SILURIAN MONOGRAPTIDS FROM ILLINOIS

by CHARLES A. ROSS

ABSTRACT. Six species of *Monograptus* are recognized from five localities in and adjacent to Illinois. The basinal lithologies of the Moccasin Springs Formation in southern Illinois and south-east Missouri contain *M. roemeri*, *M. colonus*, *M. varians* and *M. varians* var. *pumilus*?, *M. dubius*, and *M. butovicensis*, and the inter-reef lithologies in central and northern Illinois contain *M. bohemicus*, *M.* cf. *M. dubius*, and *M. colonus*. These species are indicative of the monograptid zones that characterize the Lower Ludlow Shale in Great Britain. On the basis of these assemblages, the upper part of the Niagaran Series in the central states region, the Racine Formation, the upper part of the Moccasin Springs Formation, the Mississinewa Shale of Indiana, and the Henryhouse Shale of Oklahoma are believed to be correlative to the Lower Ludlovian of Great Britain. The accepted correlation of the reef-bearing Racine Formation with the Lockport Group of New York State suggests that the Lockportian Stage of the Niagaran Series in its type region is largely, if not entirely, equivalent to the Lower Ludlovian of the type Silurian strata of Great Britain.

IN 1960 when mapping the Palaeozoic strata of the Thebes Quadrangle, Alexander County, Illinois, I discovered three beds in the upper part of the Moccasin Springs Formation that contain abundant and well preserved specimens of *Monograptus*. This discovery led to the present investigation of Silurian graptolites from Illinois and adjacent areas (text-fig. 1).

Graptolite collections in the Illinois State Geological Survey that have been studied include material from dump piles made where the Calumet Sag Channel was excavated near Blue Island and from the nearby Midlothian quarry (locality 5); from Moccasin Springs, Missouri (locality 2); and from well core material from White and Christian Counties (localities 3 and 4). Roy and Croneis (1931) and Decker (1942) identified several species of graptolites from collections at the Calumet Sag Channel, and Lowenstam (1948, p. 79) mentioned the graptolites in the Midlothian quarry (locality 5). Ruedemann (1908) and Bassler (1915) described Silurian graptolites from the Moccasin Springs Formation near Moccasin Springs (locality 2), Missouri, about 9 miles north-north-east of Cape Girardeau and 14 miles north of locality 1. Shrock (1928) described several graptoloids and dendroids from Silurian outcrops in northern Indiana.

Graptolite succession. Graptolites are widely used throughout the world for interregional correlation of Ordovician and Silurian strata. The British Silurian graptolite sequence is generally considered the standard reference section, but the graptolite succession in Bohemia is used for higher zones above the Lower Ludlow Shale (Münch 1952).

In Great Britain graptolites characteristic of the upper part of the Wenlockian include *Cyrtograptus*, the genus with a 'branched' rhabdosome, and various species of *Monograptus* having hooked thecae with the distal portions free. Graptolites characteristic of the lower part of the Ludlovian are species of *Monograptus* having simple thecae without free portions or biform thecae that have spines in the proximal region (Bulman 1958, p. 171).

The five zones of the Lower Ludlovian as recognized by Elles and Wood (1914, p. 526) are based on overlapping zonal assemblages of species. The zones of *M. nilssoni*

