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A new species of the problematic organism *Webbyites* from the Early Ordovician Fezouata Biota of Morocco

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SHORT COMMUNICATION

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ABSTRACT

The problematic colonial organism *Webbyites* has previously been considered to be a hydroid (phylum Cnidaria). In this paper, we describe a new species, *Webbyites felix* sp. nov., from the Early Ordovician Fezouata Konservat-Lagerstätte of Morocco. One specimen preserves some soft-tissue zooid remains. The presence of a stolon system in the new species and the type species indicates that *Webbyites* is a benthic graptolite. *Webbyites* lacks bithecae; thus, it is not a dendroid graptolite.

Introduction

The Lower Ordovician Fezouata Formation of Morocco has yielded a diverse variety of exceptionally preserved fossils from a large number of sites around the city of Zagora (Van Roy et al. 2010, 2015). Groups exhibiting exceptional preservation include trilobites, non-biomineralised arthropods, annelids, echinoderms, graptolites, hyolithids, palaeoscolecid worms, and sponges (Van Roy et al. 2015).

Gutiérrez-Marco et al. (2022, fig. 13a) illustrated a specimen from the Fezouata Formation, which they regarded as a possible hydroid, compared with the *Plumalina*-like form listed by Van Roy et al. (2015). The specimen lacks location data, but was purchased from a local seller in Erfoud (Morocco), and was offered for sale together with other Fezouata fossils that were mostly obtained from the well-known fossil locality at the foot of the Jbel Bou Zeroual, which is regarded as middle Floian in age on the basis of the occurrence of *Baltograptus jacksoni* Biozone graptolites (Lefebvre et al. 2016, locality Z-F0). However, this circumstance is incidental and the provenance of the fossil remains unknown.

The offer on the Internet of better-preserved material of the same species, among them an exceptional specimen (now the holotype) led J. C. Gutiérrez-Marco to travel to the Anti-Atlas to search for new material and obtain data on their geographic origin and stratigraphic age. This was possible with the help of Lahcen Ben Moula (Taichoute, SW Alnif), who recently discovered new material of *Webbyites* in the Oued Ouaoufrout section (Z-F6 according to previous authors: see Lefebvre et al. 2016; Lebrun 2017). This section contains eight fossiliferous beds (a–h) that have yielded upper Tremadocian graptolites, identified as part of the study of Gutiérrez-Marco and Martin (2016). The newly collected specimens were associated with some trilobites of long stratigraphic range within the Fezouata Shale, such as *Euloma filacovi* (Bergeron), *Asaphellus* aff. *jujuanus* Harrington, *Ampyx priscus* Thoral, and *Kierarges morrisoni* Corbacho, which have a range extending back to the upper Tremadocian (personal observation by J. C. Gutiérrez-Marco; Martin et al. 2016).

Materials and methods

Macrophotographs were obtained using a Canon EOS 5DS R fitted with a Hoya Pro1 Digital Circular Polarizing Filter. Illumination was provided by two LED lamps (Kaiser RB 5020 DS 2), each covered with a sheet of polarising filter.

Microphotographs were taken using a GXCAM HICHROME AF MET 2-megapixel digital camera (GX Microscopes, Wickhambrook, Suffolk, UK) attached to a Leica S8APO (Leica, Wetzlar, Germany), with illumination from a Leica LED3000 RL ring light with attached polarising filters. The imaging software used was GX Capture-T (GX Microscopes), and stacked images were produced using Helicon Focus. Both macro- and microphotographs were taken using cross-polarised light, which is useful for increasing contrast in fossil material (e.g. Muir et al. 2021).

The studied specimens have been deposited in the palaeontological collections of the Faculté des Sciences et Techniques of the Cadi Ayyad University of Marrakesh, Morocco (registration prefix AA).

