

ON THE OCCURRENCE OF
KINNEGRAPTUS
 SKOGLUND IN NORWAY

By

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Abstract. *Kinnegraptus kinnekullensis* SKOGLUND, 1961 and *K. aff. multiramosus* SKOGLUND, 1961 are described from the Lower Didymograptus Shales (transition beds between 3bδ and 3be) at the Old Quarry at Slemmestad, Inner Oslofjord.

In 1952, Dr. SPJELDNEs sent to Cambridge a collection of some twelve specimens of a peculiar graptolite collected from the Lower Didymograptus Shales at the Old Quarry at Slemmestad. The extreme tenuity of the branch and spine-like, sometimes even «looped», thecal processes were such as to suggest a possible relationship to KOZLOWSKI's genus *Dinemagraptus*; on closer examination this seemed doubtful, but what could be seen of the structure was so unusual that reference to the genus *Didymograptus* was equally doubtful, and the specimens were put aside in the hope that further material might supply more positive evidence. During the summer of 1961, Dr. SKOGLUND, while on a visit to Cambridge, brought photographs of his new genus *Kinnegraptus*, and it was at once apparent that this was closely similar to, if not identical with, the Slemmestad material; and on the publication of his paper (SKOGLUND 1961) it became possible to interpret the Norwegian material. One, and perhaps both, of Dr. SKOGLUND's species is represented, and the Norwegian material, although not so well preserved as that from the clayey mudstones of central Sweden, comprises more complete rhabdosomes. All the material is preserved

in pyrite in semi-relief, and «transfer preparations» have been made from specimens 66682 and 66688. We are much indebted to Professor STØRMER and Dr. SPJELDØES for the protracted loan of the material.

Kinnegraptus kinnekullensis SKOGLUND, 1961

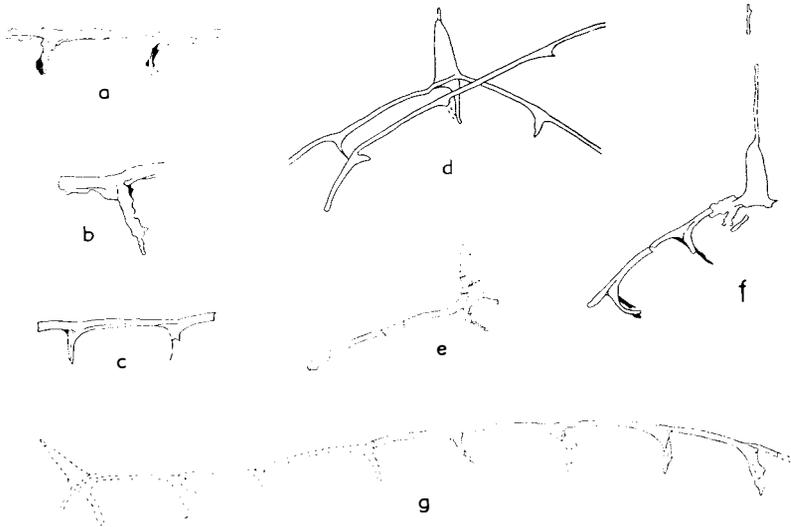
Text-figs. 1, 2; Pl. 1, figs. 1—3.

Material: about a dozen examples on specimens 66681—66689 and 72840, Paleontologisk Museum, Oslo.

Horizon: Transition Beds between 3bδ (*P. angustifolius elongatus* zone) and 3bε (*D. hirundo* zone). This is somewhat higher than the Swedish occurrences, which were assigned to the zones of *P. densus* and *P. angustifolius elongatus*.

Locality: Old Quarry, Slemmestad in Røyken, Inner Oslofjord.

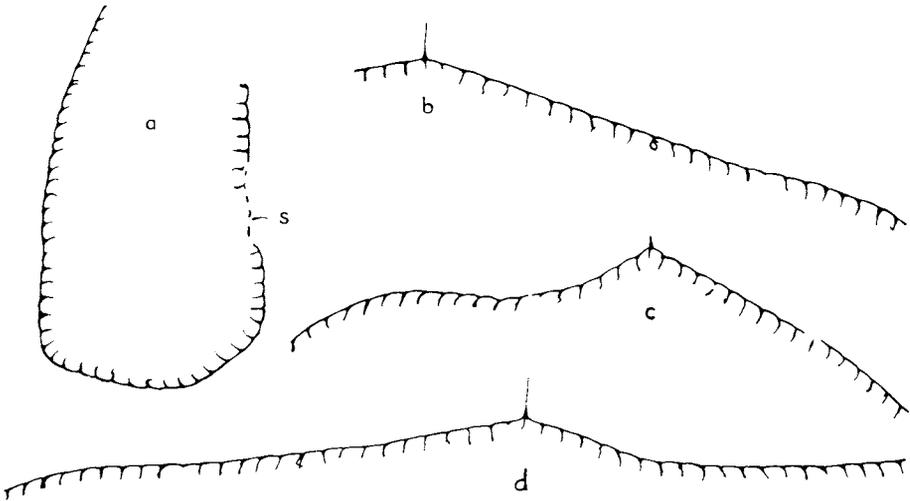
Description: The sicula (Text-fig. 1 d-g) is 0.85—0.93 mm in length,



Text-fig. 1. *Kinnegraptus kinnekullensis* SKOGLUND, Lower Didymograptus Shales, Slemmestad. All figures x 10. *a*, specimen 66682; *b*, specimen 66682; *c*, specimen 66688 A, typical thecae with apertural processes; *d*, specimen 66686, proximal end, reverse view with crossing canal in semi-relief; *e*, specimen 66688 B, obverse view; *f*, specimen 66688 A, proximal end with apertural processes preserved as paired spines; *g*, specimen 72840, natural mould of reverse view with crossing canal.

with a breadth at the aperture of 0.3 mm; it has not been possible to distinguish the metasicula from the prosicula, but the overall dimensions agree well with SKOGLUND's figures. There is a prominent apertural process («virgella») about 0.5 mm in length. No vesicle is present on any of these specimens and the length of the nema is variable; its breadth proximally is 0.04–0.07 mm.

The initial bud arises at about 0.6 mm from the apex of the sicula, apparently on either the right or the left side of the sicular process («virgella») so that, as in the Swedish material, the development can be either right- or left-handed; but here it is predominantly right-handed. Th¹ grows downwards for a short distance (0.16–0.18 mm) before turning abruptly outwards at a high angle (60–80° to the axis of the sicula). Th¹ takes its origin from th¹ at the point where the latter diverges from the sicula, then grows down towards the sicular aperture along the edge opposite the sicular spine before turning out-



Text-fig. 2. *Kinnegraptus kinnekullensis* SKOGLUND, Lower Didymograptus Shales, Slemmestad. All figures $\times 2$. Four rhabdosomes with well-preserved stipes; a, specimen 66684; b, specimen 66687; c, specimen 66683; d, specimen 66681. s = sicula.

wards at 40–55° to the axis (Text-fig. 1 d, g). Th² and th² are derived from th¹ and th¹ respectively, with extremely little overlap, so that the development is what has been termed the *bifidus* stage.

The stipes attain a length of over 8 cms (Text-fig. 2a). As noted by SKOGLUND, the thecal length is variable and there is no relationship between thecal length and position on the stipe. In our material, the interthecal distance (distance measured from one thecal aperture to the next) varies from 0.83–1.52 mm, with an average of 1.18 mm; for 45 thecae on one stipe, it varies capriciously from 0.83–1.23 mm. These figures correspond to a range of from 7.5 to 10.5 thecae per centimetre. The width of the free proximal part of the theca varies between the extremes of 0.05 and 0.13 mm, with an average of 0.086 mm. Thecal overlap is rarely visible; the amount (0.09–0.13 mm) is smaller than that quoted by SKOGLUND (one-fifth to one-seventh), but this may be due to imperfect preservation of the interthecal septum in our material.

A distinctive feature of this species is the sudden «flaring out» of the metatheca to a prominent elongate apertural process, the width of the stipe measured at the level of the apertural process being 1 mm. This process appears to have been flattened, almost spoon-shaped, with thickened margins which appear as loops when the central portion of the periderm is missing (as an accident of preservation).