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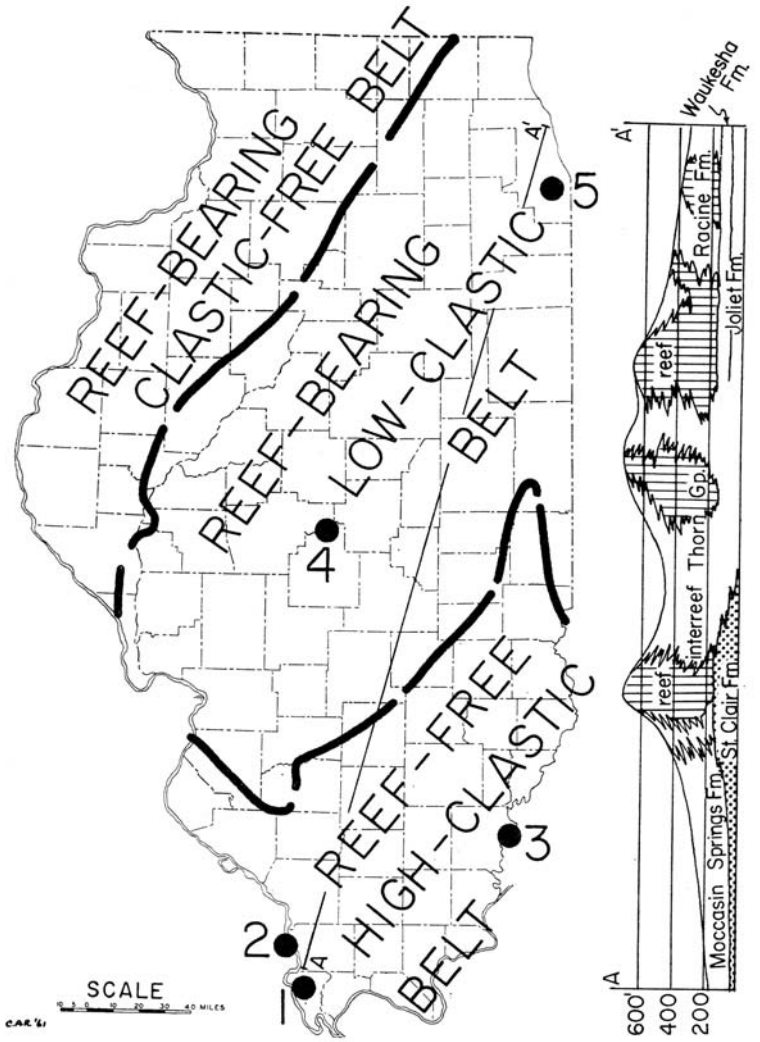
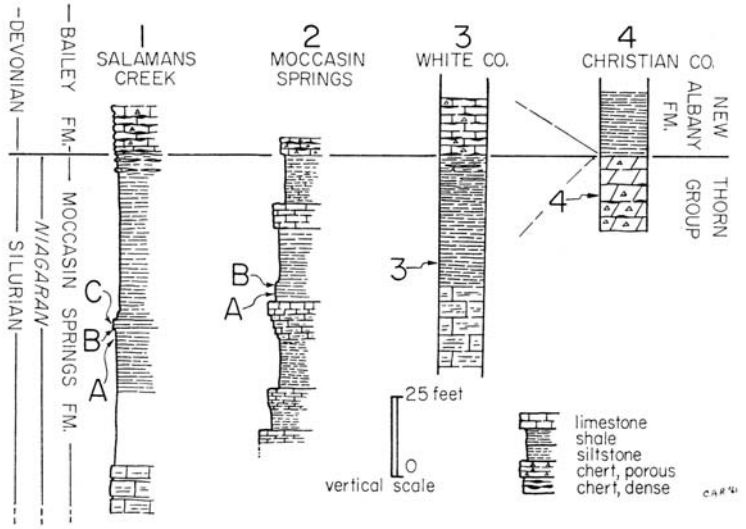


TEXT-FIG. 1. Stratigraphic framework of the Niagaran strata of Illinois (after Lowenstam 1949) and index to graptolite localities.

and *M. scanicus* are represented by many of the same species and in many regions these two zones cannot be separated. In the Cape Phillips Formation on Cornwallis Island, Canada, Thorsteinsson (1958, pp. 92–93) recorded a zone of *M. bohemicus* above the zone of *M. nilssoni* and below the zone of *M. tumescens*. This zone of *M. bohemicus* occupies the same position as the zone of *M. scanicus* in the standard graptolite succession. In

spite of slight modifications of the individual zonal limits and of the ranges of individual species, the four lowest Lower Ludlovian graptolite assemblages (zones 32 to 35, Elles and Wood 1914) grouped together represent a remarkably distinctive fauna. The overlying zone of *M. leintwardinensis* (zone 36, Elles and Wood) appears to be equally distinctive and is commonly used to mark the 'Middle Ludlovian' in central Europe and Canada.



TEXT-FIG. 2. Columnar sections at graptolite localities 1 to 4 indicating stratigraphic position of the individual collections.

STRATIGRAPHIC OCCURRENCES AND GRAPTOLITE ASSOCIATIONS

The columnar sections (text-fig. 2) indicate the stratigraphic positions of the graptolite samples except for the *Lecthayles*-bearing shale collections (locality 5), the stratigraphic position of which apparently lies near the top of the inter-reef, still-water deposits of the Racine Formation (late Niagaran) of the Blue Island area.

In placing the graptolites in the stratigraphic sequence of the Niagaran strata of Illinois, the summary and stratigraphic framework of Lowenstam (1949) who differentiated three broad depositional environments in Illinois during Niagaran time (text-fig. 1) is followed. In southern Illinois the lithologies of the St. Clair and Moccasin Springs Formations of the Bainbridge Group represent progressively deeper basin deposits. The St. Clair, a pink crinoidal limestone, thickens northward. The Bainbridge Group is about 300 feet thick adjacent to the reef-bearing low-clastic belt. The broad low-clastic belt of the Thorn Group where it extends north-eastward across central Illinois has several reefs 400 to nearly 1,000 feet thick that adjoin inter-reef deposits only 100 to 200 feet thick. The diverse reef and inter-reef limestone lithologies intertongue with one

another, with the silty basin deposits of the Moccasin Springs Formation to the south, and with the dolostone of the Niagaran Coe Group of the clastic-free belt to the north-west. Three of the graptolite collections studied are from the highly clastic strata of the Moccassin Springs Formation in the southern part of Illinois and south-eastern Missouri, and two are from the inter-reef strata of the Thorn Group in central and northern Illinois (text-fig. 1).

