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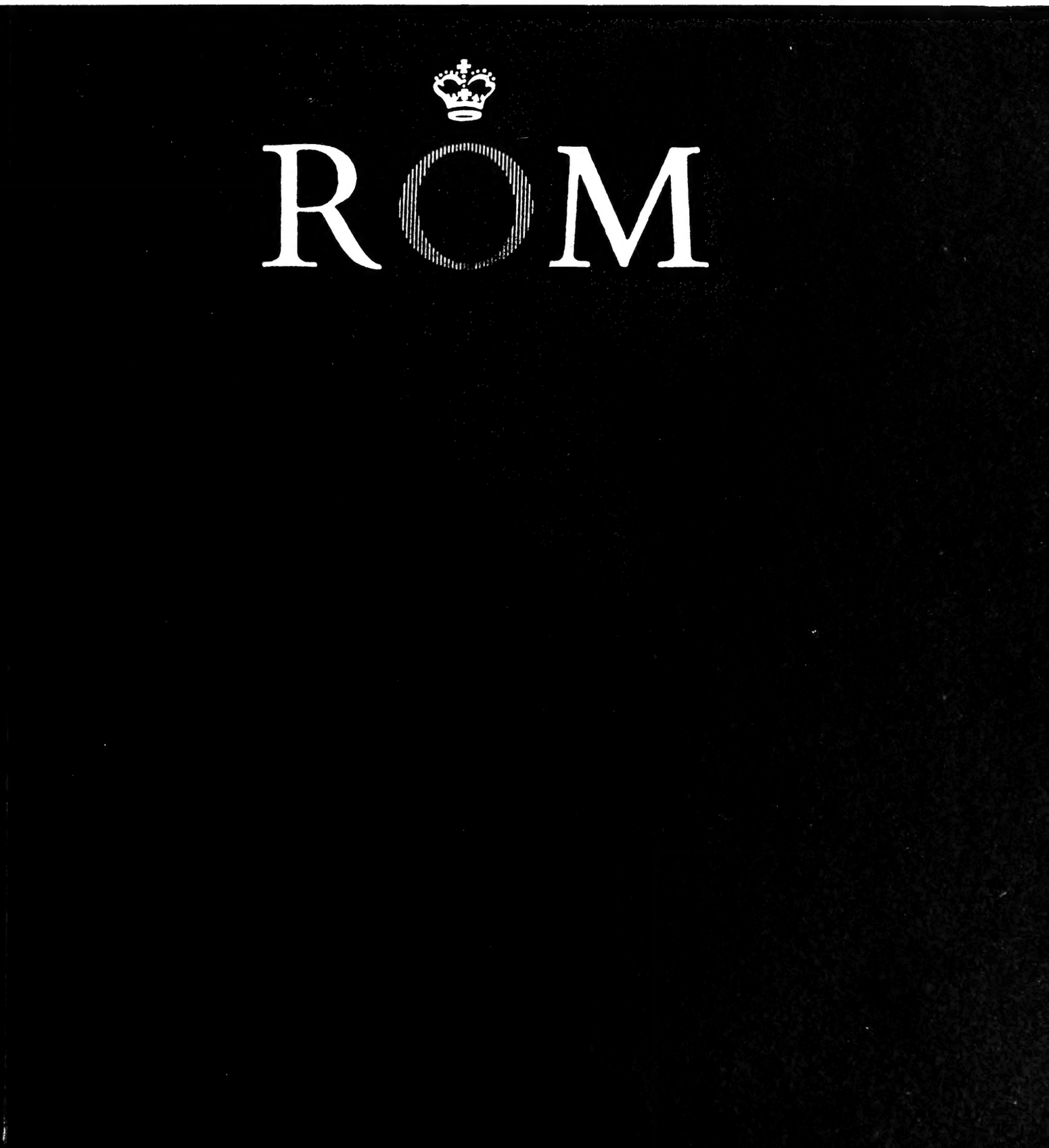
Llandoverian Graptolites of the Northern Canadian Cordillera: *Petalograptus, Cephalograptus*, *Rhaphidograptus*, *Dimorphograptus*, Retiolitidae, and Monograptidae

Alfred C. Lenz



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Contents

Llandoverian Graptolites of the Northern Canadian Cordillera: *Petalograptus, Cephalograptus, Rhaphidograptus, Dimorphograptus,* Retiolitidae, and Monograptidae

Abstract

Llandoverian graptolite faunas from 13 major sections in a region extending from the southern Northwest Territories to northern Yukon are divisible into 13 zones, of which the *persculptus* and *magnus* zones are only tentatively recognized. The biostratigraphic units, from oldest to youngest, are the *persculptus* Zone?, *acuminatus* Zone, *atavus* Zone, *acinaces* Zone, *gregarius* Zone, *triangulatus* Zone, *magnus* Zone?, *argenteus* Zone, *convolutus* Zone, *sedgwicki* Zone, *turriculatus* Zone, *spiralis* Zone, and *sakmaricus-laqueus* Zone.

This study describes 101 species of graptolites. The number of species described for each genus is as follows: nine species of *Petalograptus*, three of *Cephalograptus*, two of *Rhaphidograptus*, three of *Dimorphograptus*, two of *Retiolites*, three of *Stomatograptus*, four of *Pseudoplegmatograptus*, two of *Lagarograptus*, two of *Atavograptus,* four of *Coronograptus,* three of *Pribylograptus,* three of *Pristiograptus*, one of *Monoclimacis*, 46 of *Monograptus*, 12 of *Rastrites*, and one each of *?Diversograptus* and *Barrandeograptus*.

One new species, *Rastrites rostratus*, and one new subspecies, *Monograptus runcinatus richardsonensis*, are described.

Introduction

Graptolite-bearing strata encompassed, at least in part, within the Road River Formation, are widespread throughout the northern Canadian Cordillera. Geographically they extend from the northern Rocky Mountains of northern British Columbia in the south, through the central and western Mackenzie Mountains and the Selwyn Mountains, to the Barn Mountains in northern Yukon in the north. Depending on the locality, the age of the graptolite facies ranges from Late Cambrian through to late Early Devonian. That age range, in conjunction with the fact that some sections are essentially unbroken homoclinal sequences, make these sucessions ideal for biostratigraphic zonation.

A number of previous studies of the northern Cordillera (Jackson and Lenz, 1962; O'Bertos and Jackson, 1963; Lenz and Jackson, 1964; Jackson et al., 1965; Lenz and

Pedder, 1972; Lenz, 1978, 1979) have gradually built up an increasingly refined zonation of the graptolite faunas. Taxonomic studies of western North American Llandoverian graptolites are few, and are by Churkin and Carter (1970) in southeastern Alaska, Berry and Murphy (1975) in Nevada, Carter and Churkin (1977) in Idaho, and Lenz (1978) in northern and Arctic Canada. The most detailed and refined biostratigraphic treatment of the Llandoverian faunas of the northern Cordillera is in Lenz (1979). The purpose of this paper is the description and illustration of Llandoverian graptolites of the northern Canadian Cordillera.

The common diplograptids *Climacograptus*, *Diplograptus*, *Glyptograptus*, *Orthograptus*, and *Pseudoclimacograptus* are identified only cursorily and listed, but are not described in this study. *Cyrtograptus* is also excluded because it was the subject of an earlier study (Lenz, 1978).

Materials and Methods

The graptolites which form the basis of this study were collected from well-exposed sections of the Richardson and Ogilvie Mountains, northern Yukon, and from the central and southern Mackenzie Mountains, Northwest Territories. The sections were measured in feet (pre-1977) or metres (post-1977) above a datum, and each graptolite collection was assigned a collection number corresponding to the actual metres (or feet) above the datum; subsequently, all non-metric measurements were converted to metres. The datum differs for each section, and requires explanation.

The Peel River section was measured, almost in its entirety in 1971, beginning in the earliest Ordovician?, Tremadocian strata (see Lenz and Pedder, 1972). The same section was recollected in much greater detail in 1977 and 1978, beginning just below the Ordovician-Silurian boundary, but for consistency, the 1971 measurement numbers, and therefore collection numbers, were used. Subsequently, collection numbers were converted to metres.

Blackstone River section was measured beginning about 50 m below the Ordovician-Silurian boundary and continuing to the top of exposed Silurian strata, corresponding to the *spiralis* Zone.

Tetlit Creek and Rock River sections were sampled from below the Ordovician-Silurian boundary to above the top of the Llandovery strata.

Mount Sekwi section (locality 9), which is structurally overturned, was collected from stratigraphically youngest to oldest, beginning in Upper Silurian beds.

Delorme Range (locality 10) and Whittaker Range (locality 11) were collected by J. Etherington in 1965, beginning at the base of graptolite-bearing strata.

Finally, Clearwater Creek (locality 12), which was collected by J. Etherington in 1966, begins at the top of a prominent quartzite unit which appears to mark the highest Ordovician beds in the area.

Under the heading Occurrence in the Systematic Palaeontology section, the occurrence of each species is listed by its zonal occurrence(s), localities where collected, and the stratigraphic level (in metres) at which collection was made. The stratigraphic intervals listed are precisely the same as those listed in the complete faunal list in the appendix.

The large collection of graptolites from northern Canada were identified using

standard techniques, on the basis of a very extensive literature survey of most major and minor taxonomic works, as well as a comparison with material in the type collections of the Sedgwick Museum of Geology, Cambridge University; the British Museum (Natural History); and the Department of Historical Geology and Palaeontology, Copenhagen University. Measurements of parameters, utilized in the identification and differentiation of species, was by means of a vernier eyepiece in a binocular microscope; this permitted an accuracy of measurement of about 0.5 mm.

Synonymies given in the systematic section of this paper are generally selective, and do not necessarily list all publications perused in the identifications of the species; instead, they list the more important taxonomic literature used in this study.

The appendix lists all species identified in the course of this study, including those not described or illustrated.

Under the heading Material in the taxonomic section, a number of terms are used in describing the condition of preservation of specimens of each species. These terms and their explanations are as follows: poor (preservation)—low contrast with rock, details of thecae not clear; fair—outline of rhabdosome clear, thecal characteristics overall generally discernible; moderate—good contrast with rock, outline of rhabdosome clear, gross thecal characteristics readily discernible; moderately well—good contrast with rock, thecal characteristics fairly clear and unambiguous; well—strong contrast with rock, thecae flattened but otherwise undeformed, most thecal subtleties recognizable; very well—very strong contrast with rock, thecal outlines crisp, thecal subtleties including introversion and retroversion clearly visible.

Stratigraphy

Graptolite-bearing strata of the Richardson Mountains and the adjacent Ogilvie Mountains, Yukon, were assigned to the Road River Formation by Jackson and Lenz (1962). Subsequently the formation has been recognized in east–central Alaska, northern Yukon, central and southern Mackenzie Mountains, western Northwest Territories, and northeastern British Columbia (Fig. 1).

Lithically, the Road River Formation varies markedly from locality to locality. Typically it consists of dark shale, dark bedded chert, and dark limestone with occasional mass-flow lenses, conglomerates, and turbidites. The formation encompasses strata of greatest age range in the Richardson Mountains. Here, strata at the base are Late Cambrian in age, while those at the top are late Early Devonian. Graptolites are abundant throughout the entire sequence of Llandovery strata, although they are concentrated primarily in the shales, and are rare in the cherts and limestones. Benthic, non-graptolite faunas are rare, and when present, generally show good evidence of being allochthonous.

Llandovery strata of the Road River Formation comprise various combinations of shales, cherts, and calcareous shales, and occasional mass-flow deposits (see Lenz, 1972). Their contacts with the underlying Ashgill (Ordovician) and overlying Wenlock (Silurian) strata appear to be gradational, although there is no clear-cut evidence of the presence of the earliest Silurian *persculptus* Zone (see Lenz, 1979). Llandovery strata range from as little as 90 m to at least 250 m in thickness throughout the region (Lenz, 1979).

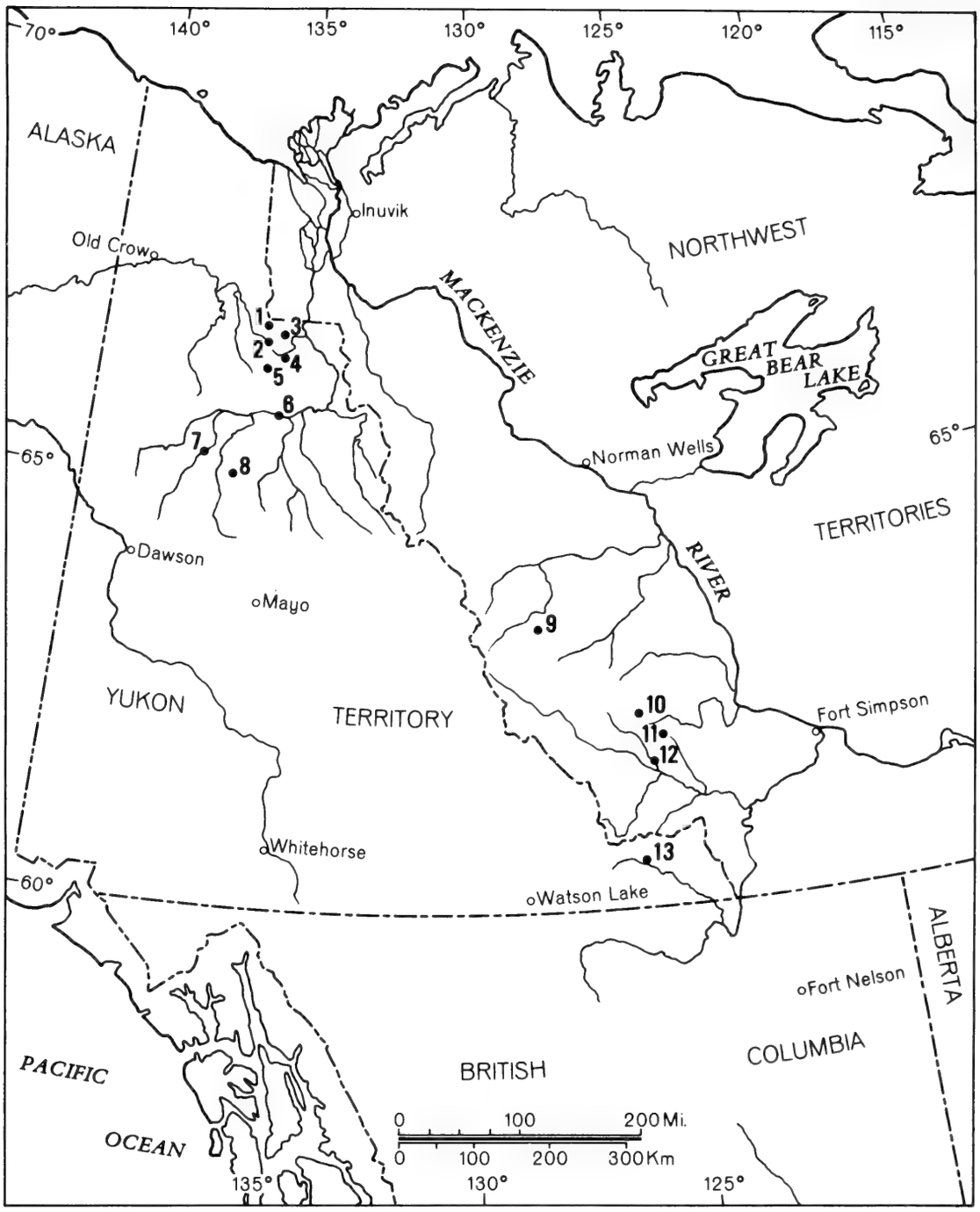


Fig. 1. Map of Yukon and adjacent western Northwest Territories showing 13 graptolite localities which form the basis of this study. Localities are as follows:

1. Rock River, north tributary, 66°55′N, 136°14′W;
2. Rock River, south tributary, 66°48′N, 136°16′W;
3. Tetlit Creek, tributary of Road River and type section of the Road River Formation, 66°44′N, 135°47′W;
4. Road River, 66°34′N, 135°43′W;
5. Unnamed creek on west side of Richardson Mountains, 66°30′N, 136°15′W;
6. Peel River, upper canyon, 65°53′N, 135°43′W;
7. Blackstone River, 65°24′N, 137°16′W;
8. Pat Lake, 65°07′N, 136°41′W;
9. Mount Sekwi, 63°29′N, 128°38′W;
10. Delorme Range, 62°45′N, 125°15′W;
11. Whittaker Range, 62°28.5′N, 124°48′W;
12. Clearwater Creek, 61°35′N, 125°35′W;
13. Beaver River, 60°30′N, 125°58′W.

Biostratigraphy

The graptolite-based biostratigraphic zonation of the Llandovery sequences of the northern Cordillera, with an accompanying range chart of all the known taxa to 1977, was given by Lenz (1979). That zonal scheme was in turn based in part on modifications of zonal schemes of Churkin and Carter (1970), Rickards (1970), Koren' (1973), Hutt (1975), Bjerreskov (1975), and Rickards (1976a) (see Table 1 for correlation of zonal schemes).

Thirteen biostratigraphic zones, of which the lowest is tentative, are recognized in the Llandoverian graptolite faunas of the northern Cordillera. Because graptolite diversity is high throughout the Llandovery, most of the recognized zones are assemblage zones, that have had the first appearance of new taxa added. For example, the *turriculatus* Zone is recognized by an association of *Monograptus turriculatus, M. exiguus exiguus* and/or *M. exiguus primulus, M. runcinatus, M. planus obtusus*, and *Pseudoplegmatograptus obesus reticulatus*; but its base is recognized by the first appearance of the first two taxa. On the other hand the *spiralis* Zone is recognized by the acme of *M. spiralis* (even though it begins in the underlying zone) in association with the first appearance of *M. priodon, M. curvus, Retiolites geinitzianus angustidens*, etc.

This study is based on a compilation of the graptolite faunas from 13 sections that include all or large portions of the Llandovery (see Fig. 1), and a number of ''spot'' outcrops. Four sections, those on Rock River, Tetlit Creek, Blackstone River, and especially that of the upper canyon of the Peel River, are outstanding with respect to completeness of sections, high faunal diversity, good exposures, and having been sampled in detail. They, therefore, form the basis of the present zonal succession.

Glyptograptus persculptus Zone

The definition of the Ordovician-Silurian boundary is at present the subject of international discussion. Traditionally, the *persculptus* Zone has been used as the basal Silurian biostratigraphic unit (Waterlot, 1945; Willefert, 1963; Churkin and Carter, 1970; Churkin et al., 1971; Hutt, 1975; Bjerreskov, 1975; Rickards, 1976a, 1976b; Rickards, Hutt, and Berry, 1977). Some workers (Münch, 1952; Obut et al., 1965, 1967; Schauer, 1971) have for practical purposes used the *Akidograptus ascensus-Orthograptus acuminatus* Zone (or zones) as the base of the Silurian (see Koren' and Kal'o, 1976, for a summary). The *persculptus* Zone, although not recognized with certainty in the northern Cordillera, is used as the base of the Silurian in this study.

Glyptograptus persculptus has not been recognized in the northern Cordillera, but strata below the *acuminatus* Zone contain a few diplograptid taxa. The assemblage is tentatively assigned to the *persculptus* Zone (see Appendix, Locality 12A).

Orthograptus acuminatus Zone

This zone is readily recognizable in several sections by the appearance of the zonal index species along with *Climacograptus* aff. *trifilis* (which in Germany occurs in the

same zone: Münch, 1952; Schauer, 1971) in association with the earliest appearances of *Cystograptus vesiculosus, Diplograptus modestus diminutus,* and *Orthograptus oberleini.*

Atavograptus atavus Zone

This zone is poorly known in the region, but is marked by the first monograptids in the Cordilleran region. These are *Atavograptus strachani*, the most common species, *A.* cf. *gracilis*, and, rarely, *A.* cf. *atavus*. *Dimorphograptus confertus swanstoni* and *D.* cf. *physophora* first appear in this zone, *Cystograptus vesiculosus* reaches its acme, and several typical diplograptids continue through this zone.

Lagarograptus acinaces Zone

The zonal designate has been identified from only a few localities, but the recognition of the zone is on firmer ground than that of the underlying *atavus* Zone. The zone is characterized by the influx of abundant, simple monograptids such as *Atavograptus* cf. *gracilus, A. strachani* (reaches its acme in this zone), *Pribylograptus* spp., as well as by *Dimorphograptus physophora alaskensis*, and the common *D. confertus swanstoni*.

This zone is correlated with the *acinaces* Zone of Hutt (1975), Bjerreskov (1975), and Rickards (1976a), and with the upper part, at least, of the *vesiculosus* Zone of Münch (1952), Obut et al. (1965, 1967), and Schauer (1971).

Coronograptus gregarius Zone

This zone is recognized by the incoming and profusion of the coronograptids, *Coronograptus gregarius gregarius*, *C. g. arcuatus*, and *C. hipposideros*, and the appearance of *M. revolutus*. The zone also contains "*Orthograptus*" *obuti*, and in a single collection yielded two specimens of *Coronograptus* cf. *cyphus*. The zone is equivalent to the well-known *cyphus* Zone of Great Britain (Hutt, 1975; Rickards, 1976a), but is older than the *gregarius* Zone of Willefert (1963), Schauer (1971), and Bjerreskov (1975). As such, the zone is in fact the "acme-zone" of *C. gregarius* and related species.

Monograptus triangulatus Zone

This zone is not widely recognized in the northern Cordillera, but the zone is recognized by the incoming of triangulate monograptids such as *M. triangulatus* and its subspecies, by *Rastrites* such as *R. approximatus* (Rickards, 1976a), as well as by *Lagarograptus inexpeditus* and the first appearance of *Petalograptus ovatoelongatus*.

The zone correlates with part of the *gregarius* Zone of Sudbury (1958) and Churkin and Carter (1970), and with at least the *triangulatus* Subzone of the *gregarius* Zone of Bjerreskov (1975).

Table 1 Correlation of some recent Llandoverian graptolite zonal schemes with the zonation of the northern Cordillera as used in this study.

	Lenz, 1979; this paper	Rickards, 1976a (U.K.)	Bjerreskov, 1975 (Denmark)	Koren', 1973 (composite) (USSR)	Churkin & Carter 1970 (Alaska)
LLANDOVERIAN	*sakmaricus-laqueus*	*crenulata*	*lapworthi*	*crenulata*	
	spiralis	*griestoniensis*	*spiralis*	*griestoniensis* *spiralis*	*grandis*
		crispus	*griestoniensis*	*crispus*	*spiralis*
			crispus		
	turriculatus	*turriculatus*	*turriculatus*	*turriculatus* *maximus*	*turriculatus/maximus*
		maximus subzone	*?*		
	sedgwicki	*sedgwicki*	*cometa* band	*sedgwicki*	*sedgwicki*
	convolutus	*convolutus*	*convolutus*	*convolutus*	*convolutus*
	argenteus	*leptotheca*	*?*	*argenteus*	
	magnus?	*magnus*	*gregarius* *pectinatus*	*gregarius* *magnus*	*gregarius*
	triangulatus	*triangulatus*	*triangulatus*	*triangulatus*	
	gregarius	*cyphus*	*revolutus*	*cyphus*	*cyphus*
	acinaces	*acinaces*		*acinaces*	*acinaces*
	atavus	*atavus*	*vesiculosus* band	*vesiculosus* = *atavus*	*vesiculosus/atavus*
	acuminatus	*acuminatus*	*acuminatus*	*acuminatus*	*acuminatus*
	persculptus?	*persculptus*	*persculptus*	*persculptus*	*persculptus*

Diplograptus magnus Zone?

This zone is the poorest documented of the Llandoverian zones of this study. It is apparently characterized by the lowest occurrence of *Monograptus involutus,* in association with *Rhaphidograptus* cf. *toernquisti,* and a number of long-ranging triangulate monograptids, *Monograptus revolutus* and *Pribylograptus angustus*. The index species, *Diplograptus magnus,* has not yet been found in the Canadian Cordillera.

Monograptus argenteus Zone

The *argenteus* Zone, although found only on the Peel and Blackstone rivers, is readily recognized by the association of *Monograptus* cf. *argenteus, M.* aff. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *M. millepeda*, and *M. communis*, as well as by the earliest occurrences of *Petalograptus intermedius* and *Rastrites orbitus*.

The zone is the correlative of the upper part of the *gregarius* Zone of Churkin and Carter (1970) and of Bjerreskov (1975), the *argenteus* Zone of Hutt (1975) and Rickards (1976a), and the *argenteus* Subzone of the *gregarius* Zone of Waterlot (1945).

Monograptus convolutus Zone

The basis for the recognition of this zone is relatively firm, thanks to its greater geographic distribution and greater thickness as compared to underlying zones, as well to its distinctive fauna. Characteristic species of the zone include *M. convolutus, M. sidjachenkoi, M. clingani, Petalograptus folium*, and *Cephalograptus cometa cometa* and *C. tubulariformis*.

The *convolutus* Zone is widely recognized in southeastern Alaska (Churkin and Carter, 1970), Great Britain (Hutt, 1975; Rickards, 1976a), Germany and Czechoslovakia (Münch, 1952; Schauer, 1971), Scandinavia (Bjerreskov, 1975), Morocco (Waterlot, 1945; Willefert, 1963), Poland (Teller, 1969), and several areas of the USSR (Obut et al., 1965, 1967).

Monograptus sedgwicki Zone

This zone, while not widespread, is well presented in the Peel and Blackstone Rivers sections. In addition to containing the acme of the index species, the zone contains *Cephalograptus cometa extrema*, *Monograptus pseudobecki, M. decipiens*, and *M.* cf. *tenuissmus*, and documents the earliest appearance of *M. spiralis* cf. *contortus, Rastrites linnaei*, and *Pseudoplegmatograptus obesus obesus*. The zone is widely recognized throughout western Europe, Great Britain, Morocco, and the USSR.

Monograptus turriculatus Zone

The *turriculatus* Zone is readily recognized through the association of *M. turriculatus*

and *M. exiguus/M. exiguus primulus*. Other guides to the zone include *M. marri, M. flagellaris, Pseudoplegmatograptus obesus reticulatus, Petalograptus altissimus,* and *Rastrites maximus*. *Rastrites linnaei* and *Monograptus tullbergi spiraloides* end and begin in this zone, respectively.

This zone is, next to the *spiralis* Zone, the most widespread Llandovery graptolite zone in the northern Cordillera, and is also recognized in Arctic Canada (Thorsteinsson, 1958).

The *turriculatus* Zone, as here used, encompasses the *turriculatus* Zone of Rickards (1976a), the *linnaei* and *turriculatus* zones of Obut et al. (1965, 1967), and Schauer (1971), and probably all of the *maximus* Zone of Churkin and Carter (1970).

Monograptus spiralis Zone

The *spiralis* Zone is the most ubiquitous and thickest Llandovery zone of the region (Jackson and Lenz, 1962; Lenz, 1979), and is well known in the Arctic Islands (Thorsteinsson, 1958; personal observation). It is characterized by an abundance of *Monograptus spiralis* in association with the first *M. priodon, Retiolites geinitzianus angustidens, Stomatograptus grandis grandis*, and *S. grandis imperfectus*. The rarer *Monograptus curvus* is found in this zone and *M. tullbergi spiraloides* becomes extinct.

As discussed by Thorsteinsson (1958), Jackson and Lenz (1962), and Lenz (1979), the *spiralis* Zone of northern and Arctic Canada is longer ranging in age than the zone of that name in Europe, and correlates with the combined *crispus* and *griestoniensis* Zones, and possibly in part with the *crenulata* Zone of Great Britain (see Rickards, 1976a).

Cyrtograptus sakmaricus-C. laqueus Zone

This zone, defined by Lenz (1979), is marked by the abrupt appearance of cyrtograptids such as *Cyrtograptus sakmaricus, C. laqueus,* and *C.* aff. *lapworthi,* in association with *Stomatograptus grandis grandis, S. grandis imperfectus*, as well as less common *Retiolites geinitzianus angustidens* and rare *Monograptus spiralis*.

The zone is the biostratigraphic correlative of the *Cyrtograptus* sp. nov. A-*Stomatograptus grandis* Zone of Thorsteinsson (1958), the *lapworthi* Zone of Bjerreskov (1975), and the *Oktavites spiralis-Stomatograptus grandis* Zone of Obut et al. (1965, 1967). It is equivalent, at least in part, to the *spiralis spiralis* Zone of Schauer (1971), and probably to the combined *M. prolosciformis-Stomatograptus grandis* Zone of Münch (1952).

Systematic Palaeontology

Repository

Illustrated graptolite types and specimens are housed in the Department of Invertebrate Palaeontology, Royal Ontario Museum, Toronto, and are assigned ROM

number 38674 to 38986. In this study, abundances of a graptolite species in a collection is listed as "rare" (1–3), "uncommon" (4–10), "common" (11–20, and "abundant" (more than 20).

Order Graptoloidea Lapworth, 1875
Suborder Diplograptina Lapworth, 1880, emended Bulman, 1970
Family Diplograptidae Lapworth, 1873

Genus *Petalograptus* Suess, 1851

Type Species

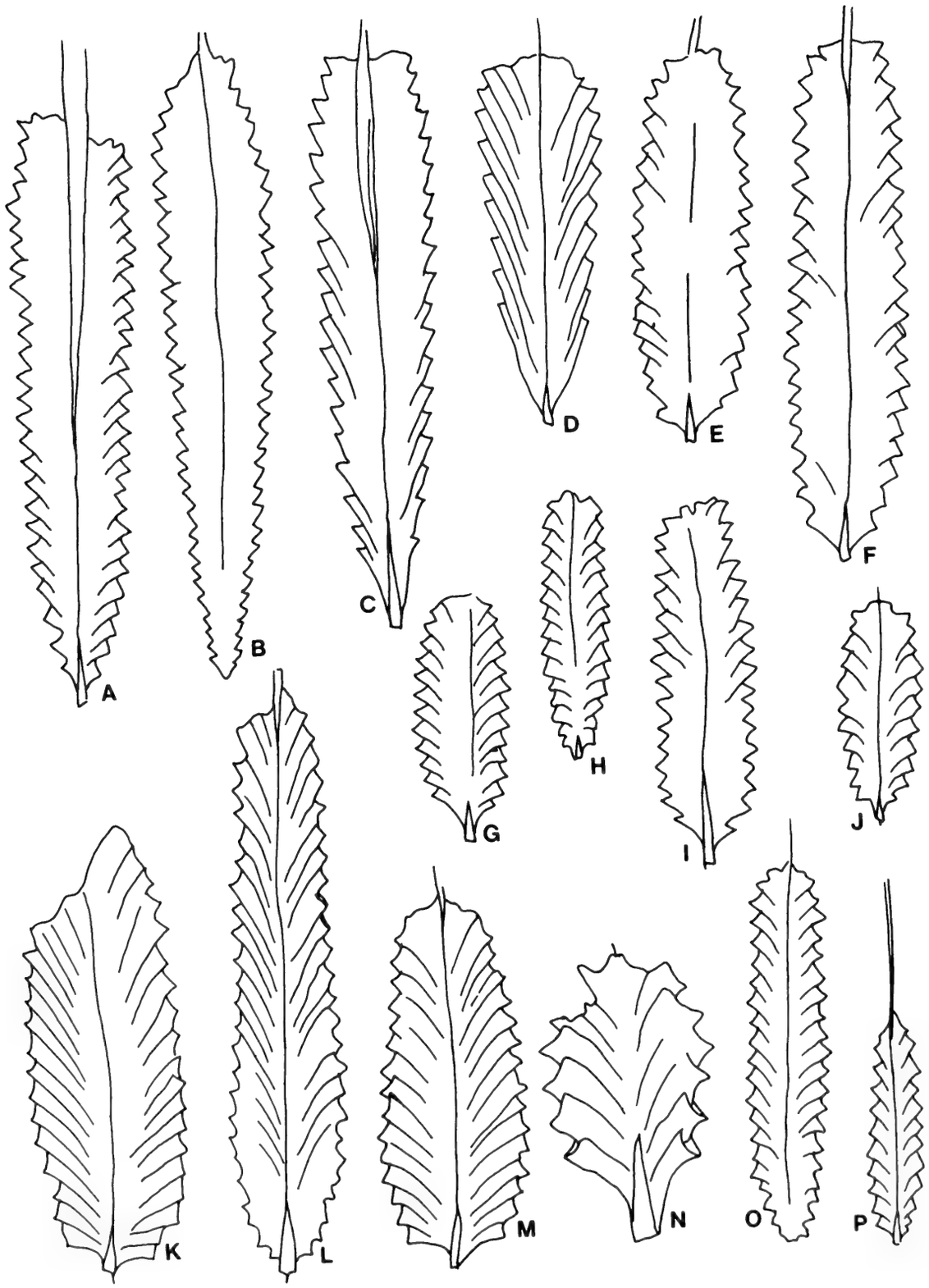
Prionotus folium Hisinger, 1837, from the Llandovery of Sweden; subsequent designation Lapworth, 1873.

Petalograptus altissimus Elles and Wood, 1908

Figs. 2A, B; 12A–C, H

Petalograptus altissimus Elles and Wood, 1908: 281.
Petalolithus altissimus, Bouček and Příbyl, 1941a: 12.
Petalolithus giganteus, Bouček and Příbyl, 1941a: 18.
Petalolithus conicus, Bouček and Příbyl, 1941a: 15.
Petalograptus (*Pet.*) *altissimus*, Schauer, 1971: 47.
Petalograptus altissimus, Bjerreskov, 1975: 34.

Fig. 2 A,B *Petalograptus altissumus* Elles and Wood, Blackstone River
A. Collection at 77.2 m, *sedgwicki* Zone, ROM 38674; × 3.4.
B. Collection at 91.4 m, *turriculatus* Zone, ROM 38675; × 3.4.
C,D. *Petalograptus folium* (Hisinger), *convolutus* Zone
C. Blackstone River, collection at 69.2 m, ROM 38676; × 3.4.
D. Peel River, collection at 498.7 m, ROM 38677; × 3.4.
E–G,I,J,N *Petalograptus intermedius* (Bouček and Příbyl)
E,F. Blackstone River, collection at 77.2 m, *sedgwicki* Zone?, ROM 38678 and 38679; × 3.4.
G,I. Blackstone River, collection at 65.5 m, *argenteus* Zone?, ROM 38680 and 38681; × 3.4.
J. Peel River, collection at 498.7 m, *convolutus* Zone, ROM 38682; × 3.4.
N. Peel River, collection at 487.4 m, *triangulatus* Zone, ROM 38683; × 6.
H,O. *Petalograptus* cf. *palmeus palmeus* (Barrande), Peel River, collection at 523 m, *turriculatus* Zone, ROM 38684 and 38685; × 3.4.
K–M. *Petalograptus ovatoelongatus* (Kurck), Peel River, *turriculatus* Zone
K. Collection at 521.8 m ROM 38686; × 3.4.
L. Collection at 523 m, ROM 38687; × 3.4.
M. Collection at 516.3 m, ROM 38688; × 3.4.
P. *Petalograptus* cf. *palmeus praecedens* (Bouček and Příbyl), Peel River, collection at 512.8 m, *convolutus* Zone, ROM 38689; × 3.4.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Occurrence

Sedgwicki Zone, Blackstone River, at 72.2 m and tentatively at 77.2 m; *turriculatus* Zone, Peel River at 521.8 and 531.9 m, and tentatively 523 m; Blackstone River, at 91.4 m and tentatively from 80.2 m.

Material

Relatively rare as fairly to moderately well-preserved carbon films on black shale. Illustrated specimens are ROM 38674, 38675, 38845 to 38847, and 38850.

Description

The rhabdosome of this species may be as much as 20 mm long, and characteristically undergoes gradual widening from 1.1 to 1.3 mm across theca 1, to a maximum of 3 to 3.5 mm. Only at the distal end of long specimens does the width decrease slightly. The thecae are simple tubes distally inclined about 70 degrees to the virgula, overlap about two-thirds their length distally, are about four times longer than wide, and number 13 to 16 in 10 mm proximally and 11 to 12 in 10 mm distally. A stout virgula may be present in the distal half of the rhabdosome.

Discussion

Canadian specimens of the species, like those of Bjerreskov (1975) from Denmark, possess more thecae than is typical for British and Czech specimens. The narrow proximal end, the slow widening of the rhabdosome, and the conical outline are typical of this species.

Petalograptus elongatus (Bouček and Přibyl, 1941)

Figs. 13B, D, G

Petalolithus elongatus elongatus Bouček and Přibyl, 1941a: 10.
Petalolithus elongatus, Münch, 1952: 62.
Petalolithus (Pet.) elongatus, Schauer, 1971: 46.

Occurrence

Sedgwicki and *turriculatus* zones, Peel River, at 513.6 m; Rock River, at 287 m; and Blackstone River, at 72.2, 77.2, and 88.7 m, and tentatively from 80.2, 85.3, 86.9, and 91.4 m.

Material

An average of eight specimens from each collection, all flattened, moderately well to well preserved. Illustrated specimens consist of ROM 38856 to 38858.

Description

The rhabdosome is up to 25 mm long and is essentially parallel-sided. The proximal end is 0.9 to 1.1 mm wide across theca 1 and width increases rapidly for the distance of 5 to 6 thecae, then remains constant. Width is variable, ranging from 1.5 mm to 2.1 mm, but averaging 2.0 mm. The sicula is 1.4 to 1.5 mm long, its apical end attaining the level of the top of theca 2 and it possesses a short virgella.

The thecae are straight and tubelike, inclined about 30 degrees, overlap one-half their length distally, are two to two and one-half times longer than wide distally, and number 12 to 10 in 10 mm. Thecal apertures are slightly curved, and form an angle of 90 degrees to 110 degrees to the thecal axis.

A spiralled, vanelike virgula extends well beyond the distal end of the rhabdosome of some specimens.

Discussion

This species is distinguished from the very similar *P. tenuis* by its longer sicula. The sicula in the Yukon specimens is shorter than the 2 mm cited by Schauer (1971) for this species and is midway between that of the typical *P. tenuis* and *P. elongatus*, raising the possibility that the two are conspecific, or at best subspecies of the same species.

Petalograptus folium (Hisinger, 1837)

Figs. 2C, D; 12 D, E

Prionotus folium Hisinger, 1837: 114.
Petalograptus folium, Elles and Wood, 1908: 282.
Petalolithus folium, Bouček and Příbyl, 1941b: 7.
Petalolithus (Pet.) folium, Schauer, 1971: 41.
Petalograptus folium, Bjerreskov, 1975: 35.
Petalolithus folium, Ni, 1978: pl. 2.
Petalolithus folius, Chen and Lin, 1978: 44.

Occurrence

Convolutus Zone, Peel River, at 496.2 and 498.7 m, and Blackstone River, at 66.4 and 69.2 m.

Material

Relatively uncommon in all collections except Blackstone River at 69.2 m, from which 22 specimens were recovered. All specimens are fairly well preserved but most are incomplete. Illustrated specimens are ROM 38676 to 38677 and 38848 to 38849.

Description

The rhabdosome is up to 2 cm long, tapering and snoutlike proximally, widening slowly from 2.7 to 3.8 mm across theca 1, to a maximum of 4.8 to 6.0 mm (average 5.2 mm) distally. The sicula is robust and 2.0 to 2.1 mm long.

The thecae are about eight times longer than wide, inclined 20 to 30 degrees throughout, overlap eight- or nine-tenths of their length and number 9 to 11 in 10 mm proximally and 9 in 10 mm distally. Theca 1 is about 4.5 mm long, whereas distal thecae are about 5.5 mm long. The virgula is threadlike proximally, but may become stout in distal parts of the rhabdosome, and beyond the main body.

Discussion

The cone-shaped proximal end and long proximal thecae are typical of this species and serve to distinguish it from other species.

Petalograptus cf. *hispanicus* Haberfelner, 1931

Fig. 12G

cf. *Petalograptus hispanicus* Haberfelner, 1931: 49.

Fig. 3A–C. *Cephalograptus cometa cometa* (Geinitz), Blackstone River, collection at 70.4 m, *convolutus* Zone, ROM 38690, 38691, and 38692; all × 3.4.

D. *Cephalograptus cometa extrema* Bouček and Přibyl, Blackstone River, collection at 77.2 m, *sedgwicki* Zone, ROM 38693; × 3.4.

E,F. *Cephalograptus tubulariformis* (Nicholson) Blackstone River, collection at 69.2 m, *convolutus* Zone, ROM 38694 and 38695; × 6.8 and × 3.4.

G–J. *Dimorphograptus confertus swanstoni* Lapworth

G,J. Peel River, collection at 460 m, *acinaces* Zone, ROM 38696 and 38697; × 6.8 and × 3.4.

H. Blackstone River, collection at 62.2 m, *atavus* Zone?, ROM 38698; × 3.4.

I. Peel River, collection at 463 m, *gregarius* Zone, ROM 38699; × 3.4.

K,N. *Dimorphograptus* cf. *physophora* (Nicholson)

K. Rock River, collection at 244 m, *gregarius* Zone, ROM 38700; × 4.

N. Blackstone River, collection at 61.9 m, *atavus* Zone?, ROM 38701; × 3.4.

L,M,O. *Dimorphograptus physophora alaskensis* Churkin and Carter

L,O. Rock River, collection at 244 m, *gregarius* Zone, ROM 38702 and 38703; × 4.

M. Pat Lake, collection 3F, *acinaces* Zone, ROM 38704; × 6.8.

P. *Rhaphidograptus* sp., Pat Lake, Collection 3F, *acinaces* Zone, ROM 38705; × 6.8.

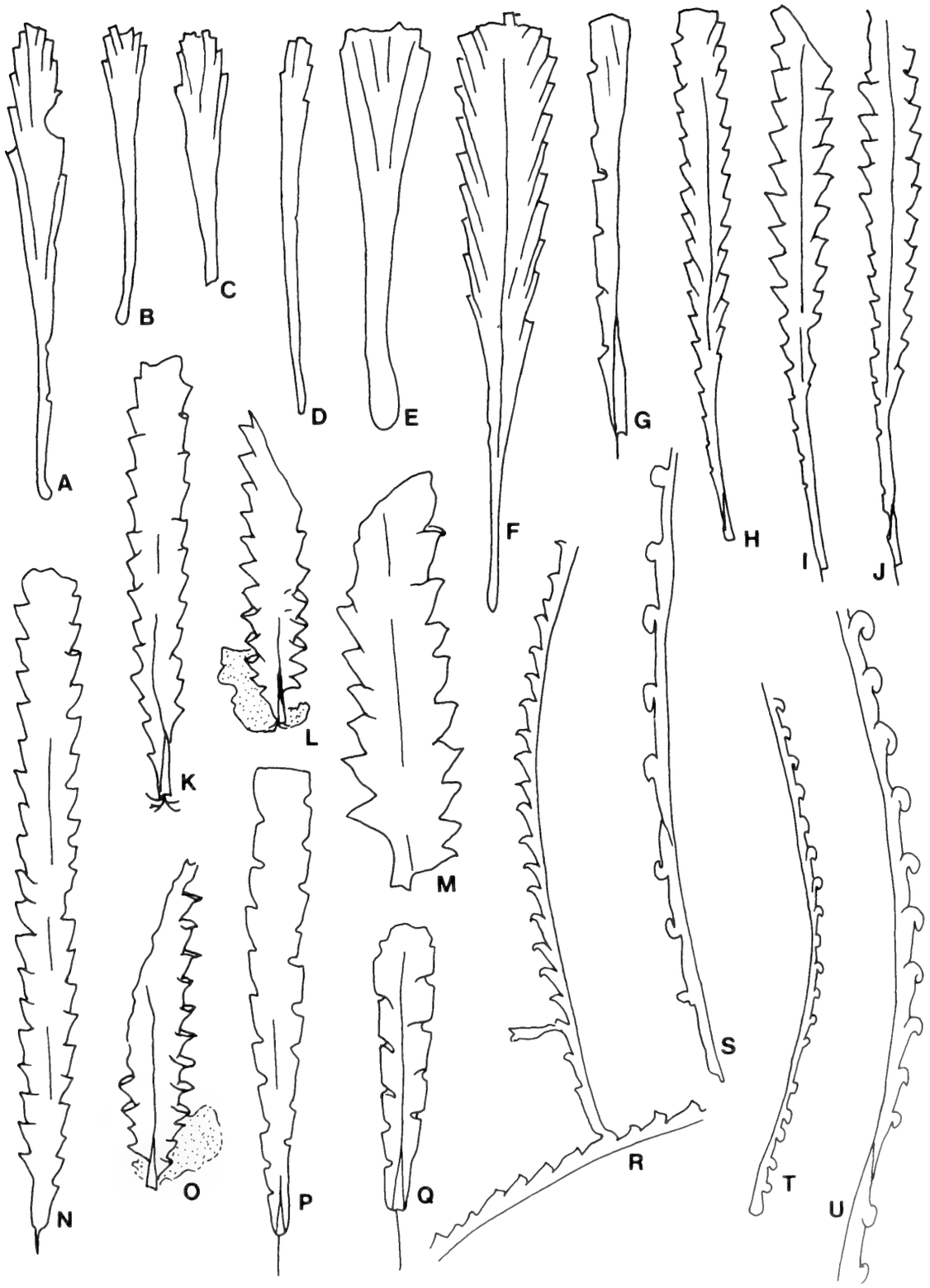
Q. *Rhaphidograptus* cf. *toernquisti* (Elles and Wood), Peel River, collection at 485.9 m, *magnus* Zone?, ROM 38706; × 6.8.

R. *Barrandeograptus* aff. *pulchellus* (Tullberg), Blackstone River, collection at 72.2 m, *sedgwicki* Zone, ROM 38707; × 3.4.

S–U. ?*Diversograptus ramosus* Manck

S. Rock River, collection 9F, *spiralis* Zone, ROM 38708; × 6.8.

T,U. Peel River, collection at 630.9 m, *sakmaricus-laqueus* Zone, ROM 38709; × 3.4 and × 6.8.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Occurrence

Turriculatus Zone, Peel River, at 544.4 m; Blackstone River, at 94.8 m; Tetlit Creek, at 144 m; and Clearwater Creek, at 65.5 m.

Material

Only a few poorly to moderately well-preserved, flattened specimens are available from each collection. Illustrated specimen is ROM 38856.

Discussion

The few specimens tentatively assigned to this species rather resemble dwarfed *P. altissimus*, but are clearly distinguished by being much narrower. The proximal end is long and tapering, the maximum width attained is 2.2 to 2.8 mm, and thecae number 12 to 14 in 10 mm proximally and 10 to 12 in 10 mm distally. The sicula, seen in only one specimen, appears to be about 1.5 mm long.

Petalograptus intermedius (Bouček and Příbyl, 1941)

Figs. 2E–G,I,J,N; 12F, I–L

Petalolithus intermedius Bouček and Příbyl, 1941b: 10.
Petalolithus primulus Bouček and Příbyl, 1941b: 6.
Petalolithus praecursor Bouček and Příbyl, 1941b: 10.
Petalolithus (Pet.) intermedius, Schauer, 1971: 41.

Occurrence

This is a long-ranging species, ranging through the *triangulatus, argenteus, convolutus,* and *turriculatus* zones. Peel River, at 487.4 m and tentatively at 498.7, 506.3, and 508.4 m; and Blackstone River, at 65.5, 70.4, 72.2, 74.7, 77.2, and 80.2 m.

Material

The species is relatively rare to uncommon in most collections, but is very abundant and dominant in collections from the Blackstone River, particularly in that made at 77.2 m. Preservation is fair to good, and many specimens preserve an external virgula. Illustrated specimens are ROM 38678 to 38683, 38851 to 38853, and 38855.

Description

The rhabdosome is typically ovate-elongate in outline, although a few large

specimens maintain more or less consistent width for about two-thirds the length. The proximal region is narrow and maximum width is attained rapidly within the distance of the first four to six thecae; distally, most rhabdosomes decrease in width. Maximum width ranges from 3.5 to 5.1 mm.

The thecae are straight and tubelike, except that their distal ends are flexed outwardly to form a lip. The thecae are inclined 30 to 40 degrees and distal thecae are about four times longer than wide. Thecae number 14 to 12 in 10 mm proximally and 10 to 12 in 10 mm distally. The sicula is 1.5 to 1.8 mm long.

Discussion

The width of this species varies considerably, even in specimens from the same collection. In one collection (Blackstone River, at 77.2 m), the width ranges from 3.6 to 5.1 m. The species is distinguished from *P. palmeus palmeus* by its consistently greater width, and from *P. p. clavatus* by its ovate outline.

***Petalograptus ovatoelongatus* (Kurck, 1882)**

Figs. 2K–M; 13 A, C, H

Cephalograptus ovato-elongatus Kurck, 1882: 303.
Petalograptus palmeus var. *ovato-elongatus*, Elles and Wood, 1908: 277.
Petalolithus ovato-elongatus, Bouček and Přibyl, 1941b: 2.
Petalolithus (Pet.) ovatoelongatus, Schauer, 1971: 40.
Petalograptus ovatoelongatus, Bjerreskov, 1975: 32.
Petalograptus ovatoelongatus, Hutt, 1975: 39.