Systematic palaeontology

Phylum Hemichordata Bateson, 1885
Class Pterobranchia Lankester, 1877
Order and Family unknown
Genus *Webbyites* Kraft, Kraft and Prokop, 2001

Type species. *Thamnograptus* (?) *rokycanensis* Bouček, 1956

Other species. *Webbyites felix* sp. nov., *Webbyites*? sp. of Gutiérrez-Marco et al. 2022

Remarks. Dzik et al. (2016) included *Webbyites* in the family Crinisdendridae, together with the problematic organism *Crinisdendrum*; however, the branches in the two genera are markedly different in structure: those of *Webbyites* consist of lines of distinct thecae, whereas those of *Crinisdendrum* appear to be hollow tubes with a distinctive 'plaited' structure. We have no particular reason to think that these two taxa were closely related, thus do not consider it useful to use this family.

Webbyites felix sp. nov.
Figures 1, 2
?2015 *Plumalina*-like form, Van Roy et al., table 1
2022 *Plumalina*-like probable cnidarian, Gutiérrez-Marco et al., fig. 13a

Etymology. Latin *felix*, happy, and in honour of Félix Collantes, an amateur palaeontologist who donated the holotype for study.

Holotype. Specimen number AA.TER.OI.32a–b (part and counterpart).

Paratypes. AA.JBZ.OI.201a–b, AA.TER.OI.33, AA.TER.OI.34.

Type locality. Oued Ouaufrout, ca 24 km NW of Zagora. Shales of probable late Tremadocian age.

Diagnosis. *Webbyites* with non-spinose thecae.

Description. The colony consists of a central axis with closely spaced branches, which branch alternately (rather than oppositely) from the axis (Fig. 1). The branches are spaced at intervals of 1.1–1.2 mm along each side of the axis. The branches are straight or slightly curved, and do not themselves branch.

The specimens have preserved lengths of 35–45 mm and preserved widths of 20–25 mm. The proximal and distal ends are not preserved in any of the specimens; thus, no details of a holdfast, which we assume to have been present, are available. The axis becomes notably narrower towards the distal end of the colony, from 0.3–0.45 mm to 0.1 mm. The branch length appears to be consistent throughout the colony; there appears to be no trend for branches to become shorter or longer with colony growth. Each branch narrows slightly towards its distal end. Traces of the stolon system are preserved in many branches and in the stem (Fig. 2A).