Because of great topographic relief associated with reef, inter-reef, and basin deposits of the Niagaran strata, the stratigraphic relations between the Silurian and Devonian strata in Illinois are complex. In the southern part of Illinois the silty shale at the top of the Moccasin Springs Formation passes with apparent conformity upwards into the cherty siltstone of the lower part of the Bailey Formation which is believed to be Helderbergian (early Devonian) in age (Cooper *et al.* 1942). The graptolite-bearing beds are 20 to 30 feet below this gradational Silurian-Devonian (Moccasin Springs–Bailey) boundary in southern Illinois. In Christian County the cherty dolostone of the Thorn Group (Niagaran) is overlain by the black shale of the New Albany (late Devonian), the greater part of the Devonian being missing over the high elevations of the Niagaran reefs. In northern Illinois Devonian beds do not directly overlie the Racine Formation near Blue Island (Willman 1943).

Locality 1. From the upper part of the Moccasin Springs Formation along Salamans Creek (SW $\frac{1}{4}$, sec. 3, T. 15 S., R. 3 W.) in Alexander County, Illinois, three silty bands contain well-preserved species of *Monograptus* and have the most diverse assemblages of the collections studied (Table 1). The species are *Monograptus roemeri* (Barrande), *M. varians* Wood, *M. varians* var. *pumilus*? Wood, *M.* cf. *M. dubius* (Suess), and *M. colonus* (Barrande). *M. roemeri* and *M. colonus* are the most abundant species in the highest graptolite-bearing band, and *M. colonus* is the most abundant in the lowest band. Except for *M. dubius*, these species are restricted to one or both of the zones of *M. nilssoni* and *M. scanicus* in Great Britain (zones 33 and 34, Elles and Wood 1914, p. 523) (Table 1) and indicate a close correlation of the upper part of the Moccasin Springs Formation with the Lower Ludlovian of Great Britain.

Locality 2. The type section of the Moccasin Springs Formation $\frac{3}{4}$ mile south of Moccasin Springs, Missouri, 9 miles north-north-east of Cape Girardeau, has numerous specimens of poorly preserved *Monograptus*. Ruedemann (1908, p. 459) described specimens from this locality as *Cyrtograptus ulrichi* but the description is based on fragments which Ruedemann considered to be secondary branches and he did not observe a main branch. Thus the reference to *Cyrtograptus*, a Wenlockian genus, was made on indirect evidence (Ruedemann 1947, p. 496), and species of this genus have not been found at this locality. Specimens examined from this locality consist of abundant rhabdosomes of *M. varians*, *M. dubius*, and *M. butovicensis* (Bouček) aligned more or less parallel and piled in several layers. Specimens overlying one another were apparently mistaken for *Cyrtograptus*. In several places on a bedding plane, spined thecae and siculae of the proximal regions of rhabdosomes directly overlie the apertural regions of other rhabdosomes, and this arrangement suggests that the spines may have been caught on the underlying specimens. This pattern may have been interpreted for a cyrtograptid.

The appearance of *Monograptus varians* and *M. butovicensis* suggest that the two

collections from locality 2 (Table 1) are part of the zones of *M. nilssoni* and *M. scanicus* (zones 33 and 34, Elles and Wood 1914, p. 523). These species suggest that the graptolite-bearing beds of the type section of the Moccasin Springs Formation are equivalent in age to the graptolite-bearing beds in the formation 14 miles to the south along Salamans Creek and to the Lower Ludlow Shale of Great Britain and central Europe.

TABLE 1

Distribution of species of *Monograptus* at localities studied in Illinois and south-eastern Missouri, and their occurrence in the British Ludlovian graptolite assemblage zones as reported by Elles and Wood (1911, p. 523). (c = very common, x = common, r = rare)

	Illinois and S.E. Missouri								*Great Britain*		
Locality	1			2		3	4	5	*Zone of* M. vulgaris	*Zone of* M. nilssoni	*Zone of* M. scanicus
	A	*B*	*C*	*A*	*B*				32	33	34
M. bohemicus							x			x	x
M. roemeri			x							x	x
M. varians	x	x		x						x	
var. *pumilus*?	r		r							c	x
M. dubius				x	x	x			x	c	x
M. cf. *M. dubius*	r					r		x			
M. colonus	c	c	c			x		x		x	
M. butovicensis				c	c				(Lower Ludlovian of central Europe)		

Locality 3. In White County, south-eastern Illinois, the core from Superior-Ford C-17 well, from which Collinson and Schwalb (1955) described Chitinozoa (sec. 27, T. 4 S., R. 14 W.), at a depth of 5,828 feet has a few broken rhabdosomes of *Monograptus colonus* and *M.* cf. *M. dubius* preserved in black silty shale near the top of the Moccasin Springs Formation. In Great Britain these two species occur together in the zones of *M. nilssoni* and *M. scanicus*.