Occurrence

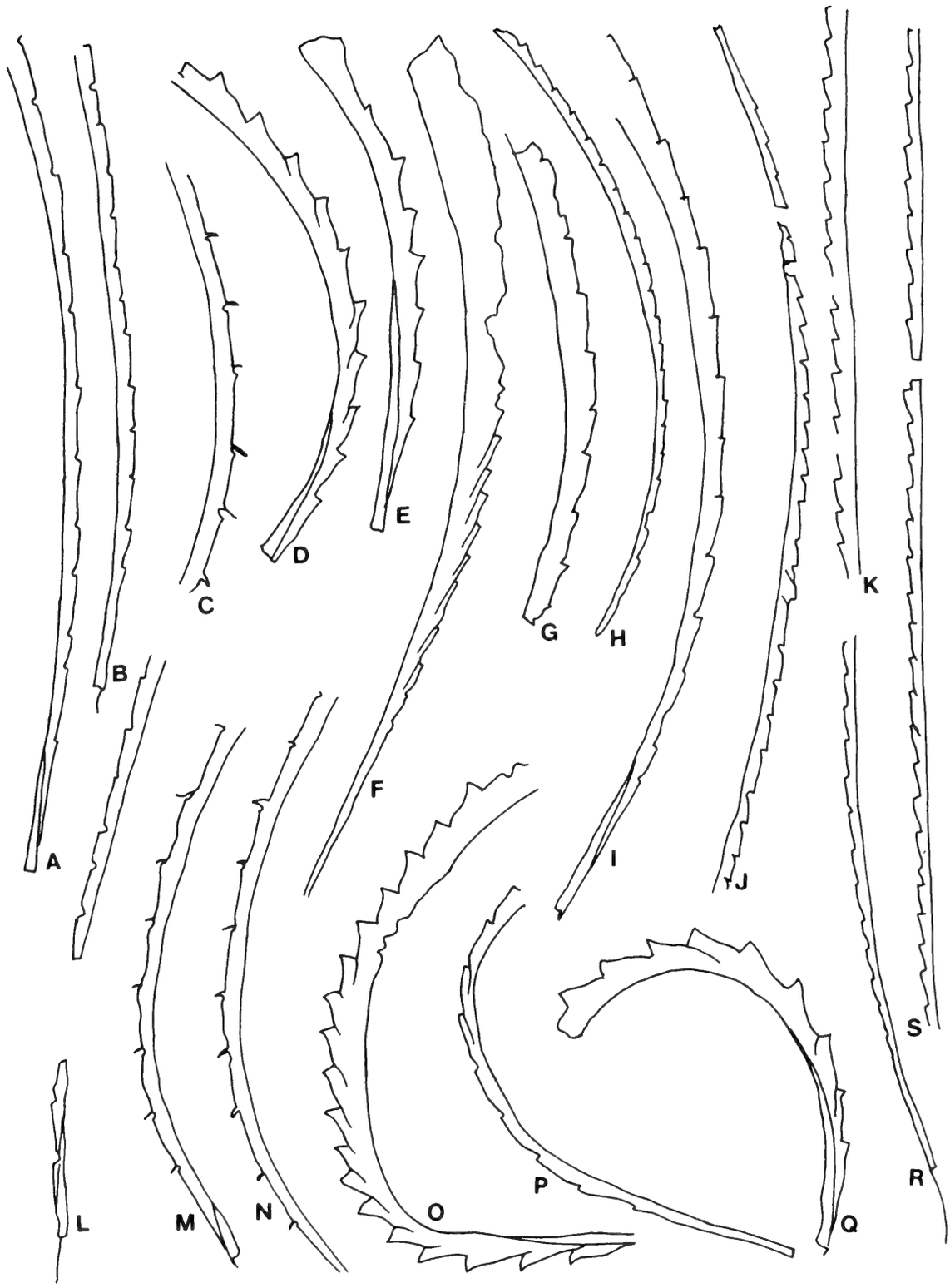
Argenteus, convolutus?, and *turriculatus* zones; Peel River collections, at 491.4, 516.3, 521.8, and 523 m; and Blackstone River, at 65.5 m, and tentatively at 88.7 m.

Material

Rare in any collection, but mostly well preserved as a carbon film on black shale. Illustrated specimens are ROM 38686 to 38688.

Description

The rhabdosome is robust and may attain lengths greater than 2 cm. The proximal end is ovate, and width increases very rapidly from an initial 3 to 4 mm to a maximum of 4.5 to 6.0 mm by thecae 4 to 6. The width thereafter decreases gradually to 3 to 4 mm. The sicula is 1.5 to 2.0 mm in length.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The proximal thecae are strongly curved outward and distal ends of the thecae subtend an angle of 70 to 90 degrees to the virgula. Distal thecae are gently curved and are inclined about 20 to 30 degrees to the virgula. The thecae number 12 to 13 in 10 mm proximally and 10 to 12 in 10 mm distally.

The virgula may be hairlike, or (rarely), robust.

Discussion

Canadian representatives of this species differ from the European specimens only in possessing slightly more widely spaced thecae and in being wider. The abrupt proximal widening and the gently tapered aspect of the distal portion of the rhabdosome are distinctive of the species.

Petalograptus cf. *palmeus palmeus* (Barrande, 1850)

Figs. 2H, O; 13F, I

cf. *Graptolithus palmeus* Barrande, 1850: 61.

Occurrence

Turriculatus Zone of Peel River, at 516.9, 518.8, and 523 m.

Material

Two well-preserved, and eight incomplete, poorly preserved specimens from 516.9 and 518.8 m, and three specimens from 523 m, flattened on black shale. Illustrated specimens are ROM 38684 to 38685 and 38860 to 38861.

Fig. 4 A,B,L. *Atavograptus* cf. *gracilis* Hutt, Peel River, collection at 461.5 m, *acinaces* Zone, ROM 38710, 38711, and 38712; all × 6.8.

C,M,N. *Lagarograptus inexpeditus* Obut and Sobolevskaya, Peel River, collection at 481.9 m, *triangulatus* Zone?, ROM 38726 and 38727; both × 6.8.

D,E,O,Q. *Coronograptus gregarius gregarius* (Lapworth)

D. Rock River, collection at 254 m, *gregarius* Zone, ROM 38713; × 8.

E. Peel River, collection at 488 m, *magnus* Zone?, ROM 38714; × 6.8.

O,Q. Peel River, collection at 465.1 m, *gregarius* Zone, ROM 38715 and 38716; both × 6.8.

F. *Coronograptus* cf. *cyphus* (Lapworth), Rock River, collection at 255 m, *gregarius* Zone, ROM 38717; × 8.

G,H,P. *Lagarograptus* cf. *acinaces* (Törnquist), Rock River, *gregarius* Zone

G. Collection at 245 m, ROM 38718; × 8.

H. Collection at 249 m, ROM 38719; × 4.

P. Collection at 254 m, ROM 38720; × 8.

I,J,K,R,S. *Atavograptus strachani* (Hutt and Rickards), *acinaces* Zone

I. Blackstone River, collection at 62.5 m, ROM 38721; × 6.8.

J,K. Tetlit Creek, collection at 133 m, ROM 38722 and 38723; both × 4.

R,S. Peel River, collection at 460 m, ROM 38724 and 38725; both × 3.4.

Description

The rhabdosome is weakly ovate, widening moderately rapidly from an initial width of 1.0 mm through the distance of the first three thecae, then gradually to a maximum width of 3.0 to 3.4 mm, which is attained about midlength. The longest specimen is 15 mm. The sicula is about 1.4 mm long.

The proximal thecae are short and moderately outwardly curved, whereas distal thecae are only gently curved, form an angle of 30 to 40 degrees with the virgula, and are about four times longer than wide. The thecae number 14 to 15 in 10 mm proximally and 12 in 10 mm distally.

Discussion

The study material differs from the typical specimens in possessing relatively more thecae, although the spacing is the same as that described by Bjerreskov (1975). It differs from *P. palmeus* of Churkin and Carter (1970) in being considerably larger.

Petalograptus cf. *palmeus clavatus* (Bouček and Přibyl, 1941)

Fig. 13E

cf. *Petalolithus palmeus clavatus* Bouček and Přibyl, 1941: 6.

Occurrence

From the *turriculatus* Zone of Peel River, 518.8 m.

Material

Two specimens, one well preserved, carbon films on black shale. Illustrated specimen is ROM 38859.

Discussion

The two specimens, although associated with *P.* cf. *palmeus palmeus,* differ strikingly from that species. They widen abruptly from an initial width of about 2.0 mm to a maximum distal width of 3.5 mm in the distance of three to four thecae, then taper gradually to a distal width of 2.3 mm. The sicula is 1.4 mm long. The proximal thecae are sharply curved so that their apertures are parallel to the rhabdosome axis, whereas the distal thecal apertures are inclined at a low angle to the axis, and form an obtuse angle with the thecal axis. The thecae number 13 in 10 mm proximally and 11 in 10 mm distally. A long external virgula with a twirled, vanelike structure is present (the "simple" vincular type of Schauer, 1971: 38, fig. 20).

This form may be an anomalous morphotype of *P. palmeus palmeus,* but because of its abrupt widening, and distally tapering rhabdosome, is tentatively assigned to *P. p. clavatus.*

Petalograptus cf. *palmeus praecedens* (Bouček and Přibyl, 1941)

Fig. 2P

cf. *Petalolithus praecedens* Bouček and Přibyl, 1941: 8.
?*Petalograptus palmeus* (Barrande), Churkin and Carter, 1970: 32.

Occurrence

Convolutus Zone of Peel River, at 512.8 m.

Material

Four specimens, two moderately well preserved, all flattened on black shale. Illustrated specimen is ROM 38689.

Discussion

This subspecies is distinguished from the typical species in being shorter (maximum length about 1 cm), and narrower (maximum width observed 2.3 mm). Otherwise it is typical of the *palmeus* group. The sicula is 1.3 to 1.4 mm long and the thecae number about 13 in 10 mm. The Yukon material appears to be almost indistinguishable from the *P. palmeus* of Churkin and Carter (1970) from southeastern Alaska, where it in part has the same stratigraphic range.

Genus *Cephalograptus* Hopkinson, 1869

Type Species

Diplograptus cometa Geinitz 1852, from the Llandovery of Germany; original designation.

Cephalograptus cometa cometa (Geinitz, 1852)

Figs. 3A–C; 14A–C

Diplograptus cometa Geinitz, 1852: 26.
Cephalograptus cometa, Elles and Wood, 1908: 285.

Cephalograptus cometa cometa, Bouček and Příbyl, 1941b: 13.
Petalolithus (Ceph.) cometa cometa, Schauer, 1971: 49.
Cephalograptus cometa cometa, Bjerreskov, 1975: 36.

Occurrence

Upper part of the *convolutus* Zone, Blackstone River, at 70.4 m.

Material

Eleven specimens, several moderately well preserved although flattened on black shale. Illustrated specimens consist of ROM 38690 to 38692 and 38862 to 38863.

Description

The rhabdosome is elongate with a long, narrow, cone-shaped proximal end and an anteriorly rounded distal end. Maximum width of 3.0 mm is attained immediately across the level of the aperture of the first thecae; thereafter, width may remain constant for the distance of the next several thecae, or, more commonly, begins decreasing. The sicula was not seen, but some specimens possess a slightly wider, bulbous end.

The proximal thecae are very elongate (about 10 mm long), inclined at a very low

Fig.5 A,B,E. *Coronograptus hipposideros* (Toghill), Peel River, collection at 471.5 m, *gregarius* Zone, ROM 38728, 38729, and 38730; all × 6.8.

C,D,R. *Coronograptus gregarius arcuatus* Obut and Sobolevskaya, *gregarius* Zone

C. Peel River, collection at 470.3 m, ROM 38731; × 6.8.

D. Tetlit Creek, collection at 136 m, ROM 38732; × 4

R. Peel River, collection at 475.5 m, ROM 38733; × 3.4.

F,G,T. *Monograptus communis* Lapworth, Peel River, collection at 496.2 m, *convolutus* Zone, ROM 38734, 38735, and 38736; all × 3.4.

H–J. *Pristiograptus regularis* (Törnquist), Peel River

H. Collection at 519.4 m, *sedgwicki* Zone? ROM 38737; × 3.4.

I. Collection at 523 m, *turriculatus* Zone, ROM 38738; × 3.4.

J. Collection at 521.8 m, *turriculatus* Zone, ROM 38739; × 3.4.

K,N,O. *Pristiograptus* cf. *variabilis* (Perner), Peel River, collection at 523 m, *turriculatus* Zone, ROM 38740, 38741, and 38742; all × 3.4.

L,M,P. *Pristiograptus nudus* (Lapworth)

L. Peel River, collection at 523 m, *turriculatus* Zone, ROM 38743; × 3.4.

M. Blackstone River, collection at 72.2 m, *sedgwicki* Zone, ROM 38744; × 3.4.

P. Blackstone River, collection at 70.4 m, *convolutus* Zone, ROM 38745; × 3.4.

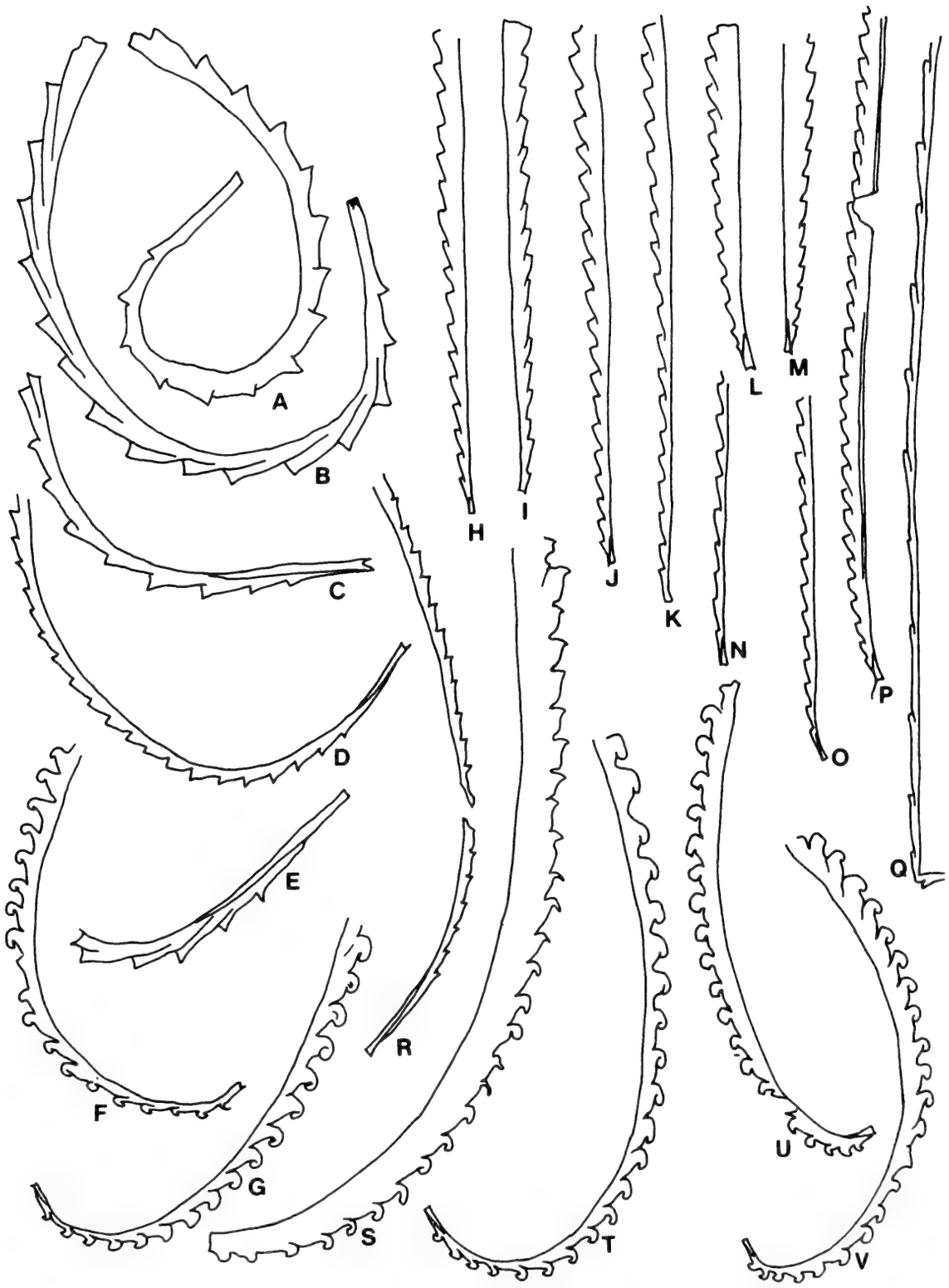
Q. *Pribylograptus angustus* (Rickards), Peel River, collection at 488 m, *magnus* Zone?, ROM 38746; × 6.8.

S. *Monograptus* cf. *argenteus* (Nicholson), Peel River, collection at 491.4 m, *argenteus* Zone, ROM 38747; × 3.4.

U,V. *Monograptus clingani* (Carruthers), Peel River, *convolutus* Zone

U. Collection at 507.8 m, ROM 38748; × 3.4.

V. Collection at 498.7 m, ROM 38749; × 3.4.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angle to the rhabdosome axis; distal thecae are shorter and inclined at 10 to 15 degrees. In the largest specimen, seven thecae are observed. Thecae number 8 in 10 mm.

Cephalograptus cometa extrema Bouček and Příbyl, 1941

Figs. 3D; 14G, H

Cephalograptus cometa, Elles and Wood, 1908: 285.
Cephalograptus cometa extrema, Bouček and Příbyl, 1941b: 14.
Petalolithus (Ceph.) cometa extrema, Schauer, 1971: 50.
Cephalograptus cometa extrema, Bjerreskov, 1975: 37.

Occurrence

Sedgwicki Zone of Blackstone River, at 77.2 m.

Material

Seven specimens, poorly to moderately well preserved on black shale. Illustrated specimens are ROM 38693 and 38869.

Description

The rhabdosome is very slender, reaching a maximum length of 16 mm. The maximum width is 1.4 to 1.5 mm which is attained immediately at the level of the aperture of theca 1; thereafter the rhabdosome narrows rapidly. The greatest number of thecae is three. A sicula was not observed.

The thecae are also very long and slender, and the first theca appears to exceed 12 mm in length, whereas distal thecae shorten markedly. The thecae are inclinded 2 to 4 degrees and overlap almost their entire length.

Discussion

C. cometa extrema is the most extremely elongated and the stratigraphically highest form of the *C. tubulariformis-C. cometa cometa-C. cometa extrema* lineage. These three species appear to be useful for precise correlation.

Cephalograptus tubulariformis (Nicholson, 1867)

Figs. 3E–F; 14E

Diplograptus tubulariformis Nicholson, 1867: 111.
Cephalograptus tubulariformis, Elles and Wood, 1908: 287.

Cephalograptus tubulariformis, Bouček and Příbyl, 1941b: 12.
Petalolithus (Ceph.) tubulariformis, Schauer, 1971: 49.
Cephalograptus tubulariformis, Bjerreskov, 1975: 36.

Occurrence

Convolutus Zone, Blackstone River, at 69.2 m.

Material

Seven specimens, three of which are moderately well-preserved, on black shale. Illustrated specimens are ROM 38694 to 38695.

Description

The rhabdosome is wedge shaped, the proximal end being narrow and cone shaped, the distal end being more or less parallel-sided. The maximum width attained is 4.2 to 5 mm, whereas the width across the first theca is 3.0 mm. The sicula was not seen.

The proximal thecae are simple, gently curved tubes, inclined about 20 degrees to the virgula and they are spaced at eight to nine in 10 mm. The initial theca appears to be about 5 mm or more in length. Distal thecae are shorter than proximal thecae and are inclined about 30 degrees.

Discussion

The Canadian material is similar to specimens of the species previously described from Europe, and differs only in possessing a slightly more protracted and more sharply pointed proximal end. Its morphology and stratigraphic position supports Rickard's et al. (1977) suggestion that it is ancestral to *C. cometa cometa.*

Family Dimorphograptidae Elles and Wood, 1908

Genus *Dimorphograptus* Lapworth, 1876

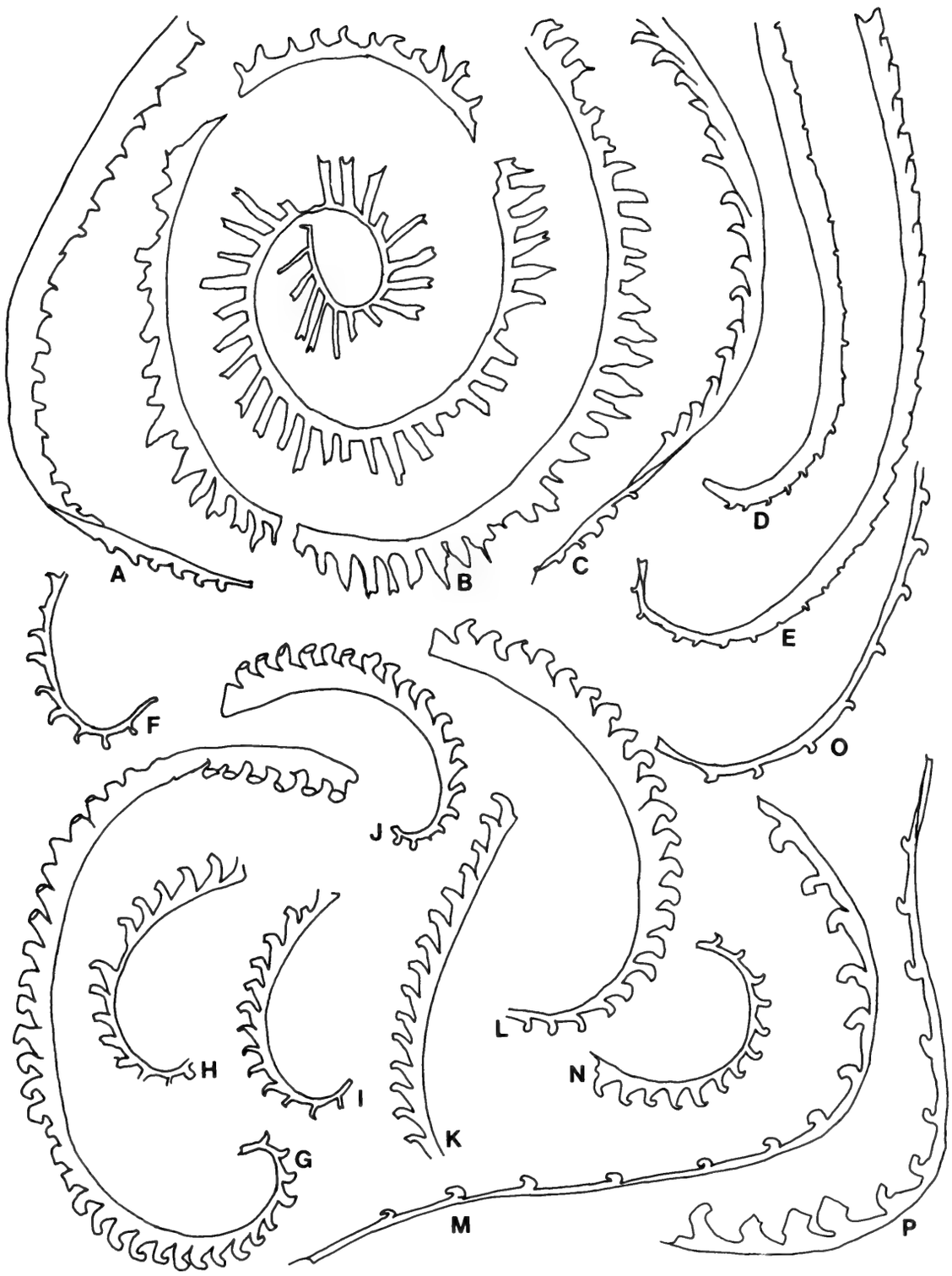
Type Species

Dimorphograptus elongatus Lapworth, from the Llandovery of Scotland; subsequent designation Bassler, 1915.

Dimorphograptus confertus swanstoni Lapworth, 1876

Figs. 3G–J; 15A, B

Dimorphograptus Swanstoni Lapworth, 1876: 548.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Dimorphograptus confertus var. *Swanstoni,* Elles and Wood, 1908: 350.
Dimorphograptus swanstoni, Obut and Solobevskaya, 1967: 72.
Dimorphograptus confertus swanstoni, Churkin and Carter, 1970: 33.
Dimorphograptus confertus swanstoni, Churkin et al., 1971: 24.
Dimorphograptus confertus swanstoni, Schauer, 1971: 52.

Occurrence

Atavus? and *acinaces* zones, Peel River, at 459.6, 460, 460.6, 461.5, 463, and 465.1 m; and Blackstone River, at 62.2 m.

Material

Five to ten incomplete and moderately well-preserved specimens from each collection. Illustrated specimens are ROM 38696 to 38699 and 38870.

Description

The rhabdosome is up to 30 mm long, and is straight except for the uniserial portion which generally shows weak dorsal curvature. The rhabdosome widens gradually from 1.5 to 1.7 mm across the first biserial thecae to a maximum of 2.1 to 2.6 mm (average 2.4 mm) distally. The uniserial portion is composed of five to six more or less climacograptid thecae, whereas those of the biserial portion are orthograptid to glyptograptid. The thecal walls of the biserial portion are sigmoidal and often lip-bearing; the apertures, which undulate, are inclined about 90 degrees to the virgula. Thecae number nine to ten in 10 mm in the uniserial portion and eight to nine in 10 mm in the biserial. The sicula is robust and 1.9 to 2.3 mm (average 2.0 mm) in length.

Fig. 6 A,C. *Monograptus curvus* Manck, Peel River, collection at 611.4 m, *spiralis* Zone, ROM 38750 and 38751; both × 3.4.

B. *Monograptus convolutus* (Hisinger), Peel River, collection at 498.7 m, *convolutus* Zone, ROM 38752; × 3.4.

D,E. *Monograptus* aff. *cygneus* Törnquist (*sensu* Obut and Sobolevskaya, 1967), Peel River

D. Collection at 512.8 m, *convolutus* Zone, ROM 38753; × 3.4.

E. Collection at 491.4 m, *argenteus* Zone, ROM 38754; × 3.4.

F,N. *Monograptus decipiens decipiens* Törnquist, Peel River, collection at 526 m, *turriculatus* Zone, ROM 38755 and 38756; both × 3.4.

G,J,L. *Monograptus decipiens valens* (Příbyl and Münch), *turriculatus* Zone

G. Peel River, collection at 518.8 m, ROM 38757; × 3.4.

J. Peel River, collection at 521.8 m, ROM 38758; × 3.4.

L. Blackstone River, collection at 88.7 m, ROM 38759; × 3.4.

H,I,K. *Monograptus* cf. *denticulatus* Törnquist, Peel River, collection at 519.4 m, *sedgwicki* Zone?, ROM 38760, 38761, and 38762; all × 3.4.

M,P. *Monograptus crispus* Lapworth, Ellesmere Island, *crispus* Zone? (≅ *spiralis* Zone), ROM 38763 and 38764; both × 6.8.

O. *Monograptus* cf. *elongatus* Törnquist, Peel River, collection at 477 m, *triangulatus* Zone, ROM 38765; × 6.8.

Discussion

Yukon specimens of this species are similar in all respects to those from Britain, as well as to those from Alaska illustrated by Churkin and Carter (1970). They differ from the illustrated specimens of Obut et al. (1967) in possessing a longer sicula.

Dimorphograptus cf. *physophora* (Nicholson, 1868)

Figs. 3K, N; 15D, E

cf. *Diplograptus physophora* Nicholson, 1868: 56.

Occurrence

Atavus? Zone, Blackstone River, at 61.9 m; and from the *gregarius* Zone, Rock River, at 244 m, and Tetlit Creek, at 136 m.

Material

A single, moderately well-preserved, flattened specimen from each of Blackstone and Rock rivers, and six incomplete specimens from Tetlit Creek. Illustrated specimens are ROM 38700 to 38701 and 38873 to 38874.

Description

The rhabdosome is longer than 25 mm, is straight, and ranges in width from 1.5 mm across theca 1, to a maximum of 2.5 mm, width increase is very gradual. The uniserial portion is short, less than 2 mm long, and bears two glyptograptid thecae, theca 1 being 1 mm long. The distal thecae are all glyptograptid in profile, inclined about 30 degrees to the virgula, overlap about one-half, and their apertures are straight and at right angles to the virgula. Thecae number 10 to 11 in 10 mm proximally and 8 in 10 mm distally. The sicula is not clearly discernible, but appears to be about 1.8 mm long and possesses a stout, virgellar spine. A faint proximal disclike body and lateral, weblike strands are seen in the specimen from Rock River.

Discussion

The uniserial portion of the single specimen from Blackstone River is longer than is typical for *D. physophora*. It differs from *D. longissimus* in possessing a distinctly shorter uniserial portion. The study specimens are most similar to *D. physophora* in the nature of their glyptograptid thecae.

Dimorphograptus physophora alaskensis Churkin and Carter, 1970

Figs. 3L,M,O; 14F, I–K

Dimorphograptus physophora alaskensis Churkin and Carter, 1970: 33.

Occurrence

Acinaces and *gregarius* zones, Blackstone River, at 62.5 m; Rock River, at 244 m; and Pat Lake, collection 3F.

Material

Thirteen specimens, of which seven are from Pat Lake. All are flattened on black shale, and are poorly to moderately well preserved. Illustrated specimens are ROM 38702 to 38704, and 38865 to 38868.

Description

The rhabdosome is as much as 30 mm long. Some specimens attain maximum width almost immediately, whereas others widen slightly, distal of the initial thecae. Most specimens range between 2.4 to 2.6 mm in width, but two specimens are 3.4 mm wide. The sicula is straight, almost completely exposed on one side and 1.6 to 1.7 mm long. The uniserial portion is straight and possesses only a single theca.

The thecae are orthograptid in outline, and vary from a straight outer wall to curving outwards and forming a lip; they overlap one-half to two-thirds their length, and number 12 to 13 in 10 mm proximally and 8 to 10 in 10 mm distally. The thecal apertures are undulose and generally form an obtuse angle with the virgula.

Some specimens possess a proximal ovate web or disclike structure; others possess only a meshworklike structure, while still others are devoid of any extraneous structures.

Discussion

The Yukon specimens differ from those of Churkin and Carter's (1970) species in being wider and in that some specimens possess a disc or weblike structure. This structure is more typical of *D. physophora physophora;* however the Yukon material differs from that species in possessing more closely spaced thecae and in being considerably wider.

Some specimens of *D. physophora alaskensis* bear a strong similarity to *Orthograptus obuti* (Rickards and Koren', 1974), and some specimens with short uniserial sections and a virgellar meshwork may be that species. Rickards and Koren' (1974) pointed out the similarity between *O. obuti* and *D. physophora,* distinguishing them by the fact of the greater width and meshwork development in the former species. In view of the relatively poor preservation of the few Yukon specimens

bearing the meshwork, and of the possession of a short uniserial portion in all specimens, they are tentatively assigned to Churkin and Carter's (1970) subspecies.

Genus *Rhaphidograptus* Bulman, 1936

Type Species

Climacograptus Törnquisti Elles and Wood (1906) from the Llandovery of Scotland; original designation.

Rhaphidograptus sp.

Fig. 3P

Occurrence

Acinaces Zone, Pat Lake, collection 3F.

Material

One specimen, moderately preserved on black shale. The illustrated specimen is ROM 38705.

Discussion

This species appears to differ from the species described herein as *R.* cf. *toernquisti* by being more tapered proximally and possessing thecae which are midway between typical climacograptid and glyptograptid profiles.

Fig. 7 A,D,F,G. *Monograptus exiguus primulus* Bouček and Přibyl, Peel River, *turriculatus* Zone
- A,D. Collection at 536.1 m, ROM 38766 and 38767; × 3.4.
- F. Collection at 548.9 m, ROM 38768; × 6.8.
- G. Collection at 531.9 m, ROM 38769; × 6.8.

B,C. *Monograptus involutus* Lapworth, Peel River
- B. Collection at 488 m, *magnus* Zone?, ROM 38770; × 6.8.
- C. Collection at 487.4 m, *triangulatus* Zone, ROM 38771; × 3.4.

E. *Monograptus flagellaris* Törnquist, Blackstone River, collection about 91.4 m, *turriculatus* Zone, ROM 38772; × 6.8.

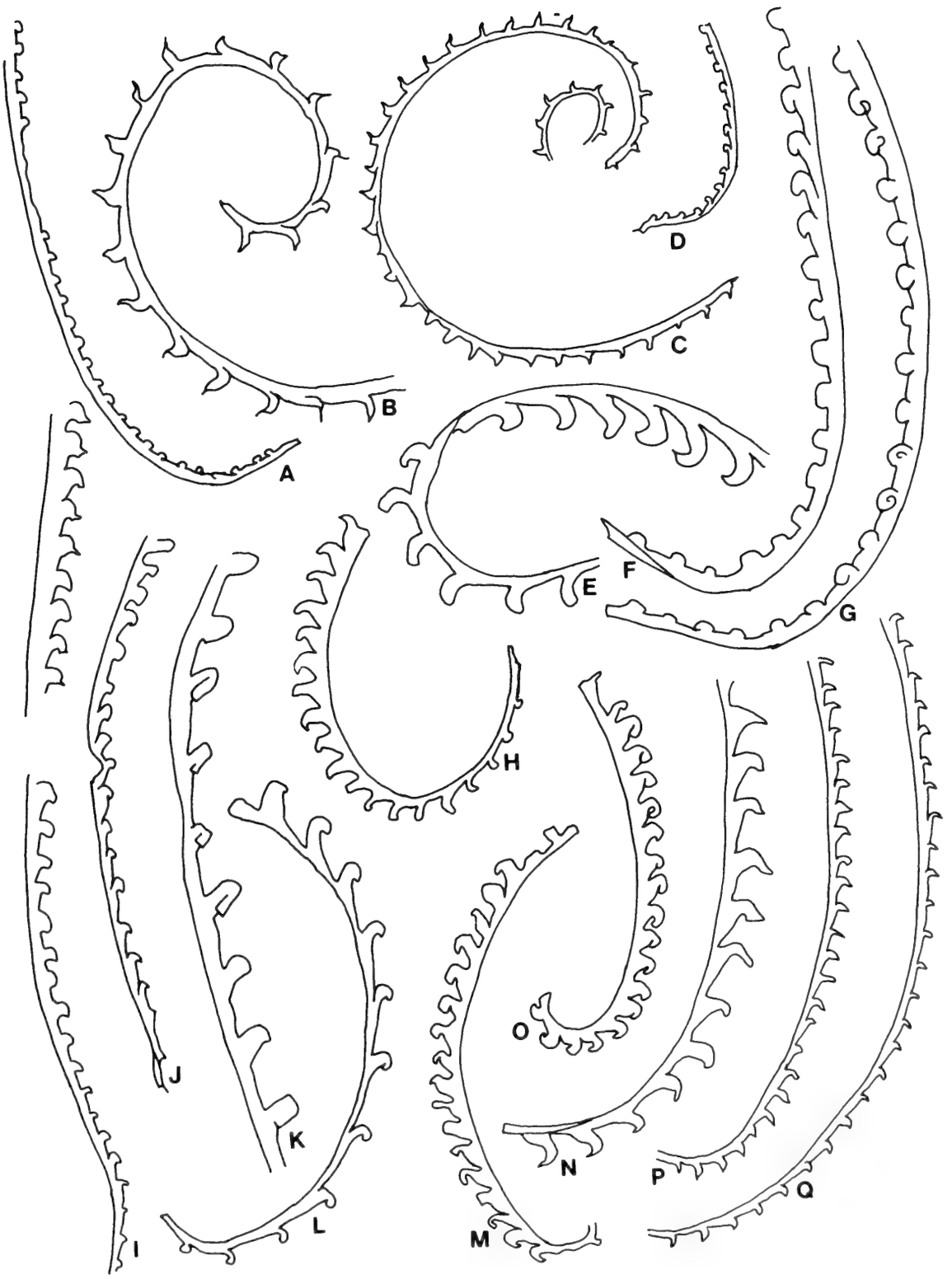
H,L. *Monograptus planus* (Barrande), Peel River, collection at 523 m, *turriculatus* Zone, ROM 38773 and 38774; × 3.4 and × 6.8.

I,J. *Monograptus lobiferus harpago* Törnquist, Peel River, collection at 502.3 m, *convolutus* Zone, ROM 38775 and 38776; both × 3.4.

K. *Monograptus* cf. *knockensis* Elles and Wood, Blackstone River, collection at 80.2 m, *turriculatus* Zone, ROM 38777; × 6.8.

M,O. *Monograptus millepeda* (M'Coy), *argenteus* Zone
- M. Peel River, collection at 491.4 m, ROM 38778; × 3.4.
- O. Blackstone River, collection at 65.5 m, ROM 38779; × 3.4.

N,P,Q. *Monograptus falx* (Suess), Peel River
- N,P. Collection at 611.4 m, *spiralis* Zone, ROM 38780 and 38781; × 6.8 and × 3.4 respectively
- Q. Collection at 544.4 m, *turriculatus* Zone, ROM 38782; × 3.4.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Rhaphidograptus cf. *toernquisti* (Elles and Wood, 1906)

Figs. 3Q; 14D

cf. *Climacograptus Törnquisti* Elles and Wood, 1906: 190.

Occurrence

Magnus? Zone, Peel River, at 485.9 m.

Material

Two incomplete and moderately well-preserved specimens on black shale. Illustrated specimens ROM 38706 and 38864.

Description

The rhabdosome is incomplete and at least 5.5 mm in length. Width increases from 0.7 mm across theca 1, to a maximum of 1.4 mm. The sicula is not clearly discernible, but appears to be about 1.5 mm long and, except for its apex, is completely exposed on one side; it possesses a long virgellar spine.

The thecae are climacograptid and overlap about one-half their length. The thecal apertures are slightly inwardly inclined. Thecae number about 12 in 10 mm.

Discussion

Although the study specimens are similar to *R. toernquisti* they are too incomplete for accurate identification.

Family Retiolitidae Lapworth, 1873

Genus *Retiolites* Barrande, 1850

Type Species

Gladiolites Geinitzianus Barrande, 1850, from the Llandovery of Czechoslovakia, original designation.

Retiolites decurtatus Bouček and Münch, 1943

Fig. 15F

Retiolites (Pseudoretiolites) decurtatus Bouček and Münch, 1943: 30.
Pseudoretiolites decurtatus, Münch, 1952: 74.

Occurrence

Convolutus Zone, Blackstone River, at 66.4 m.

Material

A single complete specimen, of only fair preservation preserved as a carbon film on black shale. The illustrated specimen is ROM 38875.

Description

The rhabdosome is 15 mm long, ovate in outline, and attains a maximum width of 5.3 mm about midlength. The sicula is not visible. A weak virgula extends through the length of the specimen.

The thecae are essentially tubelike, inclined about 60 degrees to the virgula, about six times longer than wide, possess simple apertures which are perpendicular to the thecal axis, and number 13 in 10 mm proximally and 11 in 10 mm distally. The entire rhabdosome is covered with a fine meshworklike reticulum, apparently without a distinct pattern in the median region of the rhabdosome, but more or less aligned parallel to the thecal apertures near the apertures. The meshwork of the reticulum is spaced at the rate of nine in the space of 1 mm.

Discussion

The species differs from *R. perlatus*, the only similar species, in being narrower and considerably shorter, and in possessing more closely spaced thecae. The Blackstone River occurrence of the species in the *convolutus* Zone is considerably older than its occurrence in Europe where it is found in the *turriculatus* Zone (Bouček and Münch, 1943; Münch, 1952).

Retiolites geinitzianus angustidens **Elles and Wood, 1908**

Fig. 15C, H

Retiolites (Gladiograptus) Geinitzianus var. *angustidens* Elles and Wood, 1908: 338.
Retiolites (Retiolites) geinitzianus angustidens, Bouček and Münch, 1943: 37
Retiolites (Ret.) geinitzianus angustidens, Schauer, 1971: 83.
Retiolites geinitzianus angustidens, Bjerreskov, 1975: 38.

Occurrence

Spiralis and *sakmaricus-laqueus* zones. The species is ubiquitous, and was found at the following stratigraphic localities: Peel River, at 615.7, 629.4, 630.9, and

635.5 m; Tetlit Creek, at 182, 185, 192, 213, 215, 217, 219, and 220 m; Rock River, at 323 m; Rock River main tributary in collections 1F and 3F; Mount Sekwi, at 413 m; Whittaker Range, at 728.5 and 855.6 m; Delorme Range, at 911.4 and 986 m. The species is also common in the *spiralis* Zone of northern Cornwallis Island and southern Baillie-Hamilton Island, central Arctic Archipelago.

Material

Relatively uncommon in any one collection. Preservation ranges from poor to good, and all specimens are flattened on black shale. Illustrated specimens are ROM 38871 to 38872.

Description

The rhabdosome is 3 to 4 cm long; it increases in width from about 1.5 mm across theca 1 to a maximum of 2.5 to 3.5 mm in about 2 cm, thereafter the width remains constant. The clathria is well developed and lateral branches alternate regularly on either side of the central straight or zigzag line. The virgula is present throughout the length of the rhabdosome.

The thecae are essentially simple, parallel-sided tubes which overlap throughout their lengths; they are inclined about 45 degrees to the virgula, are rectangular in cross-section, and number 14 in 10 mm proximally and 9 to 10 in 10 mm distally.

The clathria is covered by a reticulum in which meshes are more or less quadrate in outline and number four to five in 1 mm in the distal part of the rhabdosome.

Fig. 8. A. *Monograptus minimus* Bouček and Příbyl, Rock River, main branch, collection 4F, *sakmaricus-laqueus* Zone, ROM 38783; × 6.8.

B,C. *Monograptus* cf. *pandus* Lapworth, Peel River, collection at 544.4 m, *turriculatus* Zone, ROM 38784 and 38785; × 3.4.

D,E. *Monograptus marri* Perner, Peel River, collection at 548.9 m, *turriculatus* Zone, ROM 38786 and 38787; × 3.4 and × 6.8 respectively.

F,G. *Monoclimacis linnarssoni* (Tullberg), *sakmaricus-laqueus* Zone

F. Peel River, collection at 642.5 m, ROM 38788; × 3.4.

G. Mount Sekwi, collection at 384 m, ROM 38789; × 3.4.

H,I. *Monograptus parapriodon* Bouček, *sakmaricus-laqueus* Zone

H. Rock River, main branch, collection 3F, ROM 38790; × 6.8.

I. Peel River, collection at 635.5 m, ROM 38791; × 3.4.

J,K,L. *Monograptus pseudobecki* Bouček and Příbyl, Peel River

J,L. Collection at 523 m, *turriculatus* Zone, ROM 38792 and 38793; both × 6.8.

K. Collection at 519.4 m, *sedgwicki* Zone?, ROM 38794; × 3.4.

M. *Monograptus planus obtusus* Schauer, Peel River, collection at 531.9 m, *turriculatus* Zone, ROM 38795; × 3.4.

N,P,R. *Monograptus sidjachenkoi* (Obut and Sobolevskaya), Peel River, *convolutus* Zone

N,P. Collection at 507.8 m, ROM 38796 and 38797; both × 6.8.

R. Collection at 512.8 m, ROM 38798; × 3.4.

O,Q. *Monograptus* cf. *tenuissmus* (Obut and Sobolevskaya), Peel River, collection at 519.4 m, *sedgwicki* Zone?, ROM 38799 and 38800; both × 3.4.

S,T. *Monograptus proteus* (Barrande), Rock River, collection at 287 m, *turriculatus* Zone, ROM 38801 and 38802; both × 4.

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Discussion

R. geinitzianus angustidens is very much more common and ubiquitous in the available collections than is the larger, more robust *R. geinitzianus geinitzianus* from which it is distinguished principally by being considerably narrower and in possessing a finer reticulum. Uncompressed specimens from the Cape Phillips Formation, Cornwallis Island, show that the virgula is embedded in one side of the central, boxlike clathria.

Pores, such as those observed by Bjerreskov (1975) in one of her specimens, have not been recognized in any of the compressed or uncompressed specimens.

Genus *Stomatograptus* Tullberg, 1883

Type Species

Retiolites grandis Suess, 1851, from the Lower Silurian of Czechoslovakia; original designation.

Stomatograptus grandis grandis (Suess, 1851)

Fig. 16A–C

Retiolites grandis Suess, 1851: 15.
Retiolites (Stomatograptus) grandis grandis Bouček and Münch, 1943: 49.
Stomatograptus grandis grandis, Bjerreskov, 1975: 39.

Occurrence

Spiralis and *sakmaricus-laqueus* zones. Collected from Rock River collections 4F, 5F, 6F, and 8F; and Tetlit Creek, at 185 and 187 m.

Material

Relatively rare with preservation ranging from fair to very good. Illustrated specimens are ROM 38878 to 38879.

Description

The rhabdosome is greater than 60 mm in length and attains a width of 5.5 to 7.0 mm, the most rapid widening occurring in the proximal 3 cm.

The meshwork of the reticulum has three to three and one-half meshes per mm. A median row of pores may or may not be present throughout the length of the rhabdosome; the pores are oval in outline and are spaced three to four per 5 mm.

The thecae are inclined about 50 degrees to the virgula distally and overlap about seven-eighths their length. The interthecal septa are straight, and the external walls of the thecae are sclerotized and convex in profile. The thecae number 12 to 14 in 10 mm proximally and 8 to 10 in 10 mm distally.

Discussion

S. grandis grandis is readily distinguishable from *S. grandis imperfectus* by being narrower, by more consistently possessing the median row of pores and, most characteristically, by the convex profile of the outer walls of the thecae.

Stomatograptus grandis imperfectus (Bouček and Münch, 1943)

Fig. 16D, F, G

Retiolites (Stomatograptus) grandis imperfectus Bouček and Münch, 1943: 51.
Stomatograptus grandis imperfectus, Münch, 1952: 80.

Occurrence

Spiralis and *sakmaricus-laqueus* zones. From Tetlit Creek, at 215 and 219 m; Peel River, at 630.9 m; Rock River, collection 6F; Clearwater Creek, at 88.4 m; and Beaver River, a spot collection.

Material

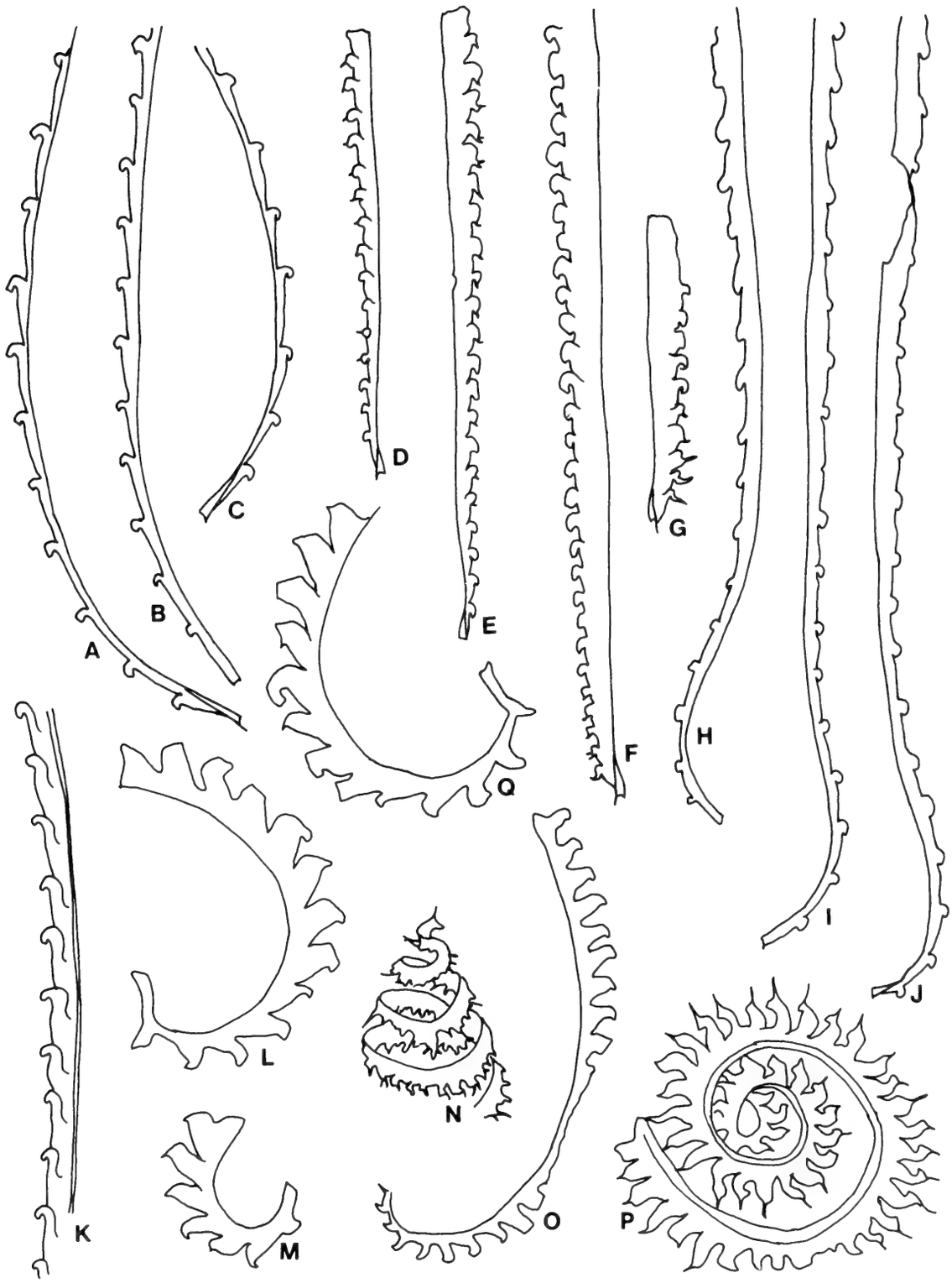
Generally only one or two moderately to well-preserved specimens in each collection. Illustrated specimens are ROM 38880 to 38882.

Description

The rhabdosome is long, the longest observed specimen being 80 mm. Width increases rapidly from about 1 mm proximally to about 5 mm by the level of theca 20 and more gradually thereafter to attain a maximum width of 6 to 7.5 mm (average: 6.5 mm).

The network of the reticulum is quadrate to polygonal, and two to three network meshes occur per 1 mm. Some specimens possess a discontinuous row of median pores with thickened rims, whereas other specimens in the same collection are devoid of pores.

