preserved specimens of an undescribed species of *Scharyia*, which included small growth stages. In 1969, on a field excursion to the Lake Siljan district, Sweden, led by Dr. V. Jaanusson, three specimens of *Scharyia* were found by the author in the Boda Limestone (Ashgill). Examination and preparation of this new British and Swedish material necessitated comparison with described *Scharyia* species. This led to a critical reappraisal of the detailed morphology of the genus, in particular the cedariiform facial suture, of which new interpretations are presented below. In attempting to work out possible phyletic lineages in the earlier proetids and otarionids, it has not been possible to find any close links between *Scharyia* and proetids, but there does appear to be a relationship with the otarionid *Panarchaeogonus*, reasons for which are discussed below.

Terminology follows that of Harrington *et al.* in Moore (ed.) (1959, pp. O117-O126) and Owens (1973, p. 4, text-fig. 1A), except for the following modification and additions: the term *cedariiform suture* (see Harrington *et al.* op. cit., p. O119) is slightly modified thus: 'opisthoparian suture in which the posterior section runs outwards (abaxially) and on to, or across the lateral border before curving backwards and then turning adaxially to the posterior margin'; ' θ ' refers to the angle between the section β - δ of the anterior branch of the facial suture and an exsagittal line drawn through δ ; ' β - β ' is the transverse distance between these points on the anterior branches of the facial sutures.

REMARKS ON MORPHOLOGY

Hawle and Corda (1847, p. 78) first described *Proetus micropygus* (the type species of *Scharyia*) from a single pygidium. Barrande (1852, pl. 15, figs. 37-38; 1872, pl. 14, figs. 20-21) later figured several cephalae as *P. micropygus*, and complete specimens

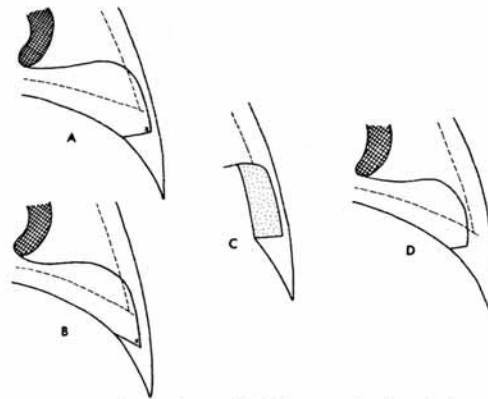
(1852, pl. 17, figs. 16-17) belonging to this species as growth stages of *Proetus* [= *Decoroproetus*] *decorus* Barrande, but he was evidently unaware of the nature of the posterior branch of the facial suture, as it is not included in any of his figures, nor was it mentioned in the text. Přibyl (1946a, p. 5, fig. 19) was the first to illustrate the cedariiform suture of *Scharyia*, and his reconstructions (see also Přibyl 1946b, pl. 2, fig. 9; 1967, p. 289, text-fig. 1, fig. 1) show the abaxial part of the posterior branch running along or just inside the posterior end of the lateral border furrow.

Examination of material of *S. micropyga* from the type and other localities in the Prague district, Czechoslovakia [in the collections of the National Museum, Prague and the British Museum (Natural History)], and of other species of *Scharyia*, has shown that two types of course of the posterior branch of the facial suture are developed, which are here referred to as 'type A' and 'type B'.

Type A. The suture crosses the lateral border furrow and runs backwards, parallel to the lateral margin of the cephalon on to the anterior part of the genal spine, and then turns abruptly adaxially across the base of the genal spine (text-fig. 1A-C).

Type B. The suture does not cross the lateral border furrow, but runs backwards along or inside it, and turns adaxially across the base of the genal spine (text-fig. 1D).

Apart from the details of the posterior branch of the facial suture the cephalic morphology of *Scharyia* remains remarkably stable over a long period of time (late Ordovician to Middle Devonian). Small differences are apparent in the degree of divergence of the anterior branches of the facial sutures, in the glabellar outline and proportions, and in the presence or absence of lateral glabellar furrows.



TEXT-FIG. 1. Comparison of facial sutures in three *Scharyia* species. A-C, type 'A', running outside lateral border furrow. A, C, *S. siceripotrix*, B, *S. micropyga*. Note difference in angles at 'X'. C shows area of doublure of free cheek overlain by fixed cheek (cf. Pl. 98, fig. 9a-b). D, type 'B', running inside or along lateral border furrow (the position of the lateral border furrow is assumed, as the free cheek is unknown), as in *S. heothina*.

