NEW EVIDENCE FOR THE AGE OF THE PRIMITIVE ECHINOID *MYRIASTICHES GIGAS*

by T. R. LISTER and C. DOWNIE

ABSTRACT. An examination has been made of the acritarchs, chitinozoa, and spores recovered from the matrix of the primitive echinoid *Myriastiches gigas*. The results strongly support a Silurian age for the fossil and indicate a Lower Ludlovian horizon.

THE holotype (and only known specimen) of *Myriastiches gigas* Sollas 1899 is preserved as an internal mould flattened on a slab of indurated grey calcareous mudstone. This was said by Sollas to have a Lower Ludlow age. However, no evidence for this age was given by him and unfortunately the locality of the specimen was not stated and is unknown. Lake was said (*in* Durham and Melville 1957) to have considered the raphiophorid trilobites associated with the echinoid to be Middle Ordovician (Llandeilian) and Mortenson (1935, p. 56, 1940, p. 349), accepting this age, regarded *Myriastiches* as the earliest known echinoid, preceding both *Bothriocidaris* (Upper Ordovician, approximately Caradocian) and *Aulechinus* (Ashgillian). Nevertheless, in the opinions of both Stubblefield and Whittington (quoted in Durham and Melville 1957), the raphiophorids compare most closely with Silurian members of the family.

Whittington considered that the resemblance to *Raphiophorus raoulti* (Barrande) from the Bohemian Wenlock, and to two British Wenlock forms, was striking and concluded that 'the probability of the raphiphorid associated with *Myriastriches* being of Silurian age is strong'.

A fragment of graptoloid stipe, also associated with the echinoid, was considered by Bulman (*in* Durham and Melville 1957) to be indeterminable, but possibly a monograptid or a dichograptid. If the latter, then it most closely resembled a rare species from the Llanvirnian, which, as Durham and Melville pointed out, would conflict with the trilobite evidence even if this indicated an Ordovician age.

Melville suggested that it might be possible to settle the question of the age of *Myriastiches* using microfossils and consequently the specimen was sent to the authors for treatment.

Preparation. A small piece weighing approximately 10 gm., was sawn off the base of the slab bearing the holotype. This was cleaned, then dissolved in HCl and HF respectively. The resulting residue was treated with heavy liquid ($ZnBr_2$) to float off the organic microfossils and the final concentrate was mounted in Canada Balsam on glass slides. All the slides are deposited in the Micropalaeontology Laboratory, Department of Geology, University of Sheffield.

NATURE OF ASSEMBLAGE

The method of concentration proved extremely effective and a rich assemblage of microfossils was obtained, consisting dominantly of acritarchs with associated chitinozoa,

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scolecodonts and spores, and some graptolite fragments. The 10 gm. of original sample yielded approximately 70,000 acritarchs and 100 chitinozoa, a figure similar to that found by Downie (1963) in a sample of Wenlock Shale.

Preservation of the material in general, was only fairly good. Both the acritarchs and chitinozoa were to a considerable degree carbonized. The chitinozoa were usually compressed, somewhat corroded, and frequently split by rock cleavage. Spines were usually broken, particularly those of the longer-spined acritarchs and the basal appendices of certain chitinozoa genera. Such imperfections hampered specific diagnosis of many specimens but enough complete individuals were recovered to surmount this difficulty.

The fossils identified are listed together with their known ranges in Table 1.

Comparison. In the assemblage there are 26 species of acritarchs belonging to ten genera. These vary in importance, the principal component of the assemblage being *Micrhystridium*, particularly forms close to *M. parinconspicuum*, which forms approximately 35 per cent. of the assemblage. Forms belonging to the *Baltisphaeridium wenlockensis–B. echinodermum* form group are common, as is *B. granulatispinosum*. Other species and the genera *Veryhachium*, *Leiofusa*, *Pterospermopsis*, *Polyedrixium*, *Helios*, and *Lophosphaeridium* are present in minor amount. Sphaeromorph acritarchs form about 60 per cent. of the assemblage.

The assemblage has little in common with those described from the Llandovery Series. Only seven of the 26 species encountered are present in the Formigosa Formation (Llandovery), described by Cramer (1964) from North Spain, and all of these seven forms, in fact, range up into the San Pedro Formation (Ludlovian). Stockmans and Willière (1963) have described the acritarchs from the Upper Llandovery of Belgium, but only seven of the 38 species they record were present in the *Myriastiches* assemblage, and all of these are long-ranging forms. None of the species described from the Llandovery of Gotland by Eisenack (1954) were seen.

When compared with the Wenlock assemblages closer similarities are apparent.