Locality 4. In Christian County, central Illinois, the well core from the Wrather No. 1, Thompson well, sec. 15, T. 15 N., R. 2 W., at a depth of 1,875 to 1,897 feet has *Monograptus bohemicus* (Barrande), *Dendrograptus* sp., and *Callograptus* sp. in silty, thin-bedded dolomitic limestone of the Thorn Group. Decker (1935, p. 440) reported *M. bohemicus* from the lower part of the Henryhouse Shale of Oklahoma and recognized its Ludlovian affinities. A closely similar species *M. falciformis* Shrock, is known from the inter-reef Mississinewa Shale of northern Indiana (Shrock 1928, p. 35). Thorsteinsson (1958, p. 92) recorded *M. bohemicus* from the Cape Phillips Formation of Cornwallis Island in the Canadian Arctic Archipelago. In Europe *M. bohemicus* occurs in the zones of *M. nilssoni* and *M. scanicus* (Elles and Wood 1914, p. 523) in the Lower Ludlow Shale of Great Britain and it is distributed widely in equivalent strata in central Europe and Scandinavia.

Locality 5. In the Blue Island area south-west of Chicago, Illinois, two localities in the *Lecthayles*-bearing shale, Racine Formation (Thorn Group), have yielded monograptids; these are the dredge piles along the Calumet Sag Channel just west of the Grand

Trunk Railway bridge at Blue Island and the Midlothian quarry 2 miles to the southwest on Crawford Avenue. From the *Lecthayles*-bearing shale, Roy and Croneis (1931, p. 245) and Decker (1942, p. 861) reported three species of *Dictyonema*, one species of *Paleodictyota*, one species of *Desmograptus*, the Wenlockian species, *Monograptus vomerinus*, and its variety *M. vomerinus* var. *basilicus*. The monograptids examined in this study from the Midlothian quarry have biform thecae and are most closely similar to *M. colonus* (Barrande). The collection from the dredge piles along the Calumet Sag Channel also has *M. colonus* and, in addition, *M.* cf. *M. dubius* (Suess). The distal parts of these specimens of *M. colonus* agree closely with illustrations given by Decker (1942, p. 861). Both *M. colonus* and *M. dubius* are common in the zones of *M. nilssoni* and *M. scanicus* in Great Britain and Scandinavia.

Of palaeoecological interest is the abundance of dendroid genera in the inter-reef lithologies of the Thorn Group, as in the core from Christian County, in the *Lecthayles*-bearing shale at Blue Island, and in the Mississinewa Shale of Indiana, and the scarcity of these genera in the basinal shales of the Moccasin Springs Formation. Cumings and Shrock (1928, pp. 62–63) noted the similarities of the many species of dendroids from the Mississinewa Shale to the assemblage reported from the Lockport Limestone at Hamilton, Ontario, and to those from the Gasport Limestone of the Lockport Group in western New York.

Elsewhere in eastern North America, at Arisaig, Nova Scotia, McLearn (1924, pp. 15, 26) described the Lower Ludlovian *Monograptus wandalensis* Watney and Welch from the upper part of the McAdam Formation, and Berry (1960) described an assemblage of Lower Ludlovian monograptids from near Ashland, Maine. From Oklahoma Decker (1935) described Lower Ludlovian graptolites from the Henryhouse Shale.

Correlation. This study of Silurian graptolites from Illinois suggests a solution to several apparent conflicts in correlation within the central states region and offers strong support for correlation of the Lockportian Stage of the Niagaran Series with the Lower Ludlovian of Great Britain.

On the basis of monograptid assemblages, the upper part of the Niagaran strata in the central states region (the Racine Formation, the upper part of the Moccasin Springs Formation, the Mississinewa Shale, and the Henryhouse Shale) are correlated with the Lower Ludlow Shale of Great Britain. The correlation of the reef-bearing Racine Formation with the Lockport Group of New York State (Swartz *et al.* 1942) suggests that the Lockportian Stage of the Niagaran Series in its type region is largely, if not entirely, equivalent to the Lower Ludlovian of the type Silurian strata of Great Britain.

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SYSTEMATIC DESCRIPTIONS

Monograptus bohemicus (Barrande)

Text-figs. 5G, H, J

Graptolithus bohemicus Barrande 1850, p. 40, pl. 1, figs. 15–18.

Monograptus bohemicus Wood 1900, p. 483, fig. 25, pl. 25, figs. 27*a*, *b*; Elles and Wood 1911, p. 367, fig. 239, pl. 36, figs. 4*a–d*.

Description. Rhabdosomes are curved ventrally in their proximal region but after arching about 120 degrees the distal portions of the rhabdosomes become nearly straight. In specimens examined the sicula has been observed only in scalariform view and most specimens have their rhabdosomes broken at the base of very short (1·0 mm.) thecae. The earliest thecae observed are short and broad, overlapping one another about one-half their length. Twelve thecae in 1 cm. are common for the proximal part. Succeeding thecae become markedly more elongate, have larger apertures, and overlap one another for about one-third their length with eight thecae in 1 cm. In the distal part of the rhabdosome, thecae are 0·8 mm. wide and 2·0 mm. long and are inclined at about 30 degrees. Thread-like processes are commonly seen on the dorsal side near the fourth theca.