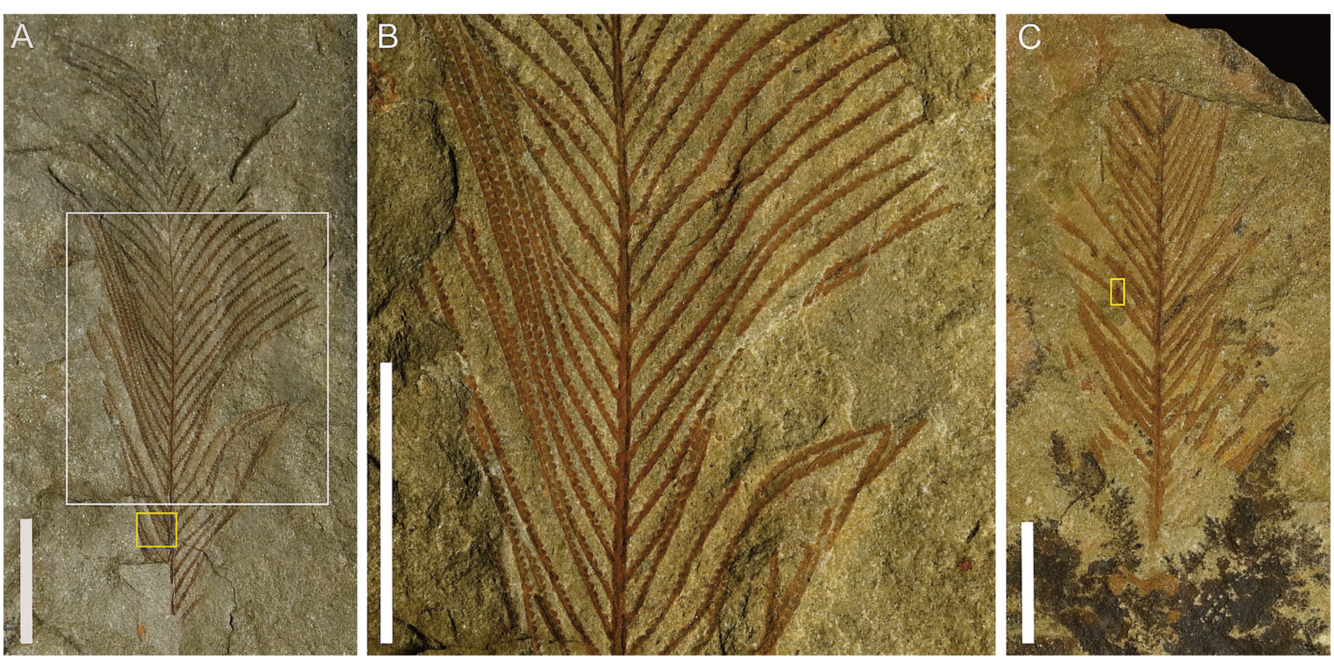

Fig. 1. *Webbyites felix* sp. nov.: **A** – holotype, specimen AA.TER.OI.32a, overall view; **B** – close-up of the middle part of the holotype (indicated by the white box in part A); **C** – specimen AA.JBZ.OI.201b. The yellow box in part A indicates the location of Fig. 2A, the yellow box in part C indicates the location of Fig. 2B. Scale bars = 10 mm.

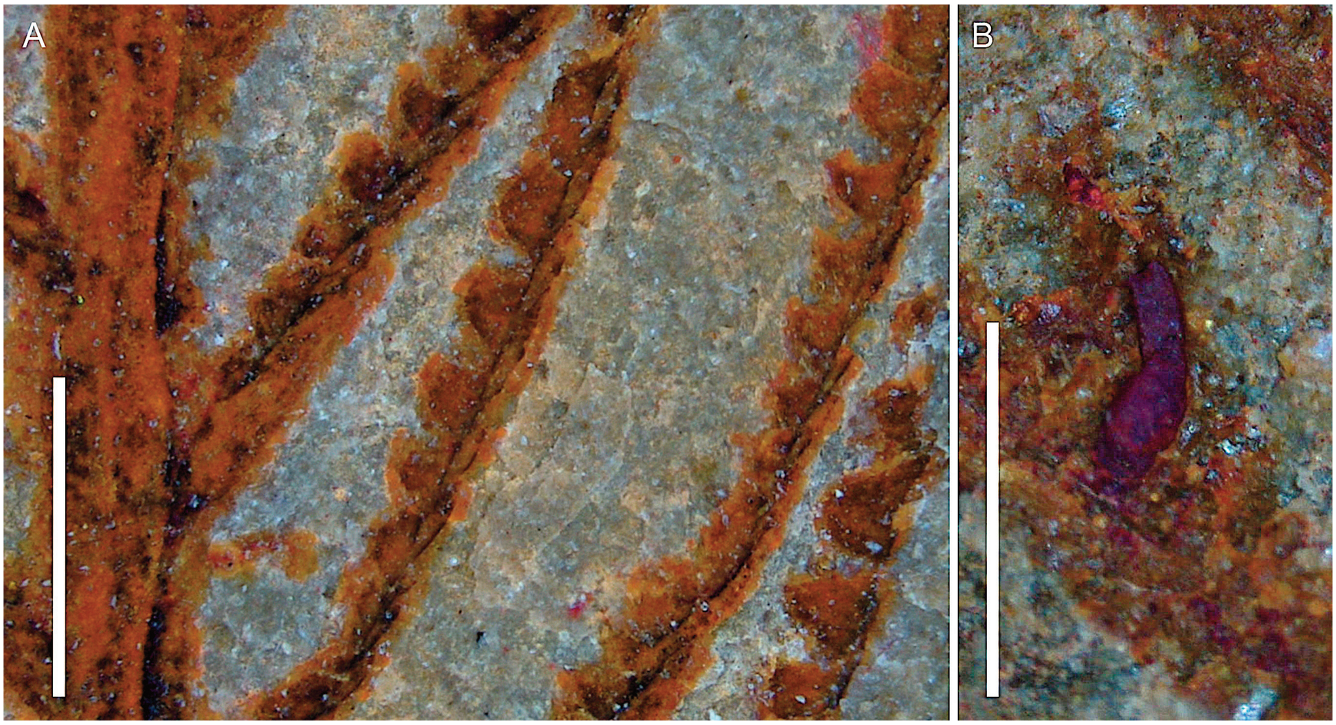

Fig. 2. *Webbyites felix* sp. nov.: **A** – close-up of the counterpart of the holotype (specimen number AA.TER.OI.32b) showing the stolon system (black) in axis and branches; **B** – soft-tissue remains, specimen AA.JBZ.OI.201b. Scale bars = 1 mm.