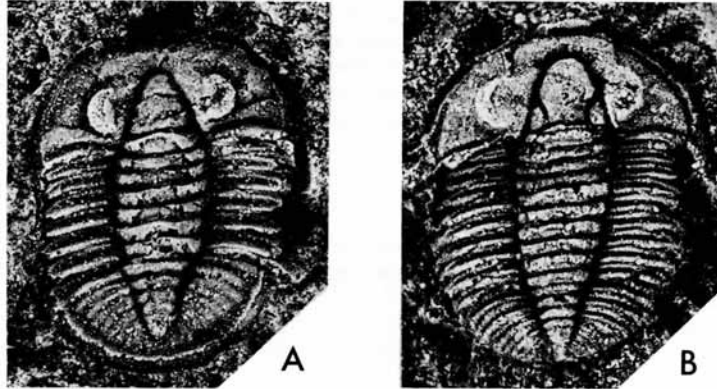
The most variable feature of the pygidium is the border, which, broadly speaking, is absent or only poorly developed in earlier species and well developed in later ones. A feature found in all known *Scharyia* species (which is not known in any other genus) is a small granule on the adaxial end of each posterior pleural band (e.g. Pl. 98, fig. 5), both on the pygidium and on the thorax, which enables dissociated parts to be readily identified.

ORIGIN AND AFFINITIES OF *SCHARYIA*

Příbyl (1946a) erected the genus *Scharyia*, which has subsequently been incorporated in various proetid subfamilies—e.g. the Tropidocoryphinae (Příbyl 1946b, p. 23) and the Eodrevermanniinae (Hupé 1953, p. 217), but Richter, Richter and Struve *in* Moore (ed.) (1959, p. O414) placed it in 'subfamily uncertain' within the Proetacea. Osmólska (1957, p. 61), however, proposed a new subfamily, the Scharyiinae to accommodate it. Příbyl (1967, p. 289) later raised the Scharyiinae to family status, and discussed the relationships of *Scharyia*. He suggested that it might be a distant descendant of the Upper Cambrian cedariids, on account of the similar facial suture and the small number of thoracic segments. This relationship is considered to be unlikely, as there is an enormous time span, embracing most of the Ordovician, between the last known cedariids and the earliest *Scharyia*, and it is believed that the similar morphology of *Scharyia* and the cedariids is due more probably to homoeomorphy than to phyletic relationship.

Erben (1961, p. 88) suggested that the cedariiform suture of *Scharyia* was simply an aberrant development of the normal type of opisthoparian suture found in proetids. If one follows Erben's hypothesis, the ancestors of *Scharyia* presumably had a similar morphology to it, but with a normal opisthoparian suture. Species of *Panarchaeogonus* Öpik, 1937 (e.g. *P. whittardi* (Begg), from the Ashgill of the Girvan district (text-fig. 2B)) have such a morphology. Features shared by *P. whittardi* and *Scharyia* species include the triangulate glabella, large palpebral lobe, position of the eye, and shape of occipital ring (cf. text-fig. 2A and B). The principal differences, apart from the suture, are the prominent basal glabellar lobes and the larger number (nine) of thoracic segments of *P. whittardi*. Because of the striking similarities between the two genera, however, it is considered that *Scharyia* might be derived from *Panarchaeogonus*. The systematic position of the latter has been somewhat confused, but on investigation of species of this genus for an intended revision, it is considered that it is an otarionid. There seems little evidence for considering *Scharyia* to be a proetid. The combination of characters seen in *Scharyia*—the triangulate glabella, eye well out from the axial furrow, the convex preglabellar field, the shape of the occipital ring, the small number of thoracic segments, and the pygidial morphology, as well as the cedariiform suture—are not known in any proetid. Therefore, the subfamily Scharyiinae is tentatively included in the Otarionidae.

Scharyia is the only known genus in the Scharyiinae. Its diagnosis has been emended because of the new morphological interpretations and familial affinities proposed here. The identification of the genus in the Boda Limestone places its origins at least as far back as the late Ordovician. The Boda Limestone is in the 'Remopleuridid Province' of Whittington and Hughes (1972) and thus it is agreed



TEXT-FIG. 2. A, *Scharyia micropyga* (Hawle and Corda, 1847) *wenlockiana* Přibyl, 1967 (BM 42384), dorsal view, $\times 11$. Silurian, Wenlock Series, Liteň Formation, Loděnice, Prague district, Czechoslovakia. B, *Panarchaeogonus whittardi* (Begg, 1939) (HM A1083), holotype internal mould, dorsal view, $\times 12$. Ordovician, Ashgill Series, Rawtheyan Stage, Upper Drummuck Group, Starfish Bed no. 2, Ladyburn, Girvan, Ayrshire. Original of Begg 1939, pl. 6, fig. 3.

with Schrank (1972, p. 32) that *Scharyia* did not originate in the 'Mediterranean Zooprovince' ('Selenopeltis Province' of Whittington and Hughes) as Přibyl (1967, p. 286) has claimed.

SYSTEMATIC PALAEOLOGY

?Family OTARIONIDAE Richter and Richter, 1926

Subfamily SCHARYIINAE Osmólska, 1957

Genus SCHARYIA Přibyl, 1946a

Type species. (Original designation) *Proetus micropygus* Hawle and Corda, 1847.

Diagnosis. Glabella triangulate, with or without shallow lateral furrows; occipital ring of almost constant width (sag. and exsag.), without lateral lobes; preglabellar field weakly convex in longitudinal section; facial suture cedariiform; thorax of 6 segments; pygidium with or without border, margin entire or crenulate; axis conical with 5–9 rings, pleural areas with 4–6 pairs of ribs; small granule on adaxial end of each thoracic and pygidial posterior pleural band; sculpture granular or surface smooth.

Known Scharyia species and their distribution, arranged stratigraphically.

Scharyia heothina sp. nov., S. sp. 1: Ordovician, Ashgill Series, Boda Limestone, Lake Siljan district, Sweden (described herein).

Scharyia sp. and *S.?* sp.: Silurian, Wenlock Series (or slightly older—see Norford 1973, p. 20), NE. Greenland (Lane 1972, p. 352, pl. 61, figs. 11–12).

Scharyia micropyga (Hawle and Corda, 1847) *wenlockiana*, Přibyl 1967: Wenlock Series, *M. flexilis*-*M.*

- testis* Zones, Prague district, Czechoslovakia (Příbyl 1967, p. 295, pl. 1, figs. 1–3 and text-fig. 1, fig. 1 and herein Pl. 98, fig. 12 and text-fig. 2A); Upper Wenlock erratics, Hiddensee Island, German Democratic Republic (Schrank 1972, p. 31, pl. 10, fig. 4); *S. micropyga* possibly referable to this subspecies: Wenlock Series, *G. nassa* Zone, Holy Cross Mountains, Poland (Tomczykowa 1957, pp. 104–105, text-fig. 10a–c); Wenlock, Roquemaillière, Montagne Noire, southern France (Chaubert 1937, p. 202, pl. 7, fig. 17a–b).
- Scharyia micropyga micropyga* (Hawle and Corda, 1847): Ludlow—Přidolí, Prague district, Czechoslovakia (Příbyl 1967, p. 293, pl. 1, figs. 4–6; pl. 2, fig. 6 and text-fig. 1, fig. 2a–b).
- Scharyia micropyga* (Hawle and Corda, 1847) *meridiana* Alberti, 1970: Ludlow Series, Ostracodenkalk, NW. Morocco (Alberti 1970, p. 71, pl. 9, figs. 5, 23).
- Scharyia siceripotrix* sp. nov.: Ludlow Series, Lower Elton Beds, Malvern Hills and Wenlock Edge (described herein).
- Scharyia yolcini* Příbyl, 1970: Ludlow Series, Kamyschenka River, north Altai region, south central U.S.S.R. (Yolkin 1965, p. 153, text-fig. 1b and Příbyl 1970, p. 109, text-fig. 2c).
- Scharyia* sp. (undescribed): Ludlow Series, Carnic Alps, Austria (Příbyl 1967, p. 285).
- Scharyia* sp.: Ludlow Series, Bowning, New South Wales, Australia (Etheridge and Mitchell 1892, p. 317, pl. 25, fig. 2d [figured as 'larval form' of '*Proetus rattei* Etheridge and Mitchell 1892] and refigured herein).
- Scharyia nympha* Chlupáč, 1971: Přidolí Formation, Prague district, Czechoslovakia (Chlupáč 1971, p. 172, pl. 23, figs. 1–6 and text-fig. 5).
- Scharyia angusta* Příbyl, 1966: Devonian, Gedinian, Lochkov Limestone, Prague district, Czechoslovakia (Příbyl 1966, p. 52, pl. 1, fig. 8; 1967, p. 296, pl. 2, figs. 1–2, text-fig. 1, fig. 4a–b).
- Scharyia vesca* Příbyl, 1966: Devonian, Pragian, Slivenec Limestone, Prague district, Czechoslovakia (Příbyl 1966, p. 53, figs. 6–7; 1967, p. 297, pl. 2, figs. 3–4 and text-fig. 1, fig. 3a–b).
- Scharyia brevispinosa* Příbyl, 1967: Devonian, Zlichovian, Chýnice Limestone, Prague district, Czechoslovakia (Příbyl 1967, p. 299, pl. 2, fig. 5, text-fig. 1, fig. 5).
- Scharyia* sp.: Devonian, probably late Emsian, New South Wales, Australia (Chatterton 1971, pl. 19, figs. 25–28 [figured as 'otarionid? sp.'], and Schrank 1972, p. 32).
- Scharyia tafilaltensis* Alberti, 1970: Devonian, high upper Emsian, southern Morocco (Alberti 1970, p. 73, pl. 9, fig. 6).
- Scharyia maura* Alberti, 1970: Devonian, basal Eifelian, NW. Morocco (Alberti 1970, p. 72, pl. 9, figs. 1–4).
- Scharyia couviniana* Osmólska, 1957: Devonian, Lower Eifelian, Wydryszów, Holy Cross Mountains, Poland (Osmólska 1957, p. 62, pl. 2, figs. 1, 2 and text-fig. 2, p. 63).

Scharyia siceripotrix sp. nov.

Plate 98, figs. 1–9; text-figs. 1A, C, 3

Derivation of name. From Latin *sicera*, cider and *potrix*, drinker; the type locality is in a well-known cider-producing region.

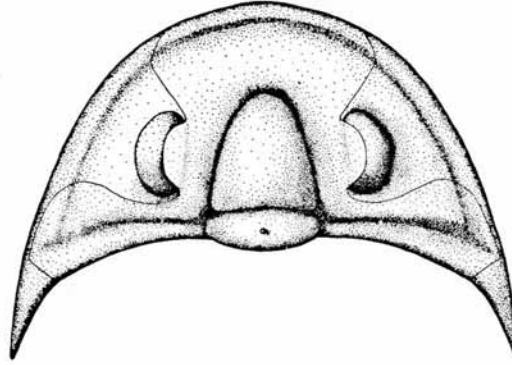
Holotype. NMW 71.6G.488, external mould of a cranidium (Pl. 98, fig. 1) from Silurian, Ludlow Series, Lower Elton Beds, exposure in lane near Oldcastle Farm, 800 m SE. of Colwall Green, Herefordshire (SO 756405).

Material. Numerous detached exoskeletal parts (NMW 71.6G.268–278, 486–487, 489–493, 529), including meraspides and late protaspides from the type locality; a pygidium (NMW 72.18G.153) from same horizon, road cutting 680 m at 95° from Ledbury station, Herefordshire (SO 71553857) and a few pygidia (BM It8860) from same horizon, exposure by ford opposite farm, Middlehope, Wenlock Edge, Shropshire (SO 49748828).

Diagnosis. Glabellar furrows lacking in larger specimens, present in smaller ones; angle at 'X' (see text-fig. 1) about 70°; θ 35°–55°; pygidial border poorly developed in adult, but distinct in transitory pygidia; dorsal surface of exoskeleton smooth.

Description. Cephalon with narrow border, defined by shallow, distinct lateral and anterior border furrows. Palpebral width ranges from being equal to sagittal length

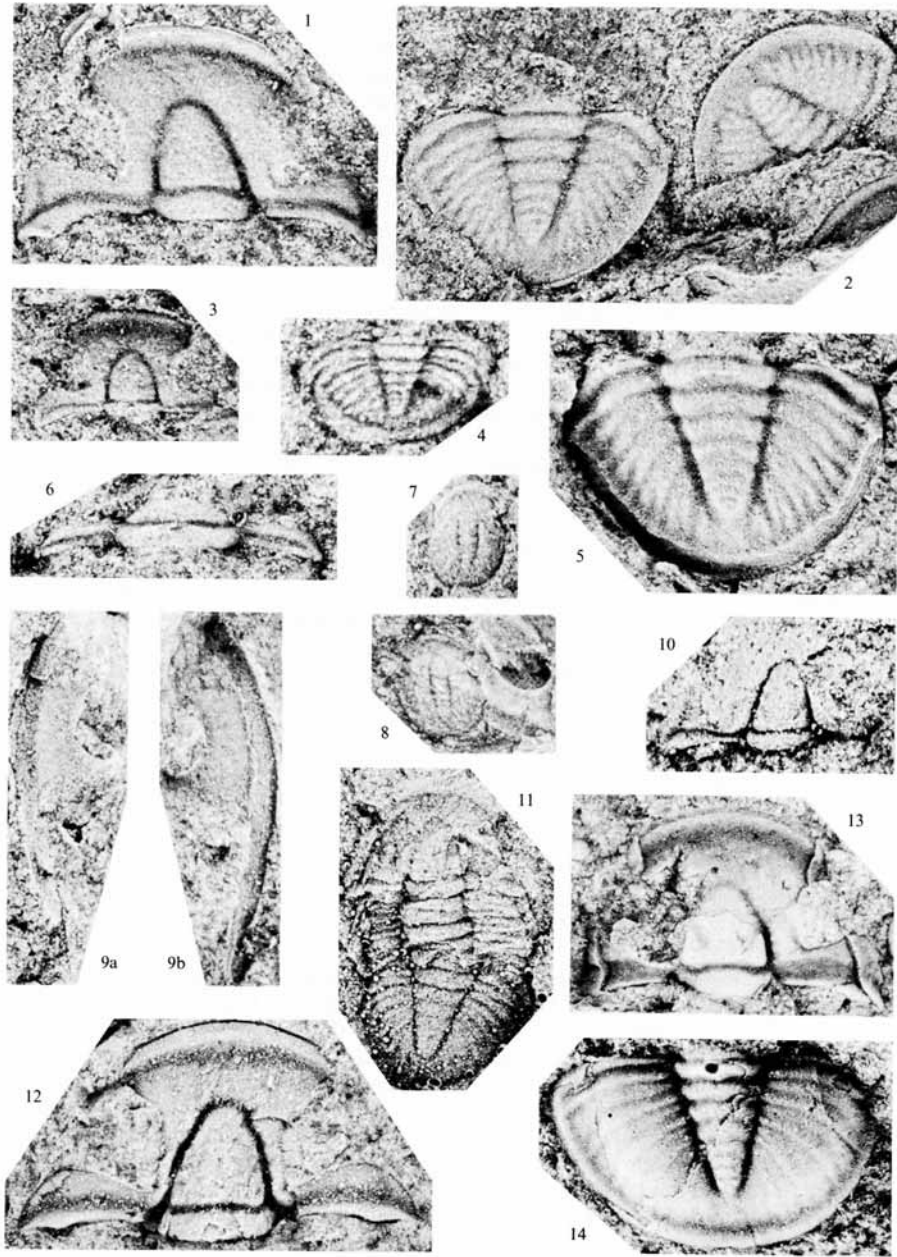
in small specimens to being 72% of it in largest ones. Glabella of triangulate outline, of approximately equal length (sag.) and maximum width (trans.). No lateral furrows seen on large specimens, but two weak pairs seen on some smaller ones (See Pl. 98, fig. 3). Occipital furrow nearly as wide as and somewhat shallower than axial furrows. Occipital ring wider (sag.) than anterior border, and a little wider (trans.) than glabella. Preglabellar field 50–75% length (sag.) of glabella in larger and smaller specimens respectively, and is weakly convex in longitudinal section.



TEXT-FIG. 3. Reconstruction of cephalon of *Scharyia siceripotrix* sp. nov. (based on Pl. 98, figs. 1 and 9a–b), $\times 25$ approx.

EXPLANATION OF PLATE 98

- Figs. 1–9. *Scharyia siceripotrix* sp. nov. Ludlow Series, Lower Elton Beds, exposure in lane near Oldcastle Farm, 800 m SE. of Colwall Green, Herefordshire (SO 756405). 1, NMW 71.6G.488, holotype cranidium, silicone rubber cast of external mould, dorsal view, $\times 20$. 2, NMW 71.6G.490b (right) and 491b (left), pygidia, silicone rubber cast of external moulds, dorsal view. Compare development of border on two specimens, $\times 15$. 3, NMW 71.6G.493a, small cranidium, internal mould, dorsal view, $\times 20$. 4, NMW 71.6G.492a, transitory pygidium, internal mould, dorsal view. Note well-developed border, $\times 20$. 5, NMW 71.6G.278a, pygidium, internal mould, dorsal view, $\times 16$. 6, NMW 71.6G.489, thoracic segment, internal mould, dorsal view, $\times 20$. 7, NMW 71.6G.486, late protaspis, internal mould, dorsal view, $\times 20$. 8, NMW 71.6G.529a, late protaspis, internal mould, dorsal view, $\times 22$. Note external mould of eye showing facets to right of protaspis. 9a–b, NMW 71.6G.487a–b, internal and counterpart external mould of free cheek. Note course of facial suture (cf. text-fig. 1c), $\times 20$.
- Figs. 10, 11. *Scharyia* sp. 10, cranidium, dorsal view, $\times 15$. 11, complete specimen, dorsal view, original of Etheridge and Mitchell 1892, pl. 25, fig. 2d, $\times 14$. Silicone rubber casts of specimens (both on same piece of rock) in Australian Museum, Sydney from Ludlow Series, Lower Trilobite Bed, Bowning Creek, Bowning, New South Wales, Australia.
- Fig. 12. *Scharyia micropyga* (Hawle and Corda, 1847) *wenlockiana* Přibyl 1967. NMP-Akz. Kat.2929/1893. Cranidium, dorsal view, silicone rubber cast of original of Přibyl 1967, pl. 1, fig. 2. Wenlock Series, Liten Formation, *M. flexilis* Zone, Loděnice, Prague district, Czechoslovakia, $\times 14$.
- Figs. 13–14. *Scharyia angusta* Přibyl, 1966. 13, NMP IT 185, cranidium, dorsal view, silicone rubber cast of original of Barrande 1852, pl. 15, figs. 37–38, and Přibyl 1967, pl. 2, fig. 1, $\times 15$. 14, NMP IT 187, holotype pygidium, dorsal view, silicone rubber cast of original of Barrande 1852, pl. 15, figs. 39–40, and Přibyl 1967, pl. 2, fig. 2, $\times 13$. Both specimens from Lower Devonian, Lochkov Limestone, Lochkov, Prague district, Czechoslovakia.



OWENS, *Scharyia*

Anterior branches of facial sutures strongly divergent, with β an acute angle and θ 35° – 55° . Posterior branches cedariiform, following course 'type A' (see text-fig. 1A), angle at 'X' about 70° . Palpebral lobe crescentic, about 75% sagittal length of glabella, and placed at about its own sagittal length from it. Shallow palpebral furrow runs more or less exsagittally from γ to ϵ . Abaxial part of fixed cheek elevated almost to height of glabella. Eye large, crescentic, its individual facets seen on some specimens (e.g. Pl. 98, fig. 8).

Field of free cheek weakly convex. Genal spine blade-like, without median groove. Posterior border furrow broader and wider than anterior and lateral, truncating the latter at base of genal spine.

No complete examples of this species are known, but number of thoracic segments assumed to be six, as in other species. Axis divided into annulus and articulating half ring of approximately equal width (sag.), articulating furrow deep. Pleura with broad, shallow pleural furrow, dividing it into slightly wider anterior band and narrower posterior band. Small granule on adaxial end of posterior band.

