

ELECTRONIC SUPPLEMENTARY MATERIAL 2 (page 1)

Cladistic analysis. Twenty-nine characters were selected in 14 species of Cambrian 'great appendage' (megacheiran) arthropods, including *Isoxys*, *Naraoia spinosa* Zhang & Hou and *Canadaspis perfecta* (Walcott) were chosen as outgroup arthropods for rooting. Characters include major features of the exoskeleton, body segments, appendage structure and organs (page 3 of this file). The data matrix (page 2 of this file) was analyzed using the heuristic search option of the parsimony program PAUP 4.0b10 (Swofford 2002). All characters are considered unordered and equally weighed. Invalid characters were considered as unknown states and were treated as unknown values. 'X' = reductive coding denoting inapplicable character. Cladogram (page 4 of this file) showing the possible relationships of *Isoxys* to other megacheiran arthropods. Strict consensus of one tree. Length= 86; Consistency Index (CI)= 0.56; Homoplasy Index (HI)= 0.44; Retention Index (RI)= 0.65; Rescaled Consistency Index (RC)= 0.3618.

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TAXA

CHARACTERS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
<i>Naraoia spinosa</i> Zhang and Hou, 1985	3	1	1	0	1	3	2	X	X	X	X	X	X	X	2	0	0	0	1	0	0	1	1	1	0	0	3	1	0
<i>Canadaspis perfecta</i> (Walcott, 1912)	3	2	0	X	2	3	0	X	X	X	X	X	X	X	0	2	X	X	X	0	0	1	1	0	0	1	X	1	X
<i>Alacomeneus cambricus</i> Simonetta, 1970	1	2	1	0	0	2	1	3	2	1	2	2	2	0	0	0	1	0	0	1	0	1	1	0	0	1	1	1	0
<i>Alacomeneus illecebrosus</i> Hou, 1987	2	1	1	0	0	2	1	3	2	1	2	2	2	0	0	0	1	0	0	2	0	?	1	0	0	1	?	1	0
<i>Anomalocaris saron</i> Hou et al. 1995	1	1	1	0	0	?	?	2	1	3	3	1	1	1	0	1	1	0	0	1	0	?	0	?	1	0	2	1	1
<i>Forfexicaris valida</i> Hou, 1999	?	2	1	1	1	3	3	1	2	1	3	1	1	1	?	?	?	?	0	?	?	?	0	?	0	1	?	0	1
<i>Fortiforceps foliosa</i> Hou and Bergström, 1997	2	0	1	0	0	0	0	3	1	2	3	2	2	2	2	0	1	1	0	0	?	?	1	1	0	1	1	1	1
<i>Haikoucaris ercaiensis</i> Chen et al. 2004	2	1	1	0	0	1	0	3	1	1	3	1	1	0	1	0	1	0	0	1	0	0	1	0	0	1	?	1	0
<i>Isoxys acutangulus</i> (Walcott, 1908)	?	1	1	2	1	3	3	1	2	2	3	1	1	1	1	0	1	0	0	1	0	?	0	?	0	1	1	0	1
<i>Jianfengia multisegmentalis</i> Hou, 1987	2	0	1	0	0	0	0	3	1	2	3	1	1	0	2	0	1	0	0	1	1	?	1	0	0	1	0	1	?
<i>Leanchoilia persephone</i> Simonetta, 1970	2	2	2	0	0	2	2	3	2	0	2	2	2	0	0	0	0	1	0	2	0	0	2	1	0	1	1	1	0
<i>Leanchoilia superlata</i> Walcott, 1912	2	2	2	0	0	3	2	3	2	0	2	2	2	0	0	0	0	1	0	2	0	0	2	1	0	1	1	1	0
<i>Occacaris oviformis</i> Hou, 1999	2	2	1	1	1	3	3	1	2	1	3	1	1	1	1	?	?	?	1	?	?	?	0	1	?	?	1	0	1
<i>Parapeytoia yunnanensis</i> Hou et al., 1995	1	2	?	x	0	?	?	2	2	1	3	2	2	2	2	1	1	0	0	1	0	?	0	1	1	0	2	0	?
<i>Tanglangia longicaudata</i> Luo and Hu in Luo et al., 1999	2	1	1	0	0	1	0	3	1	1	3	1	1	1	1	0	0	1	0	0	1	?	1	?	0	1	0	1	0
<i>Yohoa tenuis</i> Walcott, 1912	2	1	?	X	0	1	1	3	1	1	3	2	2	2	0	0	0	1	1	0	0	?	0	?	0	1	1	1	?

