AN EARLY RECORD OF PROBABLE NOWAKIID TENTACULITOIDS FROM WALES

by S. P. TUNNICLIFF

ABSTRACT. The earliest nowakiid known to date, from the Llandovery *Atavograptus atavus* Zone of central Wales, is described as *Nowakia gwyensis* sp. nov. If the new form and the slightly younger *Nowakia brevis* are true nowakiids, the origins of the Dacryoconarida must now be sought in the earliest Silurian or older deposits.

UNTIL the present, the oldest known nowakiid tentaculitoid was *Nowakia brevis* Tunnicliff from the type locality of *Monograptus sedgwickii* (Portlock) (Landovery, *M. sedgwickii* Zone) at Pomeroy in County Tyrone (Tunnicliff 1983). The mode of life and significance of these early nowakiids were discussed briefly by Tunnicliff (1983), but the history of the nowakiids before this occurrence and after it until the Devonian remained unknown. In the course of biostratigraphical research in support of geological mapping in the Rhayader area of central Wales, further older forms of nowakiid type have now been collected.

In his original description of the *Atavograptus atavus* Zone (then *Monograptus tenuis*), H. Lapworth (1900, p. 78) referred to a roadside section 'on the east side of the Builth road, about 50 yards north of a small stream which crosses the road'. Although he did not specify the fauna collected at this locality, he gave a short general list of graptolites from the *A. atavus* Zone: *A. atavus* [as *M. tenuis*], *Climacograptus normalis* and *C. rectangularis*. There is no record of any other fauna.

The British Geological Survey (BGS) collection made at this site, now identified as at National Grid Reference (NGR) SN 9799 6741, consists of some forty-two small slabs, BGS DJ 8832–8873, of thinly laminated, anoxic, hemipelagic mudstone showing no bioturbation. The collection contains only a small number of graptolites which are sufficiently well preserved to allow determination, and these only with qualification as *A.* cf. *atavus* and *C.* cf. *rectangularis*. Six of the slabs, including one pair of counterparts, do however bear small tentaculitoids which in most respects resemble *N. brevis*.

This record extends the known range of the Order Dacryoconarida to within two graptolite zones of the Ordovician–Silurian boundary, some seven graptolite zones earlier than the previous earliest record. The origins of the Dacryoconarida must now be sought in the earliest Silurian or older rocks.

Thick-shelled tentaculitoids such as *Tentaculites anglicus* are locally abundant in the mid-upper Ordovician. Hurst and Hewitt (1977) considered *Tentaculites anglicus* in some detail and concluded that it had an infaunal benthic mode of life. This would suggest the need for a free-swimming or planktonic larval stage to ensure dispersal. A planktonic mode of life has been suggested for *Nowakia* (Fisher *in* Moore 1962, p. W104; Bouček 1964, p. 37: Lardeux 1969, p. 90). The undisturbed, anoxic, thinly laminated nature of the sediments in the present specimens almost certainly precludes a benthic mode of life or the possibility that the shells were swept in after death. It is here tentatively suggested that the dacryoconarids could have arisen through neotenous development from a *Tentaculites* larval stage and that the tear-drop shaped initial stage may betray a planktonic larval origin. The degree and position of flexure is variable and would suggest that the shell retained some flexibility. The major rings would provide resistance to compression while allowing 'articulation'. We might draw an analogy with the plastic corrugated flexible pipes used in land drainage. The animal could therefore presumably wriggle and may not have been entirely passive.

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Tunnicliff (1983, p. 851) noted the coincidence of the flourishing of the nowakiids and the decline of the monograptids in the Devonian. Assuming a derivation from a tentaculitid stock, two possibilities suggest themselves for the relationship between these early forms and the Devonian nowakiids. The first is a direct relationship through a monophyletic group ranging from the late Ordovician or early Silurian to the Devonian. The second depends on the polyphyletic derivation of homeomorphic forms once or twice in the Llandovery and at least once in the Devonian. In the absence of comparable forms from intervening strata, it might be supposed that the second alternative is the more probable. However, if the early forms were true nowakiids and not simply early homeomorphic essays into the nowakiid mode of life, then it would seem that the nowakiids and the monograptids have histories which start at much the same time. While they apparently shared much the same ecological niche, the rapidly evolving monograptids were able to meet each new environmental challenge while the perhaps conservative dacryoconarids continued with little change and as a minor component of the fauna until the decline of the monograptids.