Of the three successive Assemblage Types described by Downie (1963), the highest, Assemblage Type 3 from the Tickwood Beds, shows the closest resemblance to the *Myriastiches* assemblage, particularly in the high proportion of *Micrhystridium* and *Baltisphaeridium granulatispinosum*. Twelve species were common to both assemblages,

EXPLANATION OF PLATE 23

Fig. 1. *Conochitina* cf. *claviformis*, 1278/C/1, ×200.
Fig. 2. *Ancyrochitina ancyrea* (polar view), 1278/D/1, ×1000.
Fig. 3. *Baltisphaeridium wenlockensis* (Downie) Stockmans and Willière, 1278/T/5, ×1000.
Fig. 4. *Sphaerochitina sphaerocephala* Eisenack, 1278/O/1, ×200.
Fig. 5. *Ancyrochitina primitiva* Eisenack, 1278/L/1, ×200.
Fig. 6. *Leiofusa filifera* Downie, 1278/T/8, ×1000.
Fig. 7. *Baltisphaeridium ramusculosum* Deflandre, 1278/E/2, ×1000.
Fig. 8. *Rhabdochitina magna* Eisenack, 1278/D/1, ×200.
Fig. 9. *Leiosphaeridia wenlockia* Downie, 1278/J/2, ×1000.
Fig. 10. *Veryhachium wenlockium* Downie, 1278/Q/2, ×1000.
Fig. 11. *Pterospermopsis* cf. *onondagaensis* Deunff, 1278/S/4, ×1000.
Fig. 12. *Baltisphaeridium granulatispinosum* Downie, 1278/S/2, ×750.
Fig. 13. *Punctatisporites ? dilutus* Hoffmeister, 1278/P/1, ×1000.
Fig. 14. Scolecodont, 1278/K/1, ×1000.

TABLE 1. Range chart showing the known stratigraphic distribution of acritarch and chitinozoa species identified from the *Myriastiches* assemblage: where necessary ranges have been extended to include unpublished work of one of the authors (T. R. L.).

		Silurian				
		Wenlock				
	Ordovician	*Llandovery*	*Lower*	*Upper*	*Ludlovian*	*Devonian*
Michrystridium stellatum		×	×	×	×	×
M. parinconspicuum		×	×	×	×	×
M. nannacanthum		×	×	×	×	
M. imitatum			×	×	×	
M. shinetonense		×	×	×	×	
Baltisphaeridium wenlockensis			×	×	×	×
B. granulatispinosum		×	×	×	×	×
B. cariniosum					×	
B. ramusculosum			×	×	×	×
B. microcladum			×	×	×	
B. nanum			×	×	×	×
B. arbusculiferum				×	×	×
B. longispinosum var. *parvum*			×	×	×	
B. robustispinosum			×	×	×	
Veryhachium formosum				×	×	×
V. rhomboideum			×	×	×	×
V. rabiosum					×	×
V. trispinosum		×	×	×	×	×
V. wenlockium		×	×	×	×	×
Leiofusa filifera			×	×	×	×
Leiosphaeridia wenlockia			×	×	×	×
Helios aranaides					×	×
Lophosphaeridium granulosum			×	×	×	×
Pterospermopsis cf. *onondagaensis*				×	×	
Cymatiosphaera wenlockia				×	×	×
Polyedrixium cf. *pharaonis*					×	
Conochitina filifera					×	×
C. lagenomorpha	×	×	×	×	×	×
C. tuba			×	×	×	
C. intermedia		×	×	×	×	
C. cf. *claviformis*	×	×	×	×	×	×
Ancyrochitina ancyrea		×	×	×	×	×
A. primitiva		×	×	×	×	
Sphaerochitina sphaerocephala		×	×	×	×	×
S. pistilliformis					×	
Rhabdochitina magna	×	×				
Punctatisporites ?dilutus		×	×	×	×	
Total (species)	3	15	26	30	35	22

including the species *Baltisphaeridium arbusculiferum* and the genus *Polyedrixium* neither of which were recorded from lower horizons.

Of the many forms described by Cramer (1964) from the San Pedro Formation (Ludlovian), only nine species are present in the *Myriastiches* assemblage. However, two of these species, *Helios aranaides* and *Baltisphaeridium cariniosum* make their first

appearance at this horizon, whilst *Veryhachium rabiosum* was recorded only from the Devonian. Moreover, both *Helios aranaides* and *Veryhachium rabiosum* first appear in the Lower Ludlow (Eltonian) of Shropshire, currently being investigated by one of the authors (T. R. L.), and in fact it is with these Eltonian assemblages that the closest comparison with the *Myriastiches* assemblage is to be found. Indeed, all twenty-six species present in the *Myriastiches* assemblage are found in the Lower Elton Beds, including not only the two species mentioned above, but also a form, here called *Polyedrixium* cf. *pharaonis*, which so far has only been recorded from the Lower Elton Beds of Shropshire.