Remarks. These specimens agree closely with the descriptions and illustrations given by Elles and Wood (1911, p. 367), Wood (1900, p. 483) who restudied Barrande's original specimens, and Ruedemann (1947, p. 474) for *Monograptus bohemicus*. *M. falciformis* Shrock (1928) is closely similar but differs in having wider rhabdosomes and more numerous thecae (13 in 8·5 mm.). In the Illinois samples *M. bohemicus* is associated with species of *Dendrograptus* and *Callograptus*. In North America *M. bohemicus* has been reported by Decker (1935, p. 440) from the lower part of the Henryhouse Shale of Oklahoma, and, according to Ruedemann (1947, p. 474), *M. falciformis* from the Mississinewa Shale of Indiana may also fall within the limits of *M. bohemicus*.

Occurrence. Twelve compressed specimens on four pieces of 3-inch well core from John Wrather No. 1, T. M. Thompson well (locality 4), Christian County, Illinois. Core pieces examined are from 1,875 to 1,897 foot depth in non-reef limestone of the Thorn Group.

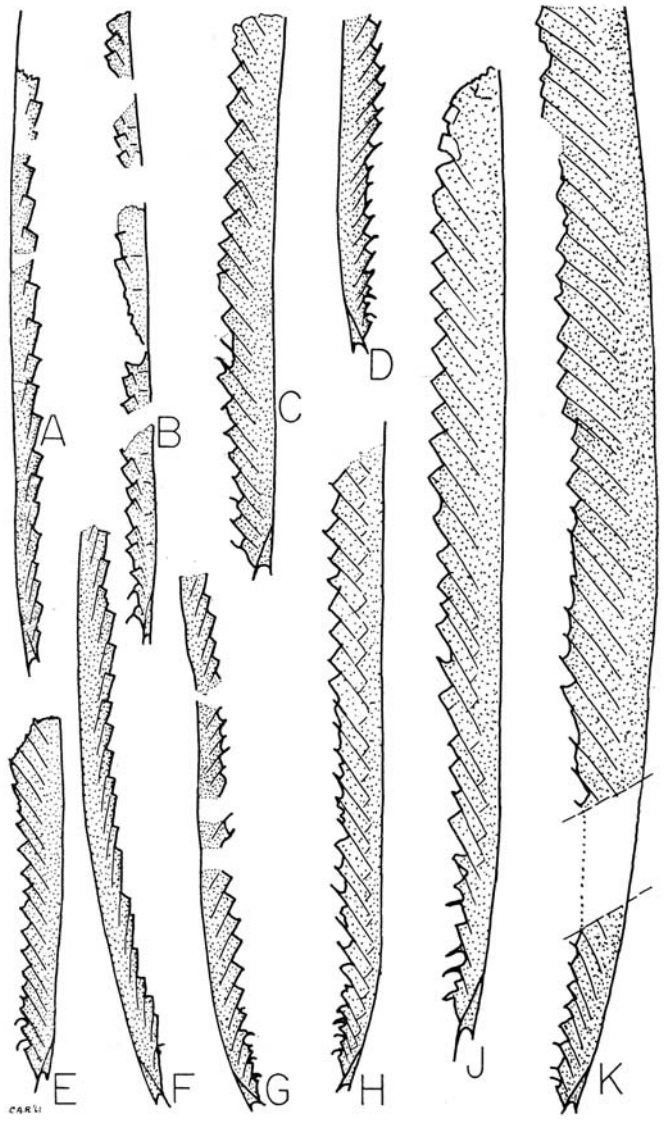
Monograptus roemeri (Barrande)

Text-fig. 3κ

Graptolithus roemeri Barrande 1850, p. 41, pl. 2, figs. 9–11.
Monograptus roemeri (Barrande) Wood 1900, p. 470, fig. 17, pl. 25, figs. 13*a*, *b*; Elles and Wood 1911, p. 397, fig. 265, pl. 39, figs. 2*a–d*.

Description. The rhabdosomes reach 5 cm. or more in length and are straight distally. The proximal tips have slight ventral curvature and the rhabdosomes widen from 1·8 mm. at the fourth theca to 3·5 mm. in the more distal thecae, but they may narrow slightly in the last 5 mm. The sicula is 0·5 mm. wide and 2·0 mm. long and reaches above the second thecal aperture. The proximal thecae are short (1·0 mm.) and the first two to four have single short spines. Thecae number fifteen in the basal 10 mm. Distally the thecae are 0·8 mm. wide and become longer reaching a maximum length of 4·0 mm. near the distal end, eleven to twelve apertures in 10 mm. Thecae are inclined 35 to 40 degrees to the nema, overlap one another nearly three-quarters of their length, and commonly are slightly curved outwards.

Remarks. Specimens of *Monograptus roemeri* from the Moccasin Springs Formation compare closely with the descriptions and illustrations given by Wood (1900, p. 470) and Elles and Wood (1911, p. 397). *M. colonus* (Barrande) and its varieties are less broad and have fewer thecae that bear spines.



TEXT-FIG. 3. Monograptids from the Moccasin Springs Formation, along Salamans Creek, sec. 2, T. 15 S., R. 3 W., Alexander County, Illinois (all figures ×4).

