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Trace fossils from the Carboniferous of the Northumberland coast, north-east England

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Abstract

Museum collections abound with undescribed, but significant specimens. A slab from the Carboniferous of north-east England preserves a moderately diverse and thought-provoking ichnofauna. Although the associated label calls the most prominent trace *Scolicia*, this reference to a post-Palaeozoic ichnogenus is not accepted. Rather, these trails, preserved as epichnial grooves, are assigned to *Cruziana embletonia* (Tate) comb. nov. These sinuous trails have a broad U-shaped section, with a median, continuous groove flanked by multiple, symmetrically developed, fine annulations. Other nominal ichnospecies are *Helminthopsis abeli* Książkiewicz and *Neoeione moniliformis* (Tate). *Helminthopsis abeli* refers to hypichnial string-like, irregularly meandering burrows. *Neoeione moniliformis* is unbranched, preserved on both upper and lower surfaces of the slab, and appears like a string of beads.

Key words: ichnology, Yoredale Group, *Scolicia*, *Cruziana*, *Helminthopsis*, *Neoeione*

1. Introduction

It is always easier to collect a palaeontological specimen than to publish a description of the same. Thus, museums accumulate unpublished specimens and invariably have a growing backlog of those awaiting satisfactory description. This paper builds on the initiative of the late Dr Fiona E. Fearnhead to provide adequate documentation of the collections of the Angela Marmont Centre for UK Biodiversity (now UK Nature) at The Natural History Museum, London.

Terminology of the morphology of trace fossils follows Häntzschel (1975), Bromley (1996) and other references mentioned in the text. Our philosophy of

ichnological nomenclature follows Pickerill (1994). All specimens are in the collections of the Natural History Museum, London (NHMUK), Angela Marmont Centre for UK Nature, London, UK.

2. Locality and horizon

The specimen label, with information arranged as below, states:

“*Scolicia* (cf. *olivellites*)

Tracks & counterparts

Carboniferous

Cullernose Point,

Craster

Northumberland,
About 8 mls. [= miles] S. of
Berwick (N. of Howick
Point)
Presd. Miss Levett
Jan 1936
NHM Palaeont. Dept. T344” [currently stored in An-
gela Marmont Centre for UK Nature]

Cullernose Point itself is not fossiliferous, being an exposure of the doleritic Whin Sill (Brenchley and Rawson, 2006). Adjacent sedimentary outcrops are part of the Carboniferous succession of the area (Tucker, 2004, figs. 7.1, 7.2). Boyd and McIlroy (2018, figs. 1, 2) recorded the type section for *Neoeione moniliformis* as in the Yoredale Group, Stainmore Formation, which straddles the Serpukhovian/Bashkirian (=Mississippian/Pennsylvanian) boundary and has a rich ichnofauna (see, for example, Tate, 1859; Boyd and McIlroy, 2016, 2017, 2018). It is logical to assume that NHMUK T344 came from this part of the succession.

Scolicia is a misidentification; this ichnogenus was considered limited to the post-Palaeozoic by Smith and Crimes (1983) where it is identified as the spoor of heart urchins (Spatangoida). However, Smith and Crimes ignored the ichnological axiom that an invertebrate trace fossil may have more than one producing organism (e.g., Donovan, 2010). Therefore, we do not disregard *Scolicia* in the Carboniferous out of hand, but consider NHMUK T344 to be more correctly assigned to *Cruziana*. This and two further distinctive ichnotaxa on the slab are described below.

The identity of Miss Levett is obscure. She is not listed in standard references to collectors such as Sherborn (1940) and Cleevely (1983). George Tate (1805–1871), a linen draper and postmaster by trade, of Alnwick, Northumberland, donated local fossils to the British Museum (Natural History) and the Geological Survey (Cleevely, 1983, p. 282).

3. Systematic ichnology

Ichnogenus *Cruziana* d’Orbigny, 1842

Type ichnospecies: *Cruziana rugosa* d’Orbigny, 1842, by the subsequent designation of Bassler (1915,

p. 292) (Häntzschel, 1975, p. W55).

Diagnosis: See Häntzschel (1975, p. W55).

Range: Late Precambrian to post-Palaeozoic.

Remarks: Specimens of *Cruziana* on NHMUK T344 are certainly not a member of the ichnogenus *Scolicia* de Quatrefages, 1849, as suggested by the specimen label. As already discussed above, *Scolicia* is at least mainly a post-Palaeozoic ichnotaxon (Smith and Crimes, 1983). Neither are specimens on NHMUK T344 close to any of the numerous ichnospecies of *Cruziana sensu stricto*, but they certainly lie in this group of traces. In particular, we compare it with the head-down ploughing burrowing attitude illustrated by Seilacher (2007, pl. 13).

Cruziana embletonia (Tate, 1859) comb. nov.

(Figs. 1, 3)

1859 *Crassopodia embletonia* Tate, pp. 66–67, pl. 2, figs. 1, 2.