SYSTEMATIC PALAEONTOLOGY

The classification used in the *Treatise on invertebrate paleontology* Part W (Moore 1962) is adopted below class level. This is compatible with that of other authors (Bouček 1964: Lardeux 1969; Larsson 1979). The material cited is in the collections of the British Geological Survey, Keyworth (BGS).

Order DACRYOCONARIDA Fisher, 1962
Family NOWAKIIDAE Bouček and Prantl, 1960
Genus NOWAKIA Gurich, 1896

Nowakia gwyensis sp. nov.

Text-fig. 1A-I.

Derivation of name: from Afon Gwy, the Welsh for the nearby River Wye.

Material, horizon and locality. Holotype, BGS DJ 8837, and paratypes, BGS DJ 8838 & 8839 (counterparts) 8847, 8848, 8864 (four individuals on this slab) from the east side of the A470 trunk road, 310 mm at 88° from Ddôl farmhouse, Rhayader, Powys. (NGR: SN 9799 6741.) This locality is within the type area of the *Atavograptus atavus* Zone, Llandovery, Silurian, and is part of the outcrop of the Ddôl Shales of H. Lapworth (1900).

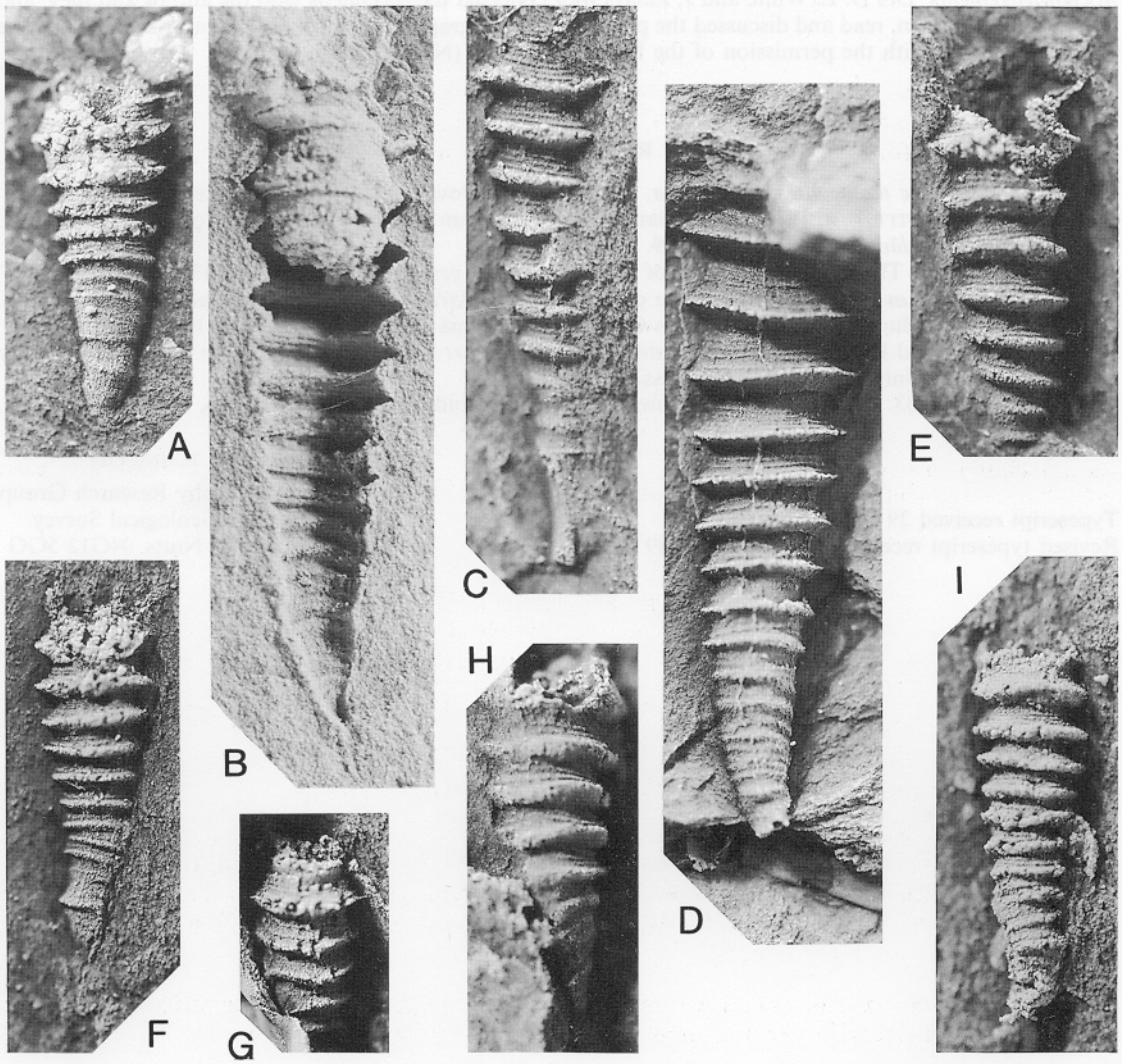
Diagnosis: medium-sized nowakiid with strong, rounded rings, fine transverse striae and faint or obscure longitudinal striae. Growth angle initially *c.* 35–40°, reducing to 16–17°.