Pygidium parabolic, margin entire. Border distinct in transitory pygidia (e.g. Pl. 98, fig. 4) but indistinct in larger specimens (e.g. Pl. 98, fig. 2 [left-hand specimen]). Axis conical, anteriorly 30–35% pygidial width (trans.), not reaching posterior margin, and consisting of seven rings and a terminal piece. Ring furrows shallow. Pleural areas with six pairs of ribs, curving gently backwards and widening slightly abaxially. Pleural and interpleural furrows of more or less equal depth, deepening abaxially. On adaxial end of each posterior pleural band is a small granule. Pygidial doublure weakly ventrally convex with fine, subparallel terrace lines. Exoskeleton smooth.

Measurements of figured specimens (in mm)

Cranidia	A	A ₁	A ₂	A ₃	A ₄	K	δ - δ	β - β	θ	
NMW 71.6G.488 (E)	1.65	0.70	0.45	0.20	0.30	0.70	(1.50)	1.80	35°	
NMW 71.6G.493b (I)	0.80	0.40	0.25	0.05	1.10	0.40	(0.80)	1.00	50°	
Pygidia	Z	Y	W	X						
NMW 71.6G.278a (I)	2.50	1.85	3.25	1.15						
NMW 71.6G.491a (I)	1.95	1.50	2.75	0.95						
NMW 71.6G.490a (I)	1.50	1.10	2.60	0.75						
NMW 71.6G.492a (I)	0.90	0.70	1.45	0.45						
Sagittal lengths of late protaspides										
NMW 71.6G.486 (I)	0.85									
NMW 71.6G.529a (I)	0.75									

Discussion. The species most similar to *S. siceripotrix* is *S. angusta* Přibyl, 1966 (see Pl. 98, figs. 13–14) from the Lower Devonian Lochkov Limestone of the Prague district, Czechoslovakia. The former differs from the latter in the proportionately narrower glabella lacking furrows in the adult stage, the wider (trans.) pygidial axis, and the poorly developed pygidial border in adult specimens (cf. Pl. 98, figs. 1, 2, 5, and figs. 13–14). Both species have an angle of about 70° at 'X' (see text-fig. 1), contrasting with that of about 55° in *S. micropyga*. The increase of this angle, the increase in divergence of the anterior branches of the facial sutures, and the development of a pygidial border appear to be evolutionary trends in *Scharyia*. A species very similar to *S. siceripotrix* occurs in the Ludlow of New South Wales, Australia, but a detailed

comparison is not possible here, as the author has seen only silicone rubber casts of rather poorly preserved material (see Pl. 98, figs. 10–11).

The material of *S. siceripotrix* is of particular interest as it includes a number of small growth stages. The smallest specimens are late protaspides (Pl. 98, figs. 7–8). As these are preserved in rather coarse sediment, it is not possible to see fine details; however, a pygidial border is present (seen on Pl. 98, fig. 8), although detail of the facial suture is unclear. There also seem to be traces of weak eye ridges.

Transitory pygidia (Pl. 98, fig. 4) have a distinct border, and their proportions are not unlike those of the adult *S. angusta* (Pl. 98, fig. 14). Small cranidia (Pl. 98, fig. 3) are also similar to those of adult *S. angusta* (Pl. 98, fig. 13), especially in glabellar proportions and in the presence of 1p glabellar furrows.

Scharyia heothina sp. nov.

Plate 99, figs. 1–6, 8

1925 '*Cyphaspis*' sp. ind. a Warburg, p. 205, pl. 5, figs. 59–60.

1925 '*Cyphaspis*' sp. ind. b Warburg, p. 208, pl. 5, fig. 61.

Derivation of name. From Greek *heothinos*, meaning early.

Holotype. A cranidium (RM Ar47554) (Pl. 99, fig. 1a–d) from Ordovician, Ashgill Series, Boda Limestone, Kallholn, Lake Siljan district, Dalarna, Sweden.

Material. Cranidia UM D75–76, RM Ar47490 and pygidia, UM D77, RM Ar10805, Ar10810–10811, Ar47496, Ar47499, Ar47555 from the Boda Limestone of Kallholn, Boda and Gryssen, Lake Siljan district, Dalarna, Sweden.

Diagnosis. Glabella with two very weak pairs of lateral furrows; broad anterior border as wide (sag.) as preglabellar field; prominent occipital tubercle; facial suture follows 'type B' course; pygidium without border, narrow interpleural furrows reaching margin; broader, shallow pleural furrows falling short of it; sculpture of fine granules.

Description. Cranidium with sagittal length slightly greater than palpebral width. Glabella about as wide (trans.) as long, with two pairs of very weak backwardly directed furrows. Occipital furrow narrower, and medially shallower than axial furrows. Occipital ring as wide (sag.) as anterior border, a little wider (trans.) than glabella and with a prominent median tubercle. Preglabellar field as wide (sag.) as anterior border, weakly convex in longitudinal section.

Anterior border furrow narrow, distinct. Anterior border gently convex, slightly more convex than preglabellar field. Anterior branches of facial suture divergent, θ 22°. Palpebral lobe about 75% sagittal length of glabella, crescentic and with a faint smooth band running parallel with its margin. Weak eye ridge seen on some specimens (e.g. Pl. 99, fig. 8). Posterior branch of facial suture cedariiiform, following course 'type B'. Posterior border furrow broad and deep, shallowing at extreme abaxial end. Free cheek and thorax unknown.