The thecae are inclined about 60 degrees to the virgula in the distal region and overlap about three-fourths their lengths. The thecal apertures are concave and the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proximodistal portion of each theca is drawn out into a liplike structure. Some compressed specimens clearly show that the lip is really a thin, but completely sclerotized, shelf which forms the base of the distal part of each theca. Interthecal septa are robust and straight. Theca number 10 to 14 in 10 mm proximally and eight to nine in 10 mm distally.

Discussion

The presence of median pores is generally considered diagnostic of the genus *Stomatograptus* (see for example Bulman, 1970: V130). Bouček and Münch (1943) found pores in only some species of *Stomatograptus*, whereas Bjerreskov (1975) reports the presence of median pores in one specimen identified as *Retiolites geinitzianus angustidens*. It therefore appears that the absence of median pores does not exclude a species from the genus *Stomatograptus*. A more diagnostic and consistent feature of *Stomatograptus* appears to be the possession of solid interthecal septa in the distal parts of the thecae. Bouček and Münch (1943) admit that their *Retiolites robustus* is very similar to *S. grandis imperfectus*, but assign it to *Retiolites* because the reticulum is not fused to the clathria, a distinction which seems exceedingly subtle or inapplicable at best, when working with flattened specimens. All specimens studied that possess a solid interthecal septum are assigned to the genus *Stomatograptus*.

Yukon specimens attain a slightly greater width than is typical of *S. grandis imperfectus* which approaches that of *S. grandis maior* Bouček. However, the presence of the liplike development is characteristic of *S. grandis imperfectus* and quite unlike the convex curvature of the outer walls of the thecae of *S. grandis maior*.

Fig. 9 A–C. *Monograptus* cf. *sartorius* Törnquist, Rock River, collection at 306 m, *spiralis* Zone? ROM 38803, 38804, and 38805; all × 8.

D,E. *Monograptus sedgwicki* (Portlock), Peel River

D. Collection at 516.3 m, *turriculatus* Zone, ROM 38806; × 3.4.

E. Collection at 513.6 m, *sedgwicki* Zone, ROM 38807; × 3.4.

F,G. *Monograptus rickardsi minor* Hutt, Rock River, collection at 287 m, *turriculatus* Zone, ROM 38808 and 38809; both × 4.

H–J. *Monograptus runcinatus richardsonensis* subsp. nov., *turriculatus* Zone

H. Blackstone River, collection at 94.8 m, ROM 38810; × 6.8.

I,J. Rock River, collection at 287 m, ROM 38811 and 38812; both × 8.

K. *Monograptus speciosus* Tullberg, Tetlit Creek, collection at 217 m, *sakmaricus-laqueus* Zone, ROM 38813; × 8.

L,M,Q. *Monograptus triangulatus fimbriatus* (Nicholson), Peel River

L,Q. Collection at 488 m, *magnus* Zone?, ROM 38814 and 38815; × 6.8.

M. Collection at 482.5 m, *triangulatus* Zone, ROM 38816; × 6.8.

N. *Monograptus turriculatus* (Barrande), Peel River, collection at 531.9 m, *turriculatus* Zone, ROM 38817; × 3.4.

O *Monograptus* cf. *triangulatus separatus* Sudbury, Peel River, collection at 480.4 m, *triangulatus* Zone, ROM 38818; × 3.4.

P *Monograptus spiralis* (Geinitz), Peel River, collection at 611.4 m, *spiralis* Zone, ROM 38819; × 3.4.

Stomatograptus sp.

Fig. 15I

Occurrence

Sakmaricus-laqueus Zone, Tetlit Creek, at 217 m.

Material

Two incomplete, moderately well-preserved specimens on black shale. The illustrated specimen is ROM 38877.

Description

Only the distal portion of the rhabdosome is preserved, but the length clearly exceeds 35 mm. Distal width exceeds 4.5 mm. The meshwork of the reticulum is fairly fine, and the meshes are more or less quadrate and about five in 1 mm. A row of large median pores is present throughout the length of the rhabdosome. The pores are ovate, 1.1 to 1.3 mm long and 0.5 to 0.6 mm wide and spaced at the rate of three in 5 mm.

The thecae are straight, overlap about three-fourths their length and number 10 in 10 mm distally. The thecal apertures are concave, and form acute angles with the axes of the thecae, but show no sclerotization or thickening of the apertural regions.

Discussion

The two Tetlit Creek specimens are most like *Stomatograptus shiqianensis* Mu et al. (1974) and *S. sinensis* Wang, although their width suggests a greater affinity with the former species.

The row of very large median pores is distinctive of the species and, in this respect, it is quite different from all well-known species. The lack of sufficient material however, prevents a more detailed discussion or description.

Genus *Pseudoplegmatograptus* Přibyl, 1948

Type Species

Retiolites perlatus var. *obesus* Lapworth, 1877, from the Llandovery of Ireland; original designation.

Pseudoplegmatograptus giganteus (Bouček and Münch, 1943)

Fig. 17C,D

Plegmatograptus giganteus Bouček and Münch, 1943: 17.
Plegmatograptus giganteus, Münch, 1952: 75.

Occurrence

Spiralis Zone, Delorme Range, at 976.9 m.

Material

Two incomplete, moderately well-preserved specimens on grey shale. Illustrated specimens are ROM 38885 to 38886.

Description

The rhabdosome was evidently much longer than the 55 mm fragment. The width is 10.5 mm inclusive of lacinia, 8.5 mm exclusive of the lacinia. The reticulum is very coarse, and each mesh is more or less hexagonal and attains a width of 1.5 to 2.0 mm. The rhabdosome is composed of four to five rows of meshes. A thin virgula is present throughout the length of the rhabdosome.

The thecae are marked by long and slightly proximally curved spines of the lacinia which emerge from the corner of the outer row of the meshes. Thecae number seven and a half to eight in 10 mm distally. The ends of the spines of the lacinia are embedded in an approximately 1 mm wide band of delicate, but dense-textured tissue (the ''Borste'' of Bouček and Münch, 1943).

Discussion

The large size, coarse reticulum, and marginal tissue band are distinctive of the species.

Pseudoplegmatograptus obesus obesus (Lapworth, 1877)

Figs. 16E; 17A, B

Retiolites perlatus var. *obesus* Lapworth, 1877: 137.
Retiolites (Plegmatograptus) obesus, Elles and Wood, 1908: 342.
Plegmatograptus obesus obesus, Bouček and Münch, 1943: 6.
Retiolites (Pseudoplegmatograptus) obesus, Schauer, 1971: 84.
Pseudoplegmatograptus obesus obesus, Hutt, 1975: 47.

Occurrence

Sedgwicki and *turriculatus* zones, Peel River, at 513.6, 519.4, and 521.8 m; and Rock River, at 302 m. A single specimen, tentatively identified as this species, was collected from the *convolutus* Zone, Peel River, at 507.8 m.

Material

Rare in any collection. Several well-preserved, flattened specimens of this rare species are present in the collections. The illustrated specimen is ROM 38884.

Description

The rhabdosome is longer than 40 mm and the greatest width attained is 5.5 mm. The meshwork of the reticulum is distinct, moderately strong, but with a loose appearance. The meshes are irregular in shape. A lacinia is fairly well developed, is about 1 mm wide and marks the position of the thecae which number 10 to 12 in 10 mm distally. A median virgula extends throughout the length of the rhabdosome but a clathria is not seen.

Pseudoplegmatograptus obesus reticulatus (Bouček and Münch, 1943)

Fig. 18B, C

Plegmatograptus obesus reticulatus Bouček and Münch, 1943: 9.
Pseudoplegmatograptus obesus reticulatus, Hutt, 1975: 48.

Occurrence

Turriculatus Zone, Peel River, at 518.8 and 548.9 m.

Fig. 10 A,B. *Monograptus tullbergi spiraloides* (Přibyl) Rock River, collection 5F, *spiralis* Zone, ROM 38820 and 38821; both × 3.4.

C,I,J. *Rastrites approximatus* Perner, Peel River, *triangulatus* Zone

C,J. Collection at 480.4 m, ROM 38822 and 38823; both × 3.4.

I. Collection at 480 m, ROM 38824; × 3.4.

D,K,L. *Monograptus revolutus* Kurck, Peel River

D. Collection at 488 m, *magnus* Zone?, ROM 38825; × 3.4.

K. Collection at 471.5 m, *gregarius* Zone, ROM 38826; × 6.8.

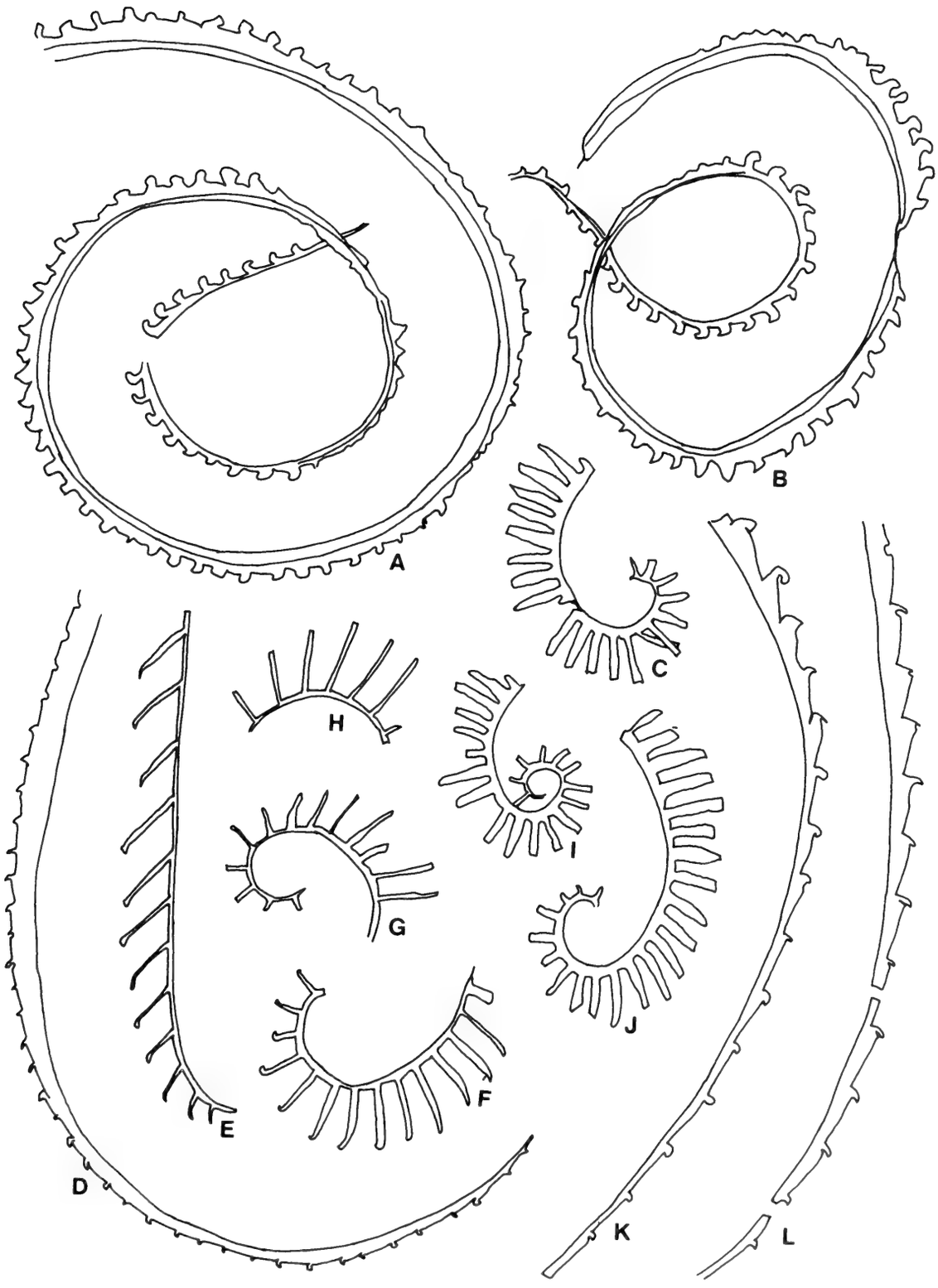
L. Collection at 482.5 m, *triangulatus* Zone, ROM 38827; × 6.

E. *Rastrites* cf. *distans* Lapworth, Peel River, collection at 513.6 m, *sedgwicki* Zone, ROM 38828; × 3.4.

F–H. *Rastrites longispinus* Perner, Peel River

F,G. Collection at 477 m, *triangulatus* Zone, ROM 38829 and 38830; both × 3.4.

H. Collection at 507.8 m, *convolutus* Zone, ROM 38831; × 3.4.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Material

Two incomplete moderately well-preserved specimens on black shale. Illustrated specimens are ROM 38891 to 38892.

Description

The rhabdosome is longer than 10 mm and the greatest width is 3.5 mm. The reticulum is very well developed and is dense, and the meshes are polygonal in outline and number about 3 in 1 mm. The thecae number 16 to 12 in 10 mm and are distinct, owing to a moderately well-developed lacinia.

Discussion

This subspecies differs from *P. obesus obesus* in possessing a dense meshwork and more closely spaced thecae. The study specimens possess more closely spaced thecae than the material described by Bouček and Münch (1943).

Pseudoplegmatograptus obscurus (Bouček and Münch, 1943)

Fig. 18D

Plegmatograptus obscurus Bouček and Münch, 1943: 15.
Plegmatograptus obscurus, Münch, 1952: 74.

Occurrence

Spiralis Zone, Rock River, at 326 m, and Tetlit Creek, at 182 m.

Material

Three slightly distorted and incomplete specimens, two moderately well preserved. The illustrated specimen is ROM 38893.

Description

The rhabdosome is clearly much longer than the fragments available and the maximum width attains 8 to 9 mm distally. The reticulum is well developed and thin walled, and forms somewhat irregular to very regular hexagonal meshes which are about 1 mm in width. The meshes of the outer rows are distinctly hexagonal in outline and the margin of the rhabdosome is markedly zigzag, marking the position of the thecae which number 8 to 9 in 10 mm. A virgula is present throughout the length of the preserved portions of the rhabdosome.

Discussion

The Yukon specimens of the species are identical in all respects to the material of Bouček and Münch (1943). This species differs from *P. giganteus* in being narrower and in lacking the lacinia with the dense marginal band.

Suborder Monograptina Lapworth, 1880
Family Monograptidae Lapworth, 1873

Genus *Lagarograptus* Obut and Sobolevskaya, 1968

Type Species

Lagarograptus inexpeditus Obut and Sobolevskaya, 1968, from the *triangulatus* Zone of the Norilsk borehole, Siberia; original designation.

Lagarograptus cf. *acinaces* (Törnquist, 1899)

Figs. 4G, H, P; 19A, C, D

cf. *Monograptus acinaces* Törnquist, 1899: 5.

Occurrence

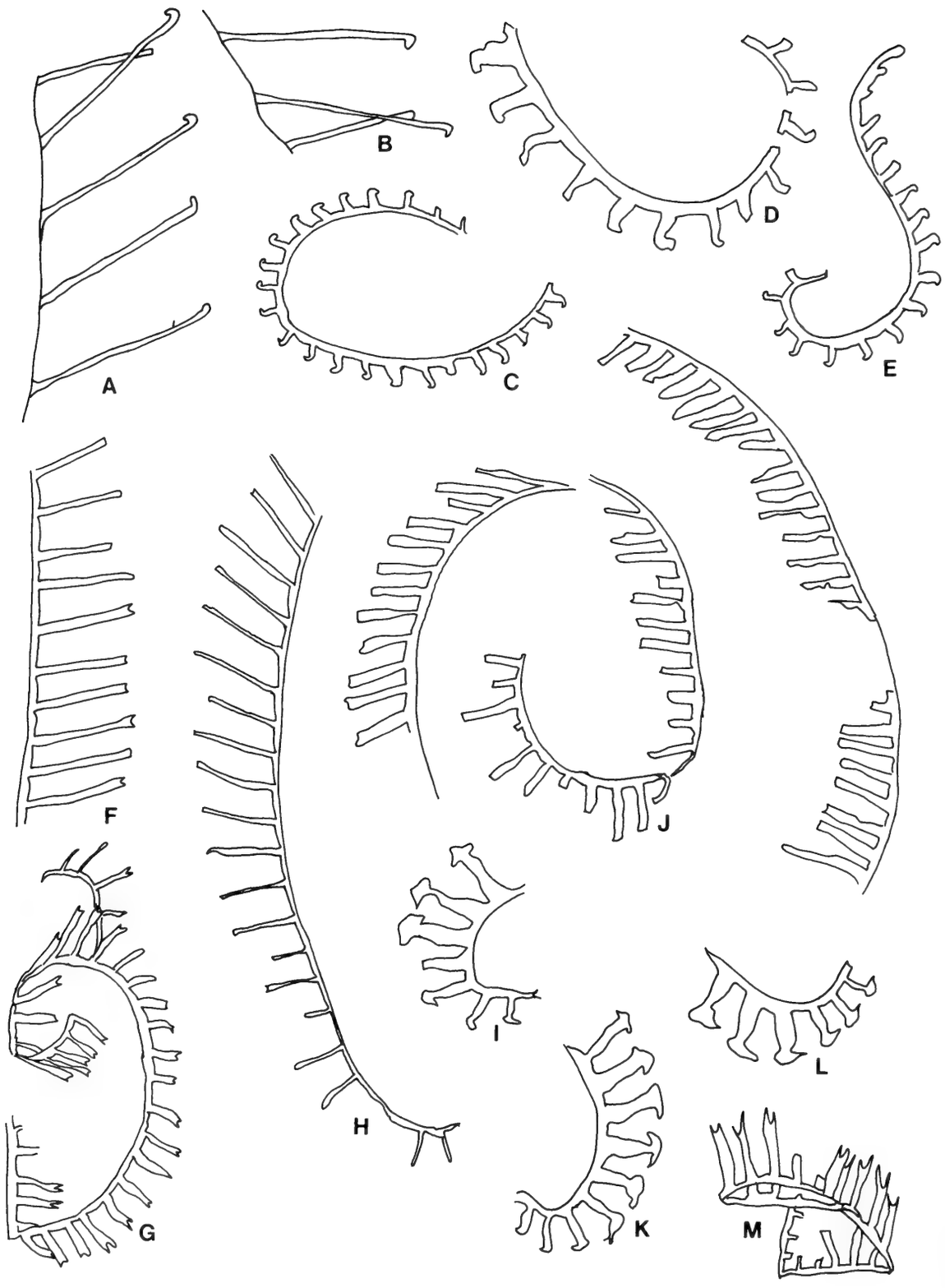
Acinaces Zone of Peel River, at 460.6 and 461.5 m, and Rock River, at 243 m, and from the *gregarius* Zone, Rock River, at 244, 245, 249, and 254 m.

Material

Relatively few, incomplete, flattened specimens from each of the collections. Illustrated specimens are ROM 38718 to 38720 and 38896.

Description

The rhabdosome is moderately to strongly dorsally curved proximally, gently curved distally. The sicula is rarely seen, but appears to be at least 3 mm long. The proximal thecae overlap about one-third, whereas distal thecae overlap one-half to two-thirds. They are inclined 15 to 20 degrees to the axis of the stipe, are slightly geniculated in the proximal region and are slightly flaring in the apertural regions. Thecae number 9 to 10 in 10 mm proximally and 8 to 10 in 10 mm distally. The rhabdosome width ranges from 0.25 to 0.35 mm to 1.1 to 1.3 mm distally.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Discussion

The recognition of this species is difficult because very few specimens have the sicular region preserved and because the sicula is relatively poorly preserved. The available specimens differ from the typical *L. acinaces* in that it apparently possesses a shorter first theca. They also appear to differ in possessing more closely spaced proximal thecae, although Churkin and Carter (1970) indicate a constant number of thecae throughout the rhabdosomal length of specimens from southeastern Alaska. The Canadian specimens are similar to *L. acinaces* in overall rhabdosome shape, thecal shape, and thecal overlap.

Lagarograptus inexpeditus Obut and Sobolevskaya, 1968

Fig. 4C, M, N; 19E

Lagarograptus inexpeditus Obut and Sobolevskaya, 1968: 91.

Occurrence

Triangulatus Zone, Peel River, at 481.9, 482.5, and 489.2 m.

Material

Numerous poorly preserved fragments; some moderately well-preserved specimens on black shale. Illustrated specimens are ROM 38726, 38727, and 38898.

Description

The rhabdosome is parallel-sided, and generally uniformly dorsally curved

Fig. 11 A,B. *Rastrites maximus* Carruthers, Peel River, collection at 521.8 m, *turriculatus* Zone, ROM 38832 and 38833; both × 3.4.

C,D. *Rastrites orbitus* Churkin and Carter, Peel River, *convolutus* Zone

C. Collection at 512.8 m, ROM 38834; × 3.4.

D. Collection at 508.4 m, ROM 38835; × 6.8.

E. *Rastrites* cf. *orbitus* Churkin and Carter, Peel River, collection at 508.4 m, *convolutus* Zone, ROM 38836; × 3.4.

F,H. *Rastrites* cf. *perfectus* Přibyl, Peel River, collection at 519.4 m, *sedgwicki* Zone?, ROM 38837 and 38838; both × 3.4.

G,J,M. *Rastrites phleoides* Törnquist, Peel River, *convolutus* Zone

G,M. Collection at 507.8 m, ROM 38839 and 38840, both × 3.4.

J. Collection at 491.4 m, ROM 38841; × 3.4 (three fragments).

I,K,L. *Rastrites rostratus* sp. nov. Peel River, collection at 515.1 m, *sedgwicki* Zone, ROM 38842, 38843, and 38844; all × 6.8.

throughout, width ranges from 0.4 mm proximally to a maximum of 0.5 mm distally. The sicula is visible on only one specimen and is 2.0 mm long.

The thecae are strongly geniculated and possess parallel-sided (?) processes which project about 0.4 mm in a ventroproximal direction from the distal end of the thecae. The thecae number seven to eight in 10 mm throughout.

Discussion

L. inexpeditus is very similar to *L. tenuis* (Portlock), and is distinguished by being narrower, possessing more numerous proximal thecae, and, especially, by the possession of apparently parallel-sided, rather than triangular (cf. Hutt, 1975: 71) thecal processes. The Yukon material appears to differ from Obut and Sobolevskaya's type in possessing a shorter sicula; however, as noted, the sicula was seen in only a single specimen.

Genus *Atavograptus* Rickards, 1974

Type Species

Monograptus atavus Jones, 1909, from the Llandovery beds of Wales; original designation.

Atavograptus cf. *gracilis* Hutt, 1975

Figs. 4A, B, L; 19H, I

cf. *Atavograptus gracilis* Hutt, 1975: 63.

Occurrence

Atavus Zone, Blackstone River, at 61.9 m; from the *acinaces* Zone, Peel River, at 461.5 m, and Pat Lake, collection 3F; and from the *gregarius* Zone of Rock River, 249 m.

Material

One to several poorly to moderately well-preserved specimens on black shale from each locality. Illustrated specimens are ROM 38710 to 38712 and 38899.

Description

The rhabdosome is curved gently dorsally, is long and delicate, and increases in width very gradually from 0.3 to 0.35 mm across theca 1 to a maximum distal width

of 0.5 mm. The longest specimens exceed 50 mm in length. The sicula is a narrow cone, and although difficult to measure with confidence, appears to be about 1.8 mm long.

The theca are simple tubes, 2.0 to 2.1 mm long, weakly geniculated, overlapping about one-half, and are parallel-sided, or are inclined at a very low angle to the axis of the stipe; they number 10 to 8 in 10 mm.

Discussion

The long slender rhabdosome and simple, weakly geniculated thecae are distinctive of *A. gracilis*. Poor preservation of the Yukon specimens, however, prevents a more accurate assessment of the thecal and sicular characteristics.

Atavograptus strachani (Hutt and Rickards, 1970)

Figs. 4I, J, K, R, S; 19B, F, G

Monograptus incommodus, Elles and Wood, 1910: 406.
Monograptus strachani Hutt and Rickards, 1970: 75.
Monograptus strachani, Rickards, 1970: 65.
Atavograptus strachani, Hutt, 1975: 64.

Occurrence

Rare in the *atavus* Zone, most common in the *acinaces* Zone, and uncommon in the *gregarius* Zone. From Peel River, at 460, 461.5, and 463 m; Tetlit Creek, at 133 m; Blackstone River, at 62.5 m; and Rock River, at 241 m. Tentatively identified from Peel River, at 470.3 m, and from Blackstone River, 62.2 m.

Material

Several to about a dozen poorly to moderately well-preserved specimens from each collection on black shale. Illustrated specimens are ROM 38721 to 38725 and 38897.

Description

The rhabdosome is curved gently dorsally throughout its length, although the proximal region may be more strongly curved. Rhabdosomal width ranges from 0.3 to 0.35 mm across theca 1 to an average of 0.8 to 0.9 mm distally, although occasionally specimens attain a maximum of 1.0 to 1.2 mm. The sicula is long and slender, attaining a length of 4 to 4.5 mm, although some appear to be as short as 3 mm in length.

The thecae are simple tubes, slightly geniculated and inclined at a very low angle; they overlap one-half to two-thirds their length and number seven to eight in 10 mm. The thecal aperture typically forms an acute angle with the axis of the theca.

Discussion

The relatively long sicula, slightly geniculated thecae inclined at very low angles, and the short proximal thecae are distinctive of the species. The last characteristic serves to distinguish it from the otherwise similar *L. acinaces*.

Genus *Coronograptus* Obut and Sobolevskaya, 1968

Type Species

Monograptus gregarius Lapworth, 1876, from the Llandovery of Scotland; original designation.

Coronograptus cf. *cyphus* (Lapworth, 1876)

Fig. 4F

cf. *Monograptus cyphus* Lapworth, 1876: 352.

Occurrence

Gregarius Zone, Rock River, at 255 m.

Material

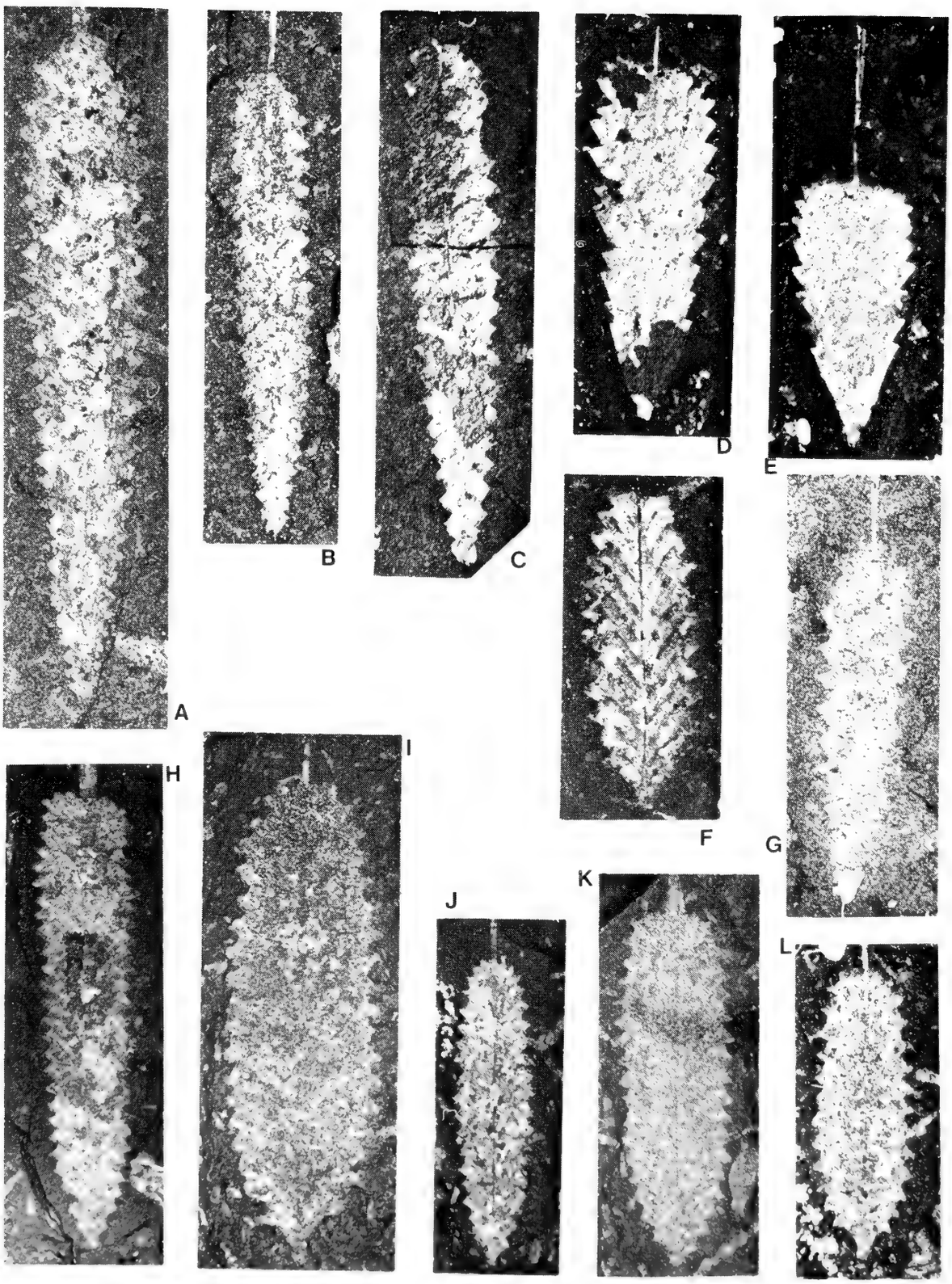
Two poorly preserved and incomplete specimens compressed on black shale. The illustrated specimen is ROM 38717.

Fig. 12 A–C,H. *Petalograptus altissimus* Elles and Wood
- A,B. Blackstone River, collection at 91.4 m, *turriculatus* Zone, ROM 38845 and 38846; both × 3.5.
- C. Peel River, collection at 531.9 m, *turriculatus* Zone, ROM 38847; × 4.0.
- H. Blackstone River, collection at 72.2 m, *sedgwicki* Zone, ROM 38850; × 2.4.

D,E. *Petalograptus folium* (Hisinger), Peel River, *convolutus* Zone
- D. Collection at 498.7 m, ROM 38848; × 2.9.
- E. Collection at 496.2 m, ROM 38849; × 2.7.

F,I–L. *Petalograptus intermedius* (Bouček and Přibyl)
- F. Peel River, collection at 487.4 m, *triangulatus* Zone, ROM 38851; × 4.6.
- J,K. Blackstone River, collection at 72.2 m, *sedgwicki* Zone, ROM 38852 and 38853; × 2.0, × 2.8.
- I. Blackstone River, collection at 77.2 m, *sedgwicki* Zone, ROM 38678; × 3.8.
- L. Blackstone River, collection at 70.4 m, *convolutus* Zone, ROM 38855; × 3.4.

G. *Petalograptus* cf. *hispanicus* Haberfelner, Peel River, collection at 544.4 m, *turriculatus* Zone, ROM 38856; × 4.0.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Discussion

The availability of only two, poorly preserved specimens prevents a detailed description; nevertheless, the importance of *C. cyphus* as a zonal indicator warrants documentation. Main characteristics of the species include a delicate proximal portion, a rapid distal widening of the rhabdosome, slight flexure of the distal thecae, and the strong overlap of the distal thecae. The thecae in the study specimens number nine in 10 mm proximally and maximum observed width is 1.2 mm.

Coronograptus gregarius gregarius (Lapworth, 1876)

Figs. 4D,E,O,Q; 20B–D

Monograptus gregarius Lapworth, 1876: 317.
Monograptus gregarius, Elles and Wood, 1911: 365.
Coronograptus gregarius gregarius, Obut and Sobolevskaya, 1968: 92.
?*Monograptus gregarius*, Churkin and Carter, 1970: 39.
Monograptus gregarius, Bjerreskov, 1975: 46.
Coronograptus gregarius gregarius, Hutt, 1975: 64.
Pristiograptus gregarius, Chen and Lin, 1978: 53.

Occurrence

Gregarius Zone, Peel River, at 465.1 and 472.7 m, and Rock River, 254 m; *triangulatus* Zone, Peel River, at 477, 487.4, and 489.2 m; and *magnus*? Zone, Peel River, at 485.9 and possibly at 488 m.

Material

Dozens of specimens, all incomplete, but many including proximal ends. Illustrated specimens are ROM 38713 to 38716 and 38900.

Description

The rhabdosome is strongly dorsally curved, up to the fifth to seventh thecae, and gently curved thereafter. The sicula ranges from 4 to 6 mm in length and its apex attains the level of the tip of theca 3 or 4. The thecae are weakly sigmoidal, flaring towards the aperture and numbering eight to ten in 10 mm proximally and eight to nine in 10 mm distally. Rhabdosomal width ranges from 0.5 to 0.55 mm across theca 1 to 0.7 to 0.8 mm distally. A single 5-cm-long fragment attains a distal width of 1.4 mm.

Discussion

C. gregarius gregarius is characterized by its long sicula, flaring thecal apertures

and, to some extent, by its thecal spacing. Among the Yukon collections, sicula lengths do not attain those noted by Hutt (1975) and Bjerreskov (1975), even though the specimens available range through three zones. On the other hand, the sicula length of the study material is considerably greater than that of the Alaskan specimens of Churkin and Carter (1970).

C. gregarius gregarius is distinguished from *C. gregarius arcuatus* of this study primarily by its greater width and more robust rhabdosome.

Coronograptus gregarius arcuatus Obut and Sobolevskaya, 1968

Figs. 5C, D, R; 20F, G, H, J

Coronograptus gregarius arcuatus Obut and Sobolevskaya, 1968: 94.
?*Pristiograptus tenellus*, Chen and Lin, 1978: 56.

Occurrence

Acinaces Zone, Pat Lake, collection 3F; *gregarius* Zone, Peel River, at 470.3, 472.7, 474, and 475.5 m; Tetlit Creek, at 136 m; and Rock River, at 244 m; and *gregarius* or *triangulatus* Zone, Peel River, at 475.5 m.

Material

Dozens of specimens, preserved as impressions on black shale. Illustrated specimens are ROM 38731 to 38733 and 38901 to 38904.

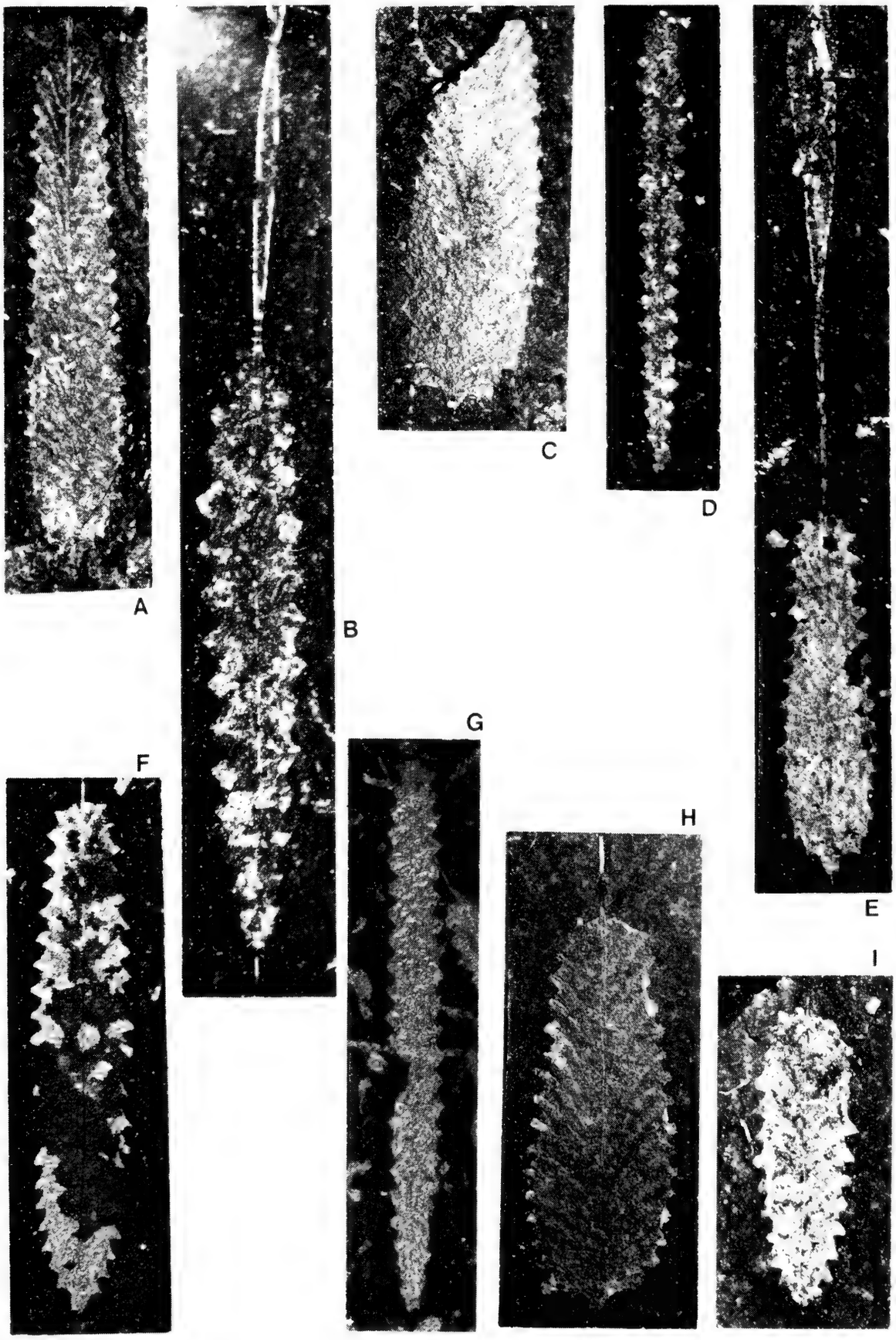
Discussion

C. gregarius arcuatus is distinguised from *C. gregarius gregarius* by its weaker dorsal curvature and lesser width. The thecal spacing of 10 to 8 in 10 mm in the specimens available is, however, unlike that of the types of Obut and Sobolevskaya (1968). The sicula of the study material ranges from 3.5 to 5.0 mm in length and its apex attains the level of the tip of theca 3. Rhabdosomal width is 0.4 to 0.45 mm initially and increases gradually to a maximum of 0.5 to 0.55 mm distally. Specimens assigned to the new species *Pristiograptus tenellus* by Chen and Lin (1978) may belong to *C. gregarius arcuatus*.

Coronograptus hipposideros (Toghill, 1968)

Figs. 5A, B, E; 20E, I

Monograptus hipposideros Toghill, 1968: 384.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Occurrence

Gregarius Zone, Peel River, at 468.2, 469.4, and 471.5 m; and Rock River, at 255 m.

Material

A few mostly incomplete, moderately well-preserved specimens from each collection. Illustrated specimens are ROM 38728 to 38730.

Description

The rhabdosome is horseshoe-shaped in curvature, and may be most strongly flexed about the level of theca 3 or 4. Rhabdosomal width ranges from 0.5 to 0.6 mm across theca 1, to a maximum distal width of 0.7 to 0.8 mm. The sicula is generally about 3 mm or slightly less in length and its apex attains the level of the end of theca 2 or 3. The thecae are sigmoidal in profile and flare towards the apertures, as in *C. gregarius (sensu stricto)*, and overlap one-third proximally and one-half distally.

Discussion

Toghill (1968), noted that the most distinctive character of this species is its strong dorsal curvature. Curvature in some specimens studied is almost 360 degrees.

Genus *Pribylograptus* Obut and Sobolevskaya, 1966

Type Species

Monograptus incommodus Törnquist, 1899, from the Llandovery of Sweden; original designation.

Fig. 13 A,C,H. *Petalograptus ovatoelongatus* (Kurck), Peel River, *turriculatus* Zone
- A. Collection at 523 m, ROM 38687; × 2.6.
- C. Collection at 521.8 m, ROM 38686; × 2.5.
- H. Collection at 516.3 m, ROM 38688; × 3.0.

B,D,G. *Petalograptus elongatus* (Bouček and Příbyl), *turriculatus* Zone
- B. Rock River, collection at 287 m, ROM 38856; × 5.4.
- D. Blackstone River, collection at 80.2 m, ROM 38857; × 2.8.
- G. Blackstone River, collection at 88.7 m, ROM 38858; × 2.8.

E *Petalograptus* cf. *palmeus clavatus* (Bouček and Příbyl), Peel River, collection at 518.8 m, *turriculatus* Zone, ROM 38859; × 3.1.

F,I. *Petalograptus* cf. *palmeus palmeus* (Barrande), Peel River, *turriculatus* Zone
- F. Collection at 518.8 m, ROM 38860; × 3.0.
- I. Collection at 523 m, ROM 38861; × 4.2.

Pribylograptus angustus (Rickards, 1970)

Figs. 5Q; 20A

Monograptus angustus Rickards, 1970: 89.

Occurrence

A single specimen from the *magnus*? Zone of Peel River, at 488 m, and another specimen tentatively identified as this species from the *gregarius* Zone, 465.1 m. The illustrated specimen is ROM 38746.

Description

The specimen is incomplete and threadlike, 30 mm long, and 0.25 mm wide throughout its length. The proximal end is missing. The thecae overlap only slightly, are inclined at a very low angle to the axis of the stipe, and number 6 in 10 mm. The ventral side of the thecae are more or less straight throughout, but the thecal apertures may be slightly flaring. The nature of the aperture is difficult to discern, but appears to be introverted.

Discussion

The single specimen has the same width and thecal spacing as does Rickard's (1970) type. The possession of probably introverted thecal apertures provides additional evidence for this specific assignment.

Pribylograptus cf. *argutus* (Lapworth, 1876)

Fig. 18F

cf. *Monograptus argutus* Lapworth, 1876: 318.

Occurrence

Convolutus Zone, Blackstone River, at 70.4 m.

Material

Several incomplete, only moderately well preserved, flattened specimens on black shales. The illustrated specimen is ROM 38895.

Description

The rhabdosome is broadly and arcuately curved in a dorsal direction. No proximal ends are preserved, but the width is about 0.3 mm in the most proximal section preserved; it increases gradually to a maximum distal width of 0.95 mm. The thecae are distinctly sigmoidal in profile throughout the length of the rhabdosome and appear to have introverted thecal apertures. They overlap one-third proximally and two-thirds distally, and number 10 to 9 in 10 mm.

Discussion

The presence of simple tubelike thecae with introverted apertures, a diagnostic feature of the species, is difficult to establish because of poor preservation. The Yukon specimens are very similar in all other characteristics to the descriptions given by Elles and Wood (1911), Rickards (1970), and Hutt (1975).

Pribylograptus sp.

Fig. 18E

Occurrence

Gregarius Zone, Peel River, at 470.3 m.

Material

A single, moderately well-preserved, long, incomplete specimen on black shale. The illustrated specimen is ROM 38894.

Discussion

This species is characterized by the possession of a long, narrow rhabdosome, not exceeding 0.55 mm in width, a thecal spacing of five to six in 10 mm, and long, very narrow, weakly inclined thecae which overlap about one-half their length. The apertural regions are distinctly retroverted and pinched, and the apertures are directed laterally in a manner similar to that of *P. incommodus* (Törnquist). This species differs however, from *P. incommodus, P. argutus* (Lapworth), and *P. argutus sequens* (Rickards), in possessing much more widely spaced thecae. It is most similar in overall dimensions to *Pristiograptus* sp. 2 of Hutt (1975: 52), but differs in possessing retroverted thecal apertures.

Genus *Pristiograptus* Jaeckel, 1889

Type Species

Pristiograptus frequens Jaeckel, 1889, from the Silurian of Germany; original designation.

Pristiograptus nudus (Lapworth, 1880)

Figs. 5L, M, P; 21D

Monograptus Hisingeri Carruthers var. *nudus* Lapworth 1880: 156.
Monograptus nudus, Törnquist, 1899: 8.
Monograptus nudus, Elles and Wood, 1911: 375.
Pristiograptus nudus, Rickards, 1970: 59.
Pristiograptus nudus, Schauer, 1971: 62.
Monograptus nudus, Bjerreskov, 1975: 47.
Pristiograptus nudus, Hutt, 1975: 59.

Occurrence

Convolutus and *sedgwicki* zones; rarely from the *turriculatus* Zone. Collected from Peel River, at 515.1, 516.9, 518.8, and 523 m; Blackstone River, at 70.4 and 72.2 m; possibly Clearwater Creek, at 65.5 m.

Material

One to several, moderately well-preserved specimens from each locality on black shale. Illustrated specimens are ROM 38743 to 38745.

Fig. 14 A–C. *Cephalograptus cometa cometa* (Geinitz), Blackstone River, collection at 70.4 m, *convolutus* Zone, ROM 38690, 38862, and 38863; × 3.4, × 3.5, × 3.5.

D. *Rhaphidograptus* cf. *toernquisti* (Elles and Wood), Peel River, collection at 485.9 m, *magnus* Zone?, ROM 38864; × 5.8.

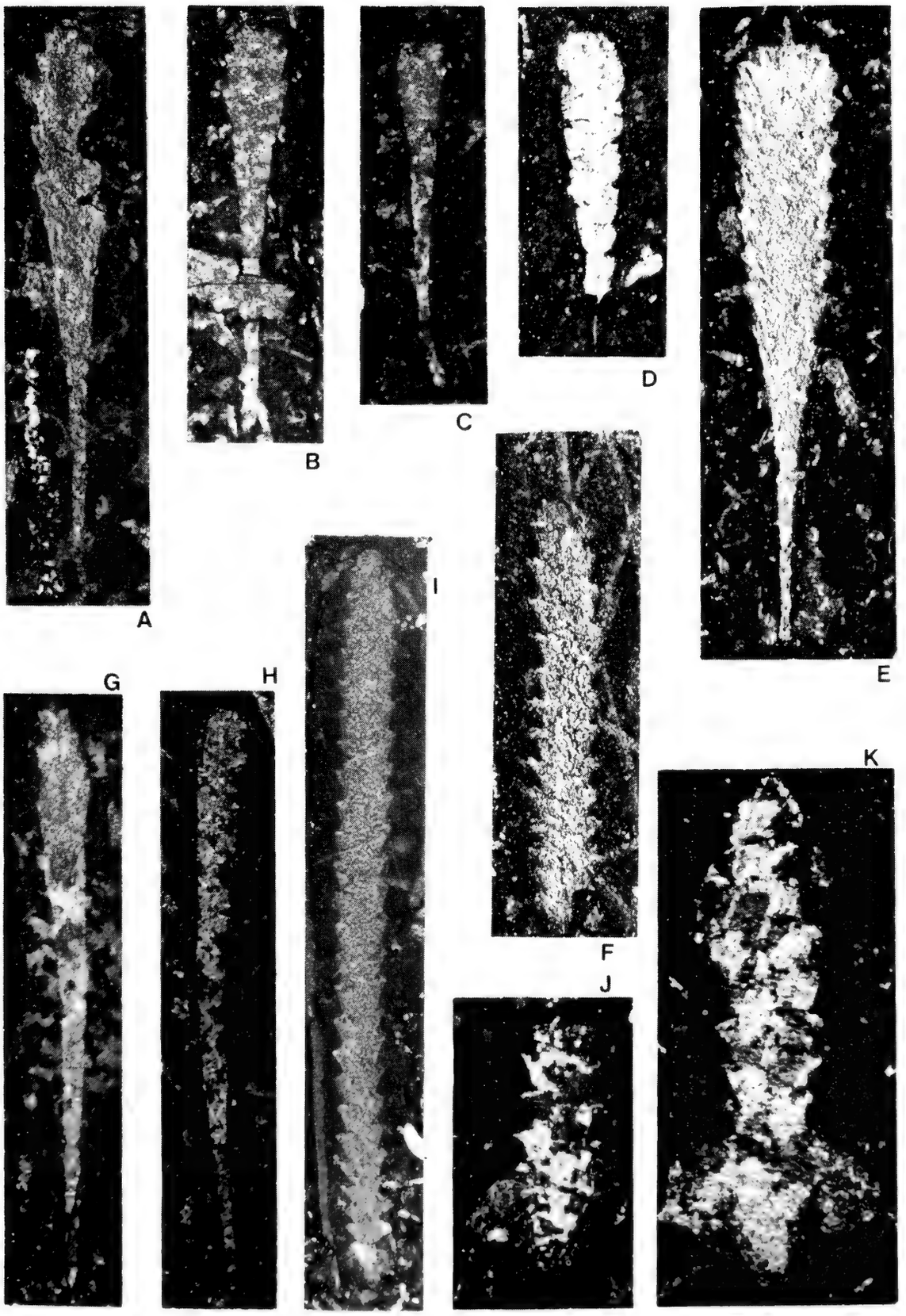
E *Cephalograptus tubulariformis* (Nicholson), Blackstone River, collection at 69.2 m, *convolutus* Zone, ROM 38695; × 3.6.

F, I–K. *Dimorphograptus physophora alaskensis* Churkin and Carter

F,I. Pat Lake, collection 3F, *acinaces* Zone, ROM 38865 and 38866; × 4.2, × 3.7.

J,K. Rock River, collection at 244 m, *gregarius* Zone, ROM 38867 and 38868; × 5.7, × 4.9.

G,H. *Cephalograptus cometa extrema* Bouček and Příbyl, Blackstone River, collection at 77.2 m, *sedgwicki* Zone, ROM 38693 and 38869; both × 3.5.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Description

The rhabdosome is straight, except for the sicular region, which is weakly dorsally curved. The sicula is 1.2 to 1.5 mm long. The rhabdosome width is 0.5 mm across theca 1 and increases gradually to a maximum of at least 1.5 mm distally. The thecae overlap one-third their length proximally and one-half distally, and number 12 to 14 in 10 mm proximally and 10 in 10 mm distally.

Discussion

The Yukon specimens are similar to the typical *P. nudus* in rhabdosomal shape, dimensions, thecal nature, and overlap. They differ slightly from typical specimens of that species in possessing somewhat more closely spaced proximal thecae and a longer sicula. In the latter parameter, however, they overlap that of Bjerreskov's (1975) Danish material.

