



A new marrellid arthropod from the Ordovician of Wales

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A new taxon of marrellid marrellomorph *Dyrnwynia conollyi* gen. et sp. nov. is described from the Middle Ordovician (middle Darriwilian, *Didymograptus artus* Biozone) Llanfallteg Formation of Northern Pembrokeshire, Wales, UK. This taxon, represented by a single specimen, is characterised by the possession of mediolateral spines with tightly spaced secondary cephalic spines limited to their external margins and that decrease in size towards the distal tip. This is the first record of marrellid arthropods from Great Britain and only the fourth record from the entire Ordovician worldwide, which, given their current geographic and temporal distribution, indicates that marrellid arthropods may be more common in the fossil record than previously recognised.

Introduction

The marrellids are a small group of enigmatic arthropods known exclusively from Palaeozoic deposits. The majority of material referred to Marrellida Raymond, 1920, is known exclusively from isolated cephalic elements and is characterised by the possession of a cephalic shield bearing, at least, two pairs of extensive spines, with later members possessing an additional pair of anteriolateral spines (Rak et al. 2013). The systematic position of marrellids has been controversial; however, the majority of recent analyses resolve them within Marrellomorpha Beurlen, 1930, as sister taxon to the cordiform carapace-bearing acercostracans (Rak et al. 2013; Legg et al. 2013; Legg 2015, 2016). To date just three named taxa have been referred to the marrellids: *Marrella splendens* Walcott, 1912, the most abundant arthropod in the middle Cambrian (Series 3, Stage 5) Burgess Shale of Canada (García-Bellido and Collins 2006); *Furca bohémica* Fritsch, 1908, from the Upper Ordovician Letná Formation of the Czech Republic (Rak et al. 2013); and *Mimetaster hexagonalis* (Gürich, 1931) from the Devonian Hunsrück Slate of Germany (Kühl and Rust 2010). Additionally an as yet undescribed taxon has also been recorded from the Lower Ordovician Fezouata Formation of Morocco (Van Roy et al. 2010), which has been resolved amongst marrellids in a number of recent phylogenetic analyses (e.g., Legg et al. 2013; Legg 2015, 2016). Additional records of cephalic shields comparable to those of *Marrella* have been reported from the lower Cambrian (Series 2, Stage 4) Balang Formation (Liu 2013) and the middle Cambrian (Series 3, Stage 5) Kaili Formation (Zhao et al. 2003) of China, and an

isolated cephalic shield of a *Furca*-like taxon has been recovered from the Ordovician (Tremadocian) of Argentina (Aris and Palomo 2014). More recently, Legg and Hearing (2015) reported a putative *Furca*-like marrellomorph from the Middle Ordovician Llanfallteg Formation of Wales. This latter taxon is described in more detail herein.

Institutional abbreviations.—NMW, National Museum of Wales, Cardiff, Wales, UK.

Material and methods

The material described herein was recovered from an ash-rich siltstone within the Cat's Hole Quarry exposure of the Middle Ordovician Llanfallteg Formation (middle Darriwilian, *Didymograptus artus* Biozone). This material consists of a single specimen, the holotype NMW 2016.7G.83 (Fig. 1), representing a single mediolateral spine, preserved in fine aggregates of framboidal pyrite. The specimen was photographed using a Canon EOS 500D digital SLR camera fitted with a EF S 60 mm f2.9 Macro Lens, with a polarising filter attached to increase contrast between the specimen and the matrix.

Systematic palaeontology

Unnamed rank Marrellomorpha Beurlen, 1930

Order Marrellida Raymond, 1920

Genus *Dyrnwynia* nov.

Etymology. After *Dyrnwyn* [pronounced *Duhrn-win*], a legendary Welsh sword which, when drawn, was engulfed in flames, referencing both the resemblance of the mediolateral spines of this taxon to a flaming sword and its Welsh origins.

Type species. *Dyrnwynia conollyi* sp. nov. (by monotypy); see below.

Diagnosis.—As for the type species by monotypy.

Remarks.—Although the internal relationships of marrellids are fairly well understood (Rak et al. 2013; Legg et al. 2013; Legg 2015, 2016), little work has been undertaken involving the taxonomy of the group and I therefore refrain from assigning *Dyrnwynia conollyi* gen. et sp. nov. to any particular family, pending further study.

Dyrnwynia conollyi sp. nov.

Fig. 1.

2015 “taxon comparable to *Furca bohémica*”; Legg and Hearing 2015: 942.

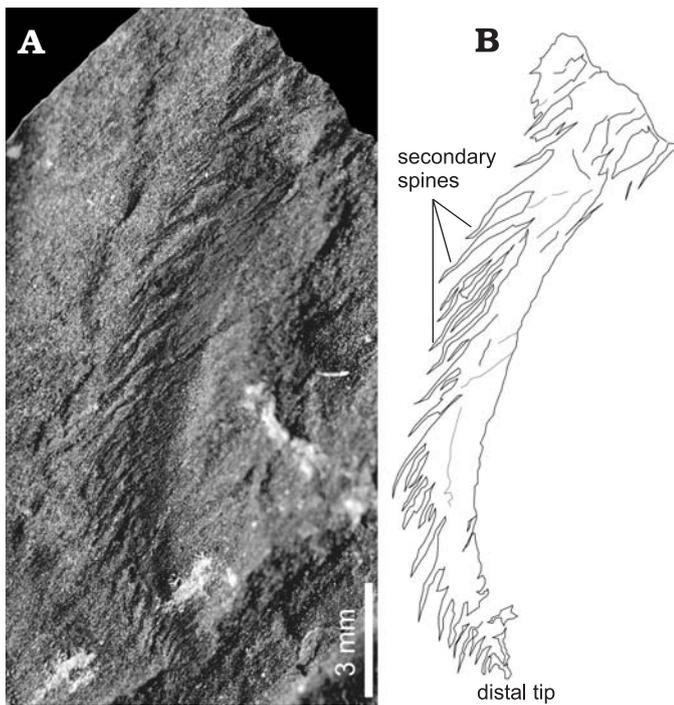


Fig. 1. Marellomorph arthropod *Dyrnwynia conollyi* gen. et sp. nov. from the Llanfallteg Formation, *Didymograptus artus* Biozone, Darrivilian, Ordovician; Pembrokeshire, Wales, UK. Holotype (NMW 2016.7G.83), isolated mediolateral spine. **A.** Photograph. **B.** Camera lucida drawing.

2016 “*Furca*-like marrellomorph”; Hearing et al. 2016: fig. 2C.

Etymology: After Cedric Conolly, for his ongoing and dedicated work excavating material from Cat’s Hole Quarry and related sites in Northern Pembrokeshire.

Holotype: NMW 2016.7G.83, a mediolateral spine.

Type locality: Pembrokeshire, Wales, UK.

Type horizon: Llanfallteg Formation, *Didymograptus artus* Biozone, Darrivilian, Ordovician.

Diagnosis.—Arthropod with gentle curved mediolateral spines which decrease in width distally and are fringed with secondary cephalic spines. The secondary cephalic spines are restricted to the outer margin of the mediolateral spines and also decrease in size towards the distal tip of the mediolateral spine.

Description.—This description is based on a single specimen, the holotype NMW 2016.7G.83 (Fig. 1). The holotype is represented by a mediolateral spine measuring 16 mm from its distal tip to the most proximally preserved margin. There are numerous tectonic striations along the length of the mediolateral spine, making detection of any additional ornamentation difficult. The spine does, however, appear to possess a smooth inner margin, showing no trace of secondary cephalic spines or associated nodes, which would probably be present if this specimen had originally borne secondary cephalic spines on its internal margin (Rak et al. 2013), and thus the latter character is treated as a genuine absence.

Secondary cephalic spines are preserved along the outer margin of the mediolateral spine. The more proximal spines are elongate, measuring ca. 3 mm in length, and show slight curvature. The secondary cephalic spines decrease in size towards

the distal tip of the mediolateral spine, measuring < 1 mm at their smallest. The preservation of the secondary cephalic spines might indicate that they possessed a degree of flexibility during life, particularly towards their distal tips; however, the more proximal spines appear more rigid and straight, and protrude from the mediolateral spine at an angle of c. 30°. The distal tip of the mediolateral spine is rounded and seems to lack secondary cephalic spines on its most distal tip.

Discussion.—Although based on a single, highly incomplete specimen, the unique combination of features possessed by *Dyrnwynia conollyi* gen. et sp. nov. (Fig. 1) allows identification of the available specimen as both a new genus and a new species of marrellid arthropod. The most prominent of these features, the lack of secondary cephalic spines on the internal margins of the mediolateral spines, is entirely unique to *Dyrnwynia conollyi* gen. et sp. nov. The tight spacing of secondary cephalic spines is reminiscent of *Furca bohémica* (Rak et al. 2013), as is the degree of spine curvature; however, in the latter taxon the longer secondary cephalic spines are located towards the distal tip of the mediolateral spines, unlike *Dyrnwynia conollyi* gen. et sp. nov. A similar condition, of secondary cephalic spines decreasing in size distally, is also observed in *Mimetaster* (Kühl and Rust 2010) and the undescribed Moroccan marrellid (Van Roy et al. 2010); however, the secondary cephalic spines of these taxa are widely spaced. These latter taxa also possess relatively elongate and thin mediolateral spines compared to those of *Dyrnwynia conollyi* gen. et sp. nov. and *Furca bohémica*.

Stratigraphic and geographic range.—Type horizon and locality only.

Concluding remarks

All marrellids, with the exception of *Marrella*, possess secondary cephalic spines (García-Bellido and Collins 2006; Rak et al. 2013). This feature may represent an important taxobasis for a less inclusive clade for all marrellids excluding *Marrella*; however, this character could not be adequately studied based on the currently available material, as it is equally parsimonious for this character to have been either gained in the lineage leading to all non-*Marrella* marrellids, or lost in the line leading to *Marrella*.

Despite their rarity, unequivocal marrellids show an almost cosmopolitan distribution throughout their geological history, with occurrences in South China (Zhou et al. 2003; Liu 2013), Canada (García-Bellido and Collins 2006), Morocco (Van Roy et al. 2010), Argentina (Aris and Palomo 2014), Czech Republic (Rak et al. 2013), Germany (Kühl and Rust 2010), and now Great Britain. Despite this, no significant patterns can be recognised in their distribution, although earlier (Cambrian) occurrences tend to occur in equatorial palaeoregions, whilst later (Ordovician) occurrences tend to be recovered in higher, even polar, palaeolatitudes. Most taxa appear to originate from continental shelf deposits (Rak et al. 2013). *Dyrnwynia conollyi* gen. et sp. nov. is unique in having been recovered from a

deeper water deposit (Legg and Hearing 2015); however, the fragmentary nature of this material may indicate that the organisms were transported into this environment rather than being autochthonous, although more specimens are required to test this hypothesis. Given the currently known distribution of marrellid arthropods, it is likely they are actually more common in the fossil record than previously reported: in particular, there are noticeable gaps in their fossil record during the late Cambrian (Drumian onwards) and the entire Silurian. It should be noted that a putative marrellomorph was reported from the Cambrian of Australia and compared to *Marrella* (Haug et al. 2013); however, the combination of features observed in that taxon, *Austromarrella klausmuelleri*, namely a multiannulated exite with a combination of lamellate and spinose gill filaments, is not unique to marrellids, and has recently been observed amongst putative megacheirans (Siveter et al. 2014).

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