

Some Silurian (Llandovery) monograptids from Saudi Arabia

A.A. El-Khayal

El-Khayal, A.A. Some Silurian (Llandovery) monograptids from Saudi Arabia. — Scripta Geol., 80: 15-22, 1 fig., 1 pl., Leiden, April 1986.

Three species of *Monograptus* are recognized from Qusayba, Al-Qasim Province, Saudi Arabia. The Qusayba Shales Member of the Tabuk Formation in central Saudi Arabia contains *M. decipiens decipiens*, *M. ex gr. barrandei* and *M. elongatus*, associated with other graptolites. This assemblage is indicative of the *Monograptus convolutus* Zone. Therefore the lower part of the Qusayba Shales are believed to be correlative to the *convolutus* Zone (Llandovery) of Great Britain.

A.A. El-Khayal, Geology Department, King Saud University, P.O. Box 2455, Riyadh 1145, Saudi Arabia.

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Introduction

Silurian graptolites from the Tabuk Formation were first noted by Steineke et al. (1958) who mention that probable *Climacograptus* and several other graptolites serve as the basis for a Silurian assignment for beds about 375 m below the top of the Tabuk Formation.

The Tabuk Formation (Ordovician-Silurian), averaging c. 1000 m, is a cyclic series of clastic sediments comprising three shallow but open marine shale members, forming roughly parallel escarpments near the top, middle and at the base, separated by sandstones of near shore and fluvio-deltaic deposition. The shale units are from bottom to top: the Hanadir Member, the Ra'an Member and the Qusayba Member.

The Qusayba Shales at their best exposure in the Qusayba depression (26°54'30"N, 43°36'42"E) (Fig. 1) form a vertical cliff facing the east. At this locality the section is

composed of 44 m of varicoloured shales, but mostly grey-green. The lower part contains the graptolites, while the upper part is laminated, more gypsiferous and contains thin beds of red, hematitic siltstone. Poorly sorted, grey, medium-grained, thin-bedded sandstones and highly weathered calcareous beds occur at the top of the unit.

The section at Qusayba could be correlated with the 47 m within the type section of the Tabuk Formation in the Tabuk area described by Steineke et al. (1958) as grey, purple and green shales, in part silty and micaceous, with layers of light grey platy fine sandstone, with *Climacograptus* at several horizons.

The material is mainly deposited in the Department of Geology, King Saud University, Riyadh, Saudi Arabia. The numbers are prefixed by the letters STQKSU (S = Silurian, T = Tabuk, Q = Qusayba, KSU = King Saud University). Duplicate material is housed in the Sedgwick Museum, Cambridge and the Rijksmuseum van Geologie en Mineralogie (National Museum of Geology and Mineralogy), Leiden.

Acknowledgments

The writer wishes to thank Dr R.B. Rickards for inviting him to compare the material with specimens stored in the Sedgwick museum. He also thanks H. Salim for laboratory assistance, A. Arafa for typing and Fathallah for developing the photographs.