The branches are straight or slightly curved. Some branches overlap each other on the bedding surface, implying that the skeletal material of the colony was flexible during the organism's lifetime. The thecae are simple cups, without spines, and with the apertures facing towards the axis. Each branch contains one row of thecae; the axis does not contain thecae. The thecae are consistent in size throughout the colony. There are approximately three thecae per millimetre. One specimen preserves soft-tissue remains of a zooid within a theca (Fig. 2B). The zooid is preserved as a reddish blob (assumed to be composed of a weathered iron mineral) 0.61 mm long and 0.17 mm wide. The zooid appears to be attached to the stolon.

Remarks. *Webbyites felix* sp. nov. is probably the '*Plumalina*-like form' that was listed (but not illustrated) by Van Roy et al. (2015). Specimen AA-JBZ-OI.201 was previously illustrated as '*Plumalina*-like probable cnidarian, possibly similar to the "*Plumalina*-like form" of Van Roy et al. (2015)' by Gutiérrez-Marco et al. (2022, fig. 13a).

Webbyites felix sp. nov. differs from the type species *W. rokycanensis* in bearing simple, rather than spinose, thecae. The new species is similar to the previously described probable hydroids *Plumalina* Hall, 1858 and *Pennalina* Cope, 2005. *Webbyites* and *Plumalina* differ in that branching is alternate in the former and opposite in the latter (Muscente and Allmon 2013). *Webbyites felix* sp. nov. can be distinguished from *Pennalina crossi* Cope, 2005 by the branches of *P. crossi* being curved rather than straight. In *Pennalina* sp. A of Cope (2005), the branch width becomes distally smaller, rather than remaining constant.

Several organisms that are currently interpreted as algae are similar in form to *Webbyites*. *Buthograptus* Hall, 1861 has a cylindrical central axis and unbranched pinnules, and is interpreted as an alga (LoDuca 2019). The pinnules of *Buthograptus*, however, appear to be cylindrical, are slightly curved, and do not bear any structure that might be interpreted as thecae (LoDuca 2019), thus clearly different from those of *Webbyites*. *Whiteavesia* Fry, 1983 from the Upper Ordovician Cat Head Member of the Red River Formation of Manitoba, Canada, which was described as an alga, differs from *Webbyites* in the spiral arrangement of the branches. In addition, the appendages of *Whiteavesia* are markedly less thick than the main stem (Fry 1983). The presence of a stolon system and the preservation of a zooid in *Webbyites felix* sp. nov. proves that this species is not an alga.

Discussion

The presence of a stolon system (Fig. 2A) indicates that *W. felix* sp. nov. is not a hydroid, because hydroids do not possess stolons (Muscente et al. 2016). A stolon system is also present in *W. rokycanensis*, the type species (Kraft et al. 2001). A stolon system is strongly indicative of a graptolite affinity, prompting comparisons with acanthograptids and dendroids such as *Ptilograptus*; however, *W. felix* sp. nov. does not possess the diagnostic dendroid character of bithecae (Maletz 2020), thus cannot be assigned to the Dendroidea. As indicated by Kraft et al. (2001), the close thecal spacing of *Webbyites* is otherwise unknown in graptolites. We conclude that *Webbyites* is a benthic graptolite of uncertain affinity.

This occurrence of *Webbyites* is from Lower Ordovician strata of Morocco. Previous records of *Webbyites* are from Lower and Middle Ordovician rocks of the Czech Republic (Kraft et al. 2001) and Upper Ordovician strata of Morocco (Gutiérrez-Marco et al. 2022). The distribution of the genus is consistent with the well-known pattern of faunal similarity between Bohemia and North Africa during the Ordovician (e.g. Gutiérrez-Marco et al. 2022).

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