A, F, *Monograptus* cf. *M. dubius* (Suess) locality 1 A, IGS 3639, 3640.
B, G, *Monograptus varians* Wood, locality 1A, IGS 3641, 3642.
C, *Monograptus colonus* (Barrande), locality 1 C, IGS 3643.
D, E, *Monograptus varians* var. *pumilus*? Wood, localities 1 A, and 1 C, respectively, IGS 3644, 3645.
H, J, *Monograptus colonus* (Barrande), locality 1 A, IGS 3646, 3647.
K, *Monograptus roemeri* (Barrande), locality 1 C, IGS 3648.

Occurrence. Monograptus roemeri is common in the highest collection from Salamans Creek (locality 1 C), Alexander County, Illinois, but was not present in other collections studied.

Monograptus varians Wood

Text-figs. 3B, G; 4A

Monograptus varians Wood 1900, p. 467, fig. 15, pl. 25, figs. 14*a*, *b*, 15, 16*a*, *b*; Elles and Wood 1911, p. 395, fig. 263, pl. 39, figs. 6*a–c*.

Description. Rhabdosomes 2·0 cm. or more in length have slight ventral curvature near the proximal tip and are straight distally. The width increases gradually from 0·8 mm. at the first thecal aperture to 1·8 mm. at 1 cm. above the sicula. The sicula is about 2 mm. long and 0·5 mm. wide at its aperture where the first theca appears to arise. The first two or three thecae have slight ogee form and their apertures may be retroverted. The succeeding four or five thecae are straight and inclined at about 20 degrees and more distal ones are inclined at 30 to 35 degrees. The distal thecae are 1·8 to 2·0 mm. long and 0·6 to 0·7 mm. wide at their apertures which lack heavy rims. Thecae overlap one another about one-half their length.

Remarks. Specimens of *Monograptus varians* from the Moccasin Springs Formation agree closely with the descriptions given by Wood (1900) and Elles and Wood (1911). The specimens assigned to this species include a wide range of morphological variations in the number of ogee thecae in the proximal region and in the length of the rhabdosome.

Occurrence. Monograptus varians is common in collections from Salamans Creek (localities 1 A and 1 B), Alexander County, Illinois, and at Moccasin Springs (locality 2 A), Missouri.

Monograptus varians var. *pumilus*? Wood

Text-figs. 3D, E

Monograptus varians var. *pumilus* Wood 1900, p. 469, fig. 16, pl. 25, figs. 17*a*, *b*; Elles and Wood, 1911, p. 396, fig. 264, pl. 39, figs. 7*a–c*.

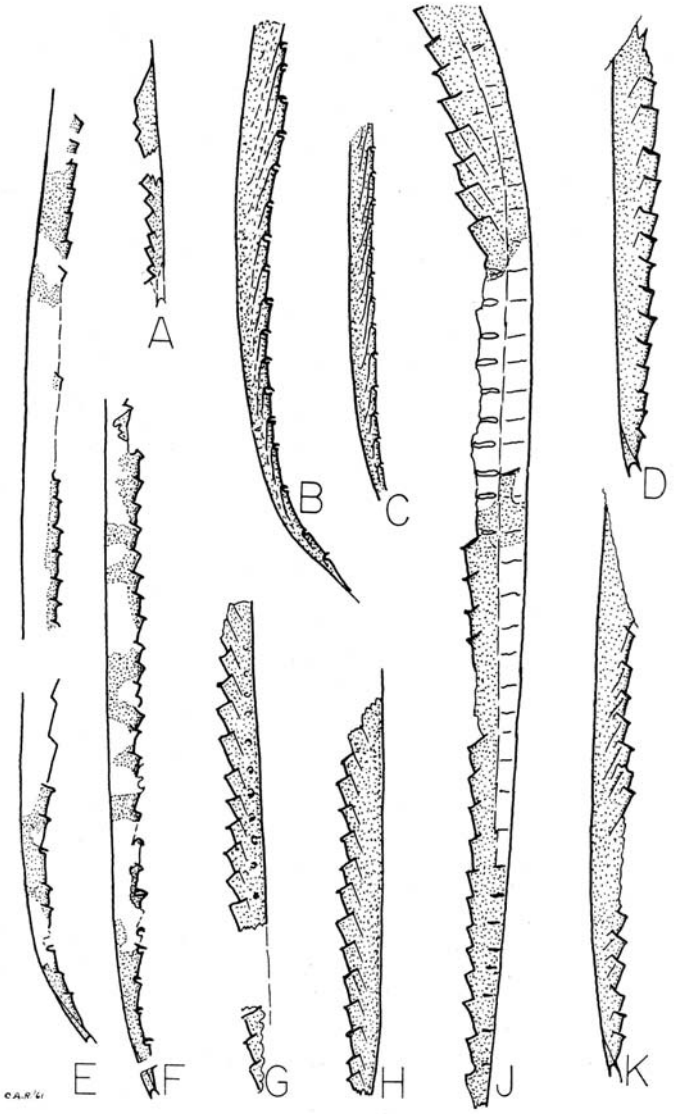
Discussion. Several specimens that are closely similar to *Monograptus varians* have shorter (1·5 cm.) and broader (2·0 mm.) rhabdosomes and more closely spaced thecae (15 in 1 cm.) than typical specimens of *M. varians*. Only the first two thecae are slightly curved. *M. varians* var. *pumilus* described by Wood (1900) and by Elles and Wood (1911) is very similar to these specimens which are questionably assigned to it.