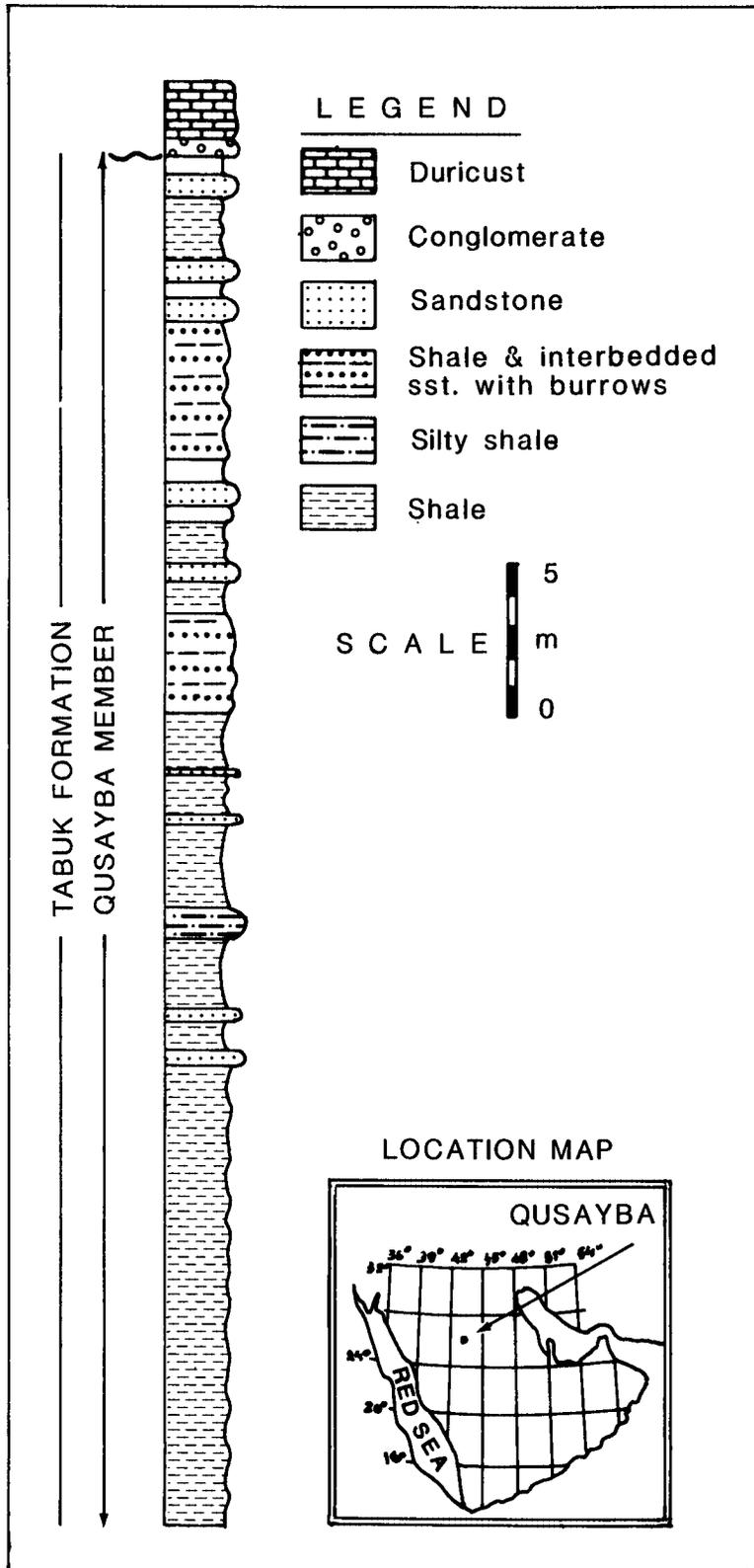
FAUNAL ASSOCIATION

Powers et al. (1966) reported that several samples collected from the Tabuk Formation, but without specific locality indication, were identified as definitely Silurian on the basis of the contained *Monograptus*.

Rickards and Koren (1974) described the species *Glyptograptus* (*Pseudoglyptograptus*) *tabukensis* from a bore hole near Tabuk, Saudi Arabia, while Rickards (1976) reported the presence of *Monograptus* cf. *tenuis* from the Qusayba Shale. Both species are from the *convolutus* Zone.

Thomas (1977) identified a trilobite *Platycoryphe dyaulax* from the Qusayba Shales, while McClure (1978) mentioned that these shales bear a rich graptolite fauna dated as lower Silurian – Lower Llandovery – *convolutus* Zone of the Idwian Stage. He also mentioned the presence of trilobites and an abundant chitinozoan and acritarch assemblage that substantiate the age assignment, but he did not list the species.

The writer has identified and described in this paper the following species from the Qusayba Shales: *Monograptus decipiens decipiens*, *M. ex gr. barrandei* and *M. elongatus*. Other graptolites identified but not described in the present work include *Petalograptus ovatoelongatus* (Kurck, 1882), *Climacograptus scalaris* (Hissinger, 1837), *C. rectangularis* (McCoy, 1850), *Monograptus convolutus* (Hissinger, 1837), *Lagarograptus* sp., *Pristograptus regularis regularis* (Törnquist, 1899), *Orthograptus insectiformis* (Nicholson, 1869), and *Retiolites perlatus perlatus* Nicholson, 1869. The systematic description of these species is in preparation.



