

Collective behaviour in 480-million-year-old trilobite arthropods from Morocco

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SUPPLEMENTARY TABLES 1-3

Supplementary Table 1 | Studied material. Abbreviations are as follows: AA, Cadi Ayyad University, Faculty of Sciences and Techniques, Marrakesh, Morocco (AA= Anti-Atlas); BOM, Palaeontological Collections, Patrick Bommel, Bizes-Minervois, France; LAC, Palaeontological Collections, Laurent Lacombe, Ouveillan, France; MGL, Musée Cantonal de Géologie, Lausanne, Suisse; MHNM, Museum d'Histoire Naturelle de Marseille, France; ROMIP, Royal Ontario Museum, Toronto, Canada (Invertebrate Palaeontology). LC, Linear Cluster.

Supplementary Table 2 | Non-Ampyx trilobite elements in linear clusters. LC, Linear Cluster.

Supplementary Table 3 | Measurements of *Ampyx priscus* linear clusters from the Lower Ordovician (Upper Tremadocian-Floian) Fezouata Shale of Morocco (Zagora area). α , inter-individual angle; D, inter-individual distance; LC, linear cluster (coll. numbers in brackets; see Supplementary Table 1); Lg, glabella length; Lp, pygidium length; nd, no data; pos/neg, positive/negative relief; TL, total length; Wc, cranidium width; Wg, glabella width; Wo, occipital ring width; Wp, pygidium width; 1 to X, trilobite (*Ampyx priscus*) number. Definition of parameters in Fig. 1e. Framed boxes correspond to maximum and minimum values. Light and dark orange indicate clockwise and anticlockwise rotation, respectively (see α in Fig. 1e).

SUPPLEMENTARY TABLE 1

Cluster N°	COLL N°	Species	Formation	Age	Locality	FIGURES
LC01	BOM 2461	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	Beni Zoli, 30 km N of Zagora, Morocco	Figs 1a-d, 2e; FigSupFig.2f
LC02	BOM 1442	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	N of Zagora, Morocco	SupFig. 5e
LC03	BOM 1703	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	Bou Chrebeb, 28 km NE of Zagora, Morocco	SupFigs 2e, 4a
LC04	BOM 1235	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	N of Zagora, Morocco	SupFig. 4c
LC06	BOM 1801	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	N of Zagora, Morocco	SupFig. 4b
LC09	BOM 1704	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	Bou Chrebeb, 28 km NE of Zagora, Morocco	not figured
LC15	AA.TER.OI.13	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	Beni Zoli, (ZF5), 30 km N of Zagora, Morocco	Figs 2d, 3; SupFigs 2b 3, 8a-c, 9, 10
LC16	ROMIP 57013	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	N of Zagora, Morocco	Fig. 1j; SupFig. 11
LC17	MGL 096718	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	N of Zagora, Morocco	Fig. 1f, g; SupFigs 2c, 5b
LC18	MGL 096727	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	N of Zagora, Morocco	Fig. 1i, 2c; SupFig. 5a
LC19	MGL 097761	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	N of Zagora, Morocco	SupFig. 5d
LC20	MHNM 15690-185	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	N of Zagora, Morocco	SupFigs 2d, 5c
LC21	AA.TER.OI.12	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	N of Zagora, Morocco	Fig. 2a, b; SupFig. 2a
LC22	AA.OBZZ.OI.1	<i>Ampyx priscus</i> Thoral, 1935	Fezouata Shale	Tremadoc	Tinzouline (ZF5(2)), N of Zagora, Morocco	SupFig. 8d
LC23	BOM 2480	<i>Ampyx priscus</i> Thoral, 1935	St. Chinian	Tremadoc	Fourbidarias Ravine, St. Chinian, Hérault, France	SupFig. 7a, b
LC24	LAC 001	<i>Ampyx priscus</i> Thoral, 1935	St. Chinian	Tremadoc	Fourbidarias Ravine, St. Chinian, Hérault, France	SupFig. 7c, d
LC25	LAC 002	<i>Ampyxinella (Eoampyxinella) villebruni</i> (Thoral, 1935)	St. Chinian	Tremadoc	Fourbidarias Ravine, St. Chinian, Hérault, