UPPER ORDOVICIAN TRILOBITES FROM NORTHERN YUKON

by A. C. LENZ and MICHAEL CHURKIN, JR.

ABSTRACT. The trilobites *Robergia yukonensis* sp. nov., *Cryptolithoides*, and *Ampyxina salmoni* Churkin are described from the Road River Formation. They occur above the Ashgillian (Late Upper Ordovician) graptolite zone of *Dicellograptus complanatus* var. *ornatus* and below beds containing the graptolite *Climacograptus scalaris* var. *normalis* of possible earliest Silurian age. *Robergia* and *Cryptolithoides*, although widely distributed geographically, have hitherto been reported from only Middle or presumed Middle Ordovician beds, and as a result have been considered reliable indices of that series.

THE trilobite genera *Robergia*, *Cryptolithoides*, and *Ampyxina* were collected in 1963 from a 10-foot interval within the Road River Formation of northern Yukon Territory. *Robergia* and *Cryptolithoides*, although widely distributed geographically, have hitherto been reported from only Middle or presumed Middle Ordovician beds, and as a result have been considered reliable indices of that series. The *Ampyxina*, in association with *Toernquistia*? *idahoensis* and *Primaspis sp.*, was described previously by Churkin (1963*a*) from a late Middle Ordovician graptolite shale in Idaho. In the same paper he noted that the presumably Middle Ordovician Caesar Canyon Limestone of Kay (1960) in Nevada has the same trilobites (*A. salmoni*, *T.*? *idahoensis*, and *Primaspis*) in association with *Robergia* and *Cryptolithoides*.

In the southern Northwest Territories, closer to the present study area, Lenz and Jackson (1964) listed *Robergia*, *Ampyxina*, *Cryptolithoides*, and other trilobites from possible late Middle or early Upper Ordovician beds containing ?*Orthograptus quadrimucronatus* (Hall). The trilobites were identified by R. J. Ross, Jr., who considered the presence of *Robergia* and *Cryptolithoides* as good evidence for a Middle Ordovician age assignment.

This paper first presents conclusive evidence, based on associated graptolites, of an extension in range of *Robergia*, *Cryptolithoides*, and *Ampyxina salmoni* into the Ashgillian (late Upper Ordovician), and then gives a formal description of the trilobites. The introductory section is by A. C. Lenz and the trilobite descriptions are by Michael Churkin, Jr.

LOCATION, STRATIGRAPHY, AND FAUNAS

The trilobites were collected just west of the Snake River, Yukon Territory (65° 21′ N., 133° 30′ W.; fig. 1) from a 10-foot shale and calcareous shale band approximately 30 feet below the top of the Road River Formation, which in this area ranges in age from Late Cambrian to Early Silurian. Graptolites were collected 10–20 ft. below, and 20–30 ft. above, the trilobites (fig. 2). The graptolites collected beneath the trilobites consist of *Dicellograptus sp.* (rare), *Orthograptus truncatus* var. *abbreviatus* Elles and Wood (fairly common), *Climacograptus supernus* Elles and Wood (fairly common), *Cl. hvalross* Ross and Berry (common), *Cl. hastatus* var. *martini* Ross and Berry (rare), *Cl.* cf. *raricaudatus* Ross and Berry (very rare), and *Glyptograptus sp.* In beds 20–30 ft.

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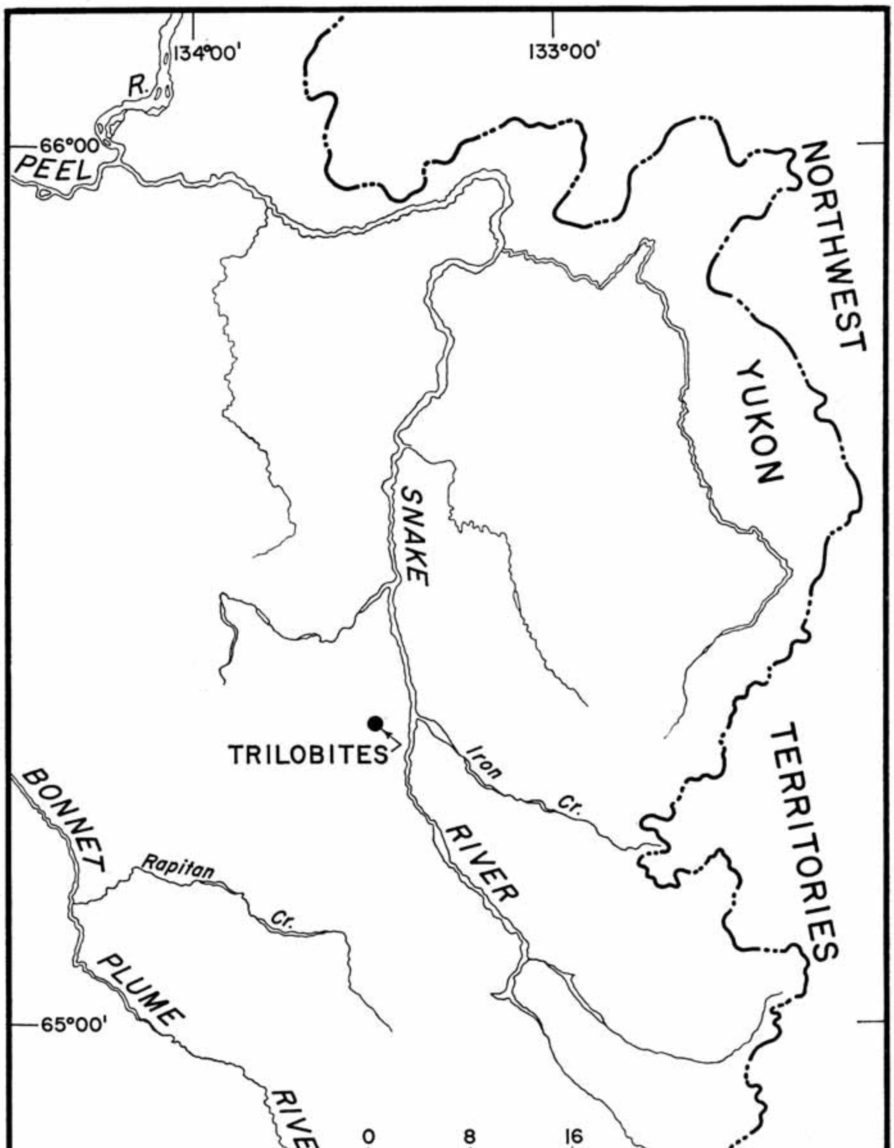


TEXT-FIG. 1. Map of part of Yukon, showing trilobite locality.

above the trilobites, the graptolite *Climacograptus scalaris* var. *normalis* Lapworth occurs in considerable numbers.

AGE AND CORRELATION

The graptolite fauna which underlies the trilobites correlates with the *Dicellograptus complanatus* var. *ornatus* Zone of northern Yukon Territory (Jackson and Lenz 1962); this is indicated by the presence of *Orthograptus truncatus* var. *abbreviatus* and *Climacograptus supernus*, both typical representatives of the Ashgillian *ornatus* Zone of Yukon. The fauna may also be correlated, at least in part, with the Ashgillian of Great Britain, the *Dicellograptus complanatus* Zone of the Basin and Range area of western United States (Ross and Berry 1963), and with the *Dicellograptus anceps* Zone of Idaho and Utah (Churkin 1963*b*). The overlying graptolite *Climacograptus scalaris* var. *normalis* ranges from uppermost Ordovician to lower Lower Silurian in Great Britain and elsewhere in northern Yukon, but because of its stratigraphic position in this section is possibly lowest Silurian.

It is therefore evident that the Ordovician trilobite genera *Ampyxina*, *Robergia*, and *Cryptolithoides*, while in this instance of Late Ordovician (Ashgillian) age, range through Middle and Upper Ordovician beds of the North American Cordillera.

SYSTEMATIC PALAEONTOLOGY

Family REMOPLEURIDIDAE Hawle and Corda
Genus ROBERGIA Wiman

Robergia yukonensis sp. nov.

Plate 4; Plate 5, figs. 1–5.

Material. Collection consists of twenty-two specimens, mostly isolated cranidia. Four specimens are nearly complete, having thoracic segments and pygidia attached to cranidia. Holotype, G.S.C. no. 19864; paratypes, G.S.C. nos. 19865–71. Geological Survey of Canada, Ottawa.

Description. Opisthoparian trilobite characterized by glabella narrowing posteriorly, expanding between eye lobes and with long (sag.) tongue, three pairs of lateral glabellar furrows successively deeper posteriorly. Anterior glabellar furrows nearly straight. Middle furrows slightly convex forward. Posterior furrows nearly straight but posterior tips faintly deflected forward in holotype. Faint axial furrow in the frontal part of the glabella, accentuated in some crushed specimens. Prominent palpebral lobes start opposite the middle of the first glabellar lobes and end opposite the third glabellar lobes. Free cheeks widest (trans.) opposite eyes, with raised convex borders and bearing long (6·8 mm.+) tapering genal spines. Eye composed of many quadrate lenses. Occipital ring bears mesial tubercule on several paratypes (Pl. 4, specimen C; Pl. 5, figs. 1, 2, 5); apparently not preserved on other specimens. Thorax narrow and gently tapering posteriorly. Thorax of eleven segments. Pleurae transversely directed and terminating in small posteriorly directed spines. Deep pleural furrows start near anterior portions of pleurae and cross each pleuron diagonally. The second pleural furrow begins at the inner posterior corner of each pleuron and intersects the longer diagonal furrow at about two-thirds of the distance from the axial furrow to the outer tip of the pleuron. Articulating half-ring, large, nearly equal to axial ring in size. Each axial ring, and to a lesser extent each corresponding axial half-ring, separated by two furrows into three transversely convex portions.

Pygidium length about equal to width. Axis extends close to posterior margin and connected to margin by narrow post-axial ridge. Five axial rings seen on holotype; pleural regions flat and with two pairs of broad ridges merging into the outer and middle pair of pygidial spines. Inner pair of pygidial spines much shorter and apparently without corresponding inter-pleural ridges.

Details of the external surface where preserved show very fine (about 11 ridges/mm.) parallel ridges. The ridges parallel the general shape of the cephalon and pygidium but run across the pleurae parallel to the exsagittal direction and form a transversally parallel pattern across the axial region of the thorax.

Measurements of type specimens are given in Table 1.

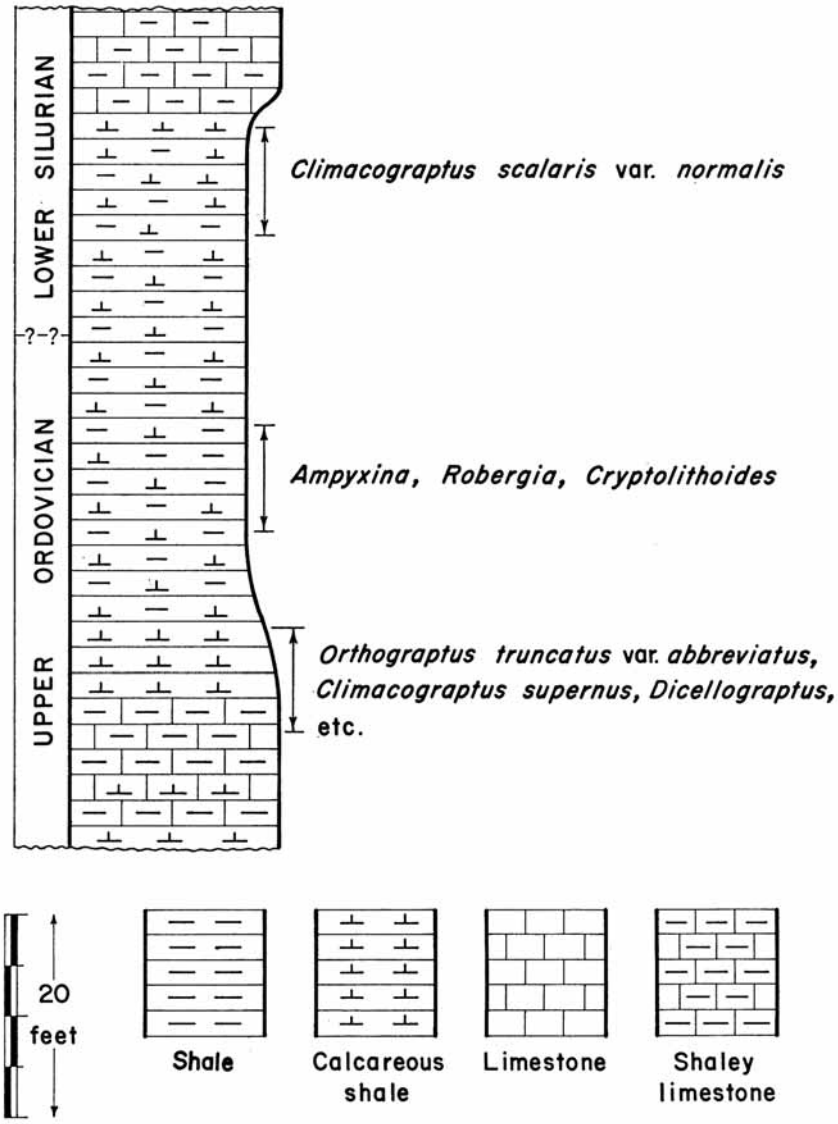
TABLE 1—*Robergia yukonensis* sp. nov.

	Holo-type	*Paratypes*					
G.S.C. no.	19864	19865	19866	19867	19868	19870	19871
Measurements in mm.							
Total length (sag.)	33·4	33·7	—	—	—	—	—
Length of cephalon (sag.)	12·7	12·3	—	—	—	11·6	5·1
Length of thorax (sag.)	14·7	15·4	—	—	—	—	—
Length of pygidium (sag.)	6·0	6·0	—	—	—	—	—
Maximum width of cephalon at base of genal spines (transv.)	17·6	—	16·5	—	—	—	—
Maximum width of cranidium across palpebral lobes (transv.)	11·2	—	10·5	10·7	13·4	11·7	5·0
Length of palpebral lobes (exsag.)	3·7	3·6	3·4	3·7	4·0	3·4	1·8
Width of first axial ring (transv.)	—	5·6	5·4	—	—	6·2	—
Width of last (11th) axial ring (transv.)	3·4	3·6	—	—	—	—	—
Length of first pleuron (transv.)	3·7	—	3·7	—	—	3·9	—
Length of last pleuron (transv.)	2·8	3·5	—	—	—	—	—

Discussion. The Yukon specimens broadly resemble *Robergia major* Raymond and *Robergia deckeri* Cooper from the southern Appalachians (Cooper, 1953; Whittington, 1959) but differ in the following ways: the glabellar furrows of *R. yukonensis* are less curved and are more posteriorly directed than in *R. major*, the middle glabellar furrow of *R. deckeri* is also more curved than in *R. yukonensis*, and the anterior end of the palpebral lobe lies behind the anterior glabellar furrow instead of directly opposite the glabellar furrow as in the Appalachian species. In *R. micropthalmus* (Linnarsson), the type species, the glabellar furrows are like those in the Appalachian species and differ

EXPLANATION OF PLATE 4

Robergia yukonensis sp. nov. ×4. A, holotype, G.S.C. no. 19864; B, paratype, G.S.C. no. 19865; C, paratype, G.S.C. no. 19866.



TEXT-FIG. 2. Section of part of Road River Formation, showing the relative occurrence of the graptolites and trilobites.

from *R. yukonensis* in the same way. In addition *R. yukonensis* has a faint axial furrow on its glabella that seems to be absent in other species of *Robergia*. Because of these differences the Yukon species is perhaps a derivative of *Robergia* as suggested by H. B. Whittington (personal communication) and could be considered a new genus.

In the thorax of *R. yukonensis* the pleural furrows, beginning at the inner posterior corners of each pleuron, intersect the longer diagonal furrows about two-thirds of the distance from the axial furrow, more than twice as far out on the pleuron from the axial furrow as in *R. deckeri*. Thus in *R. deckeri* the two sets of pleural furrows form small triangular nodes next to the axis, whereas in *R. yukonensis* most of the area of each pleuron is bounded by the same furrows.

In rare specimens possessing free cheeks the angle between the genal spine and the posterior border in *R. yukonensis* is more acute than that in the Appalachian species.

Occurrence. *Robergia* is a widespread genus that has been reported from North America, Europe, and Asia (see fig. 3). Fortunately, graptolites found in most of the *Robergia*-bearing sequences can accurately date each occurrence.

In the United States *Robergia* has only been recorded from Middle Ordovician rocks, and the National Research Council Ordovician Correlation Chart for North America (Twenhofel 1954) shows it as an important index fossil for the Black River and lower Trenton Stages (approximate equivalents to the lower half of the Caradoc Series in Great Britain).

The oldest reported occurrence of *Robergia* is from the upper part of the middle Table Head Formation of Newfoundland that is considered by Whittington and Kindle (1963) as lower Llanvirnian.

In Yukon Territory the genus occurs directly above Ashgillian graptolites possibly equivalent to the zone of *Dicellograptus anceps* and thus extends the range of *Robergia* to include highest Ordovician.

Family TRINUCLEIDAE Hawle and Corda

Genus CRYPTOLITHOIDES Whittington

Cryptolithoides sp. indet.

Plate 5, figs. 6–8

Material. Three fragmentary cephala.

Description. Cephalon subrectangular in outline and characterized by antero-lateral angulation of cephalic margin. Glabella strongly convex, clavate, and smooth. Genae (cheek lobes) without ornamentation. Fringe narrows anteriorly, increasing in width

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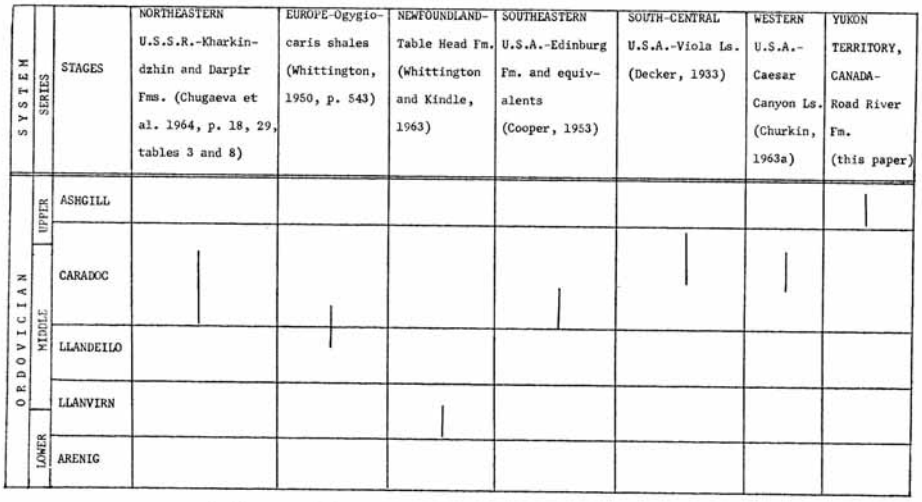
EXPLANATION OF PLATE 5

Figs. 1–5. *Robergia yukonensis* sp. nov., paratypes. 1, cranidium ×4, G.S.C. no. 19867; 2, cranidium ×4, G.S.C. no. 19868; 3, a nearly complete cephalon lying on a thorax with the pygidium attached ×2, G.S.C. no. 19869; 4, cranidium with part of the thorax attached ×2, G.S.C. no. 19870; 5, small cranidium ×4, G.S.C. no. 19871.

Figs. 6–8, *Cryptolithoides* sp. indet. 6, half of a cranidium showing the pattern of pits ×5, G.S.C. no. 19872; 7, incomplete cranidium ×4, G.S.C. no. 19873; 8, external mould of cranidium showing strongly convex and clavate glabella ×4, G.S.C. no. 19874.

Figs. 9–12, *Ampyxina salmoni* Churkin. 9, nearly complete specimen with long genal spines and small glabellar spine ×4, G.S.C. no. 19875; 10, incomplete specimen with thorax and pygidium attached to cephalon ×4, G.S.C. no. 19876; 11, pygidium ×2, G.S.C. no. 19877; 12, cranidium ×4, G.S.C. no. 19878.

antero-laterally and postero-laterally. Pits in the fringe numerous. One row of pits external to girder. The outermost row of pits (E_1) in concentric and radial arrangement with the second row (I_1) except at the posterior lateral margin where the pits of the second row (I_1) decrease in size and are not paired with the outer pits. Anteriorly,



TEXT-FIG. 3. Range of *Robergia* based on the ages of associated graptolites.

well-defined radial ridges separate the radially paired outer two rows of pits. Anterior of the glabella two more rows of pits (I_2 and I_3) in radial arrangement with the outer two pits but postero-laterally the pits inside the outer two rows irregularly arranged.

Discussion. Only fragmentary specimens were collected, but no significant differences could be found between the Yukon material and *C. ulrichi* (Whittington, 1941). The size of the Yukon specimens, length (sag.) 3–4 mm., width (trans.) 7 mm., falls within the range of the smaller cephala described by Whittington.

Occurrence. C. ulrichi occurs in the Viola Limestone of Trenton age (equivalent to part of the upper half of the Caradocian) in Oklahoma, and the genus is reported from Ordovician rocks in Texas (Whittington 1941). More recently, *Cryptolithoides* has been reported from the western U.S. where it occurs in the Caesar Canyon Limestone of the Toquima Range, Nevada, (Kay 1960) and in the Middle (?) and Upper Ordovician Hanson Creek Formation of the Seetoya Mountains, Nevada (Kerr 1962). In the Caesar Canyon Limestone, *Cryptolithoides* is associated with *Ampyxina salmoni, Robergia* cf. *major, Toernquistia*? *idahoensis, Primaspis sp.* and *Flexicalymene sp.*, a trilobite fauna much like that from graptolitic shale of Trenton age in central Idaho that is correlated (Churkin 1963*a*) with the Caradocian graptolite Zones (11) of *Climacograptus wilsoni* and (12) of *Dicranograptus clingani. Cryptolithoides* thus ranges from Trentonian (Caradocian) in the southern United States, its type area, into Ashgillian in Yukon and may have a range of Caradocian through Ashgillian in the western United States.

Family RAPHIOPHORIDEA Angelin
Genus AMPYXINA Ulrich

Ampyxina salmoni Churkin

Plate 5, figs. 9–12

1963*a* *Ampyxina salmoni* Churkin, pp. 424–5, pl. 51, figs. 1–10.

Material. Four complete specimens, six cranidia, and seven pygidia.

Description. The specimens under study agree in all essential respects with *A. salmoni* originally described from Ordovician graptolitic shale in central Idaho (Churkin 1963*a*). The Idaho collection consists of several hundred specimens, none of them as complete as those from Yukon, and the new material makes possible the following additions to the original descriptions.

Free cheeks apparently very narrow, lying along steeply flexed lateral margins of fixigenae. The long genal spines extend smoothly backward as continuations of curved cephalic margins. The spines gently curve inward, taper slightly, and extend well past the pygidium.

Thorax with five segments. Axis about one-fifth total width. Pleurae extend out horizontally but flexed downward at distal ends. Interpleural furrows extend from anterior edges of pleurae next to axial furrows and cross pleurae obliquely toward lateral margins. Furrows become deeper and broader distally. Pleural furrow of first segment curved convexly forward, on succeeding segments less curved and nearly straight across fifth segment. Distal ends of pleurae separated from each other by small notches that produce a serrated margin.

Dimensions. G.S.C. no. 19875: total length (sag.) 7·7 mm., length (sag.) of cephalon 2·9 mm., length of thorax (sag.) 2·4 mm., length of pygidium (sag.) 2·4 mm., width of cranidium at posterior margin 6·9 mm., maximum width of glabella 2·3 mm., width (trans.) of pygidium at anterior end 6·6 mm., length of genal spine 5·3 mm.+.

Discussion. The Yukon specimens possess the straight pygidial ribs characteristic of *Ampyxina salmoni* instead of backward flexed ribs as in the very similar *A. bellatula* (Savage) illustrated by Whittington (1950, 1959) and *A. powelli* (Raymond) described by Cooper (1953) and Whittington (1959). In addition, the first interpleural furrow in the Yukon specimens appears less curved forward than in *A. bellatula* or *A. powelli*.

Occurrence. Type *Ampyxina salmoni* is from the type locality of the Saturday Mountain Formation of central Idaho where it is associated with graptolites equivalent in age to the Caradocian Zones 11 and 12 of Elles and Wood (Churkin 1963*a*). The writer has identified *A. salmoni* from the Caesar Canyon Limestone of the Toquima Range, central Nevada (Kay 1960; Kay and Crawford 1964) where it is found with *Robergia* cf. *R. major* and *Cryptolithoides sp.*, an association similar to that in Yukon. *A. salmoni* occurs in Middle Ordovician (Caradocian) rocks in both Idaho and Nevada and is found in considerably younger Upper Ordovician (Ashgillian) rocks in Yukon.

Ampyxina is a widely ranging genus as it has been reported from the early Middle Ordovician (Porterfield–Wilderness Stages) of Virginia, Alabama, Tennessee (Cooper 1953; Whittington 1959), and the Upper Ordovician of Missouri and Illinois (Rowley 1909; Savage 1917).

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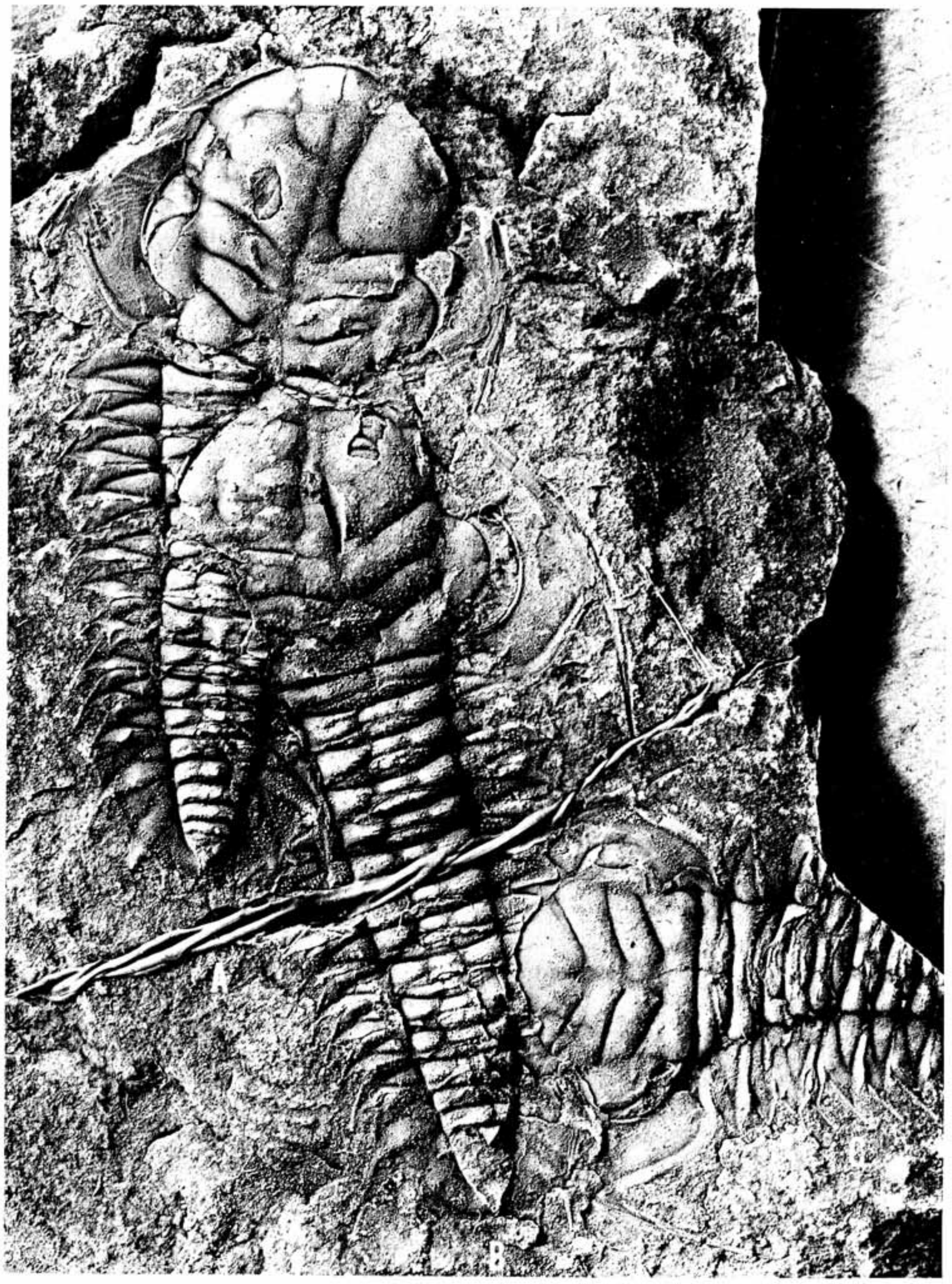
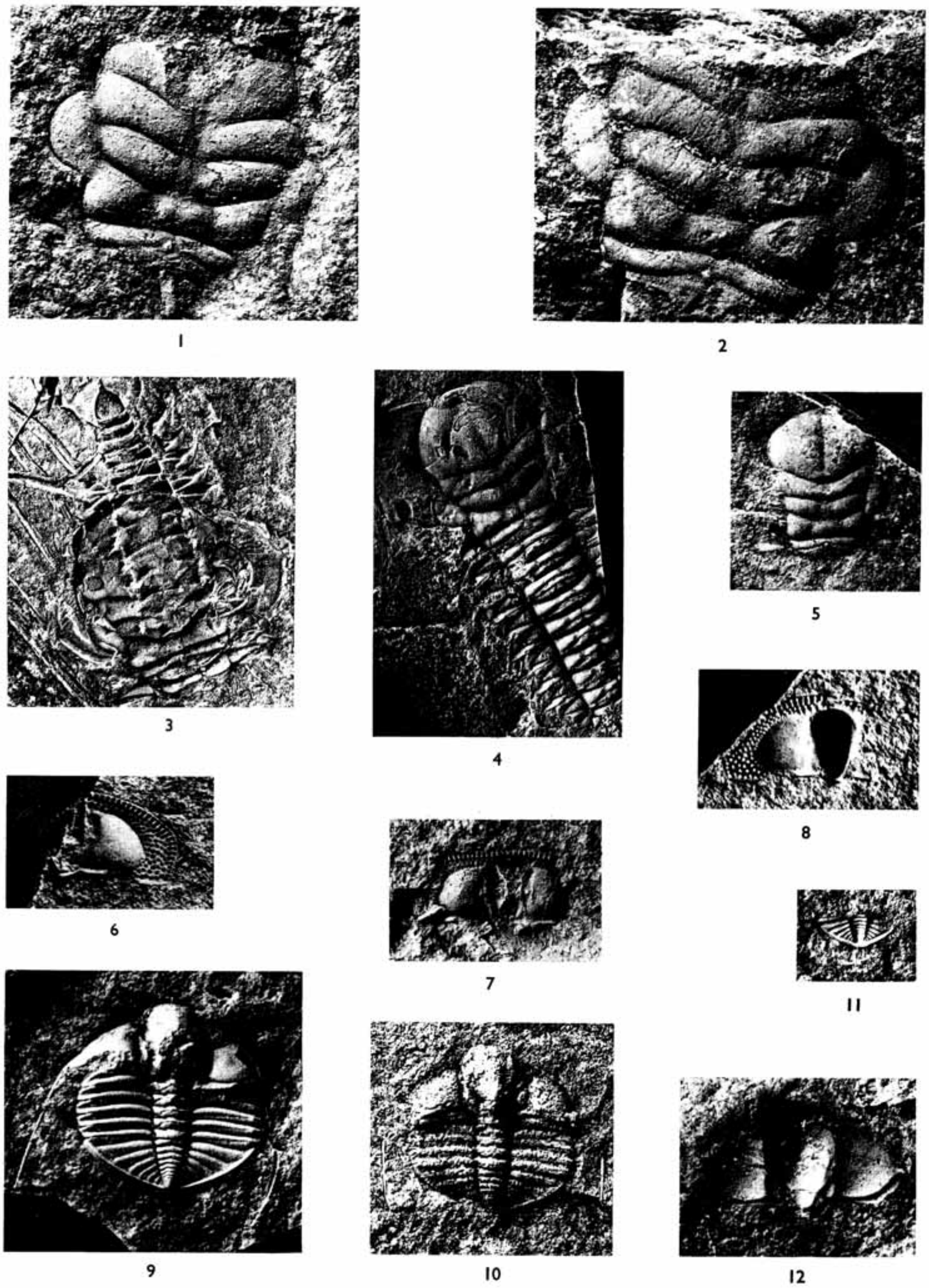


LENZ and CHURKIN, Ordovician trilobites



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