Systematic palaeontology

Class Graptolithina Bronn, 1846
 Order Graptoloidea Lapworth, 1875
 Suborder Monograptina Lapworth, 1880
 Family Monograptidae Lapworth, 1873

Genus *Monograptus* Geinitz, 1852 emend.

Type species — By subsequent designation (Bassler, 1915, p. 822): *Lomatoceras priodon* Bronn, 1835, from the Silurian of Germany.

Remarks — The genus *Monograptus* has been discussed in detail by Rickards (1970, pp. 25-27); Bulman (1970, p. V132), and Bulman & Rickards, (in Bulman, 1970, pp. V149-157), and Rickards (1974, 1976).

Monograptus decipiens decipiens Törnquist, 1899

Pl. 1, figs. 1-3, 8.

1899 *Monograptus decipiens* n. sp. – Törnquist, p. 20, pl. 4, figs. 9-14.

1913 *Monograptus decipiens decipiens* Törnquist – Elles & Wood, p. 469 (pars), pl. 47, figs. 3a, b, e (non c, d), text-fig. 325a (non b, c).

1958 *Monograptus decipiens* Törnquist – Sudbury, p. 510, pl. 21, figs. 74-75.

1970 *Monograptus decipiens* Törnquist, 1899 – Rickards, p. 83, text-fig. 13, fig. 16; text-fig. 17, fig. 8; text-fig. 18, figs. 3, 13.

1975 *Monograptus decipiens decipiens* Törnquist, 1899 – Hutt, p. 85, pl. 21, figs. 2-4; text-fig. 17, fig. 5; text-fig. 20.

Lectotype — Designated by Přibyl & Münch, 1942, p. 12: specimen figured by Törnquist, 1899, pl. 4, fig. 10; from the *convolutus* Zone of Tommarp, Sweden.

Material — Numerous fragments, preserved in low relief.

Locality and horizon — Al-Qusayba, Al-Qasim Province, Saudi Arabia, lower Qusayba Shales, Tabuk Formation, *convolutus* Zone, Llandovery, Silurian.

Diagnosis — Rhabdosome coiled, possibly spirally, with slender proximal end, having rastriform thecae and a quite robust distal portion, with triangular thecae.