Type specimens: Syntypes, Tate (1859, pl. 2, figs 1, 2), current location unknown, but likely in the Natural History Museum, London, or the collections of the British Geological Survey, Keyworth, Nottinghamshire. He considered all the specimens described herein, representing three ichnospecies, to be part of the “... fossil worms and their tracks” (Tate, 1859, p. 65).

Material: A slab, NHMUK T344, with traces on both surfaces; repository Angela Marmont Centre for UK Nature, Natural History Museum, London.

Locality and horizon: South of Cullernose Point, Northumberland, and north of Howick Point (specimen label). Carboniferous, Yoredale Group, Stainmore Formation which straddles the Serpukhovian/Bashkirian (=Mississippian/Pennsylvanian) boundary, about 55° 27’30.38”N, 1°35’34.32”W (Boyd and McIlroy, 2018, fig. 1).

Diagnosis: Sinuous trails, broad U-shaped in section, with a median, continuous groove; groove flanked by multiple, fine annulations, clustered together and symmetrically developed either side.

Description: Two sinuous trails, possibly formerly part of a single trace, but incompletely preserved. Preserved as epichnial grooves (Häntzschel, 1975, fig. 7) on base of bed. Trails broad U-shaped in section, with a median, continuous groove. Either



Fig. 1. NHMUK T344, base of slab with loosely meandering *Cruziana embletonia* (Tate) preserved as epichnial grooves (Häntzschel, 1975, fig. 7). *Neoeione moniliformis* (Tate) occurs in various directions, straight to curved and crosscutting older *Cruziana*. Carboniferous, Yoredale Group, Stainmore Formation, Northumberland, England.

side of groove sculpted by multiple, fine annulations, clustered together in multiples of fewer than ten and symmetrically developed either side of groove. Trail cross-cut by *Neoeione*. Preservation best towards left and bottom in Figure 3.

Remarks: The form of these trails is reminiscent of certain ‘bathtub’ *Cruziana* (see, for example,

Seilacher, 2007, pl. 69). The trivial name *embletonia* has precedence for this ichnospecies of continuous furrows. It is these furrows that confidently identify this surface as the base of the bed. The annulations were presumably produced by the limbs of the producer.

Identification of a trace fossil as *Cruziana* is not



Fig. 2. NHMUK T344, upper surface of slab. *Neoeione moniliformis* (Tate) burrows prominent and sub-parallel. *Helminthopsis abeli* Książkiewicz in lower left corner, crosscut by *N. moniliformis*. Carboniferous, Yoredale Group, Stainmore Formation, Northumberland, England.

meant to imply that it was produced by a trilobite. Rather, to paraphrase Donovan (2010, p. 283), “*Cruziana* ... are trace fossils that were produced by bilaterally symmetrical organisms. Most, perhaps all, were produced by arthropods, and in the Palaeozoic most *Cruziana* ... are assumed to be the spoor of certain groups of trilobites, although this certainly is not proven. Other bilaterally symmetrical organisms, including non-trilobite arthropods and arthropod-like organisms, may have

been the producers of *Cruziana* ... even in the Palaeozoic.”

Ichnogenus *Helminthopsis* Heer, 1877

Type ichnospecies: *Helminthopsis hieroglyphica* Wetzel and Bromley, 1996, designated therein, from the Paleogene of Ganei, Switzerland.

Diagnosis: (After Wetzel and Bromley, 1996, p. 13). “Simple, unbranched, elongate, cylindrical tubes with curves, windings, or irregular open

meanders” (see also Han and Pickerill, 1995, p. 103).

Range: Late Precambrian to Recent (Pickerill and Donovan, 1991, p. 26).

Remarks: An alternate identification of these burrows might be *Cosmoraphe* Fuchs, a common flysch ichnotaxon, but they lack the tighter coils found in this ichnogenus (e.g., Häntzschel, 1975, fig. 34.3; Pickerill et al., 1993, fig. 2a).

***Helminthopsis abeli* Książkiewicz, 1977**

(Figs. 2, 4)

1859 *Crassopodia media* Tate, p. 67, pl. 2, figs. 3, 4.

Material: A slab, NHMUK T344, with traces on both surfaces; repository Angela Marmont Centre for UK Nature, Natural History Museum, London.