Pristiograptus regularis (Törnquist, 1899)

Figs. 5H–J; 21A–C

Monograptus regularis Törnquist, 1899: 7.
Monograptus regularis, Elles and Wood, 1911: 372.
Pristiograptus regularis regularis, Rickards, 1970: 59.
Monograptus regularis, Sherwin, 1974: 157.
Monograptus regularis regularis, Bjerreskov, 1975: 47.
Pristiograptus regularis regularis, Hutt, 1975: 58.

Occurrence

Convolutus to *turriculatus* zones. Collected from Peel River, at 512.8, 516.9, 519.4, 521.8, and 523 m, and Tetlit Creek, at 144 m. Tentatively from Peel River, at 507.8, 523, and 526 m.

Material

A few poorly to moderately well-preserved specimens from each collection on black shale. Illustrated specimens are ROM 38737 to 38739 and 38905 to 38906.

Description

The rhabdosome is straight throughout its length, except for the proximal 1 to 2 mm, which is weakly dorsally curved. The width of the rhabdosome increases gradually from 0.45 to 0.55 mm across theca 1, to a maximum distal width of 1.2 to 1.3 mm. The sicula is short, about 1.0 mm long, and its apex attains the level of the aperture of theca 1.

The thecae are tubelike, straight, inclined 20 to 30 degrees to the axis of the stipe, overlap one-fifth to one-third proximally and one-half to two-thirds distally, and the apertures subtend an angle of 90 degrees to the axis of the thecae. The thecae number 12 to 14 in 10 mm proximally and 9 to 10 in 10 mm distally.

Discussion

P. regularis differs from *P. nudus* in its more delicate and slender proximal region, and from *P. variabilis* in being much more robust and possessing a greater thecal overlap.

Pristiograptus cf. *variabilis* (Perner, 1897)

Figs. 5K, N, O

cf. *Monograptus jaculum*, Lapworth var. *variabilis* Perner, 1897: 21.

Occurrence

Turriculatus Zone, Peel River, at 523 m; tentatively from Tetlit Creek, at 142 m.

Material

Six moderately well-preserved specimens from Peel River, and a single poorly preserved specimen from Tetlit Creek. Illustrated specimens are ROM 38740 to 38742.

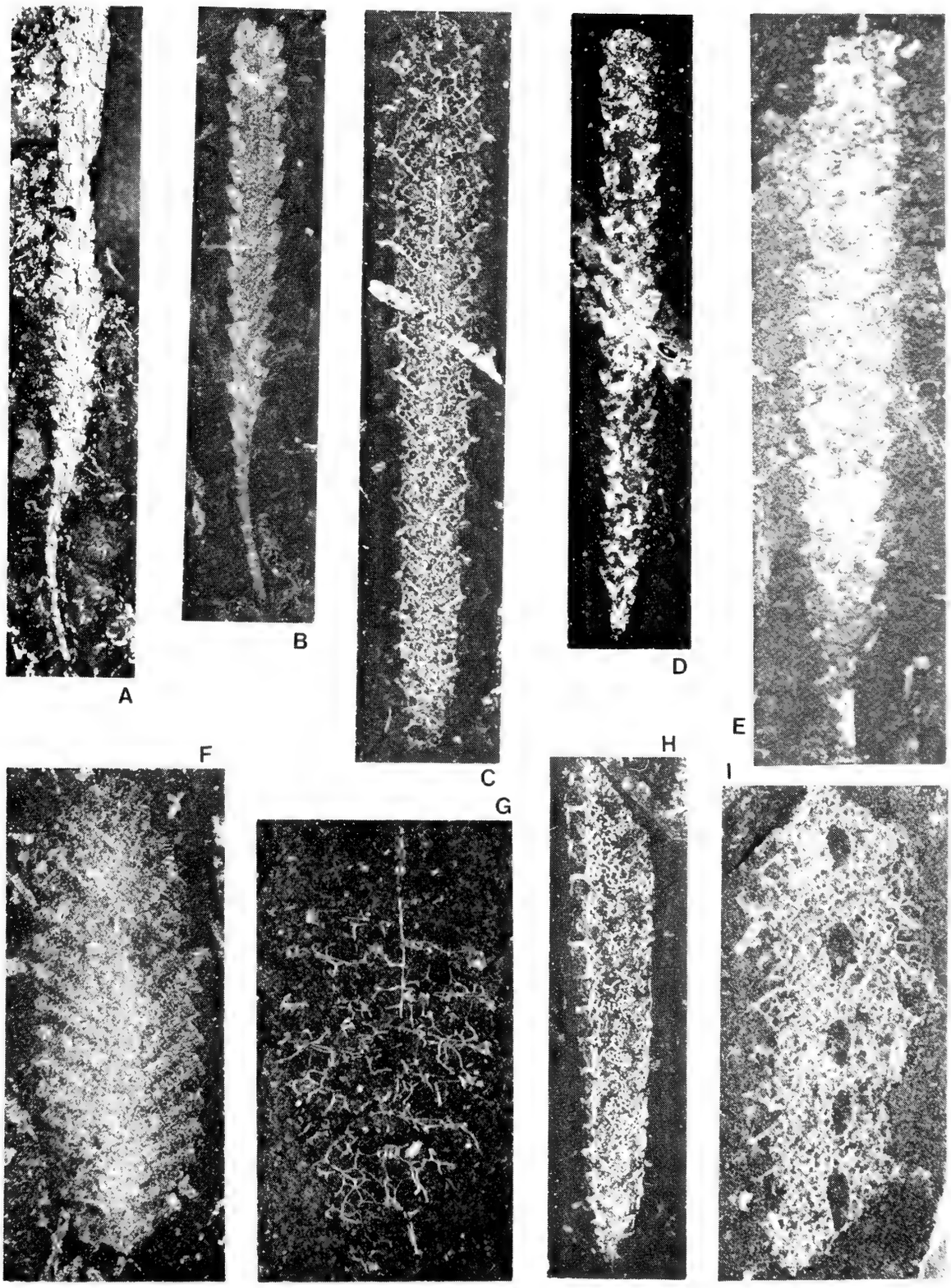
Description

The rhabdosome is straight throughout its length except for a weak dorsal curvature of the sicular region. The rhabdosome increases gradually in width from 0.4 mm across theca 1, to a maximum distal width of about 1.0 mm. The sicula is relatively robust and is 1.0 to 1.2 mm long.

The thecae are simple, straight tubes, overlapping about one-fifth proximally and one-half distally, inclined about 15 degrees to the axis of the stipe and number 10 to 9 in 10 mm.

Discussion

The characteristics of the study material agree well with the description of this species by Elles and Wood (1911). The Yukon occurrence of the species is one zone lower than the British occurrence of the species, but is the same as that in Germany (Schauer, 1971) and Czechoslovakia (Münch, 1952).


A
B
C
D
E
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I

Genus *Monoclimacis* Frech, 1897

Type Species

Graptolithus vomerinus Nicholson, 1872, from the Llandovery of northern England; original designation.

Monoclimacis linnarssoni (Tullberg, 1883)

Fig. 8F,G

Monograptus linnarssoni Tullberg, 1883: 20.
Monograptus linnarssoni, Waterlot, 1945: 77.
Monograptus linnarssoni, Bjerreskov, 1975: 54.

Occurrence

Sakmaricus-laqueus Zone, Peel River, at 638.6 and 642.5 m; and Mount Sekwi, at 384 m. Tentatively identified from Peel River, 640.1 m.

Material

Two to three incomplete specimens occur in each collection; only three moderately well-preserved specimens are available. All are flattened on grey or black shale. Illustrated specimens are ROM 38788 to 38789.

Description

The rhabdosome is long, delicate, and greater than 50 mm, and more or less straight

Fig. 15 A,B. *Dimorphograptus confertus swanstoni* Lapworth
A. Peel River, collection at 460 m, *acinaces* Zone, ROM 38870; × 2.7.
B. Blackstone River, collection at 62.2 m, *atavus* Zone? ROM 38698; × 2.3.
C,H. *Retiolites geinitzianus angustidens* Elles and Wood, *spiralis* Zone
C. Peel River, collection at 615.7 m, ROM 38871; × 5.8.
H. Rock River, main branch, collection 1F, ROM 38872; × 4.0.
D,E. *Dimorphograptus* cf. *physophora* (Nicholson)
D. Blackstone River, collection at 61.9 m, *atavus* Zone?, ROM 38873; × 2.7.
E. Rock River, collection at 244 m, *gregarius* Zone, ROM 38874; × 4.6.
F. *Retiolites decurtatus* Bouček and Münch, Blackstone River, collection at 66.4 m, *convolutus* Zone, ROM 38875; × 3.8.
G. *Pseudoplegmatograptus* sp., Peel River, collection at 531.9 m, *turriculatus* Zone, ROM 38876; × 5.6.
I. *Stomatograptus* sp., Tetlit Creek, collection at 217 m, *sakmaricus-laqueus* Zone, ROM 38877; × 5.6.

throughout its length. Width increases imperceptibly from 0.3 mm or less proximally to a maximum of at least 0.75 mm distally. The sicula was not seen.

The thecae are typically monoclimacid, overlap one-quarter their length proximally and nearly one-half distally; they are strongly sigmoidal and the metathecal portions while parallel to the stipe axis overall are slightly arched or "humpbacked" in profile. Generally, the thecal apertures are marked by deep excavations and end against very weak hoodlike structures. Thecae number seven to eight in 10 mm.

Genus *Monograptus* Geinitz, 1852 emended

Type Species

Lomatoceras priodon Bronn, 1835, from the Silurian of Germany; subsequent designation Bassler, 1915.

Monograptus cf. *argenteus* (Nicholson, 1869)

Figs. 5S; 21F

cf. *Graptolites argenteus* Nicholson, 1869: 239.

Occurrence

Argenteus Zone, Peel River, at 491.4 m.

Material

A single incomplete specimen, that is of only fair preservation. The illustrated specimen is ROM 38747.

Description

The proximal region of the rhabdosome is moderately strongly curved dorsally and the distal portion is straight. The proximal thecae are inclined about 30 degrees and overlap about one-third proximally and two-thirds distally. The metathecal portion, which involves about one third of the thecal length, is strongly hooked and its aperture faces in a proximodorsal direction. The thecae become less strongly hooked distally and distal thecae are essentially simple tubes with weakly developed lappets (?). Maximum width of the stipe is 2.0 mm and the thecae number seven in 10 mm.

Discussion

Scarcity of specimens permits only a tentative identification. The rhabdosome shape

of the Yukon specimen is typical of *M. argenteus,* as is the nature of the biform thecae (see Hutt, 1975). The single specimen differs from the typical form, however, in that the proximal thecae are more strongly hooked and the thecae are more widely spaced.

Monograptus circularis Elles and Wood, 1913

Fig. 21I

Monograptus circularis Elles and Wood, 1913: 479.
Spirograptus circularis, Příbyl, 1944: 205.
Monograptus circularis, Waterlot, 1945: 86.

Occurrence

Sedgwicki Zone, Peel River, at 513.6 m.

Material

Seven incomplete, moderately well-preserved specimens on black shale. The illustrated specimen is ROM 38910.

Description

The rhabdosome is planispirally or weakly helically coiled and the greatest rhabdosomal width observed is 8 mm. The stipe width increases gradually from 0.5 mm proximally, to a maximum distal width of 1.2 mm. The sicula is delicate, about 1 mm long, and its apex attains the level of the tip of theca 1. The theca are distinctly triangular in outline, overlap negligibly proximally and about one-third distally, and are weakly hooked only at their distal extremities. Thecae number eight in 10 mm.

Monograptus clingani (Carruthers, 1867)

Figs. 5U, V; 21E, K

Graptolithus Clingani Carruthers, 1867: 369.
Monograptus Clingani, Elles and Wood, 1913: 463.
Monograptus clingani, Strachan, 1969: 195.
Monograptus clingani, Hutt, 1975: 82.

Occurrence

Convolutus Zone, Blackstone River, at 70.4 m; Peel River, at 498.7, 502.3, and

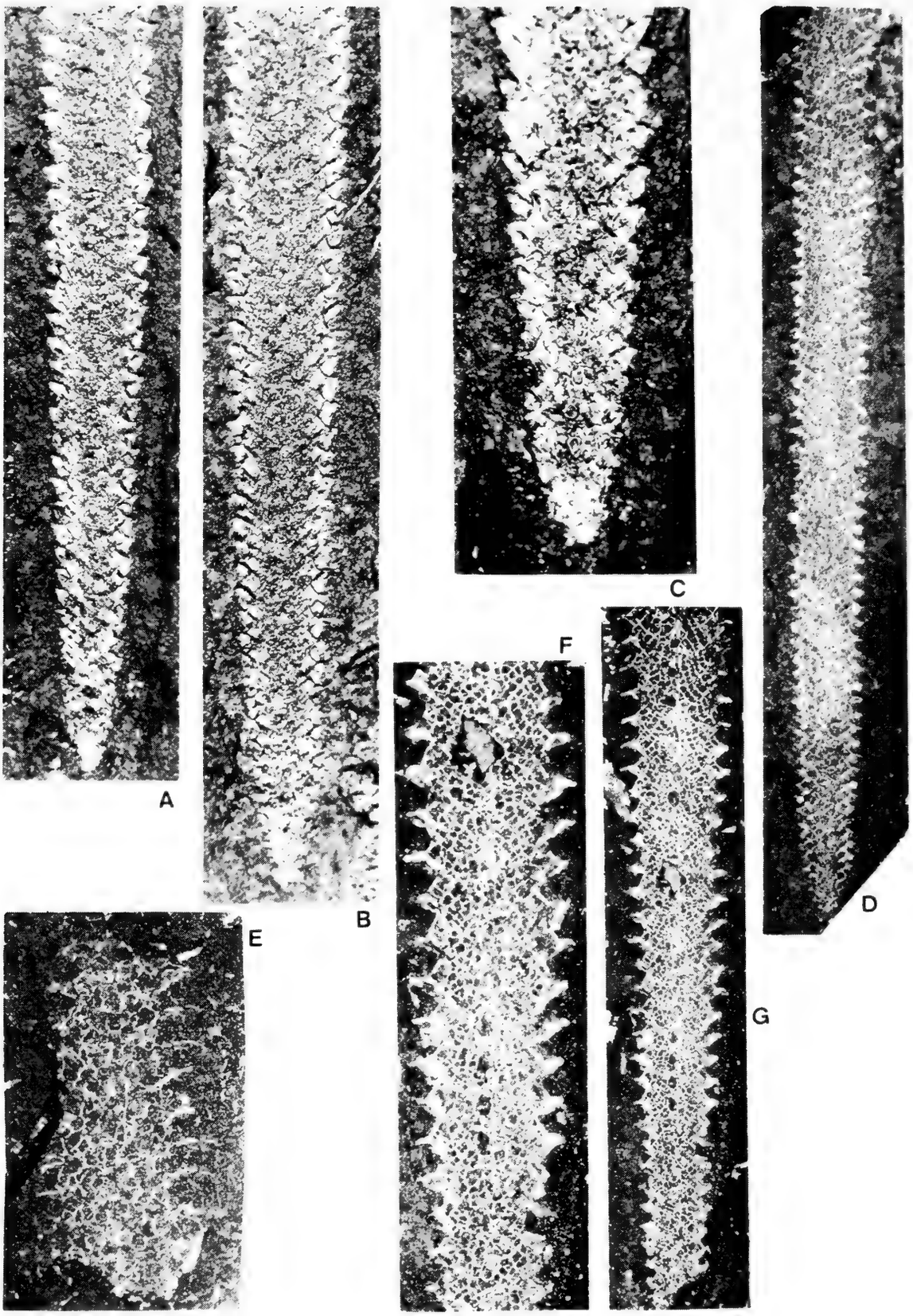

Fig. 16 A–C *Stomatograptus grandis grandis* (Suess), Rock River, *spiralis* Zone
A,C. Collection 5F, ROM 38878; × 2.6, × 4.8.
B. Collection 8F, ROM 38879; × 2.9.
D,F,G. *Stomatograptus grandis imperfectus* (Bouček and Münch), *spiralis* Zone
D. Peel River, collection at 630.9 m, ROM 38880; × 1.9.
F,G. Rock River, collection 6F, ROM 38881 and 38882; × 4.2, × 2.2.
E. *Pseudoplegmatograptus obesus obesus* (Lapworth), Peel River, collection at 553.8 m, *turriculatus* Zone, ROM 38883; × 4.0.

507.8 m; and Delorme Range, at 768.1 m. It is tentatively identified from the *turriculatus* Zone, Delorme Range, at 777.2 m.

Material

Several poorly to moderately well-preserved specimens from each collection preserved on black or grey shale. Illustrated specimens are ROM 38748 to 38749 and 38907.

Description

The rhabdosome is moderately dorsally curved proximally, and progressively less so distally. The sicular portion and the region of the first one or two thecae may be abruptly hooked dorsally. The proximal end of the rhabdosome is rather robust and width increases gradually from about 0.7 mm across theca 1 to a maximum of 1.4 to 1.5 mm distally. The thecae are strongly hooked throughout the length of the rhabdosome, although the distal thecae may be more strongly hooked and lobate than the proximal thecae. The proportion of the stipe width occupied by the hooked portions of the thecae ranges from about one-third proximally to one-half distally. Thecae number 10 to 8 in 10 mm. The sicula is 1.0 to 1.1 mm long and its apex reaches the level of the tip of theca 1.

Discussion

Features characteristic of this species are the rather robust proximal end, short sicula, and particularly the fact that distal thecae are more strongly hooked than proximal ones. Although the Yukon specimens appear to differ slightly from typical specimens in possessing more widely spaced thecae, the range observed falls within the definition of the species, especially as given by Elles and Wood (1913) and probably also by Strachan (1969) in his redescription of the species.

Monograptus communis Lapworth, 1876

Figs. 5F–G, T; 21G, H, J, L

Monograptus convolutus Hisinger, sp. Var. (a) *communis* Lapworth, 1876: 358.
Monograptus communis, Elles and Wood, 1913: 480 (pars).
Spirograptus communis communis, Příbyl, 1944: 214.
Monograptus communis communis, Sudbury, 1958: 520.
Campograptus communis communis, Obut and Sobolevskaya, 1967: 123.
Monograptus communis communis, Rickards, 1970: 84.
Oktavites communis, Chen and Lin, 1978: 66.

Occurrence

Argenteus and *convolutus* zones, Peel River, at 487.4, 498.7, and 496.2, and possibly 512.8 m; Blackstone River, at 65.5 and 66.4 m; and possibly Tetlit Creek, at 142 m.

Material

Abundant in collections from Blackstone and Peel rivers as moderately well-preserved specimens on black shale. Illustrated specimens are ROM 38734 to 38736 and 38908 to 38909.

Description

The rhabdosome is dorsally curved throughout, more strongly so in the proximal region. Width increases gradually from 0.6 to 0.7 mm across theca 1, to a maximum distal width of 1.4 to 1.5 mm. The sicula is 1.1 to 1.2 mm long and its apex reaches slightly beyond the level of the tip of theca 1.

The thecae are moderately hooked in the proximal region of the rhabdosome, where they occupy about one-half the width of the stipe, and are strongly hooked to nearly lobate in the distal region where the metathecal portion occupies more than half the stipe width. Thecal overlap is negligible proximally, but increases to about one-third distally.

Discussion

The preservation of the metathecal portion of the distal thecae makes identification difficult. The illustrations of Elles and Wood (1913) and Sudbury (1958) suggest that the metathecal portion is only moderately strongly hooked, whereas those of Přibyl (1944), Obut et al. (1967), and Rickards (1970) clearly indicate strongly hooked thecae. Elles and Wood (1913) point out that, as a result of torsion of the thecal axis, the modes of preservation vary considerably. The author has examined specimens of *M. communis* at the Sedgwick Museum, Cambridge, which possess moderately to strongly hooked thecae.

The potential for producing superficially strongly hooked or even lobate thecal profiles upon compression in *M. communis* is confirmed by an examination of uncompressed specimens from the Cape Phillips Formation, Cornwallis Island. The thecae are triangular is cross-section and, while prothecal portions of the thecae are parallel to the stipe axis, the metathecal portions show strong torsion. In addition, the thecal apertures possess weak hoods. Clearly, upon compression, and depending on the direction of compression, the metathecal portions could come to lie beneath the slightly more proximal portions of the thecae resulting in a hooked or lobate profile.

The Yukon specimens are similar in every respect to those of Obut et al. (1967). They are also similar in some respects to *M. noyensis* of Churkin and Carter (1970), but differ in being wider and in possessing more widely spaced thecae.

This species is similar in many respects to *M. clingani* from the same zone. It differs, however, in possessing a much more elongated and delicate proximal portion and in having proximal thecae that occupy much more of the rhabdosome width.

Monograptus convolutus (Hisinger, 1837)

Figs. 6B; 22A, F

Prionotus convolutus Hisinger, 1837: 114.
Monograptus convolutus, Törnquist, 1899: 21.
Monograptus convolutus, Elles and Wood, 1913: 467.
Monograptus convolutus, Waterlot, 1945: 88.
Monograptus convolutus, Sudbury, 1958: 511.
Demirastrites convolutus, Obut and Sobolevskaya, 1967: 126.
Monograptus convolutus, Rickards, 1970: 82.
Monograptus convolutus, Bjerreskov, 1975: 81.
Monograptus convolutus, Hutt, 1975: 83.

Occurrence

Convolutus Zone, Peel River, at 496.2, 498.7, and 502.3 m; and Blackstone River, at 66.4, 69.2, and 70.4 m. Tentatively from Peel River, at 507.8 m.

Material

A few poorly to moderately well-preserved specimens from each collection; two nearly complete specimens; all compressed on black shale. Illustrated specimens are ROM 38752 and 38911.

Description

The rhabdosome is planispirally coiled through at least three volutions and attains a width of at least 20 mm. The sicular portion is not preserved. The stipe width ranges from about 1.5 mm proximally to a maximum of 2.5 mm in a very short distance and remains constant thereafter, or decreases slightly. The proximal thecae are isolated and rastritiform, widen gradually towards their apertural regions, and generally bear two spines at their distal ends. Distal thecae are more triangular, slightly overlapping, weakly curved, with the aperture directed in a proximal direction, and generally appear to bear a single distal spine. Theca number 9 in 10 mm.

Discussion

This species has only rarely been reported previously from North America and was not included in Ruedemann's (1947) monumental study of North American

graptolites. The form identified by Ruedemann (1947) as *M. convolutus coppingeri* Etheridge from the Arctic Islands is probably best re-assigned to *M. spiralis*.

Monograptus aff. *cygneus* Törnquist, 1892, *sensu* Obut and Sobolevskaya, 1967

Figs. 6D, E; 22B, E

Pernerograptus aff. *cygneus* (Törnquist), Obut and Sobolevskaya, 1967: 10

Occurrence

Argenteus and *convolutus* zones, Peel River, at 491.4, 495.9, 498.7, 502.3, 506.3, 507.8, 508.4, and 512.8 m; Blackstone River, at 66.4 and 69.2 m.

Material

Few, fairly to moderately well-preserved specimens from each collection. Illustrated specimens are ROM 38753 to 38754 and 38912.

Description

The rhabdosome is moderately dorsally curved proximally, the curvature decreases distally, and the distal region is more or less straight. Stipe width ranges from about 0.5 mm across theca 1 to a maximum of 1.1 to 1.2 mm distally. Thecae number nine to seven in 10 mm.

The thecae are biform, the proximal 8 to 10 being weakly to moderately hooked and they overlap not more than one-third their length. Distal thecae are inclined at a low angle, are almost monoclimacid in outline and overlap one-half.

Discussion

The study specimens differ from those of the typical *M. cygneus* in possessing a more robust proximal region and almost monoclimacid thecae; in other respects it is very similar (see for example Elles and Wood, 1913: 387; Münch, 1952: pl. 25). The Canadian specimens are clearly very similar to those illustrated by Obut et al. (1967) and for that reason are tentatively assigned to *M. cygneus*. The specimens differ from *M. sidjachenkoi* (Obut et al., 1967) in possessing a much less curved and more attenuated proximal region.

Monograptus crispus Lapworth, 1876

Figs. 6M, P

Monograptus crispus Lapworth, 1876: 503.

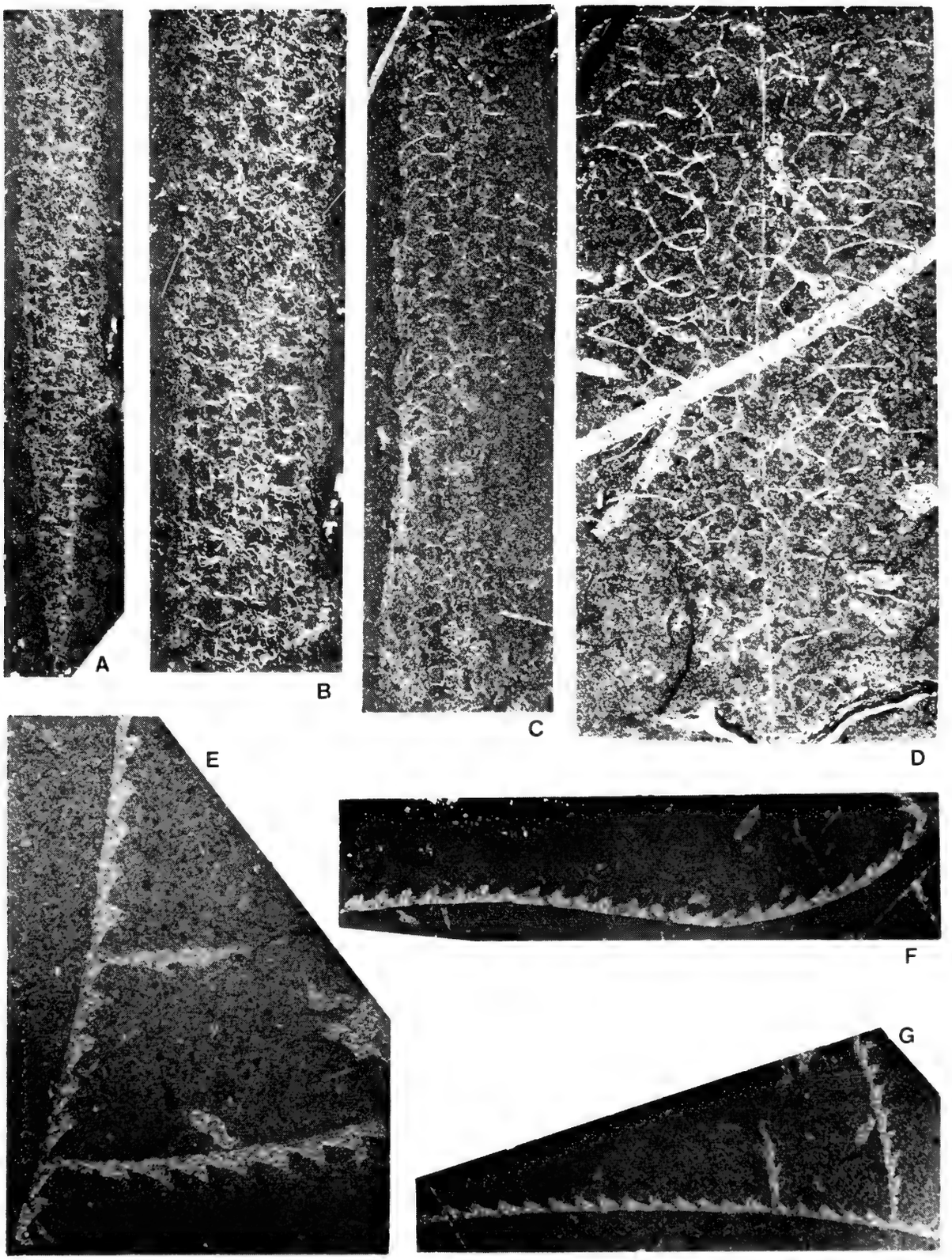

Fig. 17 A,B. *Pseudoplegmatograptus obesus obesus* (Lapworth), Peel River, collection at 513.6 m, *sedgwicki* Zone, ROM 38884; × 2.7, × 5.0.

C,D. *Pseudoplegmatograptus giganteus* (Bouček and Münch), Delorme Range, collection at 976.9 m, *spiralis* Zone?, ROM 38885 and 38886; × 1.6, × 4.0.

E–G. *Barrandeograptus* aff. *pulchellus* (Tullberg), Blackstone River, collection at 72.2 m, *sedgwicki* Zone, ROM 38887, 38888, and 38889, × 4.2, × 2.7, × 2.4.

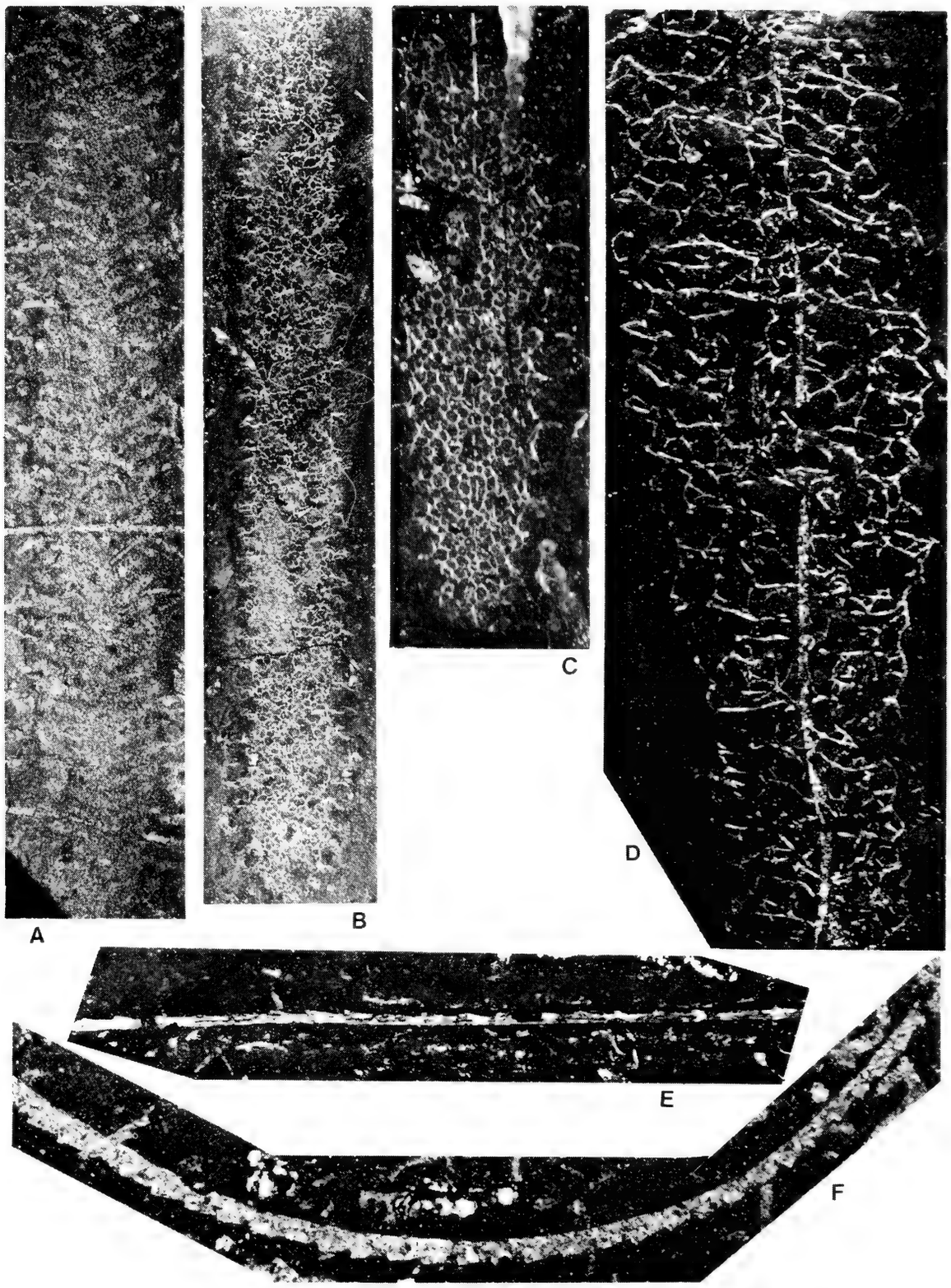

Fig. 18 A *Retiolites perlatus* Nicholson, Blackstone River, collection at 91.4 m, *turriculatus* Zone, ROM 38890; × 2.2.

B,C. *Pseudoplegmatograptus obesus reticulatus*, (Bouček and Münch), Peel River, *turriculatus* Zone

B. Collection at 518.8 m, ROM 38891; × 2.9.

C. Collection at 548.9 m, ROM 38892; × 6.4.

D. *Pseudoplegmatograptus obscurus* (Bouček and Münch), Tetlit Creek, collection at 182 m, *spiralis* Zone, ROM 38893; × 4.1.

E. *Pribylograptus* sp., Peel River, collection at 470.3 m, *gregarius* Zone, ROM 38894; × 2.2.

F. *Pribylograptus* cf. *argutus* (Lapworth), Blackstone River, collection at 70.4 m, *convolutus* Zone, ROM 38895; × 4.2.

Monograptus crispus, Elles and Wood, 1912: 456.
Monograptus (Streptograptus) crispus, Schauer, 1971: 72.
Monograptus crispus, Bjerreskov, 1975: 74.

Occurrence

Crispus Zone? (correlative in part with the *spiralis* Zone), Cape Phillips Formation, Svendsen anticlinorium, Ellesmere Island, Arctic Archipelago.

Material

Five incomplete, moderately well-preserved specimens on a single piece of light-coloured shale. Illustrated specimens are ROM 38763 to 38764.

Discussion

M. crispus has not been previously reported from the Arctic or Cordilleran regions of North America. Its discovery in the Arctic Islands is significant because it permits the tentative recognition of the *crispus* Zone of late Llandoverian age as defined in Britain.

The rhabdosome is typically S-shaped, the proximal end being dorsally curved. The sicula is 1.2 mm long. The width of the stipe increases gradually from 0.3 mm across theca 1 to an observed maximum of 0.8 to 0.9 mm.

The thecae overlap only slightly, are strongly hooked, occupy one-half to two-thirds of the stipe width, and number seven in 10 mm proximally and 9 to 10 in 10 mm distally.

Monograptus curvus Manck, 1923

Figs. 6A, C; 22C, D

Monograptus curvus Manck, 1923: 286.
Spirograptus curvus, Přĭbyl, 1944: 200.
Spirograptus curvus, Münch, 1952: 115.
Monograptus curvus, Jaeger, 1976: pl. 2

Occurrence

Spiralis Zone, Peel River, at 611.4 m; and Clearwater Creek, at 79.2 m.

Material

Relatively uncommon in collections, and of fair preservation. Illustrated specimens are ROM 38750 to 38751 and 38913.

Description

The rhabdosome is straight or gently ventrally cuved through the distance of the first seven to nine thecae; the rhabdosome then abruptly undergoes torsion through 180 degrees and is thereafter weakly ventrally curved, although the curvature lessens distally. The sicula is 1.2 to 1.3 mm long and its apex is at or slightly beyond the level of the tip of theca 1. The proximal thecae overlap about one-third, whereas distal thecae overlap two-thirds their length. The proximal thecae are moderately hooked, the hooked portion occupying about one-half the stipe width; distal thecae are distinctly triangular in profile, are only gently hooked, and the free portion of the thecae occupies one-quarter to one-third the stipe width. Thecae number 10 to 7 in 10 mm and the rhabdosome width ranges from 0.6 mm proximally to 1.5 to 1.6 mm distally.

Discussion

M. curvus has previously been reported only from Germany and Czechoslovakia (Příbyl, 1944), and from Sardinia (Jaeger, 1976). It is characterized by its curved rhabdosome with the abrupt torsion and the triangular thecae.

Monograptus decipiens decipiens Törnquist, 1899

Figs. 6F, N; 23A, C, F

Monograptus decipiens Törnquist, 1899: 20.
Monograptus decipiens, Elles and Wood, 1913: 469 (pars).
Demirastrites decipiens decipiens, Příbyl and Münch, 1942: 12.
Monograptus (Demirastrites) decipiens, Schauer, 1971: 79.
Monograptus decipiens decipiens, Hutt, 1975: 85.
Monograptus decipiens decipiens, Bjerreskov, 1975: 80.

Occurrence

Commonest in the *sedgwicki* Zone; uncommon in the *turriculatus* Zone. Found in Blackstone River, at 76.2 m; and tentatively identified from Peel River, at 526 m; and Tetlit Creek, at 144 and 168 m.

Material

Abundant at Blackstone River, and relatively uncommon elsewhere, and moderately well to well-preserved as carbon films on black shale. Illustrated specimens are ROM 38755 to 38756 and 38914 to 38916.

Description

The rhabdosome is coiled through at least one volution. The sicula is 0.8 to 0.9 mm long and its apex reaches the level of theca 1. The first eight to nine thecae are rastritiform, are inclined about 60 to 70 degrees to the axis of the stipe, are distally tapering or parallel-sided, and terminate in small hooks. Distal thecae overlap slightly, become increasingly triangular in profile and about one-quarter the length is involved in the hook. Thecae number 10 to 8 in 10 mm, and are 0.5 m high proximally and at least 1.4 mm high distally.

Discussion

The Yukon occurrence of the species appears to be slightly younger than the occurrence in Scania (Törnquist, 1899), the Lake District (Hutt, 1975), Germany (Schauer, 1971), and Bornholm (Bjerreskov, 1975).

The specimens from Peel River and Tetlit Creek, which were tentatively identified as *M. decipiens*, differ from the typical species in possessing fewer, more widely spaced and slightly shorter rastritiform thecae, as well as more distinctly triangular distal thecae.

Monograptus decipiens valens (Přibyl and Münch, 1942)

Figs. 6G, J, L; 23B, D, E, G

Demirastrites decipiens valens Přibyl and Münch, 1942: 14.
Monograptus decipiens, Elles and Wood, 1913: 469 (pars).
Demirastrites decipiens valens, Münch, 1952: 128.
Demirastrites decipiens valens, Golikov, 1973: 43.

Occurrence

Sedgwicki, and lower part of the *turriculatus* zones, Peel River, at 516.3, 516.9, 517.9, 518.8, and 521.8 m; and Blackstone River, at 80.2, 83.8, 85.3, 88.7, and 89 m.

Material

The species is common to abundant and preservation ranges from moderate to good. Illustrated specimens are ROM 38757 to 38759 and 38917 to 38919.

Description

The rhabdosome is moderately to strongly dorsally curved proximally, less so distally, but coils through at least one complete volution. In large specimens, distal

portions of the stipe may undergo torsion, so that the thecae are on the convex side. The sicula is 1.1 to 1.2 mm long, its apex is level with the tip of theca 1 and it is weakly ventrally curved.

The proximal two to three thecae are rastritiform, subtend an angle of about 70 degrees to the stipe, are weakly triangular in profile, and are hooked at their extreme distal ends. The distal thecae are triangular and are progressively overlapped to a maximum of about one-half their length. Rhabdosomal width ranges from 0.8 mm proximally to 1.6 to 1.8 mm distally. Thecal spacing is nine to seven in 10 mm.

Discussion

This subspecies differs from *M. decipiens decipiens* with which it appears to intergrade, in the possession of fewer rastritiform thecae, greater width and greater overlap of distal thecae. Distal portions of the rhabdosome are very like those of *M. planus* and *M. planus obtusus,* but *M. decipiens valens* differs in the possession of distinct rastritiform proximal thecae. This subspecies is much more abundant in Yukon than the typical form and its range appears to extend into younger beds.

Monograptus cf. *denticulatus* Törnquist, 1899

Figs. 6H, I, K; 24A, B

cf. *Monograptus denticulatus* Törnquist, 1899: 18.

Occurrence

Sedgwicki Zone, Peel River, at 519.4 m.

Material

Six incomplete, moderately well-preserved specimens on black shale. Illustrated specimens are ROM 38760 to 38762.

Discussion

The Yukon specimens differ from most illustrations of *M. denticulatus* (cf. Elles and Wood, 1913; Schauer, 1971; Hutt, 1975) in possessing only two rastritid proximal thecae, the remainder being slightly overlapped. It is however, similar to specimens described by Přĭbyl (1946) and to those illustrated by Bjerreskov (1975). *M.* cf. *denticulatus* from the Yukon differs from *M. decipiens valens* in possessing an only gently curved distal portion of the rhabdosome, slightly overlapping distal thecae, and more closely spaced thecae (11 to 8 in 10 mm). The rhabdosome width ranges from 0.5 mm proximally to 1.4 mm distally.

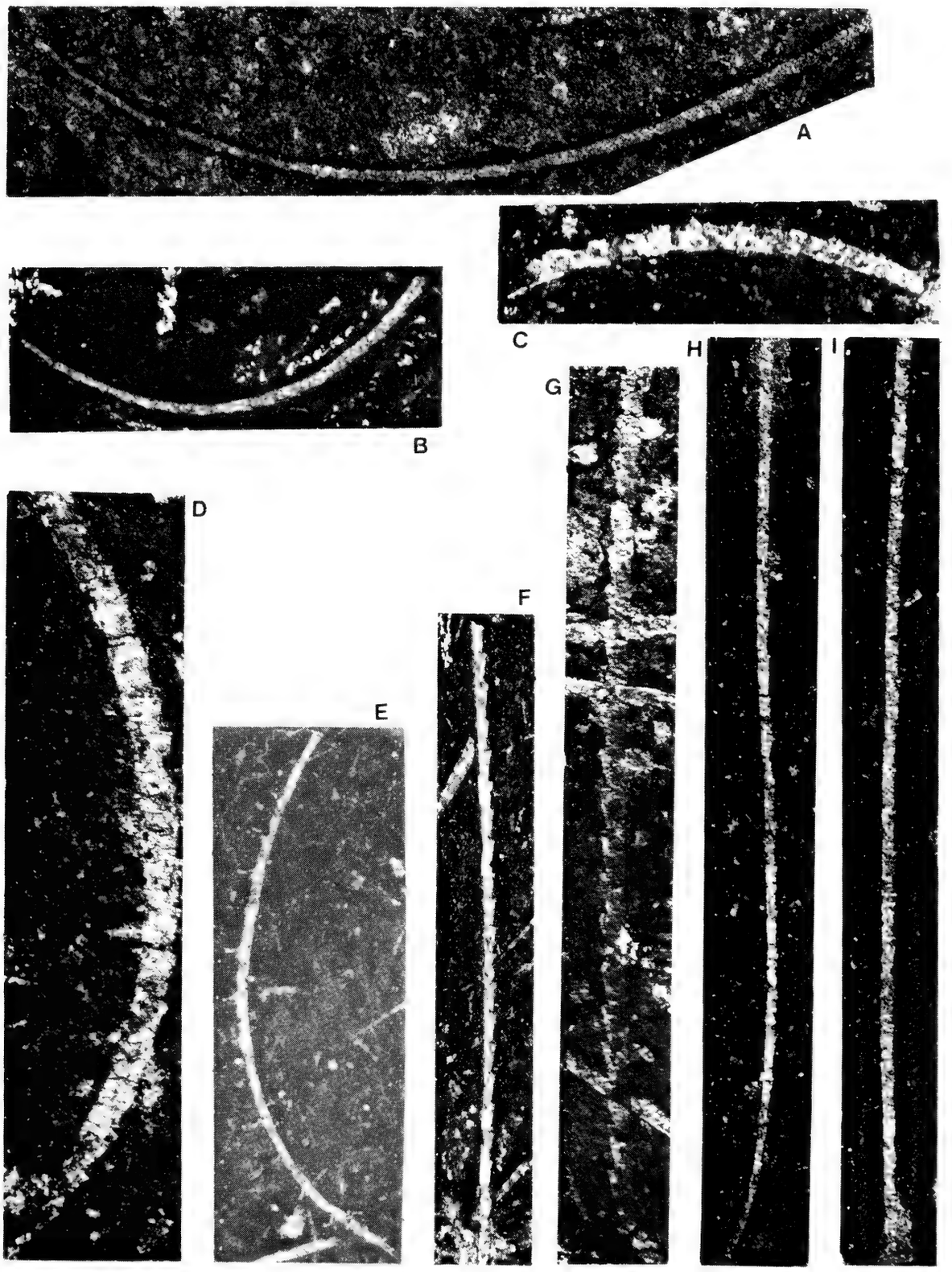

Fig. 19 A,C,D. *Lagarograptus* cf. *acinaces* (Törnquist), Rock River, *gregarius* Zone

A. Collection at 249 m, ROM 38719; × 4.3.

C,D. Collection at 245 m, ROM 38718 and 38896; × 4.3.

B,F,G. *Atavograptus strachani* (Hutt and Rickards), *acinaces* Zone

B. Blackstone River, collection at 62.5 m, ROM 38721; × 2.6.

F. Peel River, collection at 460 m, ROM 38897; × 2.5.

G. Tetlit Creek, collection at 133 m, ROM 38723; × 4.2.

E. *Lagarograptus inexpeditus* Obut and Sobolevskaya, Peel River, collection at 481.9 m, *triangulatus* Zone?, ROM 38898; × 3.6.

H,I. *Atavograptus* cf. *gracilis* Hutt, Rock River, collection at 249 m, *gregarius* Zone, ROM 38899; × 4.6. (Note: top end of H continues on lower end of I.)

Fig. 20 A. *Pribylograptus angustus* (Rickards), Peel River, collection at 488 m, *magnus* Zone?, ROM 38746; × 5.6.

B–D. *Coronograptus gregarius gregarius* (Lapworth), Peel River

B. Collection at 488 m, *magnus* Zone?, ROM 38714; × 5.4.

C,D. Collection at 465.1 m, *gregarius* Zone, ROM 38716 and 38900; × 4.9, × 4.8.

E,I. *Coronograptus hipposideros* (Toghill), Peel River, collection at 471.5 m, *gregarius* Zone, ROM 38728 and 38729; × 7.2, × 4.0.

F,G,H,J. *Coronograptus gregarius arcuatus* Obut and Sobolevskaya, *gregarius* Zone

F,H. Peel River, collection at 470.3 m, ROM 38901 and 38902; both × 4.7.

G. Tetlit Creek, collection at 136 m, ROM 38903; × 3.6.

J. Peel River, collection at 474 m, ROM 38904; × 3.4.

The distal thecae of the Yukon specimens are in the shape of deceptively simple hooks. The reason for the simple profile appears to lie in the fact that, upon compression, the distal hooked and twisted portions of the thecae are folded under, and partially hidden by, the main portion of the thecae.

Monograptus cf. *elongatus* Törnquist, 1899

Figs. 6O; 24J

cf. *Monograptus elongatus* Törnquist, 1899: 17.

Occurrence

Triangulatus Zone, Peel River, at 477 m.

Material

Proximal portions of three relatively poorly preserved specimens on black shale. The illustrated specimen is ROM 38765.

Description

The rhabdosome is very delicate, and its proximal region is weakly dorsally curved and straight thereafter. The sicula is very narrow and about 0.8 mm long. The thecae, which number eight to seven in 10 mm, overlap only slightly; the long prothecal portions are inclined at a very low angle to the axis of the stipe and the metathecal portions, which comprise about one-quarter the total length, are sharply hooked. The rhabdosome widens imperceptibly from 0.25 mm across theca 1, to an observed maximum of 0.5 mm distally.

Discussion

The specimens from the Yukon appear to differ from the types only in possessing somewhat more widely spaced thecae. The lack of adequate illustrations of the thecae in Törnquist (1899) prevents a positive identification from being made.

Monograptus exiguus primulus Bouček and Přibyl, 1942

Figs. 7A, D, F, G; 24C–F, K

Monograptus (Streptograptus) exiguus primulus Bouček and Přibyl, 1942: 7.
Streptograptus exiguus primulus, Münch, 1952: 111.
Monograptus (Streptograptus) exiguus primulus, Schauer, 1971: 71.
Monograptus exiguus primulus, Bjerreskov, 1975: 62.

Occurrence

Turriculatus Zone, Peel River, at 516.9, 517.9, 518.8, 523, 528.8, 531.9, 536.1, 544.4, 548.9, 553.8, and 559.3 m; Blackstone River, at 91.4, 92.7, 94.8, and 99 m; Tetlit Creek, at 148 m; Rock River, at 287, 293, and 302 m; Mount Sekwi, at 527.6 m; Delorme Range, at 804.7 m.

Material

Hundreds of specimens, ranging from poorly to moderately well-preserved, as carbon films on black shale. Illustrated specimens are ROM38766 to 38769 and 38920 to 38922.

Description

The rhabdosome is small, delicate, hook-shaped, strongly to moderately ventrally curved to about the level of theca 5, then decreasing to gentle curvature thereafter. The extreme proximal portion of the rhabdosome, involving the sicula and the first two thecae, may be straight or weakly dorsally curved. The sicula is 0.9 to 1.0 mm long, and its apex is level with the tip of theca 2.

The thecae are enrolled and apparently undergo considerable torsion, so that the aperture projects laterally. The enrolled part of the thecae represents about one-half the total length of the theca and occupies one-third proximally, and one-half dorsally, of the stipe width. Thecal number ranges from 12 in 10 mm proximally to 8 to 10 in 10 mm distally, depending on the length of the rhabdosome. The rhabdosome widens very gradually from 0.45 to 0.5 mm proximally to a maximum distal width of 0.8 mm.

Discussion

The separation of *M. exiguus exiguus* and *M. e. primulus* is based on the rhabdosomal width and thecal spacing. In the typical subspecies, they are 0.5 mm and 14 to 16 in 10 mm, respectively (Bjerreskov, 1975), while in *M. exiguus primulus* the width is 0.8 mm (0.9 mm according to Bjerreskov, 1975; Hutt, 1975) and thecal spacing ranges from 9 to 10 in 10 mm (Münch, 1952) to 11 to 12 in 10 mm (Bjerreskov, 1975). The Yukon specimens agree well with *M. exiguus primulus* in thecal spacing and stipe width.