Occurrence. Monograptus varians var. *pumilus*? is rare in collections from Salamans Creek (localities 1 A and 1 C), Alexander County, Illinois.

Monograptus dubius (Suess)

Text-figs. 4D, G, H, J, K; 5K, L

Graptolithus dubius Suess 1851, p. 115, pl. 9, figs. 5*a*, *b*.
Monograptus dubius Wood 1900, p. 454, fig. 9, pl. 25, figs. 1*a*, *b*; Elles and Wood, 1911, p. 376, fig. 247, pl. 37, figs. 7*a–d*.



TEXT-FIG. 4. Monograptids from the type section of the Moccasin Springs Formation, ¾ mile south of Moccasin Springs, Missouri (all figures ×4).

A, *Monograptus varians* Wood, locality 2 A, IGS 3649.

B, C, *Monograptus butovicensis* Bouček, locality 2 B, IGS 3650, 3651.

D, G, H, K, *Monograptus dubius* (Suess), locality 2 A, IGS 3652, 3653, 3654, and 3655.

J, *Monograptus dubius* (Suess), locality 2 B, IGS 3656.

E, F, *Monograptus butovicensis* Bouček, locality 2 A, IGS 3657, 3658.

Description. Rhabdosomes, 7 cm. or more in length, have slight ventral curvature at their proximal tips and are straight distally although they may slightly bend in their distal regions (text-fig. 4J). In specimens studied the rhabdosomes increase gradually in width from 1 mm. at the top of the first thecae to nearly 3 mm. at 5 cm. above the proximal tip. The sicula is 1·6 to 1·7 mm. long and is narrow; the ventral spine is commonly longer than the virgula. The thecae are nearly straight tubes with slight thickenings at the apertures that when compressed give the appearance of short spines. There are ten thecae per 1 cm. in the proximal region and nine thecae per 1 cm. 3 to 4 cm. above the proximal tip. The thecae are 2 mm. long and 1 mm. wide at their apertures in the distal region where they overlap one-third to one-half their length.

Remarks. The specimens from the upper part of the Moccasin Springs Formation at Moccasin Springs (locality 2 A), Missouri, agree closely with the description given by Wood (1900, p. 454) and Elles and Wood (1911, p. 376) for the longer forms of the species which occur in the Lower Ludlow Shales.

Occurrence. Monograptus dubius is common in collections from Moccasin Springs (locality 2 A and 2 B), Missouri, and in the core from the Superior-Ford C-17well (locality 3), White County, Illinois.

Monograptus cf. *M. dubius* (Suess)

Text-figs. 3A, F; 5C, D

Discussion. Several specimens that are rare in the collections studied are closely similar to *Monograptus dubius* but differ in several important features. These specimens have narrower rhabdosomes and narrower thecae that show slight ogee curvature in comparison to *M. dubius*. They have ten to eleven thecae per 1 cm. in the distal region and the sicula reaches nearly 2 mm. in length. The slight ogee curvature of the thecae reminds one of the thecae in *M. gotlandicus* Perner (1899) or in *M.* cf. *M. gotlandicus* illustrated by Elles and Wood (1911) which have broader rhabdosomes. The thecal curvature in specimens examined may represent distortion caused by compaction.

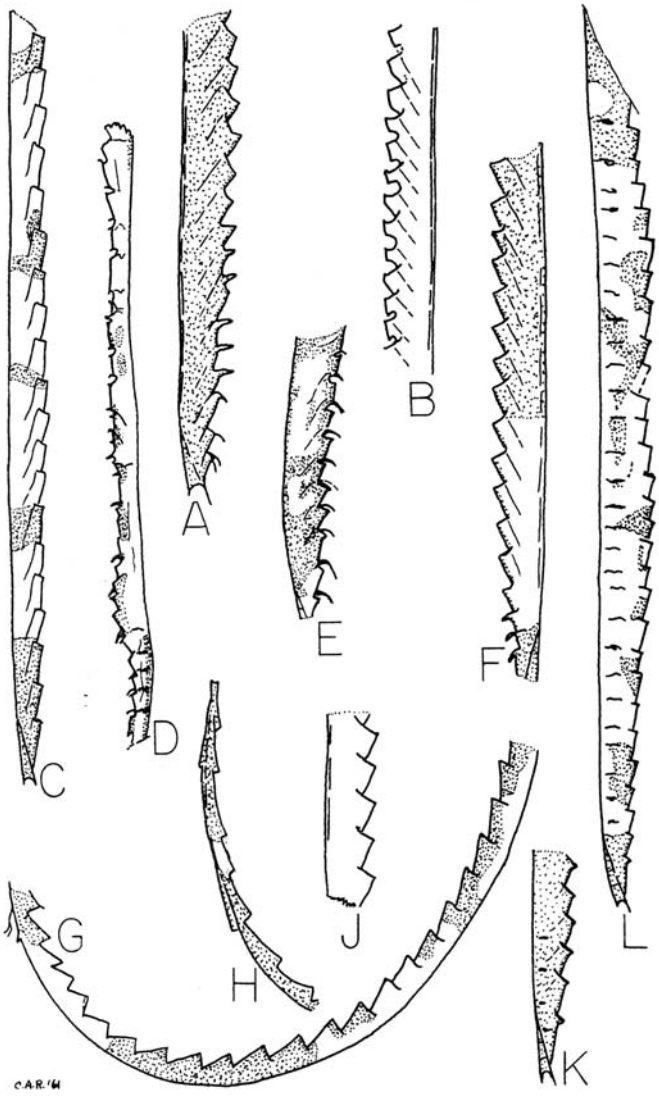
Occurrence. Monograptus cf. *M. dubius* is rare in collections from Salamans Creek (locality 1 A), Alexander County, Illinois, Superior-Ford C-17 well core (locality 3), White County, Illinois, and the Calumet Sag Channel (locality 5) near Blue Island, Illinois.