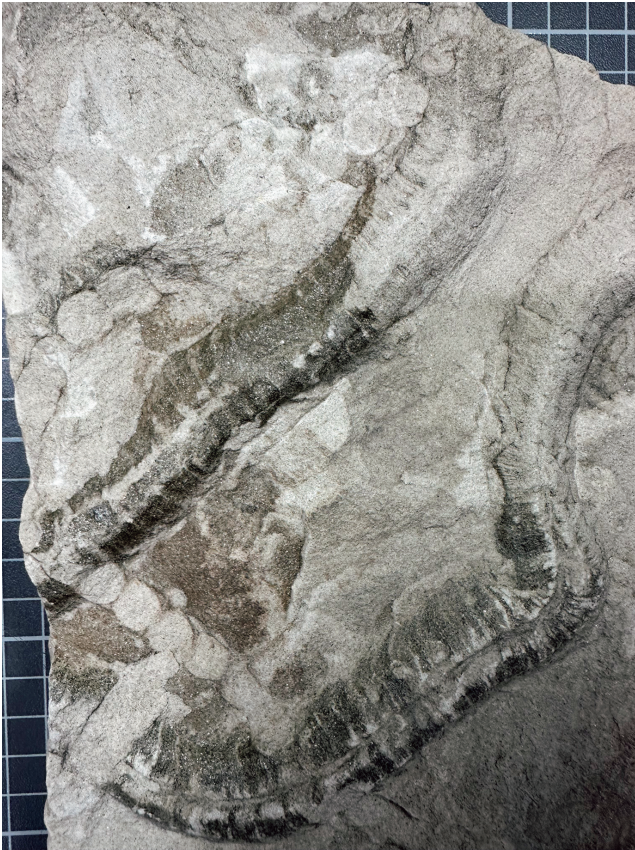


Fig. 3. NHMUK T344, base of slab showing details of *Cruziana embletonia* (Tate) and *Neoeione moniliformis* (Tate). Carboniferous, Yoredale Group, Stainmore Formation, Northumberland, England.

Locality and horizon: South of Cullernose Point, Northumberland, and north of Howick Point (specimen label). Carboniferous, Yoredale Group, Stainmore Formation which straddles the Serpukhovian/Bashkirian (=Mississippian/Pennsylvanian) boundary, about 55°27'30.38"N, 1°35'34.32"W (Boyd and McIlroy, 2018, fig. 1).

Diagnosis: “Hypichnial string- or rope-sized full burrow or in some cases cast, loosely winding with a tendency to meandering. Meanders irregular and variable in shape” (Książkiewicz, 1977, p. 117).

Description: Loosely looped burrows preserved on upper surface of and parallel to bed. Width of burrows consistent, c. 2 mm. Crosscut by *N. moniliformis*.

Remarks: As noted by Pickerill and Donovan (1991, p. 26), a complete knowledge of the exact course of irregularly winding or loosely meandering burrows of *Helminthopsis* is necessary for ichnospecific assignment (see also Fillion and Pickerill, 1990). Pickerill and Donovan also discussed the attributes of the ichnotaxon; much has been clarified by the subsequent studies of Han and Pickerill (1995) and Wetzel and Bromley (1996). *Helminthopsis* represents the feeding or grazing burrow of vermiform organisms, most likely polychaete annelids.

Ichnogenus *Neoeione* Boyd and McIlroy, 2018

Type ichnospecies: *Eione moniliformis* Tate, 1859, by original designation.

Diagnosis: See Boyd and McIlroy (2018, p. 185).

Remarks: “Locality 12 ([NGR] NU 260186). Northwards on the foreshore, the sandstones ... [have] a range of burrow structures. One of these, *Eione moniliforme*, has a very distinctive beaded appearance” (Tucker, 2004, p. 90). It is this reference that first suggested the locality from which NHMUK T344 was most likely collected.

***Neoeione moniliformis* (Tate, 1859)**

(Figs. 1–3)

1859 *Eione moniliformis* Tate, p. 68, pl. 2, fig. 6.

2004 *Eione moniliforme* Tate. Tucker, p. 90.

2018 *Neoeione moniliformis* (Tate). Boyd and McIlroy, pp. 185–187, figs. 2–9.

Material: A slab, NHMUK T344, with traces on



Fig. 4. NHMUK T344, upper surface of slab showing *Helminthopsis abeli* Książkiewicz in detail. Carboniferous, Yoredale Group, Stainmore Formation, Northumberland, England.

both surfaces; repository Angela Marmont Centre for UK Nature, Natural History Museum, London.

Locality and horizon: South of Cullernose Point, Northumberland, and north of Howick Point (specimen label). Carboniferous, Yoredale Group, Stainmore Formation which straddles the Serpukhovian/Bashkirian (=Mississippian/Pennsylvanian) boundary, about 55°27'30.38"N, 1°35'34.32"W (Boyd and McIlroy, 2018, fig. 1).

Diagnosis: (After Boyd and McIlroy, 2018, p. 186.) "Straight to sinuous, predominantly horizontal to sub-horizontal trace fossil backfilled with inclined, clay- or silt-lined sediment packages that cross-cut one another. The upper surface is a series of broadly trapezoidal protrusions. The lower surface is broad and convex. Successive branching and subvertical portions are rarely present."

Description: Unbranched. Preserved on both upper and lower surfaces of slab (Figs. 1–3) and like a string of beads. See Boyd and McIlroy (2018), whose

description is based on more specimens from this succession and using techniques not available to the present authors. The form of this ichnospecies suggests that it is the spoor of a flexible, vermiform producer.

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