The arrangement of possible muscle fibres in the Ediacaran taxon *Haootia quadriformis*

Alexander G. Liu¹, Jack J. Matthews², Latha R. Menon², Duncan McIlroy³ and Martin D. Brasier²,³†

¹School of Earth Sciences, University of Bristol, Life Sciences Building, 24 Tyndall Avenue, Bristol BS8 1TQ, UK
²Department of Earth Sciences, University of Oxford, South Parks Road, Oxford OX1 3AN, UK
³Department of Earth Sciences, Memorial University of Newfoundland, 300 Prince Philip Drive, St John’s, Newfoundland and Labrador, Canada A1B 3X5

*Haootia quadriformis* from Newfoundland, Canada, is one of the most unusual impressions of a soft-bodied macro-organism yet described from the late Ediacaran Period. Interpreted as a metazoan of cnidarian grade [1], the body impression of *H. quadriformis* possesses features interpreted as fibrous structures that represent possible evidence for muscular tissue. Evidence both in support of and against a relationship between *H. quadriformis* and the Staurozoa, one of the cnidarian groups to which *Haootia* was compared in Liu et al. [1], is outlined by Miranda et al. [2]. Our intention in our original paper was to illustrate the staurozoan body plan for comparative purposes, rather than suggest homology or direct ancestry. Nevertheless, fresh insights from workers with expertise in the biology of extant cnidarians are welcomed.

We are pleased that the main points of our paper find support from the biological community: that recently discovered *Haootia quadriformis* probably preserves the impressions of muscle fibres in a macrofossil characterized by tetra-radial symmetry, and that these structures are consistent with a cnidarian body plan [2]. Histological images provided by Miranda et al. [2], plus their accompanying discussion, present a clear picture of muscular arrangements within modern stauromedusae. We concur that *Haootia* shows both similarities and differences with respect to stauromedusans.

Miranda et al. [2] suggest that the organization of musculature described by us (see [1], fig. 3B) within the body of *Haootia* appears inconsistent with that observed in modern staurozoan taxa. While the argument for the presence of a radial (longitudinal) muscle arrangement is well reasoned (see [2], fig. 1s), a revisiting of the type material to determine the orientation of fibrous structures in *Haootia* leads us to conclude that they are essentially as published in our original paper. The paratype specimen (see [1], fig. 1f) has fibres from potential coronal muscles that extend in arcs almost to the base of the calyx, with no clear preservation of radial fibres running perpendicular to these. We would argue that this phenomenon contradicts the suggestion that coronal muscle may have been restricted to the margins of the *Haootia* body [2].

The arrangement of musculature inferred by Liu et al. [1] does not preclude the presence of additional radial muscle bundles within the body of the organism. The holotype of *H. quadriformis* contains evidence for superposition of fibrous structures. We can clearly discern that the body sheet/calyx drapes parallel fibres observed in the stalk/peduncle, and that subsidiary branches appear to extend beneath the body (figure 1). In such cases, the fibres beneath the calyx are not expressed in the fossilized impression and are inferred to lie beyond the plane of preservation. It is therefore possible that both coronal and radial musculature were present in the calyx of *Haootia* (just as both are present in the arms of modern stauromedusae [2]), but only the outermost set is recorded in the cast of the body tissues so beautifully preserved in the *Haootia* impression.

If one were to adopt a stauromedusan analogue for *Haootia*, the inferred coronal musculature would be in the ‘calyx’ rather than the radial disc. This...
References


4. Liu AG, McIlroy D, Brasier MD. 2010 First evidence for locomotion in the Ediacara biota from the 565 Ma Mistaken Point Formation, Newfoundland. Geology 38, 123–126. (doi:10.1130/G30168.1)