The spores all belong to *Punctatisporites ? dilutus* Hoffmeister, known from the Llandovery, Wenlock, and Ludlow. None of the distinctive spores characteristic of the Upper Ludlow Whitcliffe Beds (Lister, unpublished), nor any Devonian species were seen, so that a Lower, rather than an Upper Ludlow age is indicated.

Of the ten species of chitinozoa identified, seven were long-ranging forms, but one species, *Sphaerochitina pistilliformis*, has only been recorded from the Ludlow Series (Eisenack 1955), and *Conochitina tuba* and *C. filifera* make their first appearance in the Upper Silurian.

Without doubt, therefore, *Myriastiches* is of Silurian age and very likely Lower Ludlow as originally stated by Sollas.

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T. R. LISTER
C. DOWNIE
Department of Geology
The University,
Sheffield 1

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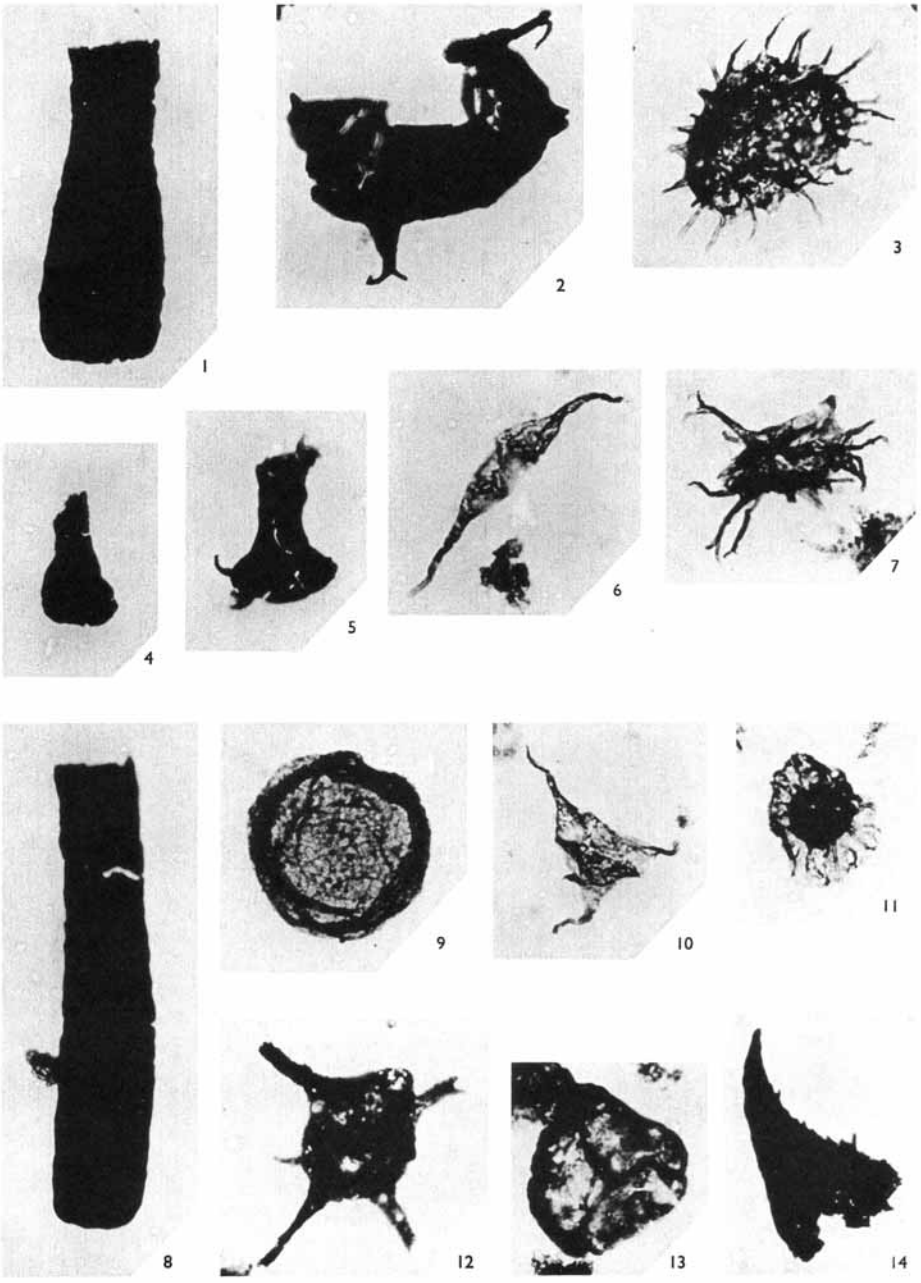

LISTER and DOWNIE, Silurian microfossils