The above description and figures agree so closely with those of Dr. SKOGLUND's *K. kinnekullensis* as to leave no doubt of their specific identity.

Kinnegraptus aff. *multiramosus* SKOGLUND, 1961

Text-figs. 3, 4.

Material: one specimen (P. M. O. no. 66681) showing sicula and proximal end of the rhabdosome, and fragments (P. O. M. no. 66689) of more mature portions of the branched rhabdosome.

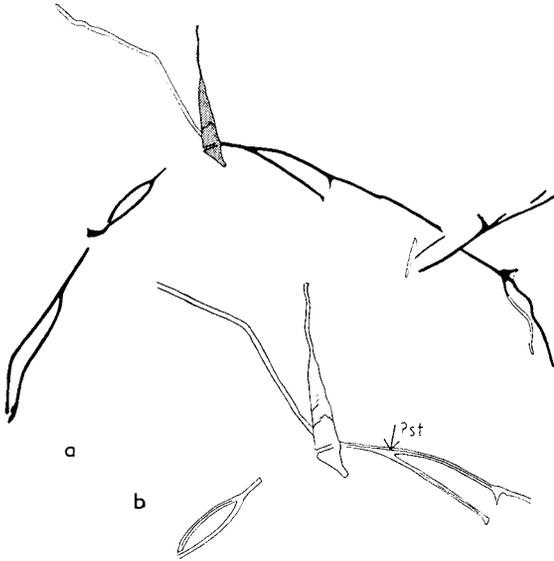
Horizon: Transition Beds between 3b δ and 3b ϵ .

Locality: Old Quarry, Slemmestad in Røyken, Inner Oslofjord.

Description: Material referred to this species occurs associated with *K. kinnekullensis* and with tangled fragments of an indeterminate dichograptid (?*Clonograptus*).

The rhabdosome is minute, declined, composed of exceedingly slender stipes bifurcating at a small angle at seemingly irregular but relatively close-spaced intervals.

The sicula (Text-figs. 3a, b) is 0.87 mm in length, with an apertural

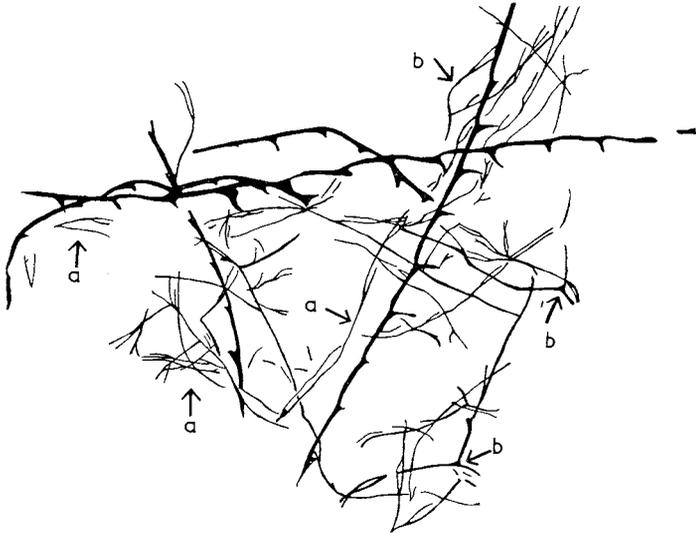


Text-fig. 3. *Kinnegraptus* aff. *multiramosus* SKOGLUND, Lower Didymograptus Shales, Slemmestad. *a*, proximal end with sicula, showing irregular branching of the bilateral rhabdosome, and traces of two thecal processes; specimen 66681, $\times 10$. *b*, proximal portion of the same, $\times 15$, showing traces of pyritized thread (?st) embedded in the dorsal side of the stipe.

width of 0.21 mm. It is not possible to distinguish prosicula from metasaccula and the apertural process is only imperfectly preserved.

Details of the origin of th 1¹ are obscure, but the theca diverges from the sicula at approximately 75° and th 1² crosses the sicula obliquely to diverge at about the same angle from (apparently) the level of the sicular aperture. The development is left-handed.