Description: straight, conical shell with a thin wall (between 0·08 and 0·04 mm). Initial stage probably tear-drop shaped (text-fig. 1B) and often slighly curved away from the main axis of the shell (text-fig. 1B, D, F). The cross-section was probably circular in life although some slight compactional flattening is assumed to have occurred in the present specimens. External surface marked by strong, somewhat rounded rings: 4–6 per mm proximally reducing to 3–5 per mm distally. Fine transverse striae present, particularly on the distal surfaces of the major rings: between 1 and 2 per 0·1 mm. An indistinct beading of some rings (text-fig. 1A) may suggest the presence of faint longitudinal striae.

There is some evidence (text-fig. 1B) of internal septa corresponding approximately with the major rings. The internal surface undulates to correspond with the external relief (text-fig. 1B) but does not apparently bear the finer ornament.

Maximum shell length seen is 4·6 mm (text-fig. 1D), while the length of the juvenile portion is about 0·7 mm. Maximum width seen is 1·4 mm (text-fig. 1B) in a specimen with a maximum juvenile width of 0·56 mm. Juvenile growth angle, *c* 35–40°; mature growth angle much less, typically 16–17°.

Discussion: The only obvious comparable form known is *N. brevis* which, apart from having more pronounced longitudinal ornament, is of similar size and appearance. The frequency of the major rings is slightly greater in the Welsh specimens, both proximally and distally, while the finer



TEXT-FIG. 1. *Nowakia gwyensis* sp. nov. A, BGS DJ 8864. B, BGS DJ 8848. C, BGS DJ 8837 (pars). D, Holotype. BGS DJ 8837 (pars). E, BGS DJ 8837 (pars). F, BGS DJ 8839 (counterpart of fig. 1I). G, BGS DJ 8847. H, BGS DJ 8837 (pars). I, BGS DJ 8838 (counterpart of fig. 1F). All latex casts except 1B which is a mould and is lit from bottom right; all ×20.

transverse striae appear somewhat coarser than in *N. brevis*. The juvenile growth angle in *N. brevis* (*c.* 30°) is somewhat less than the 35–40° in the present specimens while the mature angle in *N. brevis* (20–25°) is rather greater, giving a much greater maximum width. However, it must be observed that both width and measurable angles may be influenced by the degree and style of compaction, which is greater in the specimens of *N. brevis* seen.

It is arguable whether *Nowakia* is the appropriate generic assignment for either *N. brevis* or *N. gwyensis* and Professor Lardeux (pers. comm. 1984) who has examined latex casts of *N. brevis* is of the opinion that they are not *Nowakia*. However, although other genera are available (e.g. *Paranowakia* Bouček 1964), the use of *Nowakia* for the present serves to draw attention to the clear similarity which these early forms have to those during the great flowering of the nowakiids in the Devonian.

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