Pygidium subparabolic in outline. Axis conical with six or seven shallow ring furrows arched forwards sagittally, first widened sagittally. Pleural areas with four or five pairs of ribs which widen abaxially. Pleural and interpleural furrows more or less parallel, pleural wider and dying out before reaching margin, interpleural

narrower and reaching margin. Both sets of furrows very weak on some specimens (e.g. Pl. 99, fig. 4). No pygidial border. Sculpture of fine granules.

Measurements of figured specimens (in mm)

Cranidia	A	A ₁	A ₂	A ₃	A ₄	K	δ-δ	β-β	θ
UM D75 (E)	2.15	1.20	0.35	0.30	0.30	1.00	(1.95)	(2.00)	29°
UM D76 (E)	..	1.10	(0.25)	1.05	(1.80)	(1.60)	..
RM Ar47554 (E)	1.80	1.05	0.25	0.25	0.25	1.00	(1.70)	(1.60)	22°

Pygidia	Z	Y	W	X
UM D77 (E)	2.50	2.00	3.30	1.15
RM Ar47555 (E)	2.05	1.65	2.85	0.95
RM Ar47496 (E/I)	..	1.55	3.05	1.10
RM Ar10805 (E)	1.75	1.35	2.65	0.80

Discussion. Warburg (1925) figured and described cranidia as '*Cyphaspis*' sp. ind. a (p. 205, pl. 5, figs. 59-60), and pygidia as '*C.*' sp. ind. b (p. 208, pl. 5, fig. 61), and compared them with the type species of *Scharyia*. Both of these cranidia (see Pl. 99, figs. 6, 8) are badly preserved, but one (Pl. 99, fig. 8) shows the characteristic cedarii-form suture on the left-hand side. Additional material (Pl. 99, fig. 1a-d) from the same horizon and locality is better preserved and confirms that the cranidia can be confidently assigned to *Scharyia*. The pygidia are, as Warburg (1925, p. 209) has pointed out, quite similar to that of *S. micropyga*, although they lack the border, but they do have the characteristic granule on the adaxial end of each pleural band (e.g. Pl. 99, fig. 3).

Scharyia sp. 1

Plate 99, fig. 7

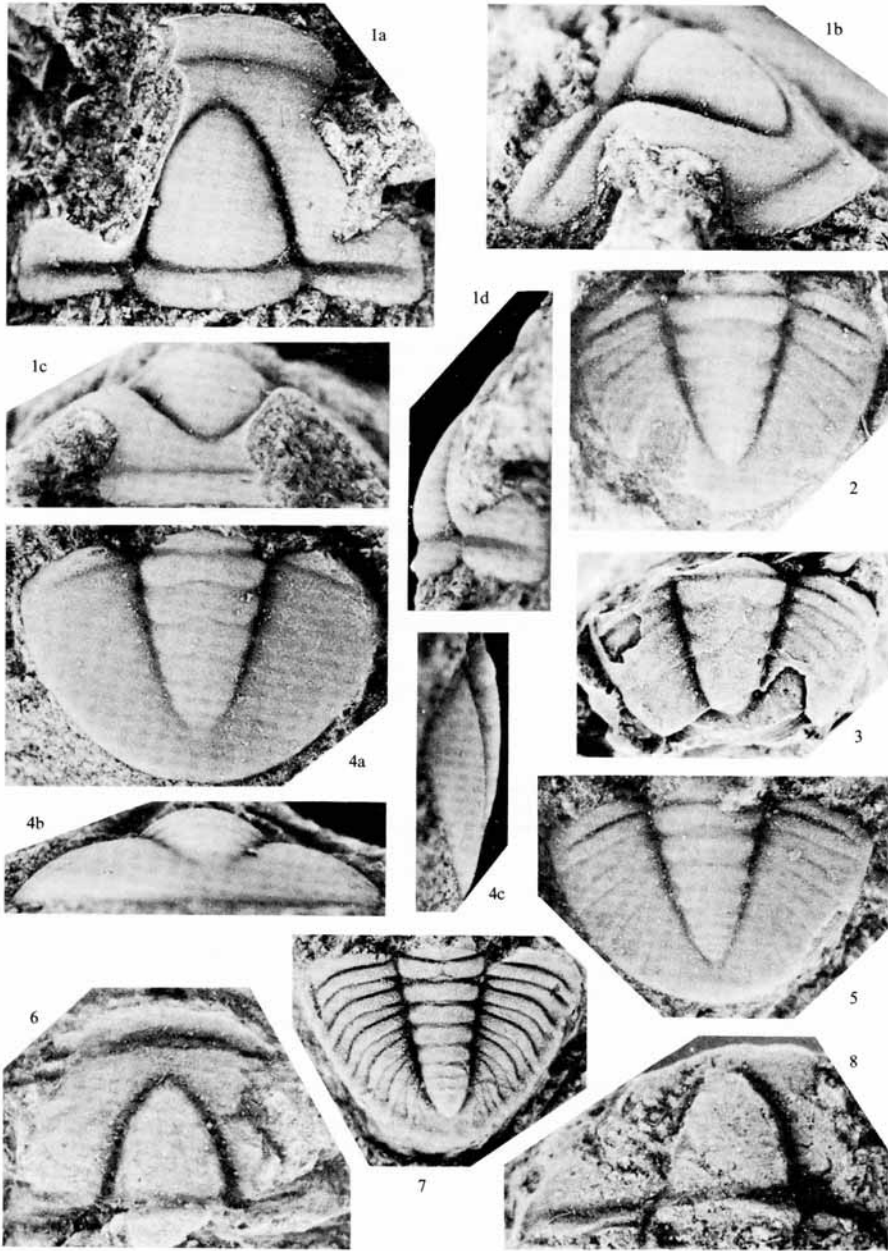
1925 '*Cyphaspis*'? sp. ind. d Warburg, p. 210, pl. 5, fig. 62.