Monograptus butovicensis (Bouček)

Text-figs. 4B, C, E, F

Pristiograptus butovicensis Bouček 1936, p. 140; Münch 1952, p. 95, pl. 22, fig. 4.

Description. The rhabdosomes are 2·0 to 2·5 cm. in length and have broad ventral curvature beginning just above the proximal tip and continuing for 1 to 1·5 cm. They are 0·5 mm. wide at the top of the first theca and 1·5 mm. wide 2 cm. above the proximal tip. The sicula is poorly seen in the specimens but as shown in text-fig. 4B it is apparently narrow and long. In the distal part of a rhabdosome there are nine to ten thecae in 1 cm. The apertures have heavy rims that commonly appear as overlying hoods. The thecae



TEXT-FIG. 5. Monograptids from the Silurian of Illinois (all figures ×4).
A, B, F, *Monograptus colonus* (Barrande), locality 5, IGS 3659, 3660, 3661.
C, *Monograptus* cf. *M. dubius* (Suess), locality 3, IGS 3663.
D, *Monograptus sp.*, locality 5, IGS 3664.
E, *Monograptus sp.*, locality 3, IGS 3662.
G, H, J, *Monograptus bohemicus* (Barrande), locality 4, IGS 3665, 3666, 3667.
K, L, *Monograptus dubius* (Suess), locality 3, IGS 3668, 3669.

are long, narrow, and nearly straight tubes that overlap for one-half their length in the distal region.

Remarks. Monograptus butovicensis from the Moccasin Springs Formation differs from *M. scanicus* in having a slightly broader rhabdosome and more overlap of the thecae. The specimens shown in text-fig. 4B and C are thick carbonaceous films whereas those shown in text-fig. 4E and F are mostly moulds.

Occurrence. Monograptus butovicensis is common in collections from Moccasin Springs (localities 2 A and 2 B), Missouri.

Monograptus colonus (Barrande)

Text-figs. 3C, H, J; 5A, B, F

Graptolithus colonus Barrande 1850, p. 42, pl. ii, figs. 2, 3.
Monograptus colonus (Barrande) Wood 1900, p. 463, pl. 25, figs. 10*a–d*; Elles and Wood 1911, p. 391, text-fig. 260, pl. 38, figs. 8*a–d*.

Description. The rhabdosome commonly reaches a length of 4 cm. or more and is straight distally but has a slight, distinct ventral curvature at the proximal end. The best-preserved rhabdosome is 5 cm. long and has thirty-nine thecae in 4 cm. and a 1 cm. nema without thecae above. The rhabdosome is 1 to 1·5 mm. wide at the first theca and increases in width to 2 to 3 mm. at the tenth theca. The sicula is 2·0 to 2·5 mm. long and reaches to the second thecal aperture and is 0·4 to 0·6 mm. wide at its aperture. The virgella is strong and reaches 1·2 mm. in length. The first theca has a double spine and the next five thecae have long sharp spines and the succeeding four or five have wide thick lips. More distal thecae have heavy rims and become broader. The thecae are short in the proximal tip, about 1·0 mm., and have ogee curvature. They gradually increase in length to 2·0 mm. and become straight about 2 cm. above the base of the rhabdosome. Later thecae become broader, increasing from 0·5 to 0·8 mm. without appreciable change in length.

Remarks. Monograptus colonus from the *Lecthayles*-bearing shale at the Midlothian quarry is closely similar to the specimens described and illustrated by Wood (1900, p. 463) and Elles and Wood (1911, p. 391). In many aspects these specimens are similar to *M. varians* var. *pumilus* Wood but that variety is distinctly shorter than *M. colonus*.

Occurrence. Monograptus colonus is common in the *Lecthayles*-bearing shale at the Midlothian quarry and along the Calumet Sag Channel at Blue Island (locality 5) and in the upper part of the Moccasin Springs Formation at Salamans Creek (localities 1 A, 1 B, and 1 C) and is present in the Superior-Ford C-17 core from White County (locality 3).

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