The width of the first theca is 0.03 mm (slightly narrower than the Swedish *K. multiramosus*), widening to 0.23 at the level of the aperture. On most of the stipe fragments, thecal apertures are invisible and details of the interthecal length and thecal number in 10 mm cannot be given. Along the dorsal edge of the stipes in specimen 66681 (Text-fig. 3b) is an exceedingly fine, «solid», pyritized thread. It may be that this is some preservational freak devoid of any real structural significance, but it is reminiscent of the pyritized stolon sometimes seen, for example, in some anisograptids preserved in shale. Had it been confined to the dorsal margin of th 1¹ it could perhaps



Text-fig. 4. *Kinnegraptus* aff. *multiramosus* SKOGLUND (a) with fragments of indeterminate dichograptid stipes (b) and *K. kinnekullensis* SKOGLUND. Lower Didymograptus Shales, Slemmestad. Specimen 66689, x 5.

have been interpreted as the long slender prothecal portion of th²¹ shown in SKOGLUND'S text-fig. 5B; but as it also occurs on more distal parts of the stipes where (according to SKOGLUND'S figures) the overlap is extremely small, this interpretation is hardly possible. Its true nature may become apparent when more is known of the detailed structure of the *multiramosus* rhabdosome.

The branches appear to divide at quite irregular intervals, but the only available material is very fragmentary and is confused with a mass of fragments of another extremely slender dichograptid (Text-fig. 4b).

There is doubt as to the reference of this material to *K. multiramosus*; the thecae are of *Kinnegraptus* type, but the sicula is larger than in *K. multiramosus*, the stipes somewhat more slender, and the structure of the proximal end is not identical. In view of the nature of the material, these differences cannot be properly evaluated, but it was thought worth putting on record as *K. aff. multiramosus*.

REFERENCE.

- SKOGLUND, R., 1961: *Kinnegraptus*, a New Graptolite Genus from the Lower *Didymograptus* Shale of Västergötland, Central Sweden. — Bull. Geol. Inst. Uppsala, vol. XI, pp. 389—400, pl. 1.

Manuscript received February 6, 1962.

Printed September 1962.

EXPLANATION OF PLATE 1.

Kinnegrapthus kinnekullensis SKOGLUND, 1961

From the Lower Didymograptus Shale (transition beds between 3bδ and 3bε) at the Old Quarry at Slemmestad in Røyken, Inner Oslofjord. Collected by N. SPJELDNÆS, 1951.

The specimens are deposited in Paleontologisk Museum, Oslo.

All figures x 4.

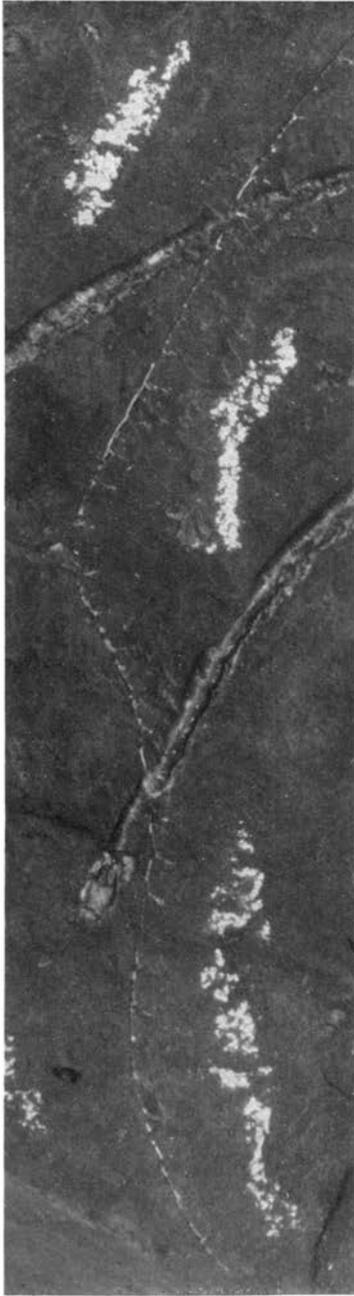
Fig. 1. Specimen no. 66687

Fig. 2. Specimen no. 66683

Fig. 3. Specimen no. 66681



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