Material. A pygidium, UM D78 from the Boda Limestone, Boda, Lake Siljan district, Sweden. Original of Warburg 1925, pl. 5, fig. 62.

Description. Pygidium subtriangular in outline, about 70% as long (sag.) as wide (trans.) with narrow border which widens slightly towards posterior. Anteriorly

EXPLANATION OF PLATE 99

Figs. 1-6, 8. *Scharyia heothina* sp. nov. 1a-d, RM Ar47554, holotype cranidium, with external surface preserved; 1a, dorsal view; 1b, anterior oblique view; 1c, anterior view; 1d, lateral view. Ordovician, Ashgill Series, Boda Limestone, Kallholn, Lake Siljan district, Sweden. All × 25. 2, UM D77, pygidium with external surface preserved, dorsal view. Original of Warburg 1925, pl. 5, fig. 61. Boda Limestone, Boda, Lake Siljan district, Sweden, × 15. 3, RM Ar47496, pygidium, partially exfoliated, dorsal view. Horizon and locality as fig. 1, × 16. 4a-c, RM Ar47555, pygidium, with exoskeleton preserved; 4a, dorsal view; 4b, posterior view; 4c, lateral view. Horizon and locality as fig. 1, × 20. 5, RM Ar10805, pygidium with exoskeleton preserved, dorsal view. Boda Limestone, Gryssen, Östbjörka, Lake Siljan district, Sweden, × 20. 6, UM D75, incomplete cranidium, dorsal view. Original of Warburg 1925, pl. 5, fig. 59. Horizon and locality as fig. 1, × 18. 8, UM D76, incomplete cranidium, dorsal view. Original of Warburg 1925, pl. 5, fig. 60. Horizon and locality as fig. 1, × 20. Fig. 7. *Scharyia* sp. 1. UM D78. Pygidium with exoskeleton preserved, dorsal view. Original of Warburg 1925, pl. 5, fig. 62. Horizon and locality as fig. 2, × 14.



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narrow axis about 30% of pygidial width (trans.), and tapers gently backwards, not reaching border. It is composed of nine rings, defined by shallow ring furrows which become progressively shallower and narrower (sag.) towards posterior. Articulating half ring about 70% width (sag.) of first axial ring, and separated from it by deep, narrow articulating furrow. Pleural areas with six pairs of ribs, pleural and interpleural furrows nearly parallel, latter a little narrower and shallower than former. Both curve gently backwards abaxially and are truncated at inner edge of border. Small granule on adaxial end of each posterior pleural band. Sculpture granulose.

Measurements (in mm)

	Z	Y	W	X
UM D78 (E)	2.30	2.00	3.30	1.00

Discussion. As with the pygidia described above as *S. heothina*, Warburg (1925, p. 211) compared this specimen with *S. micropyga*. *Scharyia* sp. 1 differs from *S. heothina* in outline, in having a narrower axis with more rings (nine compared with six or seven), a narrow border, much deeper and more distinct interpleural furrows, and in having the pleural and interpleural furrows curved backwards abaxially.

Repositories. The following abbreviations are used herein: NMW—National Museum of Wales, Cardiff; BM—British Museum (Natural History); UM—Museum of Palaeontological Institute, Uppsala; RM—Naturhistoriska Riksmuseet, Stockholm; NMP—National Museum, Prague; HM—Hunterian Museum, Glasgow.

Acknowledgements. I thank Dr. M. G. Bassett, Dr. D. L. Bruton, and Dr. J. H. McD. Whitaker for critically reading through the manuscript at various stages of its preparation and for suggesting useful amendments. I am also grateful to Professor Dr. H. K. Erben for beneficial discussion at early stages of the work, and for showing me casts of Australian material.

Dr. V. Jaanusson (RM), Mr. S. F. Morris (BM), Dr. S. Steunes (UM), Dr. J. K. Ingham (HM), and Dr. V. Zazvôrka and Mr. F. Bastl (NMP) kindly allowed me to examine and borrow specimens in their care.

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Typescript received 8 October 1973