Monograptus falx (Suess, 1851)

Figs. 7N, P, Q; 24G–I

Graptolithus falx Suess, 1851: 35.
Spirograptus falx, Přibyl, 1944: 216.
Spirograptus falx, Münch, 1952: 117.

Occurrence

Turriculatus and *spiralis* zones, Peel River, at 523, 544.4, and 611.4 m; and tentatively Whittaker Range, at 856.5 m.

Material

Several moderately to well-preserved specimens from each collection. Illustrated specimens are ROM 38780 to 38782.

Description

The rhabdosome is small, moderately dorsally curved in the proximal region and gently curved dorsally in the distal region. Stipe width ranges from 0.5 to 0.7 mm across theca 1, to a maximum distal width of 1.0 mm. The sicula is 1.0 to 1.1 mm long and its apex is almost level with the distal end of theca 1.

The thecae overlap only slightly, the prothecal portions are consistently inclined about 30 degrees to the stipe axis and the metathecae, which comprise about one-third the total length of the thecae, have the shape of broad, prominent hooks similar in nature to those in *M. tullbergi tullbergi*. Additionally, the metathecae appear to have been asymmetric and to have undergone torsion exactly as do those of *M. tullbergi*? in Bjerreskov, (1975: 65, fig. 19c). The thecae occupy one-half to two-thirds of the stipe width and are spaced at the rate of 8 to 10 in 10 mm throughout the length of the rhabdosome.

Discussion

This is the first report of *M. falx* from outside Europe. As was pointed out by Příbyl (1944), this species is very similar to *M. tullbergi* in thecal characteristics. *M. falx* differs from *M. tullbergi* in its lesser distal and proximal width and by the lack of narrow, protracted proximal end. The Yukon specimens differ from those from Czechoslavakia only in being longer.

Monograptus flagellaris Törnquist, 1892

Fig. 7E

Monograptus flagellaris Törnquist, 1892: 42.
Monograptus flagellaris, Elles and Wood, 1913: 457.
Spirograptus flagellaris, Münch, 1952: 116.

Occurrence

Turriculatus Zone, Blackstone River, at about 91.4 m (specimen from an old

collection and difficult to correlate with the writer's 1977 collection); and from Clearwater Creek, at 67.1 and 68.6 m.

Material

Several incomplete, moderately well-preserved specimens on black shale. The illustrated specimen is ROM 38772.

Discussion

The incompleteness of the Yukon specimens prevents accurate assessment of their morphology. The specimens are similar to *M. flagellaris* Törnquist (1892) and to *M. drepanoformis* Toghill and Strachan (1970). According to Toghill and Strachan (1970), *M. drepanoformis* is distinguished from *M. flagellaris* by its hooked, rather than coiled, distal thecae. Although incomplete, the Yukon specimens possess coiled thecae.

The thecae number about 10 in 10 mm distally and the maximum width of the rhabdosome is 1.1 mm.

The Yukon occurrence of *M. flagellaris* in the *turriculatus* Zone is older than is typical elsewhere (*spiralis* Zone, or equivalent). Etherington (1967) previously reported *M. flagellaris* from the *turriculatus* Zone of Clearwater Creek, and this is confirmed in this study.

Monograptus involutus Lapworth, 1876

Figs. 7B,C; 25A, B, E

Monograptus intermedius var. *involutus* Lapworth, 1876: 317.
Monograptus involutus, Elles and Wood, 1913: 478.
Spirograptus involutus, Příbyl, 1944: 204
?*Demirastrites delicatulus*, Obut and Sobolevskaya, 1968: 109.
Monograptus (Spirograptus) involutus, Schauer, 1971: 72.
Monograptus involutus, Hutt, 1975: 91.
Oktavites involutus, Golikov, 1976: 36
?*Monograptus changyangensis*, Chen and Lin, 1978: 61.

Occurrence

Magnus Zone?, Peel River, at 485.9, 487.4, and 488 m; and *argenteus* Zone, Blackstone River, at 65.5 m.

Material

The species is uncommon in any collection, is seldom complete, and few specimens

Fig. 21 A–C *Pristiograptus regularis* (Törnquist), Peel River, *turriculatus* Zone
A,B. Collection at 521.8 m, ROM 38905 and 38739; × 2.6.
C. Collection at 523 m, ROM 38906; × 2.9.

D. *Pristiograptus nudus* (Lapworth), Peel River, collection at 523 m, *turriculatus* Zone, ROM 38743; × 3.0.

E,K. *Monograptus clingani* (Carruthers), *convolutus* Zone
E. Peel River, collection at 507.8 m, ROM 38748; × 2.2.
K. Blackstone River, collection at 70.4 m, ROM 38907; × 2.4.

F. *Monograptus* cf. *argenteus* (Nicholson), Peel River, collection at 491.4 m, *argenteus* Zone, ROM 38747; × 2.1.

G,H,J,L. *Monograptus communis* Lapworth, Peel River, *convolutus* Zone
G,H,L. Collection at 496.2 m, ROM 38735, 38908, and 38736; × 2.6, × 2.1, × 2.6.
J. Collection at 498.7 m, ROM 38909; × 2.9.

I. *Monograptus circularis* Elles and Wood, Peel River, collection at 513.6 m, *sedgwicki* Zone, ROM 38910; × 7.2.

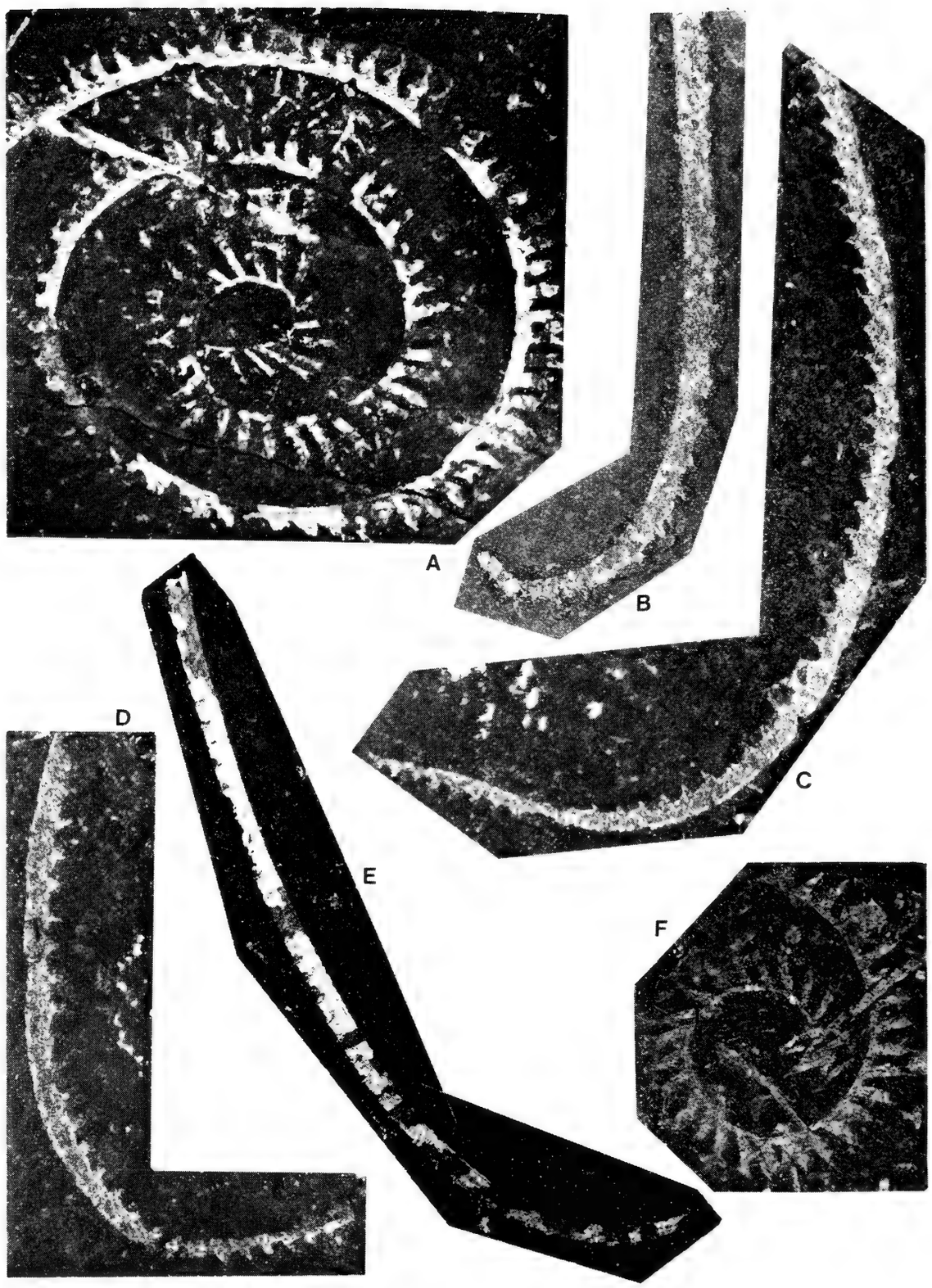

Fig. 22 A,F. *Monograptus convolutus* (Hisinger), *convolutus* Zone

A. Peel River, collection at 498.7 m, ROM 38752; × 3.4.

F. Blackstone River, collection at 70.4 m, ROM 38911; × 2.6.

B,E. *Monograptus* aff. *cygneus* Törnquist, (*sensu* Obut and Sobolevskaya, 1967), Peel River, *convolutus* Zone

B. Collection at 512.8 m, ROM 38753; × 4.1.

E. Collection at 498.7 m, ROM 38912; × 2.4.

C,D. *Monograptus curvus* Manck, Peel River, collection at 611.4 m, *spiralis* Zone, ROM 38913 and 38750; × 2.9.

are well preserved. Illustrated specimens are ROM 38770 to 38771 and 38923 to 38924.

Description

The rhabdosome is delicate and irregularly to apparently planispirally coiled through at least two volutions. Stipe width increases slowly from 0.5 mm across theca 1 to a maximum of at least 0.9 mm distally, inclusive of thecal "spines". The sicula is small, 0.9 to 1.1 mm long and its apex is level with the tip of theca 1.

The thecae number 10 to 8 in 10 mm and overlap no more than one-third their length distally. They consist of long, triangular prothecae inclined about 20 degrees to the axis of the stipe and short, sharply hooked metathecae. The metathecal beaklike profile is accented by a ventral projection of possibly transversely projecting "spines".

Discussion

The delicate, spiralled rhabdosome, and the thecae with relatively long, inclined prothecae and short, sharply hooked metathecae with "spines" are features typical of this species. The Yukon specimens show the spiralled nature of the species perhaps better than most published illustrations, as well as clearly showing the presence of the thecal "spines". Hutt (1975) states that the sicula is 0.6 mm long in her material, although Schauer (1971) notes the presence of a 1.0 mm long sicula, a length more in accord with that of the Canadian specimens.

M. calamistriatus described from Alaska by Churkin and Carter (1970) is similar to *M. involutus* but is more robust and possesses much more closely spaced thecae.

Obut and Sobolevskaya (1968) describe *Demirastrites delicatulus* from the *triangulatus* Zone of northern Siberia. Their specimens are spirally coiled and the thecae possess short, sharply hooked metathecae. A close examination of their illustration (Obut and Sobolevskaya, 1968: fig. 7, pl. 30) clearly shows the presence of thecal "spines". This species might be better assigned to *M. involutus*.

M. changyangensis Sun, illustrated in Chen and Lin (1978), appears to be identical to *M. involutus*. Hutt (1975) has placed the two species in synonymy, a practice tentatively followed in this study.

Monograptus cf. *knockensis* Elles and Wood, 1913

Figs. 7K; 25I

cf. *Monograptus knockensis* Elles and Wood, 1913: 462.

Occurrence

Turriculatus Zone, Blackstone River, at 80.2 m.

Material

A single, incomplete, poorly preserved and flattened specimen on black shale. The illustrated specimen is ROM 38777.

Discussion

The specimen from Blackstone River, although difficult to assess, is nevertheless sufficiently exceptional to warrant a comment. Its thecae are without overlap, number six in 10 mm (compared with 8 in 10 for material of *M. knockensis* described by Rickards [1970] and Hutt [1975]) and, because of an apparent sharp reverse curvature of the metathecae, the metathecae are almost parallel to each other. The stipe is 1.0 mm wide.

Monograptus lobiferus harpago Törnquist, 1899

Figs. 7I, J; 25C, F

Monograptus harpago Törnquist, 1899: 16 (pars).
Monograptus lobiferus harpago, Bjerreskov, 1975: 67.

Occurrence

Convolutus Zone, Peel River, at 502.3 m and possibly 507.8 m; tentatively *turriculatus* Zone, Clearwater Creek, at 65.5 m.

Material

About a dozen poorly to moderately well-preserved specimens from the 502.3 m collection, and a few specimens from each of the other two collections. Illustrated specimens are ROM 38775 to 38776 and 38925 to 38926.

Description

The rhabdosome is gently curved dorsally for the distance of the first three to four thecae, then very gently curved ventrally to the level of thecae 10 to 12, and thereafter generally straight. Rhabdosomal width is 0.5 mm across theca 1, increasing moderately rapidly to about 1.0 mm at the level of theca 10 and thereafter gradually to a maximum of 1.5 mm in a specimen which is more than 70 mm long. The sicula is 1.3 to 1.4 mm long.

The thecae are in contact only proximally and overlap slightly distally; they occupy at least one-half the stipe width and number eight to six in 10 mm. The proximal thecae are moderately hooked, whereas distal thecae become progressively more strongly hooked and lobate, so that apertures appear to be directed dorsally. The

proximal thecae are consistently spinose, while spines are only sporadically seen on distal thecae; the spines presumably were laterally directed.

Discussion

The distinction between *M. lobiferus lobiferus* and *M. l. harpago* was discussed fully by Bjerreskov (1975), who also suggested that *M. knockensis* Elles and Wood is probably a junior synonym of *M. lobiferus harpago*. Examination of the types of *M. knockensis* shows that the metathecae are completely folded back and that the apertures appear to be directed proximodorsally. *M. knockensis* is apparently a valid species.

Monograptus marri Perner, 1897

Figs. 8D, E; 26A–D

Monograptus Marri Perner, 1897: 21.
Monograptus Marri, Elles and Wood, 1913: 422.
Monograptus marri, Obut and Sobolevskaya, 1965: 46.
Monograptus marri, Hutt et al, 1970: 9.
Monograptus marri, Hutt, 1975: 95.
Monograptus marri, Bjerreskov, 1975: 69.

Occurrence

Common in the *turriculatus* Zone, and less common in the *spiralis* Zone. Found at Peel River, at 548.9 and 553.8 m; Rock River, at 293, 302, 323, and 326 m, and tentatively from 306, 309, and 315 m; and Blackstone River, at 92.7 and 94.8 m, and tentatively from 91.4 m.

Material

A few poorly to moderately well-preserved specimens from each collection. Illustrated specimens are ROM 38786 to 38787 and 38923 to 38924.

Description

The rhabdosome is longer than 50 mm and, except for a gentle dorsal curvature for the distance of the first two thecae, is straight throughout its length. Rhabdosomal width ranges from 0.5 to 0.6 mm across theca 1 and increases gradually to a maximum distal width of 1.4 to 1.6 mm. The sicula is moderately stout, 1.4 to 1.5 mm long, and its apex attains the level of the tip of theca 2.

The thecae are of the *priodon* type, although the metathecae are more strongly

curved than typical of that species and, as a result, the apertures are directed proximally. Thecal overlap ranges from only slightly proximally to about one-third distally, and the free portion of the thecae occupy about one-half the stipe width; they number 9 to 10 in 10 mm proximally and 8 to 9 in 10 mm distally.

Discussion

The narrow rhabdosome and proximally directed thecal apertures are characteristic of the species. Thecal spacing of the Yukon specimens is slightly less than typical, although it is similar to that of the Taimyr specimens (Obut et al., 1965).

Monograptus millepeda (M'Coy, 1850)

Figs. 7M, O; 25D, G, H

Graptolites millepeda M'Coy, 1850: 270.
Monograptus millepeda, Törnquist, 1892: 18.
Monograptus millepeda, Elles and Wood, 1913: 465.
Campograptus curtus Obut and Sobolevskaya, 1968: 104.
Monograptus millepeda, Hutt, 1975: 96.

Occurrence

Argenteus Zone, Peel River, at 491.4 m; Tetlit Creek, at 129 m; and Blackstone River, at 65.5 m. Tentatively from the *turriculatus* Zone of Blackstone River, at 86.9 m.

Material

A few moderately well-preserved specimens in each of the three collections. Illustrated specimens are ROM 38778 to 38779 and 38927 to 38928.

Description

The rhabdosome is very strongly dorsally curved in its proximal region, decreasing to gently curved distally; rhabdosomal width ranges from about 0.8 mm across theca 1 to a maximum distally of 1.4 to 1.5 mm. The sicula is not clearly discernible, but appears to be about 1.0 m long.

The thecae are triangular in profile, overlap only slightly, and possess prominently hooked and large metathecae which occupy one-half the stripe width distally; thecal apertures face the ventral wall. The thecae number about 12 to 10 in 10 mm proximally and eight in 10 mm distally.

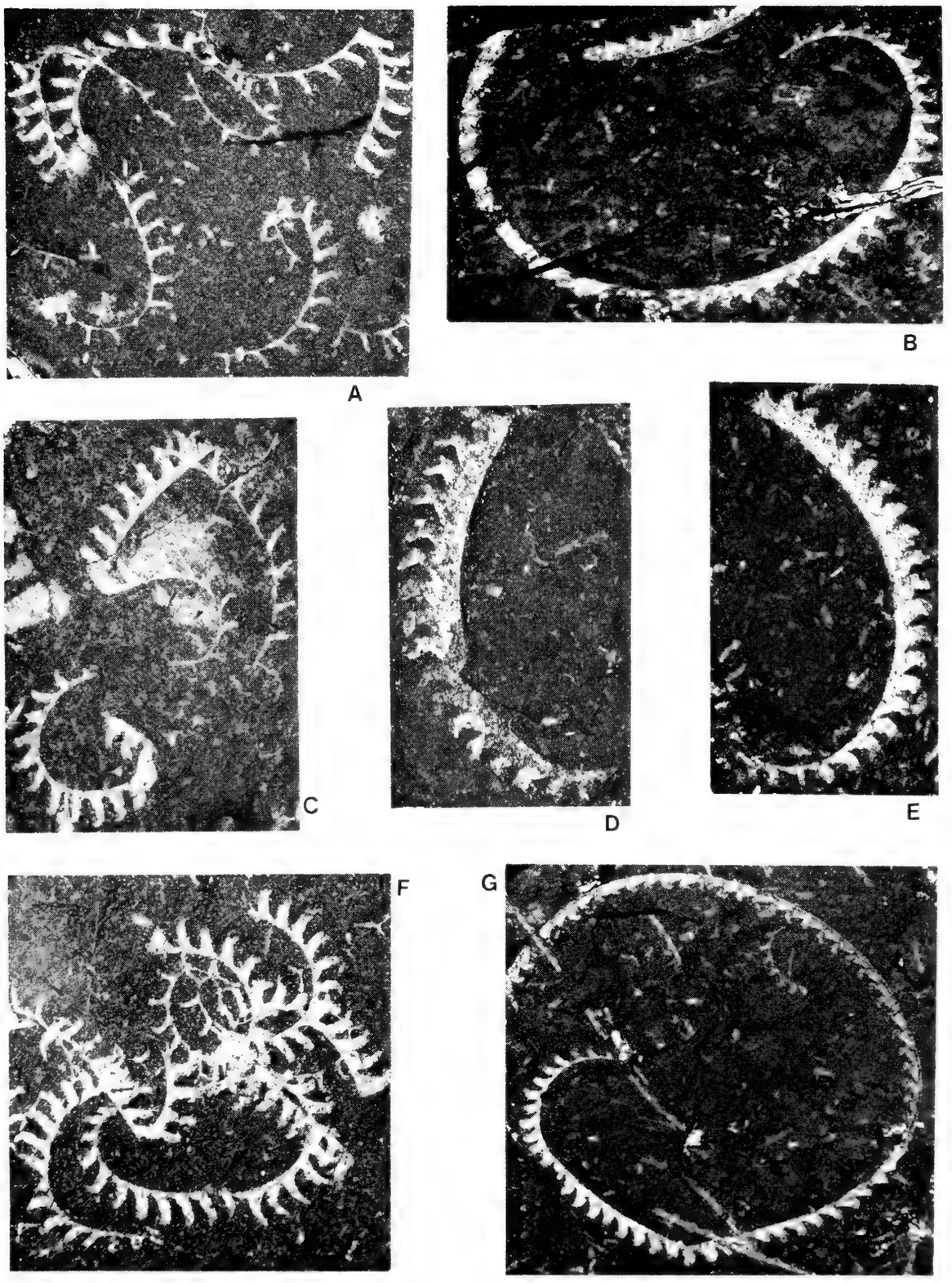

Fig. 23 A,C,F. *Monograptus decipiens decipiens* Törnquist, Blackstone River, collection at 76.2 m, *sedgwicki* Zone, ROM 38914, 38915, and 38916; all × 3.2.

B,D,E,G. *Monograptus decipiens valens* (Přibyl and Münch), *turriculatus* Zone

B. Blackstone River, collection at 83.8 m, ROM 38917; × 2.6.

D. Peel River, collection at 521.8 m, ROM 38918; × 4.0.

E. Blackstone River, collection at 88.7 m, ROM 38759; × 2.8.

G. Blackstone River, collection at 85.3 m, ROM 38919; × 2.6.

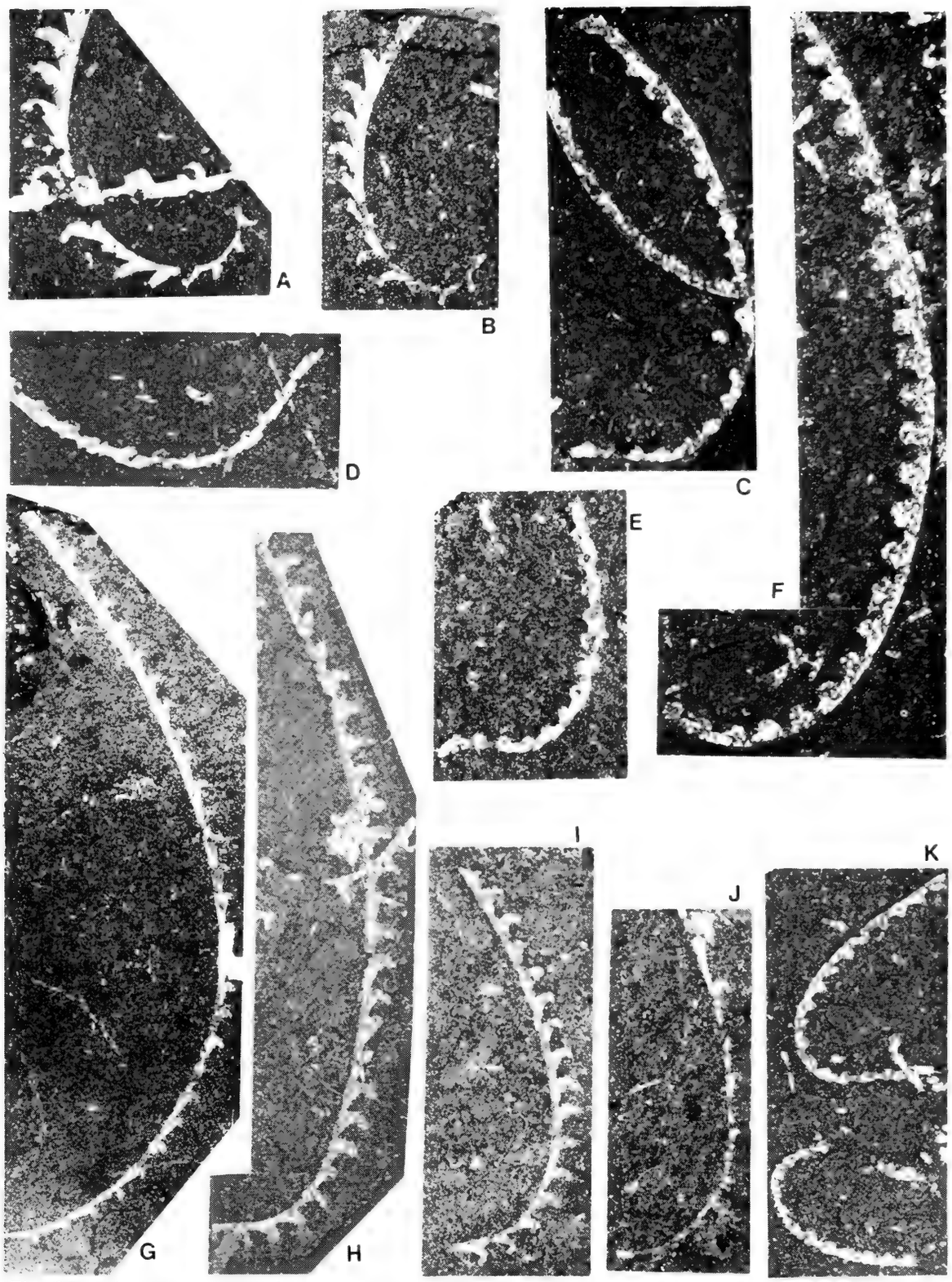

Fig. 24 A,B. *Monograptus* cf. *denticulatus* Törnquist, Peel River, collection at 519.4 m, *sedgwicki* Zone, ROM 38760 and 38761; both × 4.0.

C–F,K. *Monograptus exiguus primulus* Bouček and Přibyl, *turriculatus* Zone

C. Peel River, collection at 531.9 m, ROM 38769; × 4.0.

D. Peel River, collection at 523 m, ROM 38920; × 4.2.

E. Peel River, collection at 536.1 m, ROM 38767; × 4.0.

F. Rock River, collection at 287 m, ROM 38921; × 5.2.

K. Peel River, collection at 553.8 m, ROM 38922; × 3.0.

G–I. *Monograptus falx* (Suess), Peel River

G. Collection at 544.4 m, *turriculatus* Zone, ROM 38782; × 2.9.

H,I. Collection at 611.4 m, *spiralis* Zone, ROM 38781 and 38780; both × 3.7.

J. *Monograptus* cf. *elongatus* Törnquist, Peel River, collection at 477 m, *triangulatus* Zone, ROM 38765; × 5.3.

Discussion

The Yukon specimens are very similar to the types of *M. millepeda* except that they possess slightly fewer thecae. As is the case with the European occurrences, those of the Yukon are confined to the *argenteus* Zone.

Monograptus minimus Bouček and Přibyl, 1951

Figs. 8A; 26H

Monograptus (Mediograptus) minimus Bouček and Přibyl, 1951: 200.

Occurrence

Sakmaricus-laqueus Zone, Rock River, main branch, collections 3F and 4F.

Material

Several specimens from each collection, moderately well-preserved on black, calcareous shale. Illustrated specimens are ROM 38783 and 38934.

Description

The rhabdosome is delicate, moderately curved in a dorsal direction proximally and becoming straight distally. The sicula is prominent, 1.4 to 1.5 mm long and 0.3 mm wide, and almost attains the level of the tip of theca 2. Rhabdosomal width ranges from 0.25 mm at theca 1 to a maximum of 0.45 mm distally.

The thecae are long with the prothecal portions parallel to the stipe axis and the metathecal portions coiled into lobes which occupy one-third to one-half the stipe width. The thecae number 10 in 10 mm.

Discussion

The Yukon specimens are intermediate in their thecal spacing between that of the *M. minimus minimus* (11 to 12 in 10 mm) and *M. minimus cautleyensis* (nine in 10 mm: Rickards, 1965; Bjerreskov, 1975). The length of the sicula in the study specimens compares well with Bouček and Přibyl's (1951) description of "relatively fairly long", and Yukon specimens are assigned to *M. minimus minimus* Bouček and Přibyl.

Monograptus cf. *mirus* Perner, 1897

Fig. 26J

cf. *Monograptus mirus* Perner, 1897: 26.

Occurrence

Sedgwicki Zone, Peel River, at 515.1 and 519.4 m.

Material

Six poorly preserved specimens on black shale. The illustrated specimen is ROM 38935.

Discussion

This species bears an overall similarity to *M. involutus* but differs in that the proximal portion of the overall spiralled rhabdosome is generally curved in a direction opposite to that of the remainder of the rhabdosome, resulting in a nooselike proximal portion. Additionally, the thecae overlap only very slightly, the metathecae are sharply recurved into short hooks without spines, and the rhabdosome is more delicate overall. Thecae number nine to seven in 10 mm and stipe width ranges from about 0.5 mm proximally to about 0.75 mm distally.

M. mirus has been described, only inadequately, by Perner (1895), Waterlot (1945), and Münch (1952). Příbyl's (1944) description although agreeing with that of the Yukon specimens, is without accompanying illustrations.

Monograptus cf. *pandus* Lapworth, 1877

Fig. 8B, C

cf. *Monograptus lobiferus* var. *pandus* Lapworth, 1877: 129.

Occurrence

Turriculatus Zone, Peel River, at 531.9, 536.1, and 544.4 m, and possibly 559.3 m.

Material

One to several specimens in each collection, poorly to moderately well-preserved on black shale. Illustrated specimens are ROM 38784 to 38785.

Discussion

The relatively small proportion (one-quarter to one-fifth) of the rhabdosome occupied by the thecal hooks and the close proximity of the thecal apertures to the preceding thecae are characteristic of the species. The maximum width observed in incomplete

specimens is 2.0 mm. Sicula length is about 1.6 mm. Thecae number 10 to 11 in 10 mm proximally and eight in 10 mm distally.

Monograptus parapriodon Bouček, 1931

Figs. 8H, I; 26G, I

Monograptus parapriodon Bouček, 1931: 6.
Monograptus parapriodon, Münch, 1952: 100.
Monograptus (Monogr.) priodon parapriodon, Schauer, 1971: 57.
Monograptus parapriodon, Tsegel'nyuk, 1976: 241.

Occurrence

Sakmaricus-laqueus Zone, Peel River, at 635.5 m; Tetlit Creek, 216 m and possibly 213 m; main tributary of Rock River, collections 1F and 3F; and Mount Sekwi, at 384 m. It also occurs in lower Wenlock strata of Tetlit Creek, at 232 and 233 m.

Material

Few, poorly to well-preserved specimens in each collection. The illustrated specimens are ROM 38790 to 38791.

Description

The rhabdosome is essentially straight throughout its length, although it may show weak dorsal curvature for the distance of the first three thecae and very weak ventral curvature about the level of theca 5. The proximal portion of the rhabdosome has a generally delicate appearance and widens gradually from about 0.5 to 0.6 mm across theca 1, to a maximum of 1.8 to 1.9 mm distally. The sicula is 1.3 to 1.4 mm long and its tip is level with theca 1.

The thecae are of the *priodon* type throughout, but less of the length is involved in the hooked portion that occupies about one-third to one-quarter the width of the rhabdosome. Thecae number 10 to 11 in 10 mm proximally and 8 to 9 in 10 mm distally.

Discussion

This species is very like *M. priodon*, but differs in being much more delicate throughout its length and in possessing more widely spaced proximal thecae and less strongly hooked thecal hoods. In some respects it resembles *M. riccartonensis*, but does not possess the distinctive clawlike thecal profile. Specimens identified as *M. riccartonensis* by Lenz (1974) are now placed in synonymy with *M. parapriodon*.

Monograptus planus planus (Barrande, 1850)

Figs. 7H, L; 26E, F, K

Graptolithus proteus var. *plana* Barrande, 1850: 58.
Spirograptus planus, Přibyl, 1944: 227.
Monograptus planus, Sudbury, 1958: 524.
Monograptus (Spirograptus) planus planus, Schauer, 1971: 73.
Monograptus planus, Bjerreskov, 1975: 64.
Monograptus planus, Hutt, 1975: 99.
Oktavites planus, Sennikov, 1976: 201.

Occurrence

Turriculatus Zone, Peel River, at 523 m. Tentatively identified from Tetlit Creek, at 148 m, and Blackstone River, at 86.9 m.

Material

Four specimens, two moderately well-preserved on black shale. Illustrated specimens are ROM 38773 to 38774 and 38932 to 38933.

Description

The rhabdosome is broadly dorsally curved through approximately 360 degrees, the distal portion being less strongly curved. Width increases gradually from 0.4 to 0.5 mm across theca 1, to a maximum of 1.5 to 1.7 mm distally. The sicula is seen on only one specimen and is 1.0 mm long.

The proximal thecae are long, the prothecal portions are inclined at a low angle, and the metathecal portions form short, sharp hooks. The distal thecae are more triangular, are inclined about 45 degrees to the axis of the stipe and are moderately hooked, with hooks occupying one-half to one-third the stipe width; overlap is about one-third. The thecae number 8 to 9 in 10 mm proximally and about eight in 10 mm distally.

Discussion

Hutt (1975) has remarked on the number of axially elongated thecae in her specimens. The Yukon species bear five to six axially elongated thecae, and are thus like those of Hutt (1975) and Bjerreskov (1975), but differ in this respect from those of Sudbury (1958) or Sennikov (1976).

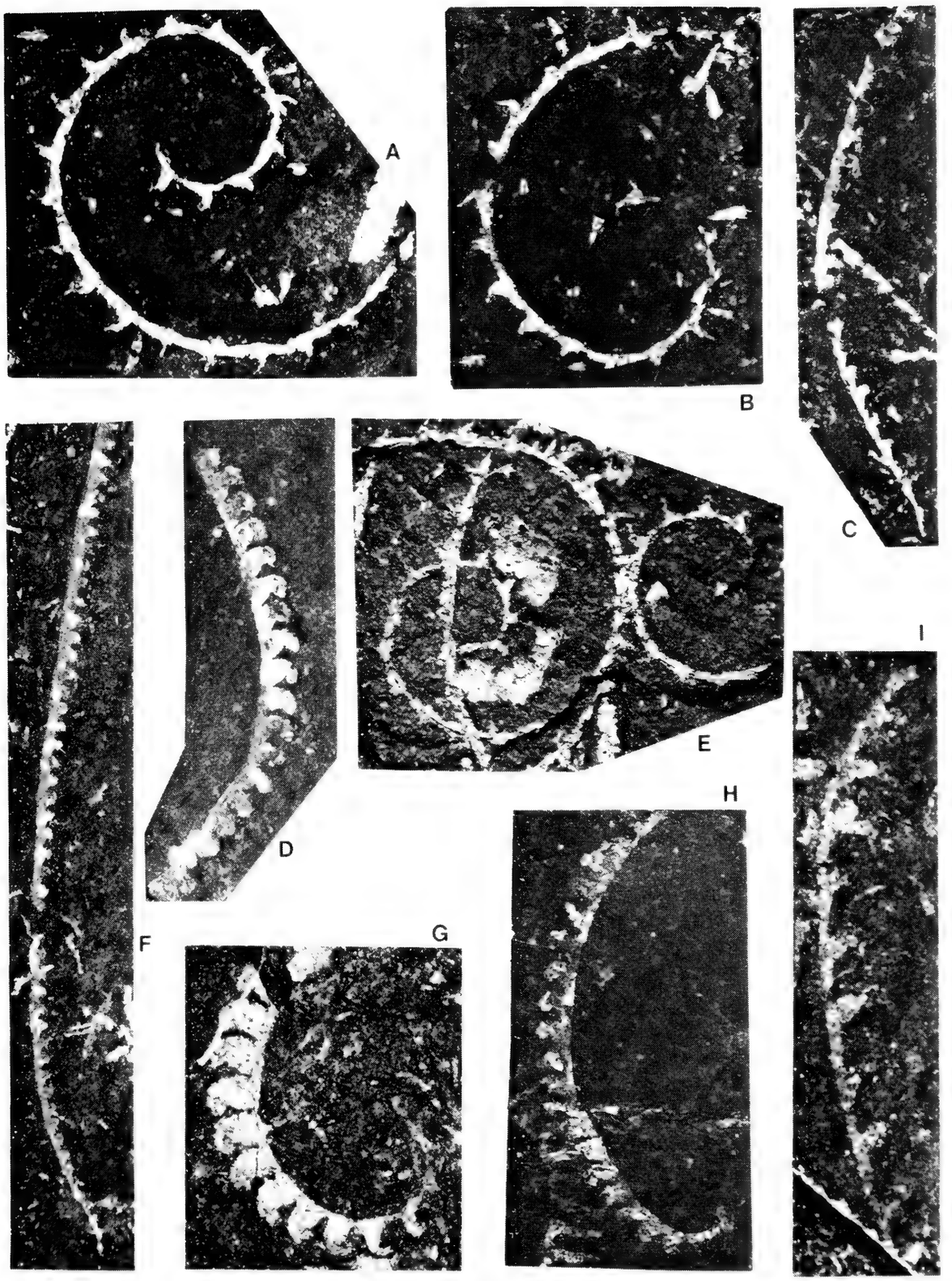

Fig. 25 A,B,E. *Monograptus involutus* Lapworth, Peel River, *magnus* Zone?

A,B. Collection at 488 m, ROM 38770 and 38923; × 5.4, × 5.5.

E. Collection at 487.4 m, ROM 38924; × 5.1.

C,F. *Monograptus lobiferus harpago* Törnquist, Peel River, collection at 502.3 m, *convolutus* Zone, ROM 38925 and 38926; × 2.6, × 1.7.

D,G,H. *Monograptus millepeda* (M'Coy)

D,H. Peel River, collection at 491.4 m, *argenteus* Zone? ROM 38927 and 38778; × 3.0, × 3.3.

G. *Monograptus* cf. *millepeda* (M'Coy), Blackstone River, collection at 86.9 m, *turriculatus* Zone, ROM 38928; × 5.5.

I. *Monograptus* cf. *knockensis* Elles and Wood, Blackstone River, collection at 80.2 m, *turriculatus* Zone, ROM 38777; × 5.6.

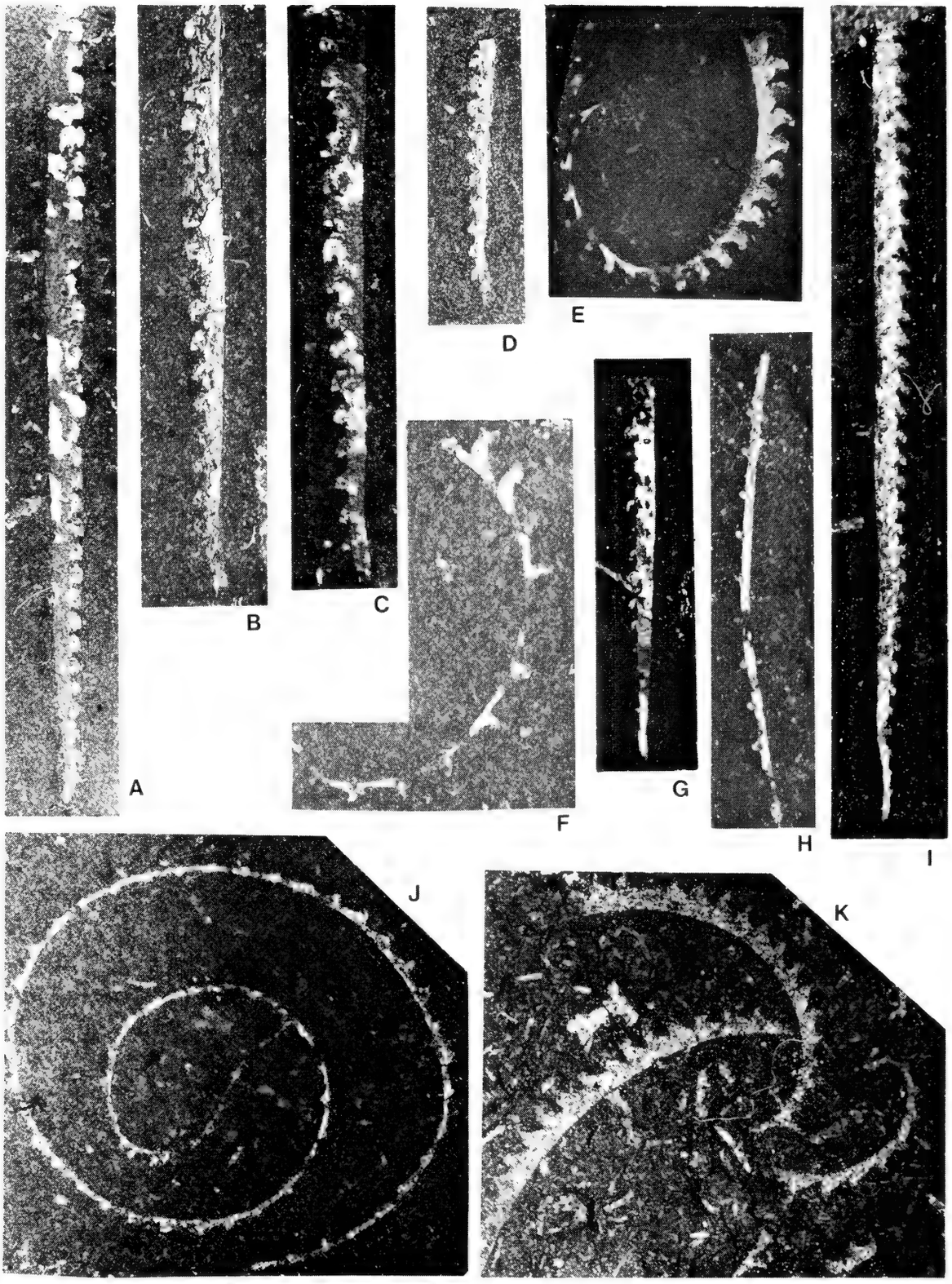

Fig. 26 A–D. *Monograptus marri* Perner, *turriculatus* Zone

A,D. Peel River, collection at 553.8 m, ROM 38929, and 38930; × 3.0.

B. Peel River, collection at 548.9 m, ROM 38787; × 4.2.

C. Rock River, collection at 293 m, ROM 38931; × 4.2.

E,F,K. *Monograptus planus planus* (Barrande), *turriculatus* Zone

E,F. Peel River, collection at 523 m, ROM 38932 and 38774; × 2.6, × 5.0.

K. Blackstone River, collection at 86.9 m, ROM 38933; × 3.0.

G,I. *Monograptus parapriodon* Bouček, *sakmaricus-laqueus* Zone

G. Rock River, main branch, collection 3F, ROM 38790; × 2.0.

I. Peel River, collection at 635.5 m, ROM 38791; × 3.2.

H. *Monograptus minimus* Bouček and Přibyl, Rock River, main branch, collection 3F, *sakmaricus-laqueus* Zone, ROM 38934; × 4.5.

J. *Monograptus* cf. *mirus* Perner, Peel River, collection at 519.4 m, *sedgwicki* Zone, ROM 38935; × 3.3.

Monograptus planus obtusus Schauer, 1971

Figs. 8M; 27A, G

Monograptus (Spirograptus) planus obtusus Schauer, 1971: 74.

Occurrence

Turriculatus Zone, Peel River, at 531.9 m; and Blackstone River, at 91.4 m.

Material

Six poorly preserved specimens from Blackstone River, and five moderately well-preserved specimens from Peel River. Illustrated specimens are ROM 38795 to 38936.

Description

The sicula appears to be about 0.8 mm long, thecae are spaced at the rate of 11 to 12 in 10 mm proximally and 9 to 10 in 10 mm distally, and the rhabdosome width ranges from 0.4 to 0.5 mm across theca 1, to a maximum distal width of 1.5 to 1.6 mm.

Discussion

The rhabdosome of the study material possesses the characteristic arcuate shape of *M. planus obtusus* and distal thecae are identical. The thecae of some specimens clearly show the torsion and hooking of the distal thecae. The subspecies differs from *M. planus planus* in its much more robust proximal portion, in which laterally elongated thecae number only two to three, and in that the thecal hooks occupy about one-half the stipe width throughout.

Monograptus priodon (Bronn, 1835)

Fig. 28A

Lomatoceras priodon Bronn, 1835: 56.

For detailed synonymy, see Schauer, 1971: 56–57.

Occurrence

Rare and identified tentatively in the *turriculatus* Zone, and common in the *spiralis* and *sakmaricus-laqueus* zones. Peel River, at 559.3?, 570.9, 579.7, 614.2, 615.7,

629.4, 630.9?, 635.5?, and 638.6 m; Blackstone River, at 91.4?, and 103.8 m; Tetlit Creek, at 148?, 185?, 187?, 220, and 223 m; Mount Sekwi, at 384 m; Whittaker Range, at 798.6?, 802.8?, 805.3, 814.4, 815.9, 823?, 827.5, 836.7, 844.3, 892.5, 896.1, 900.7?, 905.3?, 910.7, 915.9?, and 922 m; Delorme Range, at 906.8, 911.4, 912.3, and 935.7 m; Rock River, collections 1F, 4F, 5F?, 6F, 7F, 8F?, 9F, 10F?, and 11F?; and Clearwater Creek, at 76.2, 79.2, 83.8, 86.9, 89.9 and 93 m.

Material

Hundreds of poorly to moderately well-preserved specimens. The illustrated specimen is ROM 38941.

Discussion

M. priodon is the most ubiquitous and one of the commoner monograptids in northern Canada. The species is well documented from around the world; its characteristic features are well known and are not described here. Lenz (1974) documented the evolutionary development within *M. priodon*. The species is particularly well respected in the upper Llandovery and lower Wenlock strata of the Cape Phillips Formation, Arctic Islands, where it has been recovered in abundance in uncompressed form.

Monograptus proteus (Barrande, 1850)

Figs. 8S, T; 27C, H, I

Graptolithus proteus Barrande, 1850: 58.
Monograptus proteus, Elles and Wood, 1913: 477.
Monograptus proteus, Hutt, et al., 1970: 12.
Monograptus (Spriograptus) proteus proteus, Schauer, 1971: 75.
Monograptus proteus, Bjerreskov, 1975: 65.
See Rickards, 1970, for a detailed synonymy to 1970.

Occurrence

Turriculatus and lower part of the *spiralis* zones. Collected from Peel River, at 523 and 559.3 m, and tentatively 519.4 and 541.3 m; Rock River, at 287, 293, and 302 m, and possibly 323 and 326 m; and Mount Sekwi, at 547.4 m and possibly 527.6 m; and from Blackstone River, at 92.7, 94.8, and 99 m.

Material

Specimens fairly to moderately well-preserved on black shale; abundant at Rock River, common at other localities. Illustrated specimens are ROM 38801 to 38802 and

38938. Additionally, an illustrated specimen identified as *M.* cf. *proteus* (Fig. 27I) is numbered ROM 38939.

Description

The rhabdosome is helically coiled in a loose open spiral and, depending on orientation upon compression, is preserved as either a loose spiral, or as an S-shaped pattern. The proximal portion of the rhabdosome is thin and very delicate, measuring 0.25 mm across theca 1; distal portions become much more robust and attain a maximum width of 2.0 mm. The sicula is about 1.0 mm long.

The proximal thecae are very slender and axially elongate; prothecal portions are inclined at very low angles to the stipe, whereas the metathecal portions are short, sharp hooks which undergo torsion and comprise only about one-seventh or one-eighth of the thecal length. Distal thecae are much more distinctly triangular, overlap about one-third their length, and thecal hooks comprise about one-third of the thecal length.

The thecae occupy about one-half the stipe width proximally and about two-thirds the width distally; they number eight in 10 mm proximally and 10 to 12 in 10 mm distally.

Discussion

The spacing of the distal thecae in the Yukon specimens is identical to that of the type species and differs in this respect from the material described by Elles and Wood (1913) and Bjerreskov (1975). The torsion of the thecae is clearly shown in the specimens illustrated by Hutt et al. (1970: pl. 26, fig. 4) and Bjerreskov (1975: fig 19B), but is visible on only a few of the study specimens.

Monograptus pseudobecki Bouček and Přibyl, 1942

Figs. 8J, K, L; 28C, E

Monograptus Becki, Lapworth, 1876: 500.
Monograptus Becki, Elles and Wood, 1913: 452.
Monograptus (Streptograptus) pseudobecki Bouček and Přibyl, 1942: 18.
Monograptus pseudobecki, Rickards, 1970: 78.
Monograptus (Streptograptus) runcinatus pseudobecki, Schauer, 1971: 71.
Monograptus pseudobecki, Bjerreskov, 1975: 63.

Occurrence

Sedgwicki and *turriculatus* zones, Peel River, at 519.4 and 523 m; and tentatively Blackstone River, at 74.7, 83.8, 85.3, 86.9, and 88.7 m.

Material

Rare to common, poorly to moderately well-preserved specimens on black shale. Illustrated material is ROM 38787, 38792 to 38794, and 38943.

Description

The rhabdosome is S-shaped, with the proximal portion dorsally, and the distal portion ventrally, curved. Width is about 0.5 mm across theca 1 and increases gradually to a maximum of 1.1 mm. The sicula is seen in only one specimen and appears to be 1.2 mm long.

The prothecal portions of the thecae are elongate, overlap only slightly, and are parallel to the axis of the stipe. The metathecal portions of the thecae are tightly coiled to form a lobe which occupies at least one-half the width of the stipe. The thecae number 10 to 11 in 10 mm proximally and seven to nine in 10 mm distally.

Discussion

Although seen in only a single fragment, the Yukon specimen appears to differ from the European representatives only in the length of the sicula. Rickards (1970) describes a sicula length of 0.78 mm, whereas Bjerreskov (1975) lists 0.8 mm.

Monograptus revolutus Kurck, 1882

Figs. 10D, K, L; 28B, D, H

Monograptus revolutus Kurck, 1882: 299.
Monograptus revolutus, Hutt, 1974: 197.
Monograptus revolutus, Bjerreskov, 1975: 51.

Occurrence

Gregarius, argenteus, triangulatus, and possibly the *magnus*? zones. Peel River, at 468.2, 471.5, 482.5, and 488 m, and tentatively at 470.3, 474, and 487.4 m; and Blackstone River, at 65.5 m.