Plate 1

Figs. 1-3, 8. *Monograptus decipiens decipiens* Törnquist, 1899

1. Part of a rhabdosome, STQKSU 148m.d., × 10.

2. Part of specimen shown in fig. 1, enlarged, × 57.

3. STQKSU 263m.d., × 10.

8. STQKSU 89m.d., × 13.

Figs. 4-6. *Monograptus elongatus* Törnquist, 1899

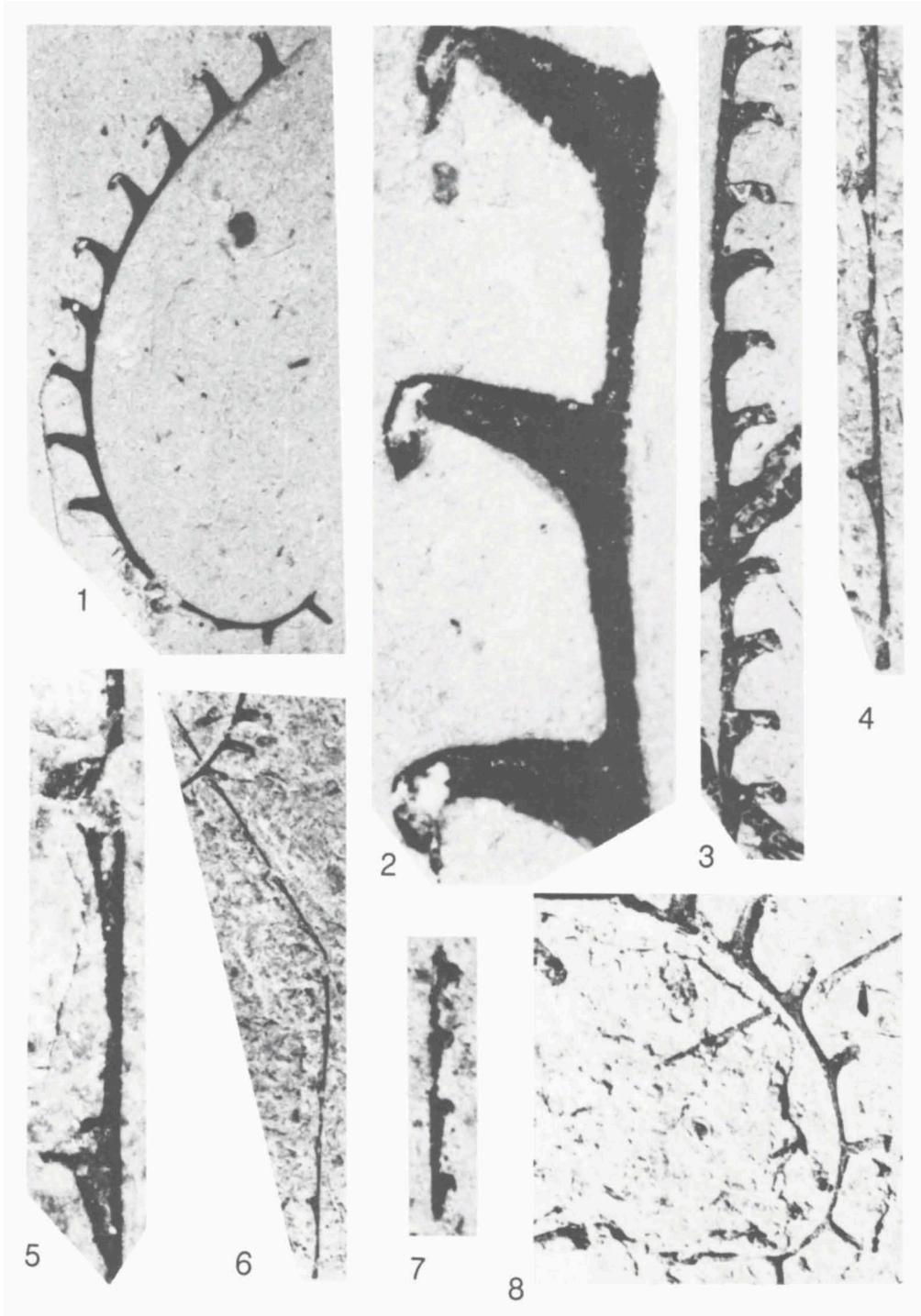
4. Part of the rhabdosome shown in fig. 6, showing sicula and three thecae, × 14.7.

5. Same specimen, enlarged, × 37.8.

6. Nearly complete rhabdosome, STQKSU 89m.d., × 6.

Fig. 7. *Monograptus* ex. gr. *barrandei* sensu Elles & Wood, 1913 STQKSU 82m.b., × 10.

Plate 1



Description — Rhabdosomes curved, sicula not observed. The first few thecae are rastriform with slender parallel sided prothecae and metathecae; the width of the metathecae is about 0.08 mm. The prothecae are parallel-sided having a maximum width of about 0.05 mm. The metathecae increase gradually in height and the later thecae reach up to 0.8 mm and even more. The thecae number 8.6 in 10 mm. The thecae terminate in small, hooked apertures.

Remarks — The Arabian specimens match the descriptions of Törnquist (1899), Sudbury (1958), Rickards (1970), and Hutt (1975). Complete specimens were not found. This is the first time that *M. decipiens decipiens* is recorded from Saudi Arabia. This species has been recorded from Sweden (Törnquist, 1899), the British Isles (Elles & Wood, 1913; Sudbury, 1958; Rickards 1970; Hutt, 1975), the U.S.S.R. (Chaletkaya, 1962; Nikiforova & Obut, 1965), and from Canada (Lenz, 1982).