outgroups

n° charact.	CHARACTERS	0	1	2	3	?	x
1	Number of cephalic appendages	2 pairs	3 pairs	4 pairs	5 pairs	unknown/uncertain	inapplicable
2	Length of head (% of body length (BL))	between 0 and 10%	between 10 and 20%	over 20%		unknown/uncertain	inapplicable
3	Eyes	absent	1 pair	two pairs		unknown/uncertain	inapplicable
4	Diameter of eyes (% of BL)	between 0 and 5%	between 5 and 10%	over 10%		unknown/uncertain	inapplicable
5	Headshield	folded, no extensions	folded with extensions	not folded, flattened		unknown/uncertain	inapplicable
6	Length of head shield (% of BL)	between 0 and 10%	between 10 and 20%	between 20 and 30%	over 30%	unknown/uncertain	inapplicable
7	Height of head shield (% of BL)	between 0 and 10%	between 10 and 20%	between 20 and 30%	over 30%	unknown/uncertain	inapplicable
8	Great appendage (GA)	straight	curved anteriorly	curved posteriorly	bent at an angle	unknown/uncertain	inapplicable
9	Length of GA (% of BL)	between 0 and 10%	between 10 and 30%	over 30%		unknown/uncertain	inapplicable
10	Number of articles of GA (excluding peduncle)	3	4	multiple		unknown/uncertain	inapplicable
11	distalmost (1st) article of GA	cylindrical, smooth	with short spine	with long spine/flagellum	claw-like	unknown/uncertain	inapplicable
12	2nd distal article of GA	cylindrical, smooth	with short spine	with long spine/flagellum	claw-like	unknown/uncertain	inapplicable
13	3rd distal article of GA	cylindrical, smooth	with short spine	with long spine/flagellum	claw-like	unknown/uncertain	inapplicable
14	4th distal article of GA	cylindrical, smooth	with short spine	with long spine/flagellum	claw-like	unknown/uncertain	inapplicable
15	Number of trunk segments bearing appendages	10 or 11	12 or 13	14 or more		unknown/uncertain	inapplicable
16	Shape of trunk tergites	inverted U-shaped	flattened	fused (e.g. posterior shield)		unknown/uncertain	inapplicable
17	Length of trunk tergites	almost constant	decreasing posteriorly			unknown/uncertain	inapplicable
18	Tergopleurae	absent	present (wing-like)			unknown/uncertain	inapplicable
19	Telescopic tube-like trunk segments	absent	present			unknown/uncertain	inapplicable
20	Maximum length of trunk appendages (% of BL)	below 20%	between 20 and 30%	over 30%		unknown/uncertain	inapplicable
21	Longest trunk appendage	between 1st and 5th trunk segment	beyond 5th segment			unknown/uncertain	inapplicable
22	Basipod of trunk appendages	smooth stem	stem with outgrowths (endites)			unknown/uncertain	inapplicable
23	Endopod of trunk appendages	shorter than exopod	longer than exopod	same length as exopod		unknown/uncertain	inapplicable
24	Number of articles of endopod (trunk appendages)	between 5 and 7	over 7			unknown/uncertain	inapplicable
25	Exopod of trunk appendages	leaf/paddle-shaped	large striped flaps			unknown/uncertain	inapplicable
26	Marginal features of exopod (trunk appendages)	absent	setae/filaments/lamellae			unknown/uncertain	inapplicable
27	Telson	spine-like, no flaps	spatulate (lateral flaps or setae)	with long trailing spines		unknown/uncertain	inapplicable
28	Crawling capabilities	no	yes			unknown/uncertain	inapplicable
29	Vision	ventral and frontal	panoramic			unknown/uncertain	inapplicable