Material

Common in Blackstone River collection, rare in other collections. Preservation of specimens ranges from poor to moderately good; all are incomplete and without sicular ends. Illustrated specimens are ROM 38825 to 38827 and 38942.

Description

The rhabdosome is dorsally and uniformly curved throughout its length, but more

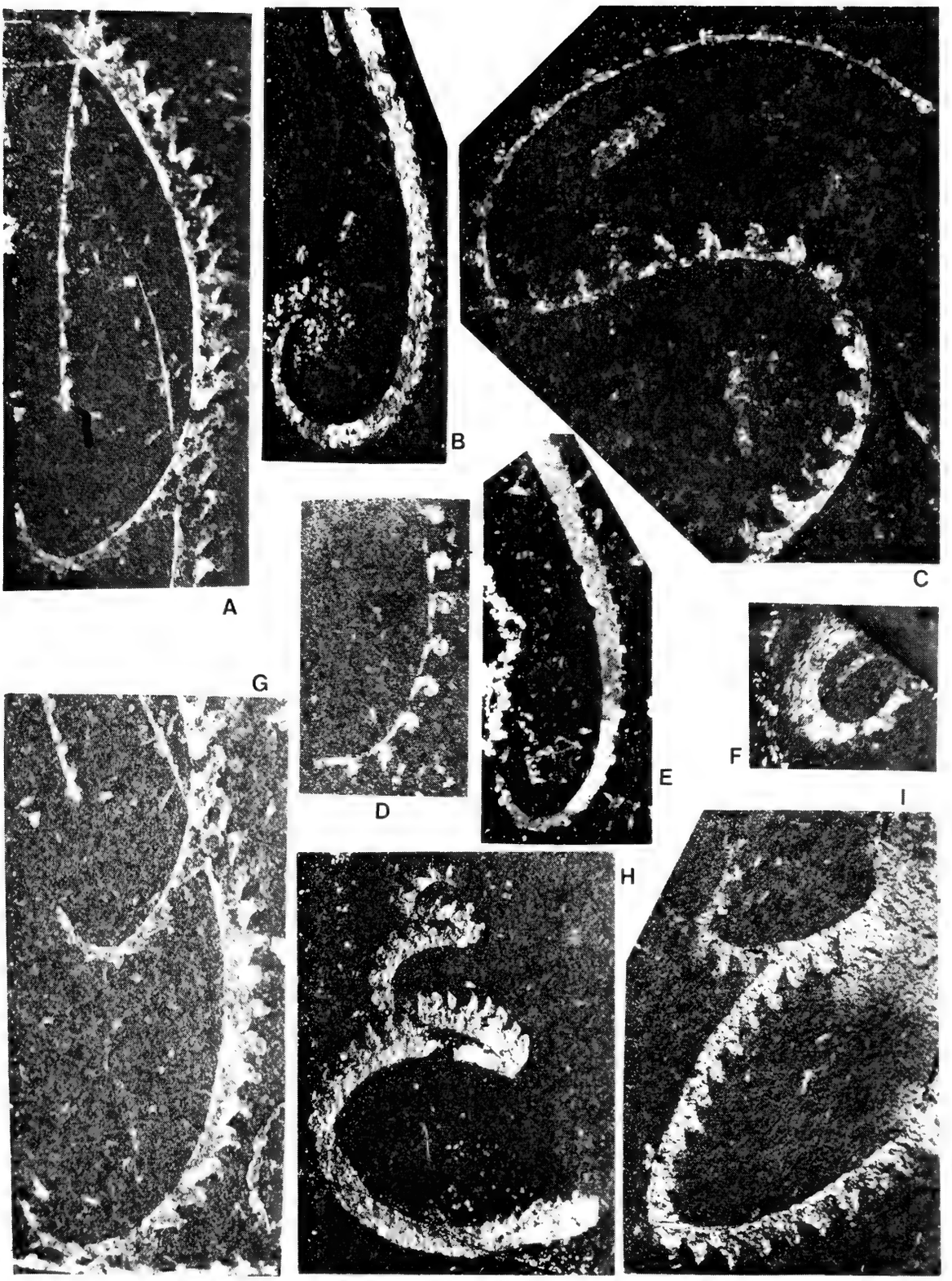

Fig. 27 A,G. *Monograptus planus obtusus* Schauer, Peel River, collection at 531.9 m, *turriculatus* Zone, ROM 38795 and 38936; both × 4.6.

B,E,F. *Monograptus sidjachenkoi* (Obut and Sobolevskaya), Peel River, *convolutus* Zone

B. Collection at 512.8 m, ROM 38798; × 4.0.

E. Collection at 496.2 m, ROM 38937; × 2.5.

F. Collection at 507.8 m, ROM 38797; × 4.6.

C,H,I. *Monograptus proteus* (Barrande)

C. Rock River, collection at 287 m, *turriculatus* Zone, ROM 38802, × 5.2.

H. Peel River, collection at 523 m, *turriculatus* Zone, ROM 38938; × 2.6.

I. *Monograptus* cf. *proteus* (Barrande), Peel River, collection at 519.4 m, *sedgwicki* Zone?, ROM 38939; × 3.5.

D. *Monograptus* cf. *tenuissmus* (Obut and Sobolevskaya), Peel River, collection at 519.4 m, *sedgwicki* Zone?, ROM 38940; × 4.1.

Fig. 28 A. *Monograptus priodon* (Bronn), Mount Sekwi, collection at 384 m, *sakmaricus-laqueus* Zone?, ROM 38941; × 4.2.

B,D,H. *Monograptus revolutus* Kurck, Peel River

B,D. Collection at 471.5 m, *gregarius* Zone, ROM 38942 and 38826; × 3.0, × 4.8.

H. Collection at 488 m, *magnus* Zone?, ROM 38825; × 4.0.

C,E. *Monograptus pseudobecki* Bouček and Příbyl, *sedgwicki* Zone

C. Blackstone River, collection at 74.7 m, ROM 38943; × 3.6.

E. Peel River, collection at 519.4 m, ROM 38787; × 2.5. (Also includes *Monograptus* cf. *denticulatus*.)

F. *Monograptus runcinatus richardsonensis* subsp. nov., Blackstone River, collection at 94.8 m, *turriculatus* Zone, ROM 38944; × 3.7.

G. *Monograptus austerus* or *M. revolutus*, Peel River, collection at 470.3 m, *gregarius* Zone, ROM 38945; × 3.0.

strongly in the proximal region. The proximal region is elongated and delicate in appearance, but width increases relatively rapidly so that, from an initial width of 0.25 to 0.3 mm, the maximum width of 0.9 to 1.0 mm is quickly attained.

The proximal thecae are axially elongated and scarcely overlap; the prothecal portions are inclined at a low angle; while the metathecal portions, which comprise about one-quarter the thecal length, form a simple, but pronounced hook. Distal thecae progressively increase their overlap and become essentially simple cylinders which are inclined about 20 degrees and overlap about one-half. The thecal apertures bear "horns" or lappets, which give an introverted profile to the thecae. Thecae number seven to nine in 10 mm proximally and 8 to 10 in 10 mm distally.

Discussion

The study specimens are wider that those described by Hutt (1974) and Bjerreskov (1975). In all other respects, however, they are very similar. *M. revolutus* is distinguished from *M. sudburiae* by its lesser width and more delicate and protracted proximal end.

Monograptus cf. *revolutus* Kurck, 1882

Fig. 28G

cf. *Monograptus revolutus* Kurck, 1882: 299.

Occurrence

Gregarius Zone, Peel River, at 470.3 m, and possibly from 485.9 m.

Material

A few poorly preserved, incomplete specimens on black shale. The illustrated specimen is ROM 38945.

Discussion

In the absence of complete specimens, the distinction between *M. austerus* and *M. revolutus* is nearly impossible. According to Hutt (1974–1975) the *revolutus* group has introverted distal thecae, whereas those of the *austerus* group are simple tubes. The study material consists of fragments with slender proximal ends and a gradually widening stipe which attains a maximum width of 0.9 m. Proximal thecae are strongly hooked and weakly overlapping, whereas distal thecae become progressively less hooked and more strongly overlapping, and distal thecae are essentially simple tubes. In some specimens distal thecae almost certainly have introverted apertures, while in others this is not entirely clear. Thecae number eight to nine in 10 mm.

Monograptus rickardsi minor Hutt, 1975

Figs. 9F, G; 29A, B

Monograptus rickardsi minor Hutt, 1975: 103.

Occurrence

Turriculatus Zone, Rock River, at 287 m; and Peel River, at 528.5 m.

Material

Several specimens, one of which is nearly complete, well preserved on black shale. Illustrated specimens are ROM 38808 to 38809.

Description

The rhabdosome is essentially straight throughout its length, except for a weak dorsal curvature over the distance of the first three thecae and an extremely weak ventral curvature about the level of theca 12. The rhabdosome width ranges from 1.2 to 1.3 m across theca 1, to a maximum (based on a single specimen only) of 2.0 mm distally. The sicula is relatively robust, 1.3 to 1.6 mm long, and its apex attains the level of the tip of theca 2.

The thecae are robust and strongly hooked, so that their apertures are directed proximally; paired lateral processes are prominent on at least the proximal four to five thecae. Distally, the thecae are more retroverted and beaklike. Thecae overlap only slightly proximally and about one-third distally, and number 10 to 11 in 10 mm proximally and eight in 10 mm distally (based on a single specimen).

Discussion

This subspecies is distinguished by the fact that the proximal thecae bear paired spines. It differs from typical *M. rickardsi* by possessing more widely spaced thecae and especially a much shorter sicula.

Monograptus runcinatus richardsonensis subsp. nov.

Figs. 9H–J; 28F; 29C, I, J

Occurrence

Turriculatus Zone, Rock River, at 287 m; and Blackstone River, at 94.8 m.

Material

One moderately well-preserved specimen from Blackstone River, and about 10 fairly to moderately well-preserved specimens from Rock River. Illustrated specimens consist of ROM 38811 (holotype) and ROM 38810, 38812, 38944, and 38946 (paratypes).

Etymology

From the Richardson Mountains, northern Yukon.

Diagnosis

Rhabdosome S-shaped, with proximal portion moderately to strongly dorsally flexed. Sicula 0.8 to 0.9 mm long. Rhabdosome 0.25 to 0.3 mm across theca 1, widening steadily to about thecae 8 to 10, then very gradually to a distal maximum of 0.6 to 0.7 mm. Thecae lobate, retroverted, with a "sagging" profile, occupying one-quarter to one-third the stipe width, and numbering 12 to 13? in 10 mm proximally and 10 in 10 mm distally.

Description

The rhabdosome is moderately to strongly dorsally curved through an arc ranging from 30 degrees to greater than 90 degrees over the distance of the first three to four thecae, then weakly ventrally curved in the region of thecae 5 to 8 and straight to gently undulating thereafter.

The prothecae are elongate and parallel, or weakly inclined to, the stipe axis, whereas the metathecae are tightly coiled, lobate and, although not clearly seen in most specimens, clearly retroverted. The overall effect upon compression is to impart a slightly sagging look to the thecal profile, so typical of *M. runcinatus runcinatus*.

Discussion

This subspecies bears an overall strong similarity to species such as *M. psuedobecki, M. capillaceous,* and *M. flexuosus,* all but the first being from Wenlockian strata. The nature of the thecae in the study specimens, that is the "sagging' or "melted candle wax" profile of the thecae due to compression of the retroverted metathecal portions thecae, is, however, typical of *M. runcinatus*.

The subspecies differs from *M. runcinatus runcinatus* in possessing a much more strongly dorsally flexed proximal region and in being only about one-half its width.

Monograptus cf. *sartorius* Törnquist, 1881

Figs. 9A–C; 29D, H

cf. *Monograptus sartorius* Törnquist, 1881: 441.

Occurrence

Turriculatus and the *spiralis* zones. Collected from Rock River, at 306, 309, and 326 m; possibly from Peel River, at 614.2, 629.4, and 637.3 m.

Material

Specimens mostly poorly preserved, common in collection from Rock River, 306 m, rare in other collections. Illustrated specimens consist of ROM 38803 to 38805.

Description

The sicula of the Yukon specimens is 1.2 mm long and the thecae are spaced at the rate of eight to nine in 10 mm proximally and seven to eight in 10 mm distally. The rhabdosome ranges in width from 0.3 mm across theca 1 to a maximum of about 0.5 mm distally (0.6 mm if the very long Peel River specimen belongs in the same species). The prothecae of the thecae are inclined about 15 degrees, while the metathecae form single short and sharp hooks.

Discussion

The proximal portion of the study material is moderately strongly curved in a dorsal direction, but because of the fragmentary state of the better preserved specimens, the nature of the distal portion of the rhabdosome is unknown. A very long (120 mm) and poorly preserved rhabdosome of what may be the same species from a collection made at 614.2 m, Peel River, is dorsally curved proximally and gently but consistently ventrally curved throughout its remaining length.

The study specimens resemble *M. jacobseni* Sherwin (1974) in rhabdosome shape and dimensions and may be that species; Sherwin (1974), although, reports a straight, as opposed to a dorsally, curved proximal portion to the rhabdosome.

Monograptus sedgwicki (Portlock, 1843)

Figs, 9D, E; 29E–G

Graptolithus (Prionotus) Sedgwickii Portlock, 1843: 318.
Monograptus Sedgwickii, Elles and Wood, 1913: 441.
Monograptus sedgwicki, Obut and Sobolevskaya, 1967: 97.
Monograptus (Monogr.) sedgwicki, Schauer, 1971: 55.
Monograptus sedgwicki, Hutt, 1975: 106

Occurrence

Sedgwicki and lower part of *turriculatus* zones. Collected from Peel River, at 513.6, 515.1, 516.3, and 521.8 m, and tentatively at 516.9 and 526 m; Blackstone River, at 72.2 and 76.2 m, and tentatively at 74.7 and 80.2 m.

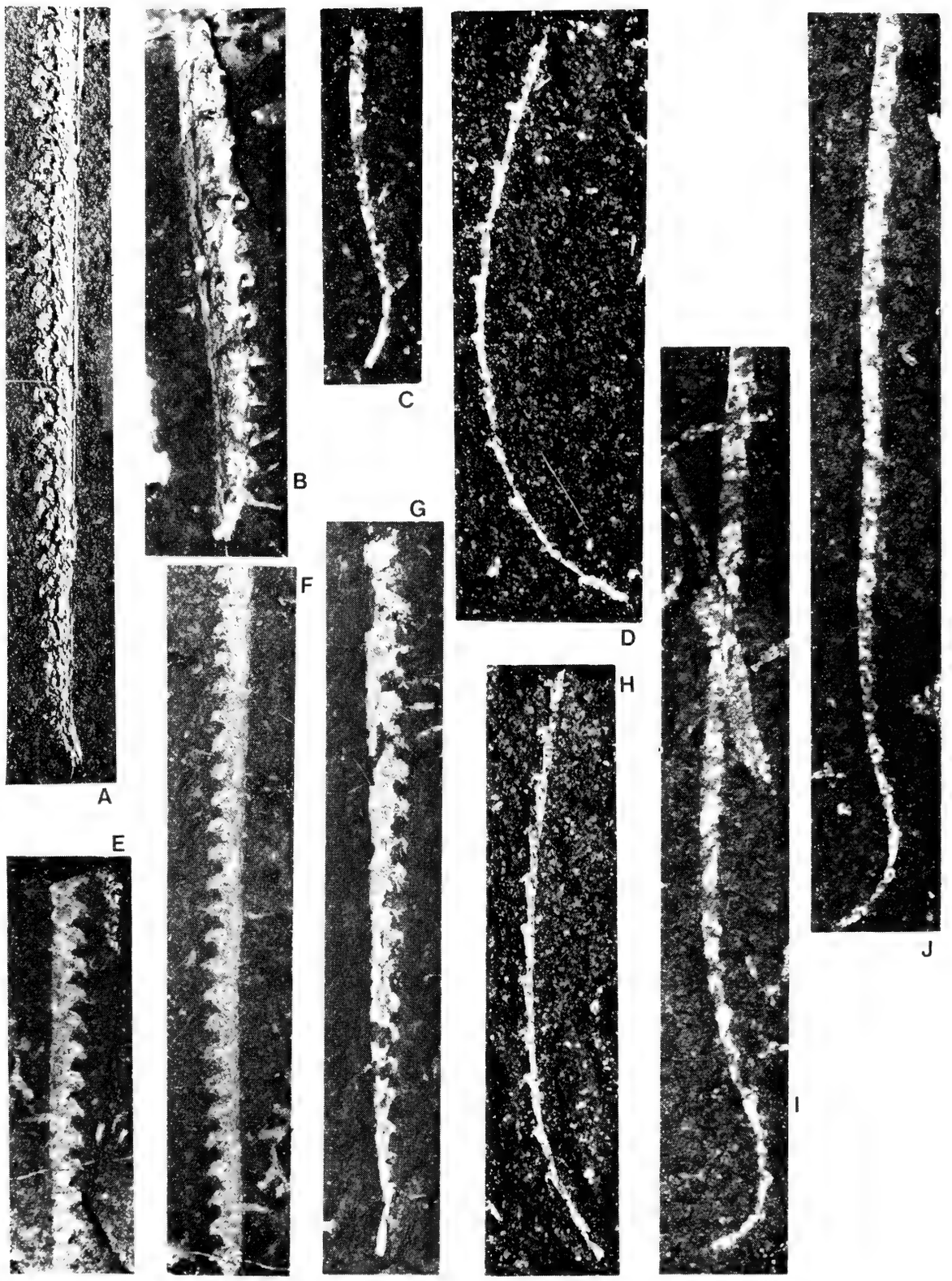

Fig. 29 A,B. *Monograptus rickardsi minor* Hutt, Rock River, collection at 287 m, *turriculatus* Zone, ROM 38808 and 38809; × 3.4, × 5.2.

C,I,J. *Monograptus runcinatus richardsonensis* subsp. nov., Rock River, collection at 287 m, *turriculatus* Zone, ROM 38946, 38812, and 38811; all × 4.9.

D,H. *Monograptus* cf. *sartorius* Törnquist, Rock River, collection at 306 m, *spiralis* Zone?, ROM 38803 and 38804; both × 5.2.

E–G. *Monograptus sedgwicki* (Portlock), *sedgwicki* Zone

E,F. Blackstone River, collection at 76.2 m, ROM 38947 and 38948; × 3.0.

G. Peel River, collection at 513.6 m, ROM 38807; × 4.2.

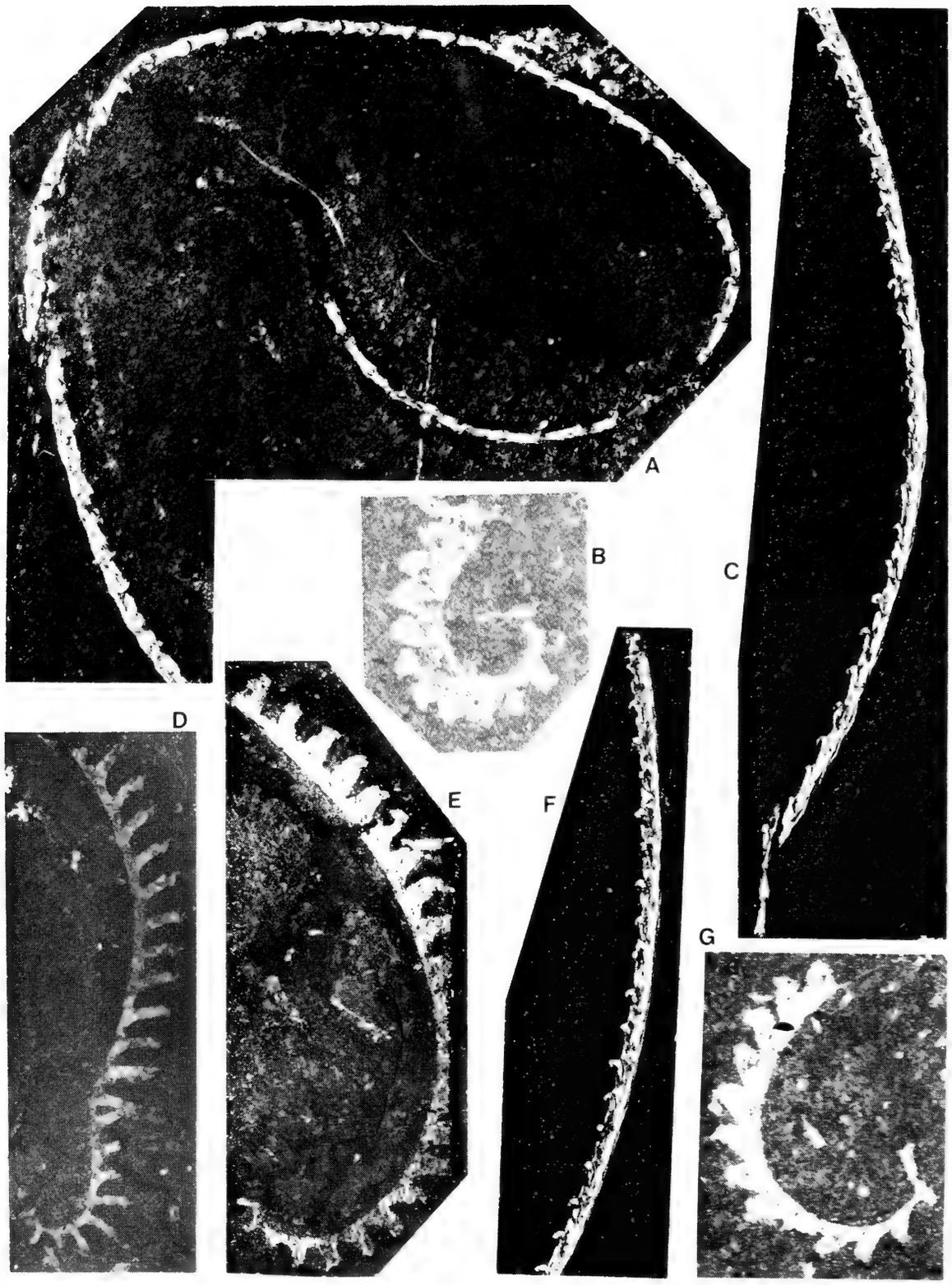

Fig. 30 A,C,F. *Monograptus speciosus* Tullberg, Tetlit Creek, collection at 217 m, *sakmaricus-laqueus* Zone, ROM 38949 and 38950; all × 4.8. (Note: base of F is the continuation of the top of C.)

B,G. *Monograptus triangulatus fimbriatus* (Nicholson), Peel River, collection at 488 m, *magnus* Zone?, ROM 38951 and 38815; × 5.9, × 5.5.

D. *Monograptus* cf. *triangulatus* (Harkness), Peel River, collection at 487.4 m, *triangulatus* Zone, ROM 38952; × 3.4.

E. *Monograptus* cf. *triangulatus separatus* Sudbury, Peel River, collection at 480.4 m, *triangulatus* Zone, ROM 38818; × 4.0.

Material

Several or more moderately well-preserved specimens from each collection. Illustrated specimens are ROM 38806 to 38807 and 38947 to 38948.

Description

The rhabdosome is more or less straight throughout its length, except for the region of the proximal two thecae which is weakly dorsally curved. The sicula is 1.4 to 1.5 mm long and its apex is level with the tip of theca 1. Stipe width ranges from 0.5 to 0.7 mm across theca 1 to a maximum of about 1.6 mm, although one specimen attains a width of 2.0 mm.

Proximal thecae are rather strongly, simply hooked and the apertural regions may be pointed or bear a spine; the hooked portion occupies about one-half of the stipe width and thecae number 10 to 11 in 10 mm proximally. Distal thecae overlap one-third to one-quarter, occupy one-half to two-thirds of the stipe width, and number 8 to 9 in 10 mm; they are very strongly hooked to lobate in cross-section, probably due to retroversion, and may or may not bear spines.

Discussion

The study specimens differ from those described by Elles and Wood (1913) in thecal spacing, but are similar in sicular length. A comparable sicular length of 1.5 mm was reported in specimens from the Kolyma region (Obut et al., 1967). On the other hand, the Yukon material differs considerably in this respect from that of Rickards (1970) and Hutt (1975), who quote a sicular length of only 1.0 mm. Sicular length may increase up the stratigraphic column, a possibility alluded to by Hutt (1975: 106).

Monograptus sidjachenkoi (Obut and Sobolevskaya, 1965)

Figs. 8N, P, R; 27B, E, F

Pernerograptus sidjachenkoi Obut and Sobolevskaya, 1965: 61.
Pernerograptus sidjachenkoi, Obut and Sobolevskaya, 1967: 111.
?*Paramonoclimacis typicalis* Wang and Ma, 1977: 362.
?*Paramonoclimacis similis* Wang and Ma, 1977: 361.

Occurrence

Convolutus Zone, Peel River, at 496.2, 502.3, 507.8, and 512.8 m; and Blackstone River, at 69.2 and 70.4 m.

Material

Three to ten, fragmentary, poorly to moderately preserved specimens in each collection. Illustrated specimens are ROM 38796 to 38798 and 38937.

Description

The proximal portion of the rhabdosome is tightly to moderately tightly coiled through an arc ranging from 270 degrees to 400 degrees, whereas the distal portion is straight, or weakly dorsally curved. The proximal region is delicate and attenuated and bears a sicula which appears to be about 0.9 mm long (though in some specimens it may be as much as 1.4 mm long).Width of the rhabdosome increases rapidly from 0.5 to 0.6 mm across theca 1, to a maximum ranging from 1.0 to 1.5 mm distally.

The proximal thecae are lobed, with the lobes occupying one-quarter the stipe width and the ventral walls parallel the stipe axis; they number 10 to 12 in 10 mm. The thecal lobes disappear in the region immediately distal of the strongly curved portion and the thecal apertures are only hooded excavations in which the hoods occupy about one-fifth to one-seventh the stipe width. Distal thecae number 9 to 10 in 10 mm.

Discussion

The distinguishing characteristics of this species are the strongly curved proximal region and the biform thecae similar to those of *M. revolutus*. The sicular end of the Yukon specimens are generally poorly preserved, making the determination of the sicular length difficult. In two instances, the sicula is clearly seen to be only 0.9 mm in length. Obut and Sobolevskaya (1967) quote a sicular length of only 0.5 mm in their material.

Paramonoclimacis typicalis and *P. similis*, described by Wang and Ma (1977), appear to be identical to *M. sidjachenkoi*.

Monograptus speciosus Tullberg, 1883

Figs. 9K; 30A, C, F

Monograptus speciosus Tullberg, 1883: 21.
Monograptus (Streptograptus)speciosus, Bouček and Příbyl, 1942: 7.
Monograptus speciosus, Bjerreskov, 1975: 76.

Occurrence

Sakmaricus-laqueus Zone, Tetlit Creek, at 215 and 217 m, and tentatively at 216 and 220 m; tentatively from the *spiralis* Zone, Mount Sekwi, at 516.9 m; and Rock River, at 245 m.

Material

Two to several mostly fairly to moderately preserved specimens from each collection; those from Tetlit Creek at 217 m are very well preserved in partial relief in black shale. Illustrated specimens are ROM 38813 and 38949 to 38950.

Description

The proximal end of this species has not been recovered, although one specimen from Tetlit Creek, 217 m, may exhibit a bipolar structure such as illustrated in Bjerreskov (1975: 77). The rhabdosome is broadly ventrally curved throughout its length and stipe width ranges from a minimum of 0.5 mm proximally to an observed maximum of 0.8 mm distally.

The prothecae are axially elongate and generally parallel to the stipe axis, whereas the short metathecae are strongly hooked, so that the apertures point in a dorsoproximal direction and occupy about one-quarter to one-third the stipe width. There is some suggestion of mild torsion of the thecal hoods. Interthecal septa are S-shaped and thecae overlap no more than one-third to one-half distally. Thecae number 9 to 10 in 10 mm throughout the length of the rhabdosome.

Discussion

Bjerreskov (1975) noted that the thecae of this species are hooked and not lobate as suggested by Bouček and Přibyl (1942). Slight thecal torsion, followed by compression, could, however, lead to lobelike thecal profiles.

Monograptus spiralis (Geinitz, 1852)

Figs. 9P; 32A–C, F

Graptolithus spiralis Geinitz, 1852: 700.
Spirograptus spiralis, Přibyl, 1944: 6.
Oktavites spiralis, Obut and Sobolevskaya, 1968: 82.
Monograptus (Spirograptus) spiralis spiralis, Schauer, 1971: 76.
Monograptus spiralis spiralis, Bjerreskov, 1975: 72.
For additional references, see Přibyl, 1944, and Bjerreskov, 1975.

Occurrence

Rare in the *turriculatus* Zone, common and abundant in the *spiralis* Zone, and uncommon in the lower part of the *sakmaricus-laqueus* Zone. It is not as ubiquitous as *M. priodon*, but is common to abundant everywhere in the *spiralis* Zone. Collected from Whittaker Range, at 728.5. 774.2, 795.5, 815.9, 823, 827.5, 836.7, 839.7, 855.6, and 922 m; Peel River, at 579.7, 611.4, 612.6, 614.2, 615.7, 629.4, and 630.9 m; Tetlit Creek, at 168, 182, 185, 213, and 217 m; Rock River, at 315, 323,

326, and 345 m; Blackstone River, at 103.8 m; Clearwater Creek, at 70.1, 73.2, 76.2, 77.7, 79.2, 85.3, 86.9, and 88.4 m; and Mount Sekwi, at 516.9 m.

Material

Specimens common to abundant, poorly to well-preserved in collections. Illustrated specimens are ROM 38819 and 38954 to 38956.

Discussion

M. spiralis is readily distinguishable from most other monograptids by its multispiralled rhabdosome, which may coil through four or more volutions, and by its possession of "isolate triangular and hooked thecae" (Bjerreskov, 1975: 72), the hooked portions of which occupy a large proportion of the stipe width distally and bear spinelike lateral projections throughout the rhabdosome. Uncompressed specimens from Cape Phillips Formation clearly show the torsion of the thecal apertures and the strong development of lateral, spinelike processes. Upon compression, one of the processes is typically hidden from view.

The rhabdosome of this species attains a distal width of at least 3.0 mm and thecae number 12 in 10 mm proximally and 8 to 9 in 10 mm distally.

Monograptus spiralis cf. *contortus* Perner, 1897

(not illustrated)

cf. *Monograptus plana* var. *contorta* Perner, 1897: 26.
cf. *Spirograptus spiralis contortus*, Příbyl, 1944: 193.
?*Monograptus spiralis* aff. *contortus*, Hutt, 1975: 107.

Occurrence

Sedgwicki and *turriculatus* zones, and lower *spiralis* Zone. Collected from Peel River, at 570.9 and 582.2 m; Rock River, at 306 and 309 m; and Blackstone River, at 77.2 m.

Material

Specimens fairly to moderately preserved, common in Peel River, 570.9 m collection, and rare to uncommon in each of the other collections.

Discussion

This subspecies possesses the spiral structure, the thecal outline, including spinelike

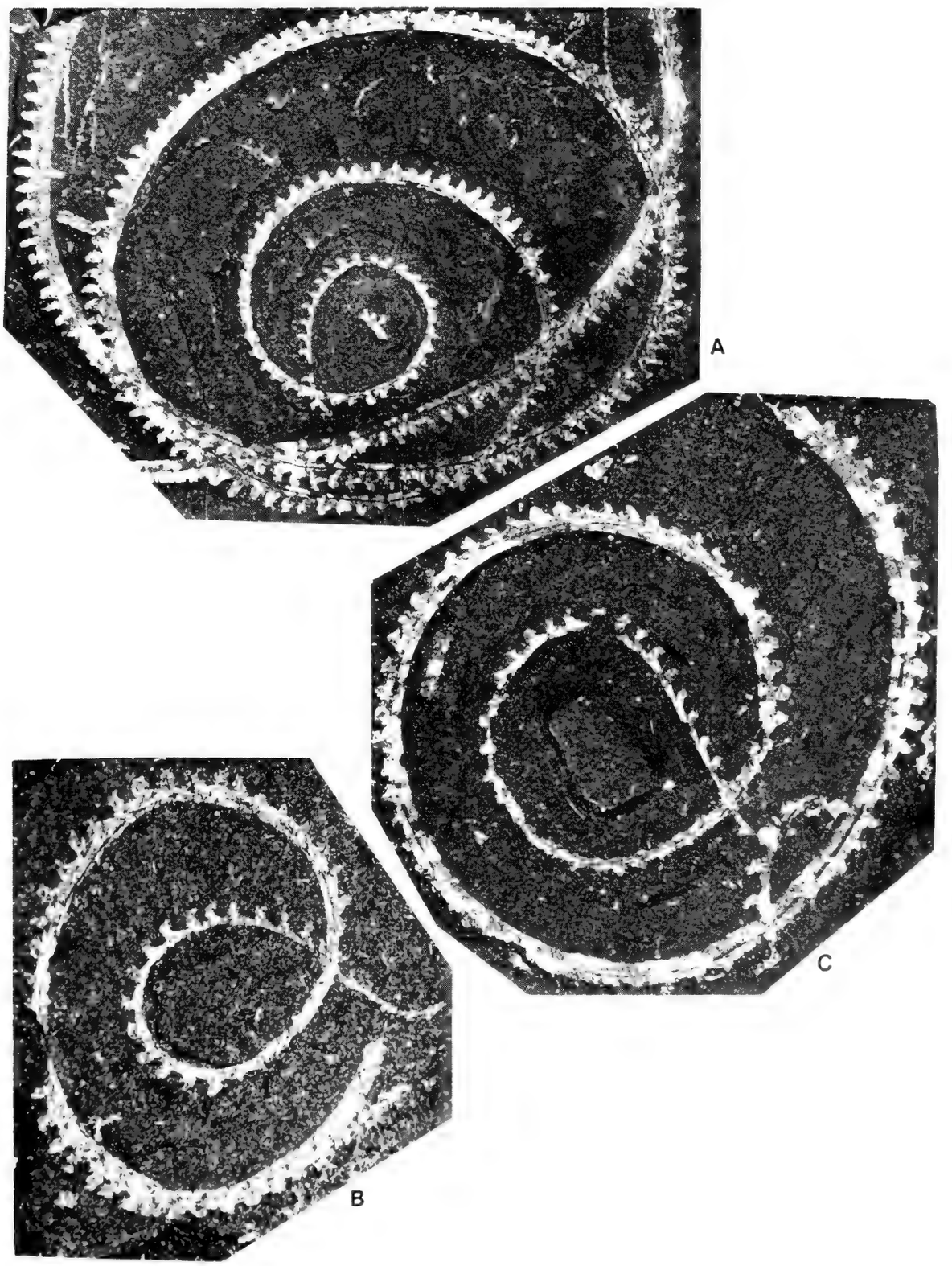

Fig. 31 A–C. *Monograptus tullbergi spiraloides* (Přibyl), Rock River, collection 5F, *spiralis* Zone, ROM 38953, 38821, and 38820; all × 2.9.

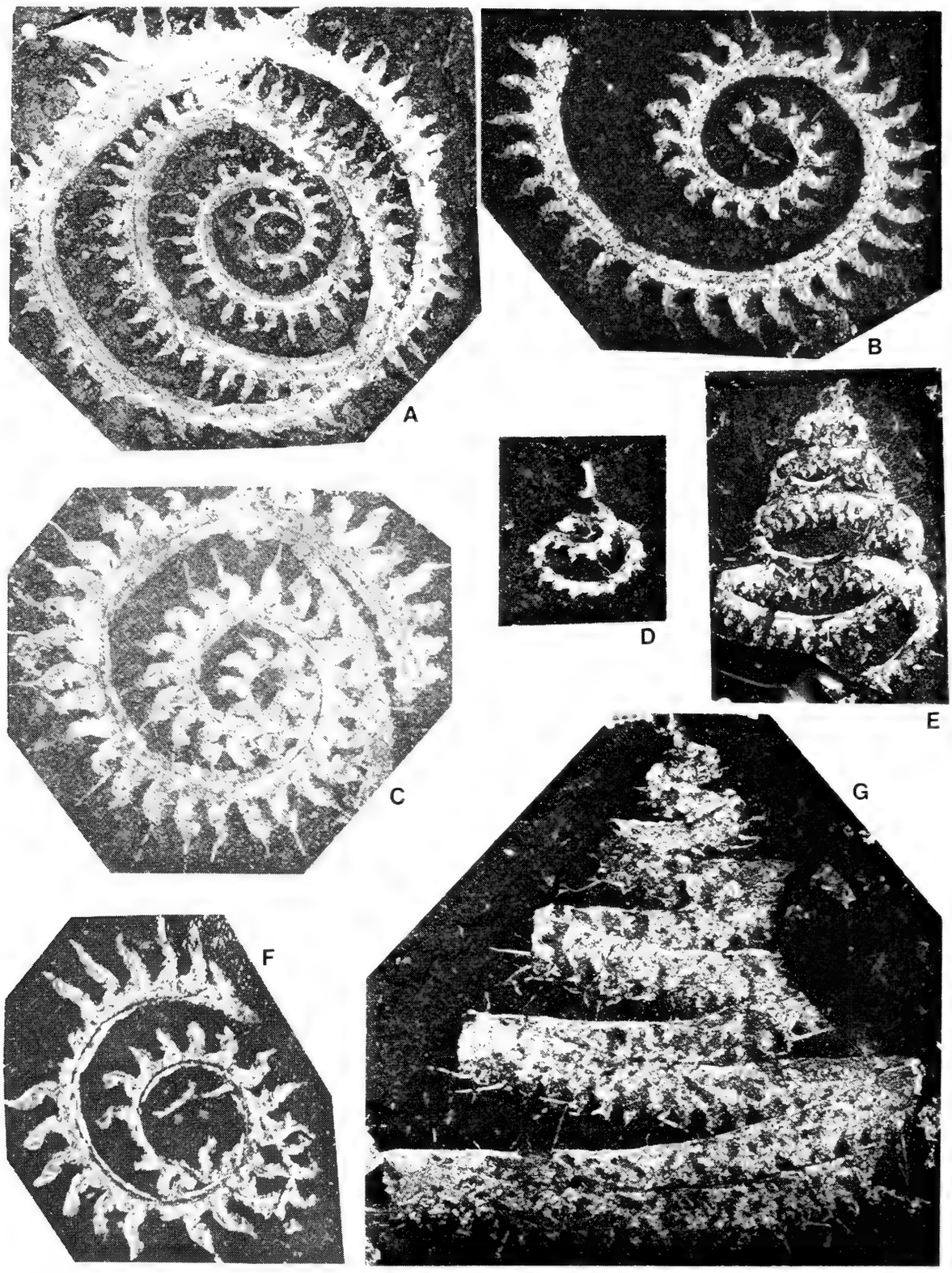

Fig. 32 A–C,F. *Monograptus spiralis* (Geinitz), *spiralis* Zone

A. Rock River, collection 6F, ROM 38954; × 2.2.

B. Mount Sekwi, collection at 516.9 m, ROM 38955; × 3.4.

C. Peel River, collection at 611.4 m, ROM 38819; × 3.4.

F. Rock River, collection 5F, ROM 38956; × 4.1.

D,E,G. *Monograptus turriculatus* (Barrande), *turriculatus* Zone

D. Peel River, collection at 518.8 m, ROM 38957; × 4.0.

E. Blackstone River, collection at 92.7 m, ROM 38958; × 2.9.

G. Rock River, collection at 287 m, ROM 38959; × 4.3.

lateral projections, and the thecal spacing of *M. spiralis spiralis*. It typically differs, however, in having a distal width of no more than 2.0 to 2.2 mm, inclusive of the spinelike projections, a sicular length of 1.4 to 1.5 mm and, most conspicuously, a more delicate proximal end which may be straight, more weakly dorsally curved than the rest of the rhabdosome, or even gently ventrally curved. Regardless of the direction of curvature of the proximal portion, it is, because of its relative straightness, typically overlapped by more distal portions of the first whorl.

The stipe width of the study specimens is about 1.5 mm, and therefore less than typical of *M. spiralis contortus*. In other respects it is very similar.

Monograptus cf. *tenuissmus* (Obut and Sobolevskaya, 1968)

Figs. 8O, Q; 27D

cf. *Globosograptus tenuissmus* Obut and Sobolevskaya, 1968: 101.

Occurrence

Sedgwicki Zone, Peel River, at 515.1 and 519.4 m; tentatively from the *triangulatus* and *magnus*? zones, Peel River, at 481.9 and 482.5 m.

Material

Specimens moderately well preserved, small, mostly with proximal ends. Collections comprise six specimens from Peel River, 519.4 m, 10 specimens from 515.1 m, a single specimen from each of the other two collections. Illustrated specimens are ROM 38799 to 38800 and 38940.

Description

The rhabdosome is moderately dorsally curved proximally and weakly so distally. Width ranges from 0.4 to 0.6 mm across theca 1 to a maximum of 0.7 to 0.8 mm distally. The sicula is narrow, very weakly ventrally curved, 1.0 mm long, and its apex is level with theca 1.

The thecae are scarcely in contact. The prothecae are inclined 30 to 40 degrees to the stipe axis. The metathecae are large, enrolled, lobate, and in all likelihood introverted; they comprise more than one-half the total thecal length. Thecae number 9 to 10 in 10 mm proximally and 8 to 10 in 10 mm distally.

Discussion

The specimens from Yukon resemble *M. tenuissmus* of Obut and Sobolevskaya (1968) closely in overall rhabdosomal shape, thecal profile, and thecal spacing. They differ in possessing a sicula which is 1.0 mm, rather than 0.5 mm, long.

The study material differs from *M. inconspicuous* Bouček (see Bouček and Příbyl, 1951) in possessing considerably more widely spaced thecae. It differs from *M. wimani* Bouček in possessing much more closely spaced thecae and more steeply inclined prothecae.

Monograptus triangulatus fimbriatus (Nicholson, 1868)

Figs. 9L, M, Q; 30B, G

Graptolites fimbriatus Nicholson, 1868: 536.
Monograptus separatus fimbriatus, Sudbury, 1958: 499.
Demirastrites pectinatus pectinatus, Obut and Sobolevskaya 1968: 108.
Monograptus triangulatus fimbriatus, Rickards, 1970: 82.
Monograptus triangulatus fimbriatus, Hutt, 1975: 110.

Occurrence

Triangulatus Zone and possibly *magnus*? Zone, Peel River, at 488 and 490.7 m, and tentatively 489.2 m.

Material

Rare in either collection, and only moderate preservation of short, proximal portions of the rhabdosome. Illustrated specimens are ROM 38814 to 38816 and 38951.

Discussion

This is the only subspecies of the triangulate monograptids with triangular thecae throughout the length of the rhabdosome. The rhabdosome is distinctly hook-shaped and the width increases rapidly from about 0.6 mm proximally to a maximum of 1.3 mm or more within the distance of the first 8 to 10 thecae. The thecae are spaced at the rate of 12 to 11 or 10 in 10 mm. The sicula is 0.9 to 1.0 mm long. This species may be conspecific with *M. pectinatus* Richter, which it closely resembles in the lack of nonrastritiform proximal thecae.

Monograptus cf. *triangulatus separatus* Sudbury, 1958

Figs. 9O; 30E

cf. *Monograptus separatus separatus* Sudbury, 1958: 496.

Occurrence

Triangulatus Zone, Peel River, at 480.4 m.

Material

A single, well-preserved, incomplete specimen lacking the sicular end. The illustrated specimen is ROM 38818.

Discussion

The single specimen of this species, although clearly a member of the triangulate monograptid group, differs from *M. triangulatus fimbriatus* in possessing four to five isolated, rastritiform proximal thecae; conversely, it differs from *M. t. triangulatus* in possessing fewer rastritiform proximal thecae and in that the distal thecae are more robust. The thecae number 12 in 10 mm proximally and 8 in 10 mm distally, a spacing less than that described by Hutt (1975), while the rhabdosome attains a maximum width of 1.6 mm.

Monograptus tullbergi spiraloides (Příbyl, 1944)

Figs. 10A, B; 31A–C

Spirograptus tullbergi spiraloides Příbyl, 1944: 203.
Spirograptus tullbergi spiraloides, Münch, 1952: 116.
Monograptus (Spirograptus) tullbergi spiraloides, Schauer, 1971: 76.

Occurrence

Turriculatus and *spiralis* zones. Collected from Peel River, at 553.8 m; Rock River collections 5F, 7F, 10F; and Delorme Range, at 777.2 m.

Material

Very abundant and well preserved in collections from Rock River, and rare and fragmental from the other localities. Illustrated specimens are ROM 38820 to 38821 and 38953.

Description

The rhabdosome is loosely coiled through two, or occasionally three, volutions. Typically, the thecae are on the convex side of the stipe, but, owing to periodic stipe torsion, thecae may occasionally lie on the concave side for a short distance. The proximal portion, encompassing the first 8 to 10 thecae, ranges from straight to gently ventrally or dorsally curved, so that the proximal region is overlapped by the first, or even second, volution. The sicula is 1.2 to 1.3 mm long and its apex is level with the tip of theca 1. Stipe width increases gradually from about 0.5 mm across theca 1, to a maximum of 1.5 to 2.0 mm distally.

The thecae are triangular in cross-section, and proximal thecae are exactly like those of *M. tullbergi* and *M. falx*. Distal thecae overlap by about one-third, but maintain the same profile as proximal thecae. The thecal apertures are clearly asymmetric and underwent torsion. Upon compression, the apertural profiles are beaklike when compressed, but are without any kind of spines or lateral processes. Thecae number 10 to 11 in 10 mm proximally and 8 to 9 in 10 mm distally.

Discussion

The large size of the rhabdosome and overlapping nature of the proximal portions of the rhabdosome of the Yukon specimens make them very like *M. spiralis contortus*. They differ, however, in the presence of *M. tullbergi*-type thecal profiles, and significantly in the total lack of apertural "spines" and a weak and gently widening portion to the rhabdosome. On the other hand, the study specimens differ from typical *M. tullbergi spiraloides* in their large size.

Monograptus turriculatus (Barrande, 1850)

Figs. 9N; 32D, E, G; 33A–C

Graptolithus turriculatus Barrande, 1850: 56.
Monograptus turriculatus, Elles and Wood, 1913: 438.
Monograptus turriculatus mut. *minor* Bouček, 1932: 155.
Monograptus (Spirogr.) turriculatus turriculatus, Schauer, 1971: 74.
Monograptus turriculatus minor, Schauer, 1971: 74.
Monograptus turriculatus, Bjerreskov, 1975: 70.
Monograptus turriculatus, Hutt, 1975: 111.

Occurrence

Turriculatus Zone. Collected from Peel River, at 516.9, 517.9, 518.8, 523, 526, 528.8, 531.9, 536.1, 544.4, 548.9, 559.3 m; Tetlit Creek, at 144 m; Rock River, at 282, 287, 293, and 302 m; Mount Sekwi, at 547.4 and 527.6 m; Blackstone River, at 80.2, 83.8, 85.3, 86.9, 88.7, 89, 91.4, 92.7, 94.8, and 99 m; Delorme Range, at 774.2 and 777.2 m; and Clearwater Creek, at 67.1, 68.6, and 70.1 m.

Material

This species, next to *M. priodon* and *M. spiralis*, is one of the most abundant and ubiquitous of all monograptids. Specimens moderately well to well preserved on black shale, common to abundant in most collections. Illustrated specimens are ROM 38817 and 38957 to 38962.

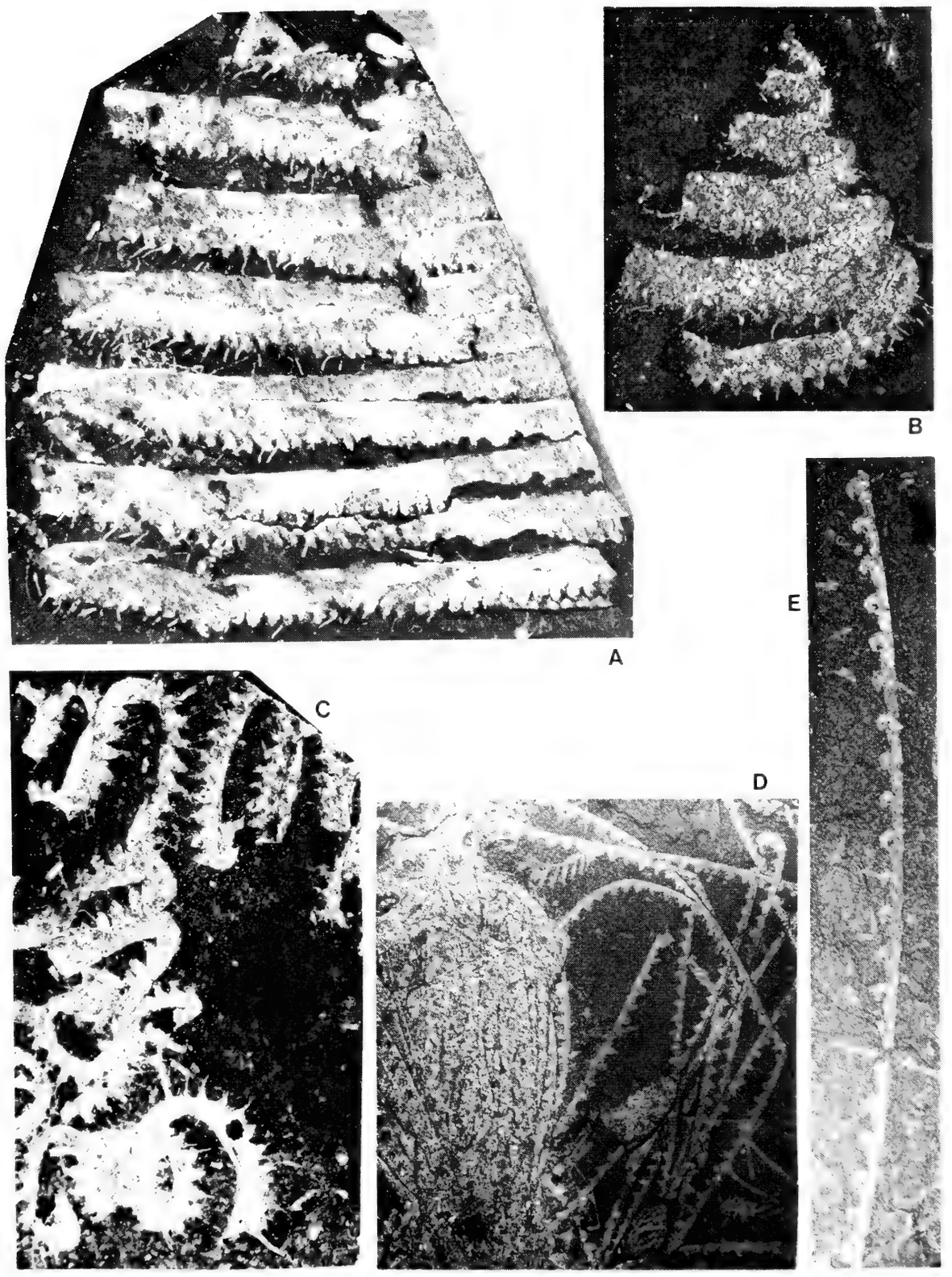

Fig. 33 A–C. *Monograptus turriculatus* (Barrande), Peel River, *turriculatus* Zone
A. Collection at 548.9 m, ROM 38960; × 2.2.
B. Collection at 559.3 m, ROM 38961; × 3.5.
C. Collection at 526 m, ROM 38962; × 3.8.
D,E. *Monograptus* cf. *undulatus* Elles and Wood, Blackstone River, collection at 72.2 m, *sedgwicki* Zone, ROM 38963 and 38964; × 1.7, × 3.6.

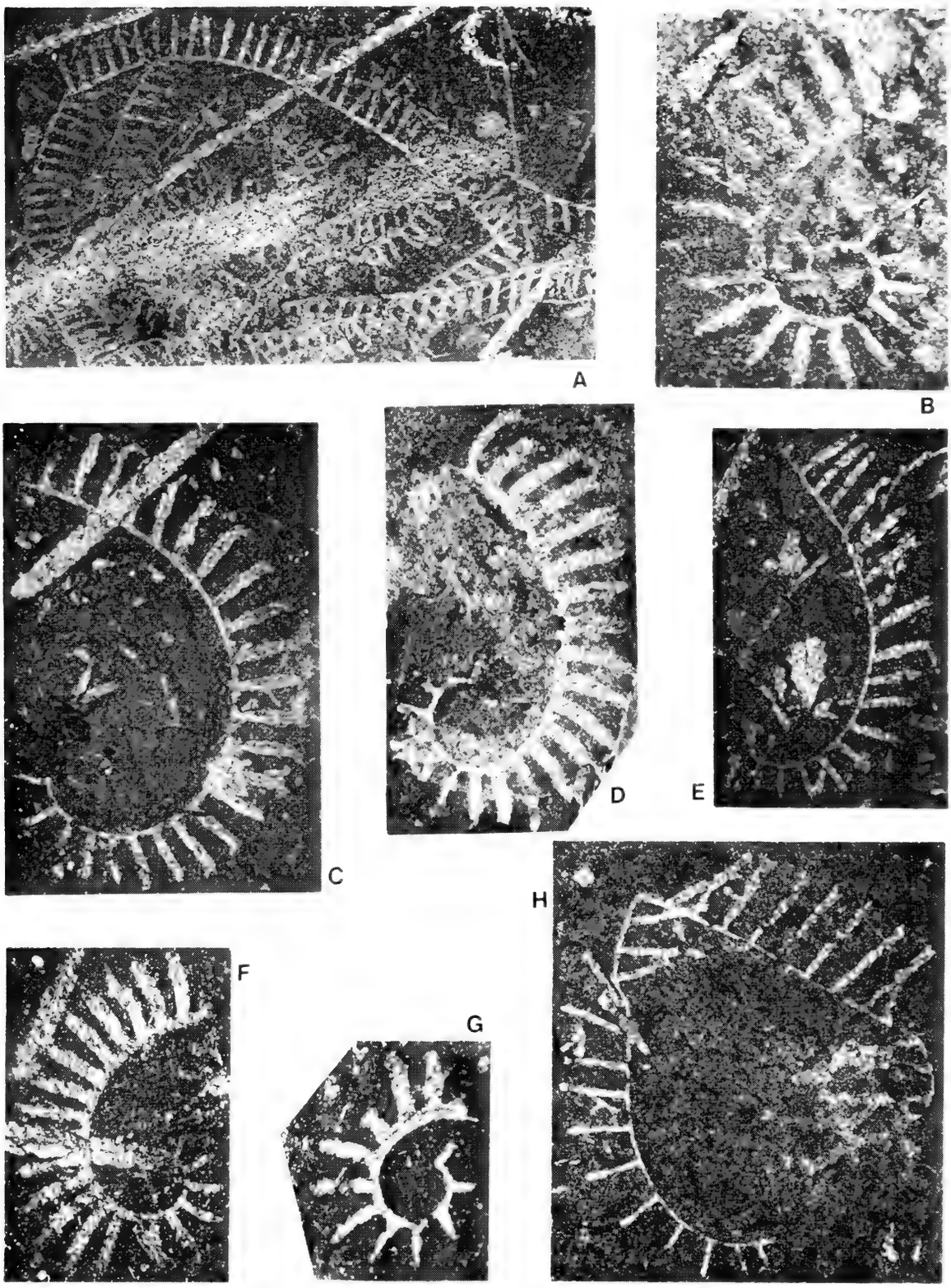

Fig. 34 A,B,D,F,G. *Rastrites approximatus* Perner

A. Blackstone River, collection at 65.5 m, *argenteus* Zone?, ROM 38965; × 1.8.

B,F,G. Peel River, collection at 480 m, *triangulatus* Zone, ROM 38824, 38966, and 38967; × 5.3, × 3.7, × 5.8.

D. Peel River, collection at 480.4 m, *triangulatus* Zone, ROM 38823; × 4.8.

C,E,H. *Rastrites approximatus geinitzi* Törnquist, *sedgwicki* Zone

C,E. Blackstone River, collection at 72.2 m, ROM 38968 and 38969; × 3.8, × 3.5.

H. Peel River, collection at 515.1 m, ROM 38970; × 3.6.

Description

The rhabdosome is small to large, coiled in a conical spiral through as many as seven whorls. The stipe widens slowly and continuously from about 0.5 to 0.6 mm proximally to nearly 3 mm in distal regions of large specimens. The sicula is 1.1 to 1.2 mm long.

The thecae are triangular in cross-section, with small apertural hooks, and possess rather long and sometimes bifurcating apertural spines. The thecae number as many as 14 to 16 in 10 mm proximally, and about 12 in 10 mm distally.

Discussion

The apertural and spine structures of this species are complex and are not fully understood. As noted by Hutt (1975) and Bjerreskov (1975) there may be no justification for the recognition of the subspecies, *minor*. The great range in variation in size of the Yukon material and the presence of both "subspecies" in the same collections adds support to the idea of a growth series. *M. turriculatus* is very commonly associated with *M. exiguus primulus*.

Monograptus cf. *undulatus* Elles and Wood, 1913

Fig. 33D, E

cf. *Monograptus undulatus* Elles and Wood, 1913: 432.

Occurrence

Sedgwicki Zone, Blackstone River, at 72.2 m.

Material

Abundant, tangled distal fragments, moderately preserved, on black shale bedding plane. Illustrated specimens are ROM 38963 to 38964.

Discussion

The presence of only distal fragments of the rhabdosome precludes positive identification. The stipe attains a maximum width of 1.0 mm and the thecae number seven or eight in 10 mm. The thecae are triangular in profile, occupy about one-half the stipe width and overlap only slightly; they are inclined about 20 degrees to the axis of the stipe and the metathecae form moderately tight hooks. The apertures appear to face in a slightly dorsoproximal direction, probably owing to a slight retroversion.

The thecae of the study specimens resemble those illustrated by Elles and Wood (1913: 432, fig. 295) much more closely than those of Hutt (1975: text fig. 19, fig. 6).

Genus *Rastrites* Barrande, 1850

Type Species

Rastrites peregrinus Barrande, 1850, from the Llandovery of Bohemia; subsequent designation Hopkinson, 1869.

Rastrites approximatus Perner, 1897

Figs. 10C, I, J; 34A, B, D, F, G

Rastrites peregrinus var. *approximatus* Perner, 1897: 15.
Rastrites approximatus approximatus, Přibyl, 1941: 7.
Monograptus (Rastrites) approximatus, Waterlot, 1945: 90.
Rastrites approximatus approximatus, Schauer, 1967: 177.

Occurrence

Triangulatus and *argenteus* zones. Collected from Peel River, at 480, 480.4, and tentatively 481.9 m; Blackstone River, at 65.5 m; and Tetlit Creek, at 138 m and tentatively 139 m. Additionally several specimens from the *sedgwicki* Zone of Blackstone River, at 72.2 m, and Peel River, at 515.1 m, are tentatively referred to this species.

Material

Specimens incomplete, poorly to moderately well preserved, comprising 12 specimens from Blackstone River, at 65.5 m, and only a few specimens from each of the other collections. Illustrated specimens are ROM 38822 to 38824 and 38965 to 38967.

Description

The rhabdosome is hook-shaped, with the proximal region being typically tightly coiled through nearly 360 degrees and the distal portions gently dorsally curved. The sicula is narrow and appears to be less than 1.0 mm long. The thecae are approximately at right angles to the stipe axis, 0.5 to 0.8 mm long across theca 1, and attain a maximum length of 2.2 to 2.6 mm distally. They are fairly stout, more or less parallel sided, 0.4 to 0.5 mm wide distally and tend to be pointed at their distal ends, and number 16 to 12 in 10 mm.

Discussion

The thecal spacing and the possession of stout thecae are typical of this species. The Yukon specimens occur in beds older than is typical of the European occurrences, where the species appears to be confined to the *convolutus* Zone (Přibyl, 1941; Schauer, 1967).

Rastrites approximatus geinitzi Törnquist, 1907

Fig. 34C, E, H

Rastrites approximatus var. *Geinitzi* Törnquist, 1907: 9.
?*Monograptus (Rastrites) approximatus* var. *Geinitzi*, Elles and Wood, 1914: 492.
Monograptus (Rastrites) approximatus var. *Geinitzi*, Waterlot, 1945: 89.
Rastrites approximatus geinitzi, Schauer, 1967: 177.

Occurrence

Convolutus and *sedgwicki* zones, Peel River, at 507.8 and 515.1 m; *sedgwicki* Zone, Blackstone River, at 72.2 m.

Material

Several incomplete, moderately well-preserved specimens from each collection. Illustrated specimens are ROM 38968 to 38970.

Description

The rhabdosome is broadly dorsally curved, more so proximally, through 90 degrees or more. The sicula is not seen. Thecal length ranges from about 0.9 to 1.0 mm across theca 1, to a maximum of 3.2 to 3.5 mm distally. The thecae are perpendicular to the axis of the stipe and very narrow and delicate in appearance; they widen towards their apertural ends, where the tip is two-pronged, and number 10 to 11 in 10 mm proximally and 9 to 12 in 10 mm distally.

Discussion

This subspecies differs from the typical form in possessing fewer thecae in 10 mm, longer and more delicate thecae with split apertural ends, and a much less strongly coiled rhabdosome. It differs from *R. longispinus* and *R. perfectus* in possessing anteriorly widening, distally notched thecae.

Rastrites distans Lapworth, 1876

not illustrated

Rastrites distans Lapworth, 1876: 313.
Rastrites distans abbreviatus Törnquist, 1907: 12 (pars.)
Monograptus (Rastrites) equidistans, Waterlot, 1945: 89.
Rastrites distans, Schauer, 1967: 183.

Occurrence

Sedgwicki Zone, Peel River, at 513.6 m.

Material

Three fragmentary, poorly preserved specimens lacking proximal ends.

Description

The rhabdosomal fragments are straight and very delicate, with thecae perpendicular to the stipe axis. The thecae are very thin, appear to be hooked at their extreme distal ends, are spaced at the rate of three to four in 10 mm, and are 3.0 to 3.7 mm long. The chief characteristic of the species is that the thecal length and spacing are nearly identical.

Rastrites cf. *distans* Lapworth, 1876

Figs. 10E; 35A

cf. *Rastrites distans* Lapworth, 1876: 313.

Occurrence

Sedgwicki Zone, Peel River, at 515.1 m.

Material

Several incomplete, moderately well-preserved specimens. Illustrated specimens are ROM 38828 and 38971.

Description

The rhabdosome is gently curved proximally, nearly straight distally. The sicula is 0.9

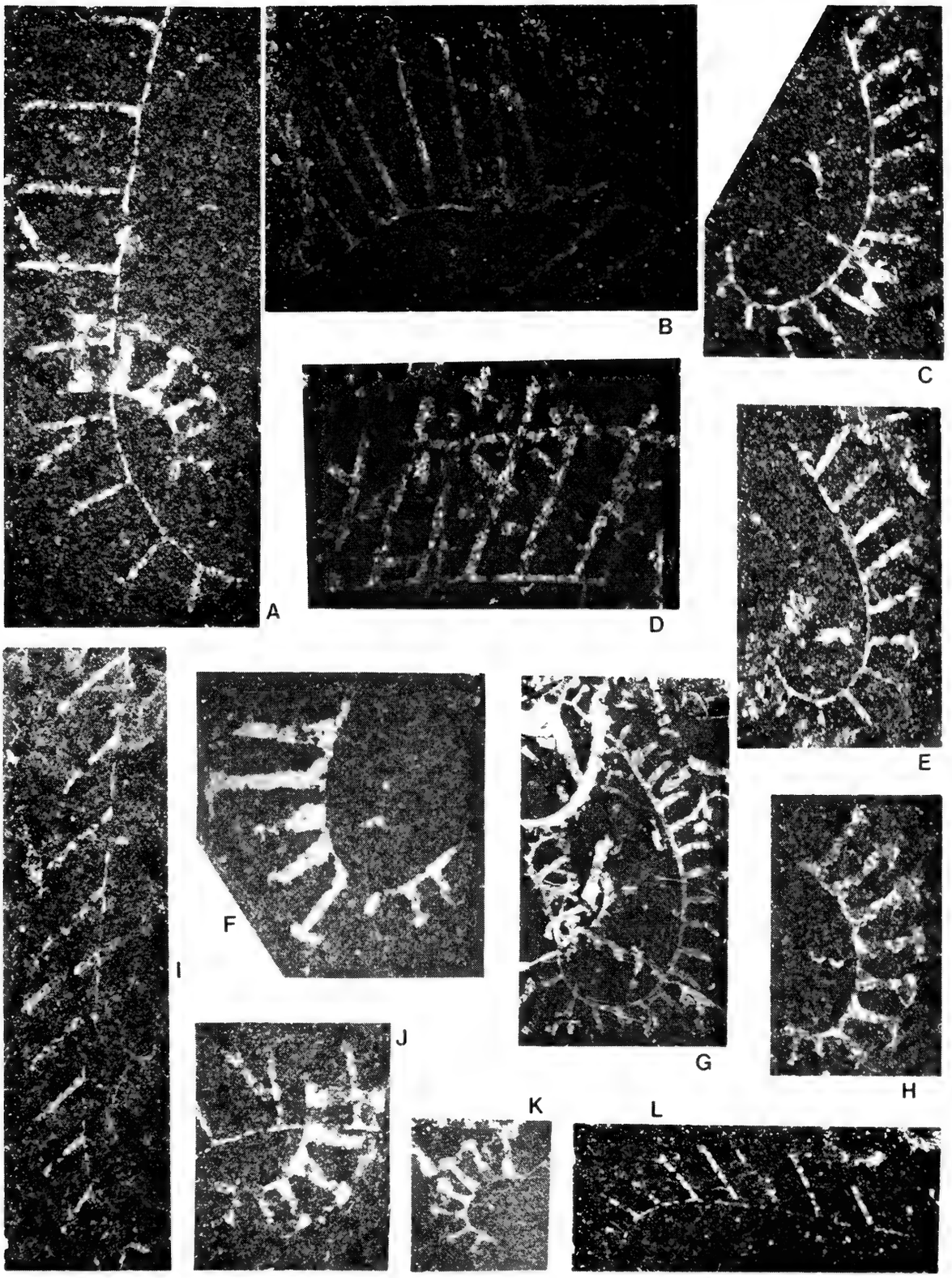

Fig. 35 A. *Rastrites* cf. *distans* Lapworth (and *R. rostratus* sp. nov.), Peel River, collection at 515.1 m, *sedgwicki* Zone, ROM 38971; × 5.1.

B,D. *Rastrites linnaei* Barrande

B. Peel River, collection at 528.8 m, *turriculatus* Zone, ROM 38972; × 3.2.

D. Blackstone River, collection at 74.7 m, *sedgwicki* Zone, ROM 38973; × 3.8.

C,E,G. *Rastrites* cf. *hybridus* Lapworth

C,E. Peel River, collection at 515.1 m, *sedgwicki* Zone, ROM 38974 and 38975; both × 4.7.

G. Blackstone River, collection at 66.4 m, *convolutus* Zone, ROM 38976; × 2.6.

F,H,J,K. *Rastrites rostratus* sp. nov., Peel River, *sedgwicki* Zone

F. Collection at 519.4 m, ROM 38977; × 7.0.

H,J,K. Collection at 515.1 m, ROM 38843, 38978, and 38842; × 6.0, × 5.1, × 4.2.

I,L. *Rastrites* cf. *linnaei* Barrande, Peel River

I. Collection at 513.6 m, *sedgwicki* Zone, ROM 38979; × 7.6.

L. Collection at 531.9 m, *turriculatus* Zone, ROM 38980; × 3.2.

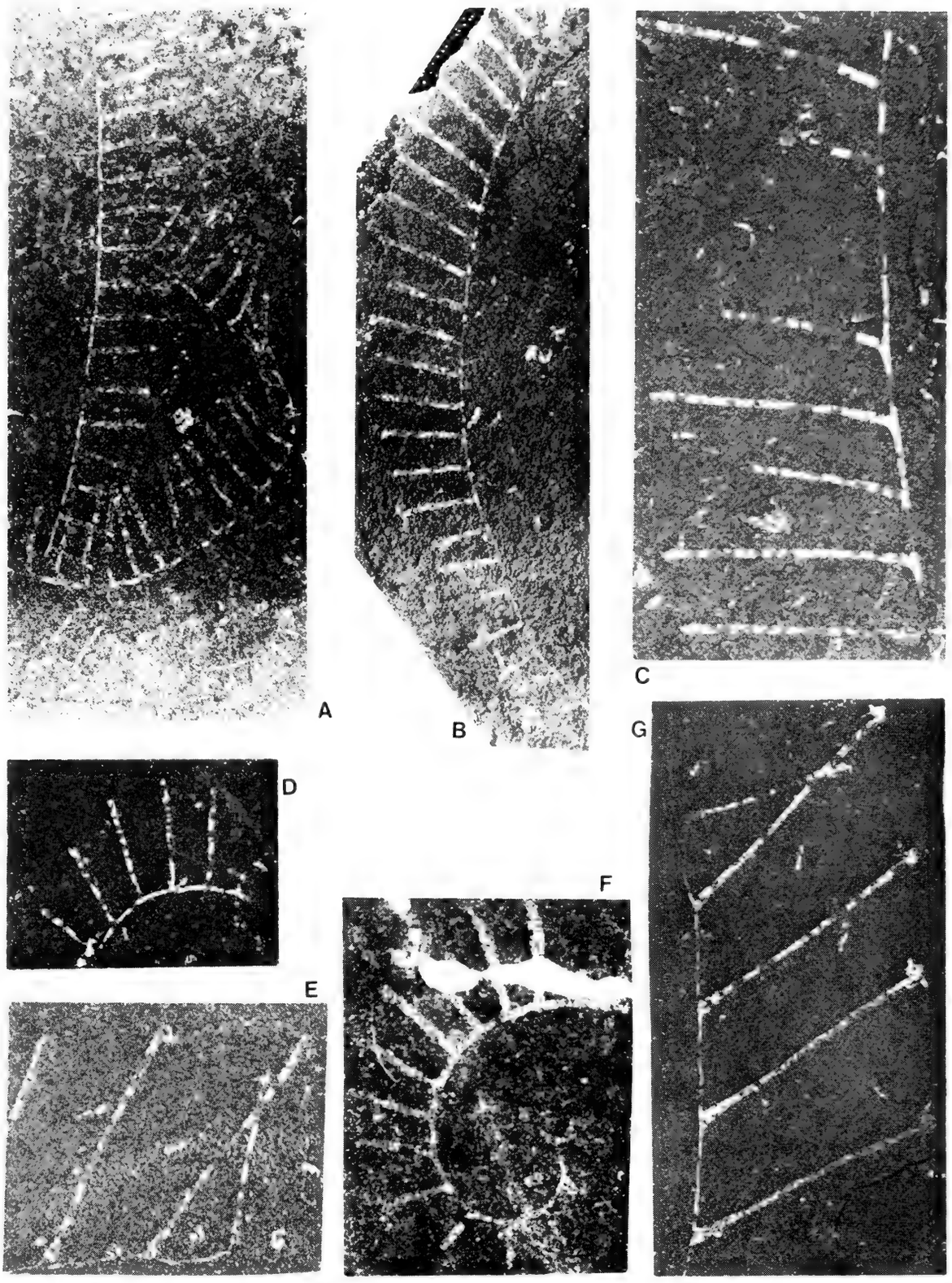

Fig. 36 A,B. *Rastrites* cf. *perfectus* Přibyl, Peel River, collection at 519.4 m, *sedgwicki* Zone, ROM 38837 and 38838; × 3.0, × 3.3.

C,E,G. *Rastrites maximus* Carruthers, Peel River

C. Collection at 513.6 m, *sedgwicki* Zone, ROM 38981; × 3.0.

E,G. Collection at 521.8 m, *turriculatus* Zone, ROM 38833 and 38832; × 4.2.

D,F. *Rastrites longispinus* Perner, Peel River

D. Collection at 507.8 m, *convolutus* Zone, ROM 38831; × 4.6.

F. Collection at 477 m, *triangulatus* Zone, ROM 38830; × 5.2.

to 1.0 mm long and very narrow. Theca 1 is 0.9 to 1.0 mm long and thecal length increases rapidly so that, by theca 5, the maximum length of 2.0 to 2.2 mm is attained. The thecae are inclined 60 degrees to 90 degrees to the stipe, are thin and delicate, weakly hooked at their distal ends; there are 8 to 9 in 10 mm proximally and 6.0 to 6.5 in 10 mm distally.

Discussion

This species differs from the typical *R. distans* in possessing more closely spaced thecae. In other aspects it is similar. From species such as *R. longispinus* and *R. perfectus* it differs in possessing shorter and considerably more widely spaced thecae.

Rastrites cf. *hybridus* Lapworth, 1876

Fig. 35C, E, G

cf. *Rastrites peregrinus* var. *hybridus* Lapworth, 1876: 313.

Occurrence

Convolutus and *sedgwicki* zones, Peel River, at 496.2, 513.6, and 515.1 m; Blackstone River, at 66.4 m.

Material

Specimens incomplete, poorly to moderately preserved, comprising more than 20 specimens from the 513.6 m collection on Peel River, and several from each of the other two collections. Illustrated specimens are ROM 38974 to 38976.

Description

The rhabdosome is fairly strongly dorsally curved proximally, and weakly curved distally. The width of the rhabdosome is 0.6 to 0.9 mm measured across theca 1, and increases to a maximum of 2.1 to 2.3 mm distally. The sicula appears to be about 1.0 mm long.

The thecae are more or less perpendicular to the axis of the stipe, especially distally, and are 0.25 to 0.3 mm wide at their widest portion and slightly narrower at their bases. Their distal ends are slightly hooked, or manifest a hook or pronglike development (the "two terminal threadlike processes" of Elles and Wood, 1913: 491). Thecae number 12 to 14 in 10 mm proximally and about 10 in 10 mm distally.

Discussion

The chief difference between the typical *R. hybridus* and the Canadian specimens is

in the slightly closer spacing of thecae. In all other parameters, including pronglike distal processes of the thecae, they are identical.

Rastrites linnaei Barrande, 1850

Fig. 35B, D

Rastrites linnaei Barrande, 1850: 65.
Rastrites linnaei, Törnquist, 1907: 14.
Monograptus (Rastrites) linnaei, Elles and Wood, 1914: 493.
Rastrites linnaei, Přibyl, 1941: 10.
Rastrites linnaei, Schauer, 1967: 180.

Occurrence

Sedgwicki and *turriculatus* zones, Peel River, at 513.6, 528.8, and 531.9 m; Blackstone River, at 74.7 m.

Material

About ten fragmentary, poorly preserved specimens without proximal ends from the four occurrences. Illustrated specimens are ROM 38972 to 38973.

Description

The proximal end of rhabdosome is unknown. Distally, the rhabdosome is approximately straight or weakly curved. Thecal inclination ranges from 70 to 90 degrees. Thecae are long, essentially parallel sided, and about 0.4 mm wide; they are slightly hooked at their distal ends and attain a maximum observed length of 6 to 7 mm. The thecae are spaced at the rate of three to seven in 10 mm, mostly four to six in 10 mm.

Rastrites longispinus Perner, 1897

Figs. 10F–H; 36D, F

Rastrites peregrinus var. *longispinus* Perner, 1897: 9.
Monograptus (Rastrites) longispinus, Elles and Wood, 1914: 489.
Rastrites longispinus, Přibyl, 1941: 6.
Rastrites longispinus, Schauer, 1967: 176.
Rastrites longispinus, Bjerreskov, 1975: 82.

Occurrence

Triangulatus and *convolutus* zones, and possibly the *argenteus* Zone, Peel River,at

477 and 507.8 m; and Tetlit Creek, at 139 m. A poorly preserved specimen is tentatively identifed from the *convolutus* Zone of Tetlit Creek, at 142 m.

Material

Specimens fairly to moderately well preserved, comprising five from Peel River at 477 m and three from 507.8 m, including proximal ends, and a single distal fragment from Tetlit Creek, at 139 m. Illustrated specimens are ROM 38829 to 38831.

Description

The rhabdosome is moderately strongly dorsally curved proximally and weakly so, or even straight, distally. Width is 0.8 mm measured at the first theca and increases fairly rapidly to a maximum of 3.4 to 3.6 mm distally (possibly as much as 4.0 mm). The sicula is unknown.

The thecae are perpendicular to the stipe axis, are relatively thin and delicate in appearance (0.2 to 0.25 mm wide), parallel-sided, and expand in width only very slightly at their apertural ends. The thecae number 13 in 10 mm proximally and 9 to 11 in 10 mm distally (in one instance there may be as few as 7 in 10 mm distally).

Discussion

The species bears a strong resemblance to the younger *R. perfectus*, from which it is distinguished by its more closely spaced thecae.

Rastrites maximus Carruthers, 1867

Figs. 11A, B; 36C, E, G

Rastrites maximus Carruthers, 1867: 541.
Rastrites maximus, Törnquist, 1907: 15.
Monograptus (Rastrites) maximus, Elles and Wood, 1913: 494.
Rastrites maximus, Schauer, 1967: 184.
Rastrites maximus, Bjerreskov, 1975: 84.

Occurrence

Sedgwicki and *turriculatus* zones, Peel River, at 513.6, 516.3, and 521.8 m; tentatively from Blackstone River, at 72.2 m.

Material

Several distal fragments in each collection, all fairly to moderately well preserved on black shale. Illustrated specimens are ROM 38832 to 38833 and 38981.

Description

The rhabdosome is incomplete. The virgular region is very thin and delicate. The bases of the thecae are triangular; the thecae then become thinner and essentially parallel sided and about 0.25 mm wide. The width increases towards the apertural region, resulting in a distinct clublike hook possessing an apparent apertural spine. The thecae range in length from 5.5 to 10 mm and are spaced at the rate of 2.5 to 3.5 in 10 mm.

Discussion

The specimens from the Yukon differ from the typical *R. maximus* in possessing shorter thecae; they are, however, all short fragments and therefore give no indication of the maximum thecal length. Thecal shape and spacing are typical of *R. maximus* (Bjerreskov, 1975: 84, fig. 24).

Rastrites orbitus Churkin and Carter, 1970

Figs. 11C,D; 37E,F; ?11E; ?37C

Rastrites orbitus Churkin and Carter, 1970: 45.

Occurrence

Magnus?, *argenteus*, and *convolutus* zones, Peel River, at 490.7, 491.4, 508.4, and 512.8 m; Blackstone River, at 69.2 and 70.4 m; and Tetlit Creek, at 142 m.

Material

Several, or more, incomplete, poorly to moderately well-preserved specimens from each collection, none with the sicular end. Illustrated specimens are ROM 38834 to 38835 and 38985 to 38986, and tentatively 38836.

Description

The rhabdosome is circular, or nearly so, in outline, with a more or less uniform curvature through an arc greater than 360 degrees. Proximal width appears to be about 0.6 mm measured through theca 1 and maximum distal width, inclusive of the virgula, is 1.8 mm, although the majority of specimens are in the range 1.3 to 1.4 mm.

The thecae are generally inclined about 70 degrees to the virgula. They are relatively broad (0.3 to 0.35 mm) and generally increase in width towards their apertural ends, which are sharply curved into a distinct hook. Thecae number 12 in 10 mm proximally and 8 to 10 in 10 mm distally.

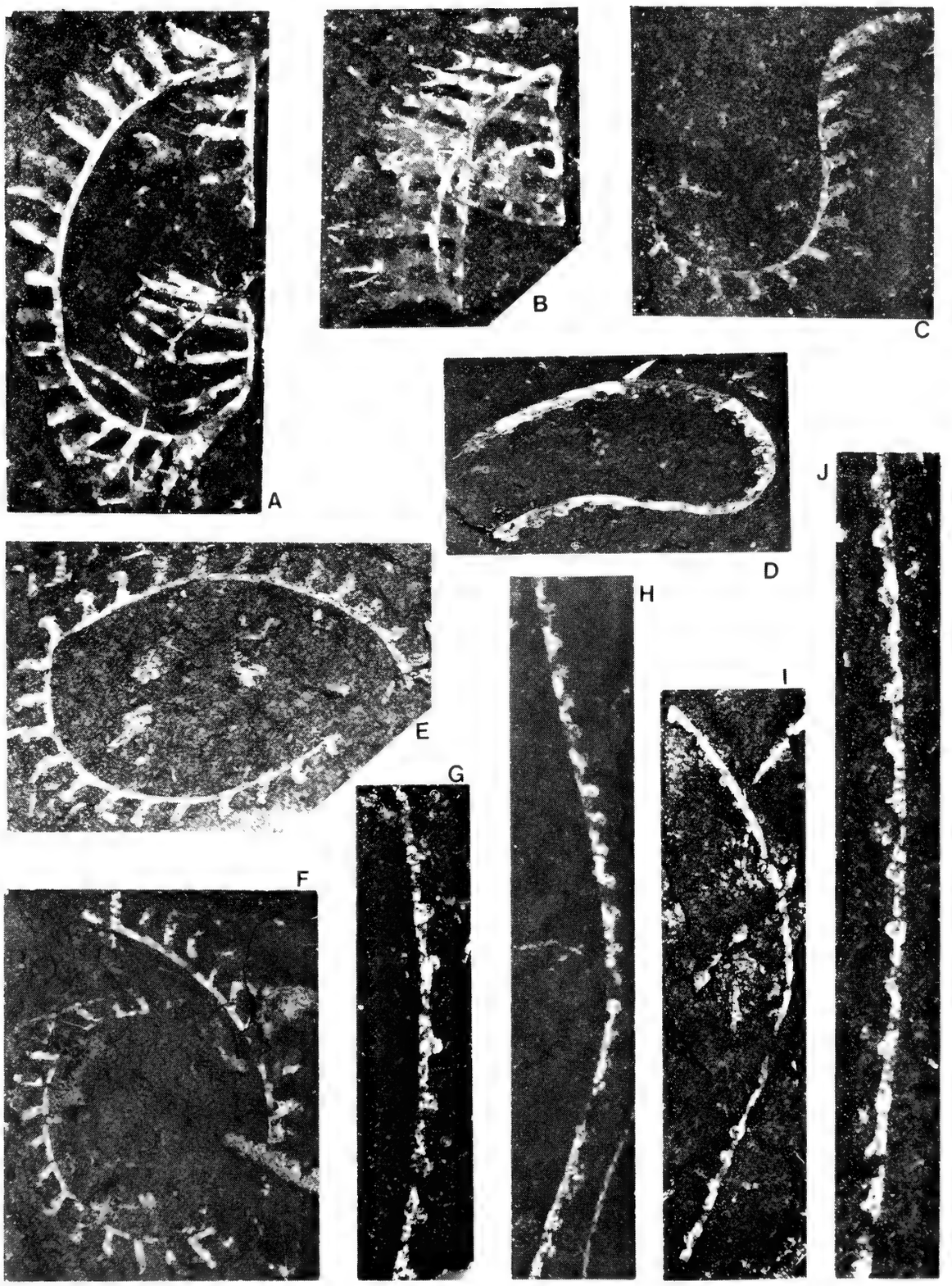

Fig. 37 A,B. *Rastrites phleoides* Törnquist, Peel River, collection at 507.8 m, *convolutus* Zone, ROM 38839 and 38840; both × 4.1.

C. *Rastrites* cf. *orbitus* Churkin and Carter, Peel River, collection at 508.4 m, *convolutus* Zone, ROM 38836; × 3.5.

D,G–J. ?*Diversograptus ramosus* Manck

D,I. Peel River, collection at 528.5 m, *turriculatus* Zone, ROM 38982 and 38983; × 3.8, × 2.1.

G,J. Rock River, collection 9F, *spiralis* Zone, ROM 38708 and 38984; × 4.8, × 4.0.

H Peel River, collection at 630.9 m, *spiralis* Zone, ROM 41647, × 3.6.

E,F. *Rastrites orbitus* Churkin and Carter, Peel River

E. Collection at 512.8 m, *convolutus* Zone, ROM 38985; × 3.8.

F. Collection at 490.7 m, *argenteus* Zone, ROM 38986; × 3.4.

Discussion

The nearly circular rhabdosome is distinctive of this species and this feature distinguishes it from species with similar thecae, such as *R. peregrinus* and *R. richteri*. In Alaska, this species is found only in the "*gregarius* Zone" of Churkin and Carter (1970), a zone that is equivalent to the *triangulatus, magnus?,* and *argenteus* zones of the present study.

Rastrites cf. *perfectus* Přibyl, 1942

Figs. 11F, H; 36A, B

cf. *Rastrites perfectus* Přibyl, 1942: 3.

Occurrence

Sedgwicki Zone, Peel River, at 515.1 and 519.4 m; and Blackstone River, at 77.2 m.

Material

About five poorly to moderately well-preserved specimens of mostly distal portions of the rhabdosome from each collection. Illustrated specimens are ROM 38837 to 38838.

Description

The rhabdosome appears to be large, probably in excess of 30 mm in length. The proximal end is apparently gently to moderately dorsally curved, while the distal region is straight. The sicula is 0.9 to 1.0 mm long. Stipe width ranges from 0.9 to 1.0 mm across theca 1 to 3.0 to 4.2 mm distally.

The thecae may or may not be perpendicular to the stipe axis, are delicate in appearance, 0.2 to 0.25 mm wide, and are spaced 9 to 11 in 10 mm proximally and 7 to 9 in 10 mm distally. The distal ends of the thecae are expanded and exhibit double-pronged processes.

Discussion

Thecal spacing and length of the study specimens are very similar to the typical *R. perfectus*. Since, however, most of the material is fragmental and mostly of distal parts of the rhabdosome, only a tentative identification is possible.

Rastrites phleoides Törnquist, 1887

Figs. 11G, J, M; 37A, B

Rastrites phleoides Törnquist, 1887: 490.
Rastrites phleoides, Törnquist, 1907: 11.
Rastrites phleoides, Příbyl, 1941: 16.
Demirastrites phleoides, Münch, 1952: 130.
Rastrites phleoides, Hutt, 1975: 115.

Occurrence

Argenteus? and *convolutus* zones, Peel River, at 491.4, 495.9, 508.4, and 512.8 m; and tentatively Tetlit Creek, at 142 m.

Material

Specimens rare to uncommon in any collection, poorly to moderately well preserved. Illustrated specimens are ROM 38839 to 38841.

Description

The rhabdosome is spiralled through at least two complete volutions in spite of the fact that the proximal end is not present in any specimen. The thecae are somewhat undulose in width; the proximalmost thecae seen are delicate and only about 0.2 to 0.25 mm wide, whereas the distal thecae are more robust and 0.3 to 0.35 mm wide. Thecal apertures are flared outward and split by a V-shaped notch and bear two thin, hairlike spines (''bristles'' of Törnquist, 1907: 11). The longest thecae observed measure 3.4 mm and thecal spacing is at the rate of 10 to 12 in 10 mm.

Discussion

The presence of well-developed, twin terminal spines on each theca is characteristic of this species, resembling only the proximal region of *M. convolutus*. *R. phleoides* is readily distinguished from *M. convolutus*, however, by the fact that spine-bearing thecae are present throughout the entire length of its rhabdosome.

Rastrites rostratus sp. nov.

Figs. 11I, K, L; 35F, H, J, K

Occurrence

From the *sedgwicki* Zone of Peel River, 515.1 and 519.4 m.

Material

Ten moderately well-preserved specimens from 515.1 m and two from 519.4 m, all apparently juvenile stages. Described specimens consist of ROM 38843 (holotype) and 38842, 38844, 38977, and 38978 (paratypes).

Etymology

From *rostratus*, Latin for beaked.

Diagnosis

Rhabdosome hook shaped, thecae broad at the bases and nearly in contact, narrowing toward distal end and abruptly expanding into prominent clublike hooks bearing a single beaklike process. Thecae 14 to 16 in 10 mm.

Description

The rhabdosome is hook shaped, moderately strongly curved proximally, much less so distally. All rhabdosomes are small and probably immature. The proximal two or three thecae are rastritiform and more or less parallel-sided. The remaining thecae are broad-based and nearly in contact, narrow in their mid regions and then are abruptly hooked over into very broad clublike structures which project in both a proximal and distal direction. On the proximal side of the apertural region of the thecae, the thecal apertures are protracted into a beaklike process. The net effect of the development of the clublike apertural region is a profile resembling a bird's head. Thecal length increases rapidly; theca 1 is 0.5 to 0.7 mm, theca 3 about 0.9 mm, theca 4 is 1.4 mm and theca 8 is 1.8 mm, the latter being the maximum observed length.

Discussion

This species of *Rastrites* resembles no other known species in the nature of its thecal apertural processes. The bird-head structures of the apertural regions are probably asymetrically developed laterally expanded hoods, which when crushed, take on the present profile.

Genus *Diversograptus* Manck, 1923

Type Species

Diversograptus ramosus Manck, 1923, from the Silurian of Germany; original designation.

?*Diversograptus ramosus* Manck, 1923

Figs. 3S–U; 37D, G–J

?*Diversograptus ramosus* Manck, 1923: 283.

Occurrence

Turriculatus and the *spiralis* zones of Peel River, at 528.5, 531.9, 615.7, and 630.9 m; Blackstone River, at 74.7 m; and Rock River, collections 9F, 10F. Tentatively identified from Peel River, at 602.6 m, and Blackstone River, at 74.7 and 86.9 m.

Material

Specimens incomplete, fairly to moderately preserved, common in Peel River collection at 615.7 m, rare in other collections; only a very few show the bipolar structure. Illustrated specimens are ROM 38708 to 38709 and 38982 to 38984.

Description

The rhabdosome is long and flexuous and width increases gradually from 0.45 to 0.5 mm proximally to 0.6 to 0.7 mm distally. The sicula is not visible; instead some specimens show an apparent overlapping of opposite facing proximal thecae.

The prothecae are straight and inclined at an angle of about 10 degrees, whereas the metathecae, which comprise about one-third the thecal length, are abruptly hooked into fairly strong lobes which occupy about one-half to two-thirds the stipe width. Thecae number 8 to 10 in 10 mm proximally and 8 to 9 in 10 mm distally.

Discussion

The study specimens are similar to the typical *D. ramosus* in the shape and spacing of the thecae, but the critical thecal bulge (Rickards, 1973) was not recognized. The Yukon specimens can, therefore, only be tentatively identified as the genus *Diversograptus*.

Genus *Barrandeograptus* Bouček, 1933

Type Species

Cyrtograptus pulchellus (Tullberg, 1883), from the Silurian of Sweden; subsequent designation Bouček, 1933.

Barrandeograptus aff. *pulchellus* (Tullberg, 1883)

Figs. 3R; 17E–G

aff. *Cyrtograptus pulchellus* Tullberg, 1883: 36.

Occurrence

Sedgwicki Zone, Blackstone River, at 72.2 m.

Material

Three incomplete, moderately well-preserved fragments on black shale. Illustrated specimens are ROM 38707 and 38887 to 38889.

Description

The proximal end of the rhabdosome is not seen, although one fragment is 35 mm long. The stipes are gently curved and two orders of cladia are present. Stipe width is 0.9 mm and uniform throughout.

The thecae are triangular, inclined about 20 degrees and appear to overlap about one-fifth their length and number 8 or 9 in 10 mm. The triangular portion of the thecae comprises about nine-tenths their length, but clearly there is an abrupt torsion of the metathecal portions of the thecae which conceals the apertures; the result is a superficially simple, tubelike theca.

Cladia arise from apertural regions of the earlier formed branch, apparently identical in nature to those of typical *Cyrograptus* (see Thorsteinsson, 1955; Lenz, 1974).

Discussion

Tullberg (1883) and Bouček (1933) stated that the thecae of *B. pulchellus* are simple tubes (see also Bulman, 1970: V135). Bjerreskov (1975) showed that the simplicity is illusory and that the metathecae undergo torsion.

The study specimens are similar in some of their characteristics to those of *B. pulchellus* but apparently differ in possessing two orders of cladia. The lack of a preserved proximal region allows only tentative identification. Additionally, the Yukon specimens occur in much older beds than is typical of the species elsewhere (*lapworthi* Zone of Bjerreskov, 1975).

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Appendix Index of Localities and Faunal Lists of Graptolites in Collections

The following generic abbreviations are used throughout the appendix: *A.—Atavograptus, Ak.—Akidograptus, B.—Barrandeograptus, C.—Climacograptus, Ceph.—Cephalograptus, Cr.—Coronograptus, Cy.—Cystograptus, Ct.—Cyrtograptus, D.—Diplograptus, Dm.—Dimorphograptus, Div.—Diversograptus, G.—Glyptograptus, H.—Holoretiolites, L.—Lagarograptus, M.—Monograptus, Mon.—Monoclimacis, O.—Orthograptus, Pc.—Pseudoclimacograptus, Pb.—Pribylograptus, P.—Petalograptus, Pr.—Pristiograptus, Pl.—Plectograptus, Ps.—Pseudoplegmatograptus, Pt.—Pseudoretiolites, R.-Rastrites, Ret.—Retiolites, Rh.—Rhaphidograptus, St.—Stomatograptus*

LOCALITY 1 Rock River, main branch; approximately 66°55′N, 136°14′W. Note: Section not measured, but graptolites collected in stratigraphic succession from oldest to youngest.
Collection 1F, *spiralis* Zone: *M. spiralis, M. priodon, M.* cf. *geinitzi, M. parapriodon, Ret. geinitzianus angustidens, St.* sp.
Collection 2F, *sakmaricus-laqueus* Zone: *Mon.* cf. *crenulatus, M.* sp., *Ct.* aff. *bohemicus, Ret. geintzianus* cf. *angustidens*
Collection 3F, *sakmaricus-laqueus* Zone: *M. parapriodon, M. minimus, Ct. sakmaricus, C.* aff. *bohemicus, Ret. geinitzianus angustidens*
Collection 4F, *sakmaricus-laqueus* Zone: *M. priodon, M. minimus, Ct.* aff. *bohemicus*

LOCALITY 2A Rock River, south branch; 66°48′, 136°16′W. Note: collected in 1962, not measured, but graptolites collected in stratigraphic succession from oldest to youngest.
Collection 1F, *atavus* Zone?: *C. innotatus obesus, C. rectangularis, C. normalis, D.* cf. *modestus, D.* cf. *elongatus, G. enodis* cf. *linearis, O. acuminatus, Cy. vesiculosus, A. strachani.*
Collection 2F, *acinaces* Zone: *C. innotatus obesus, C. normalis, Cy.* cf. *vesiculosus penna, G.* ex. gr. *tamariscus, Cy.* sp., monograptid indet.
Collection 3F, *turriculatus* Zone: *M. exiguus, M. turriculatus, M. proteus, M. marri, Mon. vomerina* cf. *crenulata, Ret. geinitzianus angustidens, ?Div.* sp.
Collection 4F, *spiralis* Zone: *M. marri, M. proteus, M.* cf. *griestoniensis, St. grandis grandis, ?Div.* sp.
Collection 5F, *spiralis* Zone: *M. spiralis, M. marri, M. tullbergi spiraloides, M.* cf. *priodon, Mon.* cf. *vomerina crenulata, Ret. geinitzianus angustidens, St. grandis grandis, St.* cf. *longus, ?Div.* sp., *Ps.* sp.
Collection 6F, *spiralis* Zone: *M. priodon, M. spiralis, St. grandis imperfectus, Ct.* sp.
Collection 7F, *spiralis* Zone: *M. spiralis, M. priodon, M.* cf. *marri, M. tullbergi spiraloides, M.* cf. *praecedens, ?Pl.* sp., *?Div.* sp.
Collection 8F, *spiralis* Zone: *M. spiralis, M.* cf. *priodon, Mon.* cf. *griestoniensis, St. grandis grandis, ?Ps.* sp.
Collection 9F, *spiralis* Zone: *M. spiralis, M. priodon, Mon. vomerina* cf. *crenulata, Ret.* sp., *?Div. ramosus*
Collection 10F,*spiralis* Zone: *M. spiralis, M.* cf. *priodon, M. tullbergi spiraloides, Mon.* ex. gr. *vomerina, Ret. geinitzianus angustidens, St.* sp., *?Div.* cf. *ramosus*
Collection 11F, *sakmaricus-laqueus* Zone: *M.* cf. *priodon, Mon.* ex. gr. *vomerina, Ret. geinitzianus geinitzianus, Ret.* g. *anugstidens, St. grandis grandis, Ct.* cf. *sakmaricus*

LOCALITY 2B Rock River, same as 2A, measured in 1978.
Collection at 241 m, *acinaces* Zone: *Cy. vesiculosus, C.* cf. *innotatus, C.* cf. *rectangularis, D. elongatus, A. strachani*
Collection at 243 m, *acinaces* Zone: *D. elongatus?, C.* sp., *C. innotatus, G.* cf. *tamariscus linearis, Cy. vesiculosus, Dm. confertus swanstoni, L.* cf. *acinaces*
Collection at 244 m, *gregarius* Zone: *Dm. physophora alaskensis, G. tamariscus linearis, C. normalis, C. innotatus obesus, Dm.* cf. *physophora, G.* cf. *lanpheri, Cy. vesiculosus, Cr. gregarius arcuatus, L.* cf. *acinaces*
Collection at 245 m, *gregarius* Zone: *L.* cf. *acinaces, G.* sp., *G. tamariscus* cf. *magnus, C. rectangularis, C. innotatus obesus, Cy. vesiculosus*
Collection at 247 m, *gregarius* Zone: *G. tamariscus* (s.l.), *C.* cf. *rectangularis, Cy. vesiculosus*
Collection at 249 m, *gregarius* Zone: *G. tamariscus magnus, G.* sp., *C. medius, Cy. vesiculosus, ?Dm.* ex

gr. *physophora, Dm. confertus swanstoni, A.* cf. *gracilis, A.* cf. *atavus, L.* cf. *acinaces*
Collection at 254 m, *gregarius* Zone: *Cr. gregarius L.* cf. *acinaces, C.* ex gr. *tamariscus, C.* cf. *miserabilis, C.* cf. *rectangularis, Cy. vesiculosus, Cy.* sp., *Dm. physophora*?
Collection at 255 m, *gregarius* Zone: *Cr. hipposideros, Cr.* cf. *cyphus, G. incertus,* ?*C.* cf. *miserabilis*
Collection at 282 m, *turriculatus* Zone: *M. turriculatus, M.* cf. *conspectus, M.* sp. indet., *Pr.* cf. *nudus, P.* sp.
Collection at 287 m, *turriculatus* Zone: *M. proteus, M. turriculatus, M. rickardsi minor, M. exiguus primulus, M. runcinatus richardsonensis* subsp. nov., *Pr.* cf. *nudus, P. elongatus,* ?*Ps.* sp.
Collection at 293 m, *turriculatus* Zone: *M. proteus, M. marri, M. exiguus primulus, M. turriculatus, M.* cf. *rickardsi minor, Ps.* sp.
Collection at 302 m, *turriculatus* Zone: *M. proteus, M. marri, M. exiguus primulus, M. turriculatus, M. spiralis*?, *Pr.* sp., *Ps. obesus obesus*
Collection at 306 m, *spiralis* Zone: *M.* cf. *marri, M. spiralis* cf. *contortus, M.* cf. *sartorius*
Collection at 309 m, *spiralis* Zone: *M. spiralis* cf. *contortus, M.* cf. *sartorius, M.* cf. *marri, Mon.* sp., *Ret. geinitzianus*
Collection at 315 m, *spiralis* Zone: *M. spiralis, M.* cf. *marri, Mon.* sp., *Ret. geinitzianus*
Collection at 323 m, *spiralis* Zone: *M. spiralis, M. marri, M. exiguus primulus, M.* cf. *proteus, Mon.* sp., *Ret. geinitzianus angustidens*
Collection at 326 m, *spiralis* Zone: *M. marri, M. spiralis, M.* cf. *sartorius, M.* cf. *proteus, Mon.* sp., *Pr.* sp., *St. grandis grandis, Ps. obscurus*
Collection at 345 m, *spiralis* Zone: *M. spiralis, M.* cf. *speciosus, Mon.* sp., *Ret. geinitzianus geinitzianus, Ret.* sp.