Monograptus ex gr. *barrandei* Suess, 1851, sensu Elles & Wood, 1913
Pl. 1, fig. 7.

- ex gr. 1913 *Monograptus barrandei* (Suess) – Elles & Wood, p. 462, pl. 46, figs. 6a, b, text-fig. 320.
1970 *Monograptus* cf. *M. barrandei* sensu Elles & Wood – Hutt, Rickards & Skovington, p. 10, pl. 2, figs. 30-32.
?1974 *Monograptus* cf. *barrandei* sensu Elles & Wood, 1913 – Sherwin, p. 165, pl. 11, fig. 3.
1975 *Monograptus* ex gr. *barrandei* sensu Elles & Wood, 1913 — Hutt, p. 79, text-fig. 24, figs. 8-10.

Material — A few fragments.

Locality and horizon — Al-Qusayba, Al-Qasim Province, Saudi Arabia; Qusayba Shales, Tabuk Formation, *convolutus* Zone, Llandovery, Silurian.

Description — Straight fragments, thecae have narrow, nearly parallel prothecae 0.15 mm wide and do not exceed 0.4 mm at apertural fold. The thecae number 11.4 in 10 mm.

Remarks — The Arabian forms compare well with the figures given by Elles & Wood (1913). Boucek and Přibyl (1952) discussed this species and mentioned that the original specimens of *M. barrandei* are lost and they rejected the figured British specimens from the synonymy but did not name them. Earlier Přibyl (1948) had accepted Elles & Wood's figures as *M. barrandei*. The Qusayba specimens differ from those described by Elles & Wood (1913, p.462) from Scotland and Co. Down in having a higher thecal count. Hutt et al. (1970) noted the presence of this species in the Swedish *turriculatus* Zone from the Bollerup and Klubbudden stages of Dalarna, Sweden. Sherwin (1974) has described specimens from Australia that have proximal ends, while Hutt (1974) mentioned that specimens from the Lake District display the same thecal characteristics as the Swedish material.

Monograptus elongatus Törnquist, 1899
Pl. 1, figs. 4-6

1899 *Monograptus elongatus* n. sp. – Törnquist, pp. 17-18, pl. 3, figs. 12-18.

Type specimen — Not yet designated; Törnquist's syntypes are from the Llandovery of Sweden.

Material — Several fragments, preserved in low relief.

Locality and horizon — Al-Qusayba, Al-Qasim Province, Saudi Arabia; base of Qusayba Shales, Tabuk Formation, *convolutus* Zone, Llandovery, Silurian.

Diagnosis — Straight rhabdosome, slender, thecae have initial thread-like portions swelling gradually into a triangular lobe with straight to concave ventral wall and small hooked aperture. Thecae number 6.7 in 10 mm.

Description — Rhabdosome straight, slender, fragmentary preserved, sicula is 1.2 mm long. The thecae have initial thread-like prothecae, 0.075 mm wide, which account for over $\frac{3}{7}$ the total thecal length. The thread-like prothecae gradually expand into a triangular portion with hooked lobes. The dorsoventral width of the rhabdosome in the region of the first aperture is 0.375 mm. Most thecae are about 1.5 mm long. The theca number 6.7 in 10 mm.

Remarks — The Arabian forms agree well with the figures given by Törnquist (1899). *M. elongatus* differs from *M. capis* by having smoothly triangular thecae with straight or concave ventral walls, while the ventral margin of each theca is convex in *M. capis*; also the Arabian forms have larger sicula: 1.2 mm long as compared with 0.9-1.05 mm in *M. capis*.

Říbyl (1945) discussed this species and later (Říbyl, 1948) put it into synonymy with *M. intermedius* Carruthers, as proposed earlier by Gortani (1923). Strachan (1969, p. 54) redescribed Carruthers' type graptolites and showed that *M. elongatus* Törnquist is not a junior synonym of *M. intermedius* Carruthers.

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Manuscript received 1 August 1985.