

## **Additional file 8: Character coding**

Selected characters and character states from Yang et al. [1], for those referred to in 'The impact of taphonomic data on phylogenetic resolution: *Helenodora inopinata* (Carboniferous, Mazon Creek Lagerstätte) and the onychophoran stem lineage'.

### **1. Paired appendages**

- (0) absent
- (1) present

### **12. Nature of first post-ocular (deutocerebral) appendage**

- (0) lobopodous ambulatory limb
- (1) lobopodous sensorial limb
- (2) lobopodous limb with sclerotized jaw
- (3) arthropodized antenniform with distinct podomeres
- (4) arthropodized short great-appendage
- (-) inapplicable: paired appendages (Character 1) absent

### **13. Inner blade of deutocerebral jaw with diastema**

- (0) absent
- (1) present
- (-) inapplicable: deutocerebral jaw (Character 12) absent

### **14. Deutocerebral limb pair structurally differentiated from rest of trunk appendages**

- (0) undifferentiated, or reduced in size only
- (1) structurally differentiated
- (-) inapplicable: paired appendages (Character 1) absent

### **15. Nature of second post-ocular (tritocerebral) appendage**

- (0) undifferentiated lobopodous limb
- (1) specialized papillae
- (2) arthropodized ambulatory limb with distinct podomeres
- (3) arthropodized specialized post-antennal appendage
- (-) inapplicable: paired appendages (Character 1) absent

### **19. Spines/spinules on pre-ocular (protocerebral) appendage**

- (0) absent
- (1) present (radiodontans, gilled lobopodians, certain lobopodians)
- (-) inapplicable: paired appendages (Character 1) absent; protocerebral appendages fused into labrum (Character 18)

### **23. Mouth opening orientation**

- (0) anterior
- (1) ventral
- (2) posterior

### **24. One or more pairs of appendages located anteriorly relative to the mouth opening**

- (0) absent
- (1) present
- (-) inapplicable; paired appendages (Character 1) absent

### **25. Radially symmetrical circumoral structures**

- (0) absent
- (1) present

### **26. Nature of radial circumoral structures**

- (0) scalids
- (1) oral papillae or lamellae
- (2) radial plates organized as a mouth apparatus
- (-) inapplicable: radial circumoral structures (Character 25) absent

### **29. Eyes**

- (0) absent
- (1) present

**36. Annulations**

- (0) absent
- (1) present
- (–) inapplicable: sclerotized dorsal integument with arthroal membranes (Character 33) present

**38. Organization of trunk annulation**

- (0) homonomous
- (1) heteronomous
- (–) inapplicable: annulations (Character 36) absent

**39. Metamerically arranged dorsolateral epidermal specializations**

- (0) absent
- (1) present

**41. Proportions of epidermal trunk evaginations**

- (0) wider than tall (e.g. nodes or plates)
- (1) taller than wide (e.g. spines)
- (–) inapplicable: epidermal evaginations (Character 40) absent

**42. Trunk epidermal evaginations with acute distal termination**

- (0) absent
- (1) present
- (–) inapplicable: epidermal evaginations (Character 40) absent

**44. Sclerotization of epidermal evaginations**

- (0) absent
- (1) present
- (–) inapplicable: epidermal evaginations (Character 40) absent

**46. Sclerites consist of a stack of constituent elements**

- (0) absent
- (1) present
- (–) inapplicable: sclerotized epidermal evaginations (Character 44) absent; terminal claws on limbs (Character 64) absent

**47. Maximum number of primary dorsal epidermal specializations above each leg pair**

- (0) one
- (1) two
- (2) three
- (3) four
- (4) five
- (5) seven
- (–) inapplicable: epidermal specializations (Character 39) absent

**48. 'Secondary' sclerotized dorsolateral spines**

- (0) absent
- (1) present
- (–) inapplicable: epidermal specializations (Character 39) absent; epidermal evaginations (Character 40) absent

**50. Spacing between dorsolateral epidermal specializations along longitudinal body axis**

- (0) epidermal specializations regularly spaced
- (1) epidermal specializations irregularly spaced
- (–) inapplicable: epidermal specializations (Character 39) absent

**51. Papillae on trunk annulations**

- (0) absent
- (1) present
- (–) inapplicable: annulations (Character 36) absent

**52. Serially repeated mid-gut glands**

- (0) absent
- (1) reniform, submillimetric lamellar

**59. Secondary structures on lobopodous limbs**

- (0) absent
- (1) present
- (–) inapplicable: limbs (Character 8) not lobopodous

**60. Nature of secondary structures**

- (0) spines/setae
- (1) appendicules
- (–) inapplicable: secondary structures on the lobopodous limbs (Character 59) absent

**62. Papillae on lobopodous limbs**

- (0) absent
- (1) present
- (–) inapplicable: limbs (Character 8) are not lobopodous

**64. Terminal claws on trunk limbs**

- (0) absent
- (1) present
- (–) inapplicable: paired appendages (Character 1) absent

**65. Terminal claws with multiple branches**

- (0) absent
- (1) present
- (–) inapplicable: terminal claws (Character 64) absent

**66. Number of claws on trunk limbs**

- (0) one
- (1) two
- (2) three
- (3) four
- (4) seven
- (–) inapplicable: terminal claws (Character 64) absent

**67. Differentiated distal foot in lobopodous trunk limbs**

- (0) absent
- (1) present
- (–) inapplicable: paired appendages (Character 1) absent; post-ocular appendages (Character 8); inner branch modified as lateral flaps (Character 11)

**75. Limbless posterior extension of the lobopodous trunk beyond last appendage pair**

- (0) absent
- (1) present
- (–) inapplicable: paired appendages (Character 1) absent; dorsal trunk covered by sclerotized plates (Character 33) present

**77. Posteriormost trunk appendage pair structurally differentiated**

- (0) undifferentiated
- (1) differentiated
- (–) inapplicable: paired appendages (Character 1) absent

**80. Claws on posterior appendages directed anteriorly**

- (0) normal orientation (claws pointing posteriorly)
- (1) rotated anteriorly
- (–) inapplicable: appendages lack terminal claws (Character 64); appendicular tail (Character 78) present