LOCALITY 3 Tetlit Creek, tributary of Road River, and type section of Road River Formation: 66°44′N, 135°47′W.
Collection at 133 m, *acinaces* Zone: *C. innotatus* cf. *obesus, C. rectangularis, D.* sp., *Pc.* sp., *Cy. vesiculosus, A. strachani*
Collection at 136 m, *gregarius* Zone: *Cr. gregarius arcuatus, C. medius, C. innotatus, C.* cf. *rectangularis, D.* sp., *G.* ex gr. *tamariscus, Dm.* cf. *physophora, Dm.* sp., *Cy.* cf. *vesiculosus*
Collection at 138 m, *triangulatus* or *magnus*? Zone: *C.* cf. *rectangularis, G.* sp., *M.* cf. *sudburiae, R. approximatus, R.* cf. *richteri*
Collection at 139 m, *argenteus* Zone: *M. millepeda, M.* cf. *sudburiae, C.* cf. *medius, O.* cf. *cyperoides, R.* cf. *approximatus, R. longispinus, R.* sp.
Collection at 142 m, *convolutus* Zone: *R.* cf. *longispinus, R. orbitus,* ?*R. phleoides, M.* cf. *cygneus, M.* cf. *communis, Pr.* cf. *variabilis, O. obuti, Ret.* sp.
Collection at 144 m, *turriculatus* Zone: *M. cf. decipiens, M. turriculatus, M.* cf. *intermedius, Pr. regularis, P.* cf. *hispanicus, R.* cf. *hybridus gracilis*
Collection at 148 m, *turriculatus* Zone: *Pr.* sp., *M. exiguus primulus, M.* cf. *priodon, M.* cf. *spiralis, M.* cf. *planus, Ret.* sp., ?*Div.* sp.
Collection at 168 m, *spiralis* Zone: *M. spiralis, M.* cf. *decipiens, Mon.* sp.
Collection at 182 m, *spiralis* Zone: *Ret. geinitzianus angustidens, M. spiralis, M.* cf. *priodon, Ps. obscurus,* monograptid indet.
Collection at 185 m, *spiralis* Zone: *St. grandis grandis, Ret. geinitzianus angustidens, M.* cf. *priodon, M. spiralis, Mon.* ex gr. *vomerina*
Collection at 187 m, *spiralis* Zone: *Mon.* sp., *M. spiralis, M.* cf. *priodon, St. grandis grandis*
Collection at 192 m, *spiralis* Zone: *Ret. geinitzianus angustidens*
Collection at 213 m, *sakmaricus-laqueus* Zone: *Ct.* cf. *lapworthi, M. spiralis, M.* cf. *parapriodon, Mon.* cf. *vomerina, Ret. geinitzianus angustidens*
Collection at 215 m, *sakmaricus-laqueus* Zone: *Ct. sakmaricus, Ret. geinitzianus angustidens, Ct.* cf. *lapworthi, M. speciosus, Mon.* sp., *St. grandis imperfectus*
Collection at 216 m, *sakmaricus-laqueus Zone: Ct.* aff. *lapworthi, Mon.* cf. *linnarssoni, Mon.* cf. *vomerina, M. parapriodon, M.* cf. *speciosus, Ret.* sp.
Collection at 217 m, *sakmaricus-laqueus* Zone: *Ct.* cf. *lapworthi, Ct. sakmaricus, Ret. geinitzianus angustidens, M. spiralis, M.* sp., *M. speciosus, St.* sp., *Mon.* sp.
Collection at 219 m, *sakmaricus-laqueus* Zone: *Ct. sakmaricus, Ct.* cf. *lapworthi, Ret. geinitzianus angustidens, Ret.* g. *geinitzianus, St. grandis imperfectus.*
Collection at 220 m, *sakmaricus-laqueus* Zone: *Ct.* aff. *sakmaricus* (sp. nov.?), *M.* cf. *speciosus, M. priodon, M.* sp., *Ret. geinitzianus angustidens*

Collection at 223 m, *sakmaricus-laqueus* Zone: *Ct.* cf. *laqueus, M. priodon, Mon.* sp.
Collection at 225 m, *sakmaricus-laqueus* Zone: *Mon.* sp., *Ct. sakmaricus, Ct.* cf. *laqueus*
Collection at 228 m, *sakmaricus-laqueus* Zone: *Ct.* cf. *laqueus*

LOCALITY 4 Road River, east-central Richardson Mountains; approximately 66°38′N, 135°40′W. Two collections separated by 59.4 m (195 ft) strata.
Collection 1F, *acinaces* Zone: *Cy. vesiculosus, C.* cf. *innotatus, C.* cf. *rectangularis, Dm.* sp., *A. strachani*
Collection 2F, *spiralis* Zone: *Ret. geinitzianus angustidens, M.* cf. *spiralis, St.* sp.

LOCALITY 5 Unnamed creek, west side of Richardson Mountains; approximately 66°32′N, 136°13′W. A single "spot" collection.
gregarius Zone: *C. normalis, ?Cy. vesiculosus, Dm. physophora alaskensis,* monograptid indet.

LOCALITY 6 Peel River, upper canyon, southwestern side of Richardson Mountains; 65°53′N, 135°43′W. Note: Because of the importance of this section, it was measured twice, once in 1976 and again in 1977. Because of the problems of precise duplications of measurements and collections, and the somewhat differing faunas of the two collections, the collections of 1976 and 1977 are listed separately, as 6A and 6B. Because the section was originally measured in feet, both metres and feet are given.

LOCALITY 6A (1976 Collections)
Collection at 451.7 m (1482 ft): Ashgillian graptolites
Collection at 452.6 m (1485 ft), *acuminatus* Zone: *C. normalis, C.* cf. *rectangularis, O. acuminatus, ?Rh.* sp., *D.* aff. *elongatus, G.* cf. *gnomus*
Collection at 453.8 m (1489 ft), *acuminatus* Zone: *C. normalis, C.* aff. *pacificus pilosus, C.* ex gr. *innotatus, G.* cf. *lanpheri, G.* cf. *gnomus, O. acuminatus*
Collection at 454.8 m (1492 ft), *acuminatus* Zone: *C. normalis, D. modestus diminutus, G.* cf. *lanpheri, G.* sp., *O. acuminatus*
Collection at 455.4 m (1494 ft), *acuminatus* Zone: *C. normalis, C.* cf. *rectangularis, G.* cf. *lanpheri, O. acuminatus*
Collection at 456 m (1496 ft), *atavus* Zone: *C. normalis, C. innotatus, C. rectangularis, ?Cy. vesiculosus, D.* cf. sp. A Churkin and Carter, *G.* ex gr. *tamariscus*
Collection at 457.5 m (1501 ft), *atavus* Zone: *C. normalis, C.* cf. *rectangularis, D.* sp., *G. tamariscus magnus*
Collection at 460 m (1509 ft), *acinaces* Zone: *Cy. vesiculosus, C. innotatus obesus, C.* cf. *rectangularis, C. normalis, G.* cf. *enodis enodis, G.* cf. *tamariscus magnus, Dm. confertus swanstoni, Pc. hughesi, A. strachani*
Collection at 461.5 m (1514 ft), *acinaces* Zone: *G.* cf. *lanpheri, C. innotatus, C. rectangularis, ?Cy. vesiculosus, Dm.* sp., *Pc. hughesi, L. acinaces, A.* cf. *gracilis,* monograptid indet.
Collection at 465.1 m (1526 ft) *gregarius* Zone: *Cr. gregarius, L.* cf. *acinaces, Pb.* cf. *angustus, ?Cy. vesiculosus, O. obuti, Dm. confertus swanstoni, D.* cf. *elongatus, G. enodis latus, G.* cf. *tamariscus tamariscus*
Collection at 468.2 (1536 ft), *gregarius* Zone: *G.* ex gr. *tamariscus, G.* ex gr. *enodis, G.* sp., *D.* sp., *M. revolutus, Cr. hipposideros*
Collection at 470.3 m (1543 ft), *gregarius* Zone: *G. laciniosus, G.* sp., *A.* cf. *strachani, Cr. gregarius arcuatus, C. rectangularis, C. normalis, M.* cf. *revolutus, O.* cf. *obuti, Pb.* sp.
Collection at 474 m (1555 ft), *gregarius* Zone: *Cr. gregarius arcuatus, G. laciniosus, G.* sp., *?Rh.* sp., *?D.* sp., *Pr.* sp. 2 (of Hutt, 1975), *M.* cf. *revolutus,* monograptid indet.
Collection at 477 m (1565 ft), *triangulatus* Zone: *M.* cf. *elongatus, M.* sp., *Cr. gregarius, C.* cf. *rectangularis, C. normalis, R. longispinus,* retiolitid indet.
Collection at 480 m (1574 ft) *triangulatus* Zone: *R. approximatus, ?D.* sp., *C. normalis,* monograptid indet.
Collection at 480.4 m (1576 ft), *triangulatus* Zone: *C. normalis, C.* cf. *rectangularis, M.* cf. *triangulatus separatus*, monograptid indet., *R. approximatus, R.* sp., *G.* sp.
Collection at 481.9 m (1581 ft), *triangulatus* Zone: *L.* cf. *inexpeditus, M. revolutus,* monograptid indet. *C.* cf. *rectangularis, D. modestus, M.* cf. *tenuissmus, R.* cf. *approximatus, R.* sp.
Collection at 485.9 m (1594 ft), *magnus* Zone?: *Rh.* cf. *toernquisti, ?Rh.* sp., *M. involutus, M.* cf. *revolutus, M.* sp., *Cr. gregarius, C.* cf. *laciniosus, C.* sp.

Collection at 488 m (1601 ft), *magnus* Zone?: *Cr.* cf. *gregarius, M. involutus, M. revolutus, M. triangulatus fimbriatus, G.* cf. *laciniosus, R.* sp., *C.* sp., *?Pc.* sp., *Pb. angustus*
Collection at 491.4 m (1612 ft), *argenteus* Zone?: *M.* aff. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *M. millepeda, M.* cf. *argenteus argenteus, M.* cf. *lobiferus, R.* sp., *R. orbitus, ?Ps.* sp., *G.* cf. *laciniosus, p. ovatoelongatus, P.* cf. *minor, R. phleoides*
Collection at 496.2 m (1628 ft), *convolutus* Zone: *M. communis, M. sidjachenkoi, M. convolutus, P. folium, P.* cf. *minor, D. thuringiacus, O.* cf. *inopinatus, G. tamariscus tamariscus, G.* cf. *enodis, Pc. hughesi, R.* sp., *R.* cf. *hybridus*
Collection at 498.7 m (1636 ft), *convolutus* Zone: *M. convolutus, M. communis, M.* aff. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *M.* sp., *P. folium, P.* cf. *intermedius, D. thuringiacus, C.* cf. *medius, O.* cf. *insectiformis, G. tamariscus tamariscus, R.* cf. *approximatus, R.* sp.
Collection at 502.3 m (1648 ft), *convolutus* Zone: *M. convolutus, M. lobiferus harpago, M. clingani, M.* aff. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *M. sidjachenkoi, M.* sp., *G.* ex gr. *tamariscus, R.* cf. *richteri, O. insectiformis, C.* cf. *medius, D. thuringiacus, P. minor*
Collection at 507.8 m (1666 ft), *convolutus* Zone: *D.* cf. *thuringiacus, R. approximatus geinitzi, R. richteri, R. longispinus, ?Div.* spp., *M. sidjachenkoi, M.* aff. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *?M. convolutus, M. clingani, M.* cf. *lobiferus harpago, Pt.* cf. *undulatus, G.* ex gr. *tamaricus, Ps.* cf. *obesus, Ceph.* sp., *R. phleoides, P.* sp., *C. medius, Pr.* cf. *regularis*
Collection at 512.4 m (1681 ft), *convolutus* Zone: *M.* aff. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *M. sidjachenkoi, M. communis* cf. *communis, M. buddingtoni, Pr. regularis, Pr.* sp. 1 (of Hutt, 1975), *R. phleoides, R. orbitus, P. intermedius, P.* cf. *palmeus praecedens, D.* sp., *Pc.* cf. *undulatus* (*sensu* Churkin and Carter, 1970), *C.* sp.
Collection at 519.4 m (1704 ft), *sedgwicki* Zone: *R. perfectus, R. rostratus* sp. nov., *Pr. regularis, Pr.* sp., *M.* cf. *proteus, M.* cf. *denticulatus, M. pseudobecki, M.* cf. *mirus, M.* cf. *tenuissmus, M.* cf. *marri, Ps. obesus obesus*
Collection at 521.8 m (1712 ft), *turriculatus* Zone: *M. sedgwicki, M. decipiens valens, M. turriculatus, Pr. regularis, Pr.* cf. *nudus, P.* cf. *ovatus, P. tenuis, P. ovatoelongatus, P. altissimus, P. elongatus, Ps. obesus obesus, R. maximus*
Collection at 523 m (1716 ft), *turriculatus* Zone: *P.* cf. *palmeus palmeus, P. ovatoelongatus, M.* cf. *decipiens valens, M. turriculatus, M. exiguus primulus, M. spiralis, M.* spp., *Pr. nudus, Pr.* cf. *variabilis*
Collection at 526 m (1726 ft), *turriculatus* Zone: *M. turriculatus, M.* cf. *decipiens, M.* cf. *sedgwicki, M.* ex gr. *exiguus, M.* sp., *G.* sp., *Pr.* cf. *regularis, P.* sp.
Collection at 528.5 m (1734 ft), *turriculatus* Zone: *P.* sp., *?Div. ramosus, G.* sp., *M. rickardsi minor, M. turriculatus, M.* cf. *planus*
Collection at 536.1 m (1759 ft), *turriculatus* Zone: *M. exiguus primulus, M. turriculatus, M.* cf. *conspectus, M.* cf. *pandus*
Collection at 541.3 m (1776 ft), *turriculatus* Zone: *M. exiguus* cf. *primulus, M.* cf. *proteus, ?D.* sp.
Collection at 544.4 m (1786 ft), *turriculatus* Zone: *M. exiguus primulus, M.* cf. *conspectus, M. falx, M.* cf. *pandus, M. turriculatus, Ps.* sp., *Ret.* sp., *P.* cf. *hispanicus*
Collection at 553.8 m (1817 ft), *turriculatus* Zone: *M. exiguus primulus, M. tullbergi spiraloides, M. turriculatus, M. marri, M.* sp., *Mon.* ex gr. *vomerina, Ps. obesus obesus*
Collection at 559.3 m (1835 ft), *turriculatus* Zone: *M.* cf. *sartorius, M. proteus, M. exiguus primulus, M.* cf. *pandus*
Collection at 579.7 m (1902 ft), *spiralis* Zone: *M. spiralis, M. priodon, M.* cf. *sartorius, Mon.* ex gr. *vomerina*

LOCALITY 6B (1977 collections)
Collection at 454.2 m (1490 ft), Ashgillian graptolites
Collection at 454.5 m (1491 ft), *acuminatus* Zone: *C. normalis, C.* cf. *miserabilis, C. trifilis, O. acuminatus, G.* sp.
Collection at 454.8 m (1492 ft), *acuminatus* Zone: *D. modestus, O. acuminatus, C. rectangularis, C. normalis, G.* sp., *?Ak.* sp.
Collection at 455.1 m (1493 ft), *acuminatus* Zone: *C. rectangularis, C. normalis, D.* aff. *mucroterminatus*
Collection at 455.4 m (1494 ft), *acuminatus* Zone: *O. acuminatus, C. normalis, C.* aff. *pilosus, G.* cf. *gnomus*
Collection at 456 m (1496 ft), *acuminatus* Zone: *O. acuminatus, C.* aff. *pilosus, C. normalis, D. modestus diminutus, O. eberleini, Ak.* sp., *G.* cf. *lanpheri.*

Collection at 456.3 m (1497 ft), *acuminatus* Zone: *C. normalis, C. rectangularis, G.* cf. *lanpheri, O. acuminatus, D. modestus diminutus*, ?*Ak. ascensus*
Collection at 456.9 m (1499 ft), *acuminatus* Zone: *O. acuminatus, C. normalis, D.* sp., *D. modestus diminutus, C. rectangularis*
Collection at 457.8 m (1502 ft), *atavus* Zone?: *C. rectangularis, C. normalis, C. innotatus, G. laciniosus, G. lanpheri*, ?*Cy. vesiculosus, Pc. hughesi*
Collection at 459 m (1506 ft), *atavus* Zone: *C. rectangularis, C. innotatus obesus, Cy. vesiculosus*, ?*Pc. hughesi, G.* sp., *G.* ex gr. *tamariscus*
Collection at 459.6 m (1508 ft), *atavus* Zone: *C. rectangularis, C.* cf. *normalis, D.* cf. *elongatus*, ?*Cy. vesiculosus*, monograptid indet.
Collection at 460.6 m (1511 ft), *acinaces* Zone: *C. rectangularis, C. innotatus, C. innotatus obesus, C. normalis, Cy. vesiculosus, A. strachani, L.* cf. *acinaces, Pc. hughesi, Dm. confertus swanstoni, O. eberleini*
Collection at 461.5 m (1514 ft), *acinaces* Zone: *Pc. hughesi, C. medius, C. innotatus, C. rectangularis, Cy. vesiculosus, Dm. confertus swanstoni, A. strachani, G. laciniosus, G. tamariscus magnus*
Collection at 463 m (1519 ft), *acinaces* Zone: *Pc. hughesi, C. medius, C. rectangularis, C. innotatus obesus, D.* cf. *elongatus, G. tamariscus magnus, G. enodis, A. strachani, O. eberleini, Dm. confertus swanstoni, Dm. physophora alaskensis, Cy. vesiculosus*
Collection at 469.4 m (1540 ft), *gregarius* Zone: *C.* cf. *laciniosus, Cr. hipposideros, Pc. hughesi*, monograptid indet., *C. rectangularis*?, *C.* sp.
Collection at 471.5 m (1547 ft), *gregarius* Zone: *Cr.* cf. *cyphus, Cr. hipposideros, Cr. gregarius arcuatus, Cr. gregarius, C. rectangularis, C.* cf. *normalis, C.* sp. nov.,? *D.* cf. *elongatus, D.* cf. *mucroterminatus, D.* cf. *magnus, "M."* cf. *incommodus, M. revolutus, G. incertus, Dm.* cf. *physophora, O. inopinatus*
Collection at 472.7 m (1551 ft), *gregarius* Zone: *C.* cf. *rectangularis, Cr. gregarius, Cr. gregarius arcuatus, G. laciniosus, G.* cf. *tamariscus magnus*
Collection at 475.5 m (1560 ft), *gregarius* or *triangulatus* Zone: *Cr. gregarius arcuatus, Cr.* aff. *gregarius, G. incertus, C. rectangularis, "M."* cf. *incommodus, M. triangulatus, M.* aff. *fragilis, M.* sp., *D.* sp.?
Collection at 482.5 m (1583 ft), *triangulatus* Zone: *M. revolutus, M. triangulatus fimbriatus, M. communis rostratus*?, *M.* cf. *tenuissmus, M.* cf. *involutus, M. inexpeditus, C.* cf. *rectangularis, R.* cf. *peregrinus, G. tamariscus magnus*
Collection at 487.4 m (1599 ft), *triangularis* Zone: *C. rectangularis, C. innotatus, C.* sp., *M.* cf. *triangulatus, M.* cf. *involutus, M.* cf. *revolutus, M.* cf. *communis, M. communis, M. millepeda, Cr. gregarius, P. intermedius, D.* cf. *thuringiacus, R.* sp.
Collection at 489.2 m (1605 ft), *triangulatus* or *magnus*? Zone: *M.* cf. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *M. inexpeditus, M.* sp., *M.* cf. *triangulatus fimbriatus, Cr. gregarius, G.* cf. *incertus*
Collection at 490.7 m (1610 ft), *argenteus* Zone: *G.* cf. *tamariscus magnus, R. orbitus, "M."* cf. *fragilis, M.* aff. *cygneus (sensu* Obut and Sobolevskaya, 1967), *M. triangulatus fimbriatus, D.* sp., *O.* cf. *inopinatus*
Collection at 495.9 m (1627 ft), *convolutus* Zone: *M.* aff. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *M. communis, P. folium, G.* cf. *tamariscus, D.* cf. *thuringiacus, C.* sp., *R. phleoides, R.* sp., *O.* cf. *obuti*
Collection at 506.3 m (1661 ft), *convolutus* Zone: *M.* aff. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *M.* sp. (lobate thecae), *Pc. undulatus, P.* cf. *intermedius, D.* cf. *thuringiacus, R.* sp.
Collection at 508.4 m (1668 ft), *convolutus* Zone: *R. orbitus, R. phleoides, P.* cf. *intermedius, D.* cf. *thuringiacus, Pc. undulatus, M.* aff. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *M.* cf. *tenuissmus*
Collection at 513.6 m (1685 ft), *sedgwicki* Zone: *R.* cf. *hybridus, R. distans, R. maximus, R. linnaei, Ps. obesus obesus, Pr. regularis, Pr.* cf. *nudus, M. turriculatus, M. communis, M.* cf. *proteus, M.* cf. *circularis, M. sedgwicki, P. elongatus*
Collection at 515.1 m (1690 ft), *sedgwicki* Zone: *Pr. regularis, R. nudus, R. perfectus, R. rostratus* sp. nov., *R.* cf. *hybridus, R. approximatus geinitzi, R.* cf. *distans, R.* cf. *approximatus, M. sedgwicki, M.* cf. *tenuissmus, M.* cf. *mirus, M.* sp., *M.* aff. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *M.* sp. (*nodifer* type), ?*Ps.* sp., *P. elongatus*
Collection at 516.3 m (1694 ft), *turriculatus* Zone: *M. decipiens valens, M. sedgwicki, M. involutus, M.* cf. *elongatus, Pr. regularis, R. maximus, D.* sp., *Ps.* cf. *obesus, P. ovatoelongatus, P.* sp.
Collection at 516.9 m (1696 ft), *turriculatus* Zone: *Pr. regularis, Pr. nudus, M.* cf. *runcinatus, M. decipiens valens, M. turriculatus, M. exiguus primulus, M.* cf. *sedgwicki, M.* sp., *Ps.* sp., *P. elongatus, P.* cf. *palmeus palmeus*

Collection at 517.9 m (1699 ft), *turriculatus* Zone: *M. decipiens valens, M. exiguus primulus, M. sedgwicki, M. turriculatus, Pr. nudus, Pr. regularis, P.* cf. *tenuis, P.* cf. *palmeus clavatus, Ps.* sp.
Collection at 518.8 m (1702 ft), *turriculatus* Zone: *M. decipiens valens, M. turriculatus, M. exiguus primulus, M.* cf. *circularis, Pr. regularis, Pr. nudus, P. wilsoni, P. palmeus clavatus, P.* cf. *palmeus palmeus, Ps. obesus reticulatus*
Collection at 523 m (1716 ft), *turriculatus* Zone: *M. planus, M. pseudobecki, M. proteus, M.* cf. *halli, M. turriculatus, M. falx, P.* cf. *altissimus, Pr. nudus, Pr.* cf. *regularis, R.* spp., *G.* cf. *tamariscus*
Collection at 528.8 m (1735 ft), *turriculatus* Zone: *M. pseudobecki, M. exiguus primulus, M. turriculatus, M. planus obtusus, M. halli, M.* cf. *conspectus, M.* cf. *marri, R. linnaei, Mon.* ex gr. *vomerina*
Collection at 531.9 m (1745 ft), *turriculatus* Zone: *M. exiguus primulus, M. turriculatus, M.* cf. *pandus, M. planus obtusus, R. linnaei, P. altissimus, Ps.* sp., *Ps.* cf. *obesus, ?Div. ramosus, Pr. nudus*
Collection at 548.9 m (1801 ft), *turriculatus* Zone: *M. marri, M. exiguus primulus, M. turriculatus, M. proteus, Ps.* sp., *Ps. obesus reticulatus*
Collection at 559.3 m (1835 ft), *turriculatus* Zone: *Pr. initialis, M. exiguus primulus, M.* cf. *priodon, M.* turriculatus, M. cf. *spiralis, M.* sp., *Div.* sp., *Ret. geinitzianus (sensu lato)*
Collection at 570.9 m (1873 ft), *spiralis* Zone: *M. spiralis* cf. *contortus, M. priodon, Div.* sp., *Ret.* sp.
Collection at 582.2 m (1910 ft), *spiralis* Zone: *M.* cf. *parapriodon, M. spiralis* cf. *contortus, Mon.* ex gr. *vomerina*
Collection at 602.6 m (1977 ft), *spiralis* Zone: *M. spiralis, ?Div. ramosus,* monoclimacid, *Ret. geinitzianus angustidens*
Collection at 611. 4m (2006 ft), *spiralis* Zone: *M. spiralis, M.* cf. *sartorius, M.* sp., *M. curvus, M. falx, Mon.* ex gr. *vomerina, Ret. geinitzianus angustidens*
Collection at 612.6 m (2010 ft), *spiralis* Zone: *Ret. geinitzianus angustidens, M. spiralis, Mon.* cf. *crenulata, Pr.* ex gr. dubius
Collection at 614.2 m (2015 ft), *spiralis* Zone: *M. spiralis, M.* cf. *sartorius, M. priodon, Mon.* cf. *griestoniensis, Ret. geinitzianus angustidens*
Collection at 615.7 m (2020 ft), *spiralis* Zone: *?Div.* sp., *?Div. ramosus, Mon. griestoniensis, M. spiralis, M. priodon, M.* cf. *continens, Ret. geinitzianus angustidens*
Collection at 629.4 m (2065 ft), *spiralis* Zone: *Ret. geinitzianus angustidens, M. priodon, M. spiralis, M.* cf. *sartorius, Mon.* ex gr. *vomerina, Mon.* cf. *griestoniensis*
Collection at 630.9 m (2070 ft), *spiralis* Zone or *sakmaricus-laqueus* Zone: *M. spiralis* (rare), *M.* cf. *priodon, Mon.* ex gr. *vomerina, Mon.* cf. *griestoniensis, Ret. geinitzianus angustidens, St. grandis imperfectus, ?Div. ramosus*
Collection at 635.5 m (2085 ft), *sakmaricus-laqueus* Zone: *Mon.* ex gr. vomerina, M. cf. *priodon, M. parapriodon, Ct.* aff. *lapworthi, ?Div.* sp., *Ret. geinitzianus angustidens*
Collection at 637.3 m (2091 ft), *sakmaricus-laqueus* Zone: *?Div.* sp., *St. grandis imperfectus, Ct. laqueus, Ret. geinitzianus angustidens, M.* cf. *priodon, M.* cf. *sartorius, Mon.* ex gr. *vomerina*
Collection at 638.6 m (2095 ft), *sakmaricus-laqueus* Zone: *M. priodon, Mon. linnarssoni, Ret.* sp., *Ct.* aff. *lapworthi*
Collection at 640.1 m (2100 ft), *sakmaricus-laqueus* Zone: *M.* cf. *praecedens, ?H.* sp., *?Pl.* sp., *Mon.* cf. *linnarssoni, Ct. laqueus, Ct.* aff. *lapworthi, ?Ret. balticus*
Collection at 641.6 m (2105 ft), *sakmaricus-laqueus* Zone: *Ct. laqueus, M.* cf. *praecedens*
Collection at 642.5 m (2108 ft), *sakmaricus-laqueus* Zone: *M.* cf. *praecedens, M.* cf. *parapriodon, Mon. linnarssoni, Ct. laqueus*

LOCALITY 7 Blackstone River, Ogilvie Mountains, east bank: 65°26′N, 137°20′W.
Collection at 36.6 m (120 ft): Ashgillian graptolites
Collection at 53.3 m (175 ft), *persculptus* Zone?: *O. truncatus pauperatus, C. normalis* (transitional to *C. miserabilis*), *C.* sp. (long proximal spines), *?G.* sp., *D. modestus* (very abundant)
Collection at 58.8 m (193 ft), *acuminatus* Zone: *C. normalis, C. rectangularis, C. innotatus* cf. *obesus, C. innotatus innotatus, ?Cy. vesiculosus*
Collection at 60.7 m (199 ft), *acuminatus* Zone?: *C. rectangularis, C. normalis, C. innotatus* cf. *obesus, ?Cy. vesiculosus*
Collection at 61.3 m (201 ft), *acuminatus* Zone?: *C. rectangularis, C. innotatus* cf. *obesus, C.* cf. *normalis, G.* sp., *G. tamariscus magnus*
Collection at 61.9 m (203 ft), *atavus* Zone?: *G. tamariscus magnus, Dm.* cf. *physophora, Pc.* sp., *A.* cf. *gracilis, ?Cy. vesiculosus*
Collection at 62.2 m (204 ft), *atavus* Zone?: *Cy. vesiculosus, C.* cf. *medius, C. innotatus* cf. *obesus, G.*

tamariscus magnus, Dm. confertus swanstoni, Pc. hughesi, A. cf. *strachani*
Collection at 62.5 m (205 ft), *acinaces* Zone: *G. tamariscus magnus, Cy. vesiculosus, Pc. hughesi, C. medius, C. rectangularis, C.* ex gr. *innotatus, Dm. confertus swanstoni, Dm. physophora alaskensis, A. strachani*
Collection at 65.5 m (215 ft), *argenteus* Zone: *R. approximatus, R.* sp., *M. revolutus, M. communis, M. millepeda, M. involutus, P. ovatoelongatus, Cr. gregarius, P. intermedius, D.* cf. *elongatus, C.* cf. *rectangularis, G.* cf. *tamariscus, L.* cf. *acinaces, ?Ps.* sp., *?Nymphograptus* sp.
Collection at 66.4 m (218 ft), *convolutus* Zone: *R.* cf. *hybridus, M.* cf. *crenularis, M. communis, M. convolutus, M.* aff. *cygneus* (*sensu* Obut and Sobolevskaya, 1967), *M. noyensis, P. folium, P.* cf. *minor, P.* cf. *intermedius, Ret. decurtatus, M.* cf. *argenteus, G. tamariscus tamariscus, G.* cf. *gnomus, O. inopinatus, O. insectiformis, ?Ps.* sp.
Collection at 69.2 m (227 ft), *convolutus* Zone: *M.* aff. *cygneus, M.* cf. *sedgwicki, M.* cf. *elongatus, M. sidjachenkoi, M. communis, M. communis rostratus*?, *M. convolutus, Ceph. tubulariformis, P. folium, P.* sp., *P. orbitus, Pc. undulatus, O. inopinatus, O. insectiformis, D. thuringiacus, G. tamariscus tamariscus, G.* cf. *gnomus, M.* cf. *lobiferus*
Collection at 70.4 m (231 ft), *convolutus* Zone: *P. intermedius, P.* sp., *M. sidjachenkoi, M. clingani, M. convolutus, M. communis, Ceph. cometa cometa, R. orbitus, G.* sp., *Pc. undulatus, D. thuringiacus, Pb.* cf. *argutus, Pr. nudus*
Collection at 72.2 m (237 ft), *sedgwicki* Zone: *Pc.* sp., *B.* aff. *pulchellus, P. intermedius, P. elongatus, P.* sp., *P. altissimus, R. approximatus geinitzi, R.* cf. *maximus, Pr. nudus, Pr. regularis, M.* cf. *undulatus, M.* cf. *spiralis, M.* sp., *M. sedgwicki, ?Ps.* sp.
Collection at 74.7 m (245 ft), *sedgwicki* Zone: *?Div. ramosus, M. spiralis* cf. *contortus, M.* cf. *decipiens valens, M. crenularis, M.* cf. *sedgwicki, M. pseudobecki, R. linnaei, Pr.* cf. *regularis, P. intermedius, G.* sp.
Collection at 76.2 m (250 ft), *sedgwicki* Zone: *Pc. undulatus, P.* sp., *M. decipiens, M. sedgwicki, M.* cf. *lobiferus, M.* cf. *crenularis, M.* cf. *limatulus, Pr. regularis, O.* cf. *cyperoides, Mon.* sp., *Ceph.* sp.
Collection at 77.2 m (255 ft), *sedgwicki* Zone: *P. intermedius, P. elongatus, P. altissimus, Pr.* cf. *regularis, Pr.* cf. *nudus, R.* cf. *perfectus, M.* cf. *planus, M.* cf. *dextrorsus, M. sedgwicki, M. spiralis* cf. *contortus, Ceph. cometa extrema*
Collection at 80.2 m (263 ft), *turriculatus* Zone: *M. decipiens valens, M.* cf. *dextrorsus, M.* cf. *decipiens, M. turriculatus, M.* cf. *knockensis, M.* cf. *sedgwicki, R.* sp., *P. intermedius, P.* cf. *elongatus, P.* cf. *altissmus, ?Pt. perlatus, ? Ps.* sp., *G.* sp.?, *Pr.* cf. *regularis*
Collection at 83.8 m (275 ft), *turriculatus* Zone: *M. decipiens valens, M.* cf. *pseudobecki, M. turriculatus, M. exiguus* cf. *primulus, M. spiralis, M.* cf. *marri, Pr. regularis, P.* cf. *tenuis, P.* sp.
Collection at 85.3 m (280 ft), *turriculatus* Zone: *M. decipiens valens, M.* cf. *pseudobecki, M. spiralis, M. halli, M. turriculatus, D.* sp., *P.* ex gr. *palmeus, P.* cf. *elongatus, Pr.* cf. *regularis*
Collection at 86.9 m (285 ft), *turriculatus* Zone: *M. turriculatus, M.* cf. *planus, M.* cf. *pseudobecki, M.* cf. *millepeda, ?Div. ramosus, P.* sp., *P.* cf. *elongatus*
Collection at 88.7 m (291 ft), *turriculatus* Zone: *P.* cf. *ovatoelongatus, P. elongatus, M. turriculatus, M. decipiens valens, M.* cf. *sedgwicki, M.* cf. *pseudobecki, Pr.* cf. *regularis, D.* sp.
Collection at 89 m (292 ft), *turriculatus* Zone: *M. turriculatus, M. decipiens valens, Pr.* cf. *regularis*
Collection at 91.4 m (300 ft), *turriculatus* Zone: *Ret. perlatus, M. planus obtusus, M. turriculatus, M. exiguus primulus, M.* cf. *marri, M.* cf. *proteus, M.* cf. *priodon, M. flagellaris, M.* cf. *sedgwicki, M.* cf. *delicatulus, P. altissimus, P.* cf. *elongatus*
Collection at 92.7 m (304 ft), *turriculatus* Zone: *M. marri, M. exiguus primulus, M. turriculatus, M. proteus, M. runcinatus, Pr.* cf. *nudus*
Collection at 94.8 m (311 ft), *turriculatus* Zone: *P.* cf. *hispanicus, M. proteus, M. marri, M. turriculatus, M. exiguus primulus, M. runcinatus richardsonensis* subsp. nov.
Collection at 99 m (325 ft), *turriculatus* Zone: *M. proteus, M. turriculatus, M. exiguus primulus, M. marri, ?Ps.* sp.
Collection at 103.6 m (340 ft), *spiralis* Zone: *M. priodon, M. spiralis, Mon.* cf. *crenulata, St. grandis grandis*

LOCALITY 8 Unnamed tributary of Hart River, 5 km (3 mi) north of Pat Lake, west side of creek: 65°09′N, 136°42′W. Section not measured, but collected in stratigraphic succession.
Collection 1F: Ashgillian graptolites
Collection 2F, *acuminatus* Zone?: *C. innotatus, C.* cf. *pacificus, C. normalis, C.* cf. *rectangularis, G. lanpheri*

Collection 3F, *acinaces* Zone: *C. normalis, C. rectangularis, C. innotatus, C.* cf. *pacificus pilosus, O. acuminatus, Pc.* sp., *?Cy. vesiculosus, D. elongatus, G.* cf. *lanpheri, G.* cf. *laciniosus, Dm. physophora alaskensis, Cr. gregarius arcuatus, A. strachani, A.* cf. *gracilis, Rh.* sp.

LOCALITY 9 Mount Sekwi, central western Mackenzie Mountains, overturned section: 63°20′N, 128°33′W.
Collection at 654.7 m (2148 ft), *acuminatus* Zone?: *C. normalis, D.* cf. *modestus*
Collection at 547.4 m (1796 ft), *turriculatus* Zone: *M. exiguus primulus, M. turriculatus, M. proteus, M.* cf. *praecedens, M.* cf. *delicatulus*
Collection at 527.6 m (1731 ft), *turriculatus* Zone: *M. exiguus primulus, M. turriculatus, M.* cf. *proteus*
Collection at 516.9 m (1696 ft), *spiralis* Zone: *M. spiralis, M.* cf. *speciosus, Mon.* cf. *crenulata*
Collection at 413 m (1355 ft), *spiralis* Zone?: *Ret. geinitzianus angustidens*
Collection at 384 m (1260 ft), *sakmaricus-laqueus* Zone?: *M. priodon, M.* cf. *parapriodon, Mon. linnarssoni, Mon.* ex gr. *vomerina*

LOCALITY 10 Delorme Range, Mackenzie Mountains, central region: 62°45′N, 125°15′W. (Collected by J.E. Etherington, 1965.)
Collection at 768.1 m (2520 ft), *convolutus* Zone: *P. minor, M. clingani*
Collection at 774.2 m (2540 ft), *turriculatus* Zone: *M. turriculatus*
Collection at 777.2 m (2550 ft), *turriculatus* Zone: *M. turriculatus, M. tullbergi spiraloides, M.* cf. *clingani, C.* sp., *Mon.* ex gr. *vomerina*
Collection at 804.7 m (2640 ft), *turriculatus* Zone: *M. exiguus primulus*
Collection at 861.1 m (2825 ft), *turriculatus* Zone: *M. exiguus primulus, M.* cf. *priodon,* retiolitid indet.
Collection at 906.8 m (2975 ft), *spiralis* Zone: *M. priodon*
Collection at 911.4 m (2990 ft), *spiralis* Zone: *M. priodon, M. spiralis, M.* cf. *spinulosus, Ret. geinitzianus angustidens, ?Ct.* sp.
Collection at 912.3 m (2993 ft), *spiralis* Zone?: *M. priodon*
Collection at 935.7 m (3070 ft), *spiralis* Zone?: *M. priodon, M. spiralis, St. grandis* cf. *maior*
Collection at 969.9 m (3182 ft), *spiralis* Zone?: *M. spiralis*
Collection at 973.2 m (3193 ft), *spiralis* Zone?: *Ret.* sp.
Collection at 976.9 m (3205 ft), *spiralis* Zone?: *M. spiralis, Ret.* sp., *Ps. giganteus, Mon.* ex gr. *vomerina*
Collection at 986 m (3235 ft), *spiralis* Zone?: *Ret. geinitzianus angustidens*
Collection at 1027.2 m (3370 ft), *sakmaricus-laqueus* Zone: *Ct.* aff. *lapworthi, Mon.* cf. *greistoniensis*
Collection at 1028.4 m (3374 ft), *sakmaricus-laqueus* Zone: *M.* cf. *praecedens, Mon.* cf. *griestoniensis, ?Ct.* aff. *lapworthi*
Collection at 1031.4 m (3384 ft), *sakmaricus-laqueus* Zone: *M. praecedens, Ct.* aff. *lapworthi*

LOCALITY 11 Whittaker Range, Mackenzie Mountains, central region: 62°28′30′′N, 124°48′W. (Collected by J. E. Etherington, 1965.)
Collection at 728.5 m (2390 ft), *spiralis* Zone: *M. priodon, M. spiralis, Ret. geinitzianis angustidens, St. grandis maior*
Collection at 752.2 m (2468 ft), *spiralis* Zone: *?St. grandis*
Collection at 762 m (2500 ft), *spiralis* Zone: *St. grandis*
Collection at 765 m (2510 ft), *spiralis* Zone: *M. spiralis, Mon. crenulata*
Collection at 768.1 m (2520 ft), *spiralis* Zone: *M. priodon*
Collection at 769.6 m (2525 ft), *spiralis* Zone: *St. grandis maior*
Collection at 774.2 m (2540 ft), *spiralis* Zone: *M. spiralis*
Collection at 795.5 m (2610 ft), *spiralis* Zone: *M. spiralis*
Collection at 798.6 m (2620 ft), *spiralis* Zone: *M.* cf. *priodon, St. grandis grandis*
Collection at 802.8 m (2634 ft), *spiralis* Zone: *M.* cf. *priodon*
Collection at 805.3 m (2642 ft), *spiralis* Zone: *M. priodon*
Collection at 814.4 m (2672 ft), *spiralis* Zone: *M. priodon*
Collection at 815.9 m (2677 ft), *spiralis* Zone: *M. spiralis, M. priodon*
Collection at 819.9 m (2690 ft), *spiralis* Zone: *Mon.* cf. *crenulata*
Collection at 823 m (2700 ft), *spiralis* Zone: *M. spiralis, M.* cf. *priodon, Mon.* cf. *crenulata*
Collection at 827.5 m (2715 ft), *spiralis* Zone: *M. spiralis, M. priodon*
Collection at 836.7 m (2745 ft), *spiralis* Zone: *M. spiralis, M. priodon*

Collection at 839.7 m (2755 ft), *spiralis* Zone: *M. spiralis, M.* cf. *spinulosus, Mon.* cf. *crenulata*
Collection at 844.3 m (2770 ft), *spiralis* Zone: *M. priodon, M.* cf. *spinulosus,* retiolitid indet.
Collection at 855.6 m (2807 ft), *spiralis* Zone: *M. spiralis, Ret. geinitzianus angustidens*
Collection at 856.6 m (2810 ft), *spiralis* Zone: *Mon.* cf. *vomerinus vomerina, M.* cf. *falx*
Collection at 861.1 m (2825 ft), *spiralis* Zone: *Mon.* cf. *crenulata*
Collection at 868.7 m (2850 ft), *spiralis* Zone: *M.* cf. *spiralis*
Collection at 892.5 m (2928 ft), *spiralis* Zone: *M. priodon, Pr. dubius*
Collection at 896.1 m (2940 ft), *spiralis* Zone: *M. priodon, Pr.* ex gr. *dubius, Mon.* cf. *crenulata*
Collection at 900.7 m (2955 ft), *spiralis* Zone: *M.* cf. *priodon, Pr. dubius dubius*
Collection at 905.3 m (2970 ft), *spiralis* Zone: *M.* cf. *priodon, Pr. dubius dubius, Mon.* cf. *crenulata*
Collection at 910.7 m (2988 ft), *spiralis* Zone: *M. priodon, Mon.* cf. *crenulata*
Collection at 914.4 m (3000 ft), *spiralis* Zone: *Pr.* cf. *dubius, Mon.* ex gr. *vomerinus*
Collection at 915.9 m (3005 ft), *spiralis* Zone: *M.* cf. *priodon*
Collection at 922 m (3025 ft), highest recognizable Llandovery (zonal assignment not possible): *M. priodon, M. spiralis, Pr.* cf. *dubius, Mon.* cf. *crenulata*

LOCALITY 12A Clearwater Creek, tributary of South Nahanni River, southern Mackenzie Mountains, west bank of creek: 61°35′N, 125°35′W. (Collected by J.E. Etherington, 1966.)
Collection at 13.7 m (45 ft), *persculptus* or *acuminatus* Zone: *C. miserabilis*
Collection at 15.2 m (50 ft), *persculptus* or *acuminatus* Zone: *C. miserabilis, C.* cf. *innotatus*
Collection at 18.3 m (60 ft), *persculptus* or *acuminatus* Zone: *C. miserabilis, G.* sp.
Collection at 19.8 m (65 ft), *persculptus* or *acuminatus* Zone: *C. miserabilis, G.* sp. *?O.* sp.
Collection at 21.3 m (70 ft), *persculptus* or *acuminatus* Zone: *C. miserabilis, G.* sp.
Collection at 24.4 m (80 ft), *persculptus* or *acuminatus* Zone: *C. miserabilis*
Collection at 25.9 m (85 ft), *persculptus* or *acuminatus* Zone: *C. miserabilis*
Collection at 30.5 m (100 ft), *acuminatus* Zone: *C. miserabilis, C.* cf. *innotatus obesus, C.* aff. *trifilis, G.* sp.
Collection at 32 m (105 ft), *acuminatus* Zone: *C. miserabilis, C. innotatus obesus, G.* sp.
Collection at 33.5 m (110 ft), *acuminatus* Zone: *C. miserabilis, C. innotatus obesus, C.* aff. *trifilis*
Collection at 35.1 m (115 ft), *acuminatus* Zone: *C. innotatus, C.* cf. *miserabilis, G.* cf. *enodis latus*
Collection at 36.6 m (120 ft), *acuminatus* Zone: *C. miserabilis, C. innotatus* cf. *obesus*
Collection at 38.1 m (125 ft), *acuminatus* Zone: *C. miserabilis, C. innotatus* cf. *obesus*
Collection at 41.1 m (135 ft), *acuminatus* Zone: *C. normalis, C. miserabilis, C.* aff. *trifilis*
Collection at 42.7 m (140 ft), *acuminatus* Zone: *C. innotatus* cf. *obesus, C. normalis, G.* sp.
Collection at 44.2 m (145 ft), *acuminatus* Zone: *C. normalis, C. innotatus* cf. *obesus*
Collection at 45.7 m (150 ft), *acuminatus* Zone: *C. normalis, C. innotatus* cf. *obesus*
Collection at 47.2 m (155 ft), *acuminatus* Zone: *C. normalis, C.* aff. *trifilis*
Collection at 64 m (210 ft), *convolutus* Zone?: *G.* sp., *R.* sp., *M.* cf. *convolutus, M.* cf. *communis*
Collection at 65.5 m (215 ft), *sedgwicki* or *turriculatus* Zone: *P.* cf. *hispanicus, M.* cf. *lobiferus harpago, M.* cf. *turriculatus, M.* cf. *clingani, Pr.* cf. *nudus, ?Div. ramosus*
Collection at 67.1 m (220 ft), *turriculatus* Zone: *M. flagellaris, M. marri, M. turriculatus, M. sedgwicki?, P. palmeus* (s.l.)
Collection at 68.6 m (225 ft), *turriculatus* Zone: *M. flagellaris, M.* cf. *pandus, M. turriculatus*
Collection at 70.1 m (230 ft), *turriculatus* Zone?: *M. spiralis, M. turriculatus, M.* cf. *pandus*
Collection at 73.2 m (240 ft), *spiralis* Zone: *M. spiralis, M. pandus, Mon.* ex gr. *vomerina, Ret. geinitzianus angustidens*
Collection at 76.2 m (250 ft), *spiralis* Zone: *M. marri, M. priodon, M. spiralis, Mon.* cf. *griestoniensis, Mon.* ex gr. *vomerina, Ret. geinitzianus angustidens*
Collection at 77.7 m (255 ft), *spiralis* Zone: *M.* cf. *dextrorsus, M. spiralis, Mon.* ex gr. *vomerina*
Collection at 79.2 m (260 ft), *spiralis* Zone: *M. curvus, M. priodon, M. spiralis, Mon. griestoniensis, Ret. geinitzianus angustidens*
Collection at 82.3 m (270 ft), *spiralis* Zone: *M.* cf. *spiralis*
Collection at 83.8 m (275 ft), *sakmaricus-laqueus* Zone: *M. priodon, M.* cf. *praecedens, Ct.* aff. *lapworthi, St.* sp., *Mon.* ex gr. *vomerina, Ret. geinitzianus angustidens*
Collection at 85.3 m (280 ft), *sakmaricus-laqueus* Zone: *M. spiralis, M.* cf. *spinulosus, Mon.* ex gr. *vomerina*
Collection at 86.9 m (285 ft), *sakmaricus-laqueus* Zone: *M. spiralis, M. priodon, ?B.* sp., *Mon.* ex gr. *vomerina*

Collection at 88.4 m (290 ft), *sakmaricus-laqueus* Zone: *M.* cf. *praecedens, M. spiralis, M.* cf. *spinulosus, Ct. sakmaricus, Ct.* aff. *lapworthi, Ret. geinitzianus angustidens, St. grandis grandis*
Collection at 89.9 m (295 ft), *sakmaricus-laqueus* Zone: *M. priodon, Mon.* ex gr. *vomerina, Ct.* cf. *sakmaricus, Ct.* aff. *lapworthi, St. grandis grandis, Ret. geinitzianus angustidens*
Collection at 93 m (305 ft), *sakmaricus-laqueus* Zone: *M. priodon, Pr.* cf. *dubius, Ct.* aff. *lapworthi, Ct.* aff. *rigidus*

LOCALITY 12B Clearwater Creek, same section as 12A, but sampled on the east side of the creek. Not measured, but collected in stratigraphic succession.
Collection 1F, *acuminatus* Zone?: *C. miserabilis*
Collection 2F, *acuminatus* Zone: *C. miserabilis, C.* cf. *rectangularis, G.* sp., *?D.* ex gr. *modestus*
Collection 3F, *acuminatus* Zone: *C. innotatus innotatus, G.* sp.
Collection 4F, *spiralis* Zone: *M. spiralis, M. priodon, Mon.* cf. *crenulata, St.* cf. *grandis imperfectus*
Collection 5F, *spiralis* Zone: *M. spiralis, M. priodon, M.* sp., *Mon.* ex gr. *vomerina, Ret. geinitzianus angustidens*
Collection 6F, *sakmaricus-laqueus* Zone: *M. spiralis, M. priodon, Mon.* cf. *crenulata, Ct.* cf. *sakmaricus*

LOCALITY 13 Beaver River, Yukon, southern Mackenzie Mountains, a single collection: approximately 60°30′N, 125°58′W.
spiralis Zone: *M. spiralis, M.* cf. *priodon, Mon. vomerina gracilis, Mon.* cf. *griestoniensis, St. grandis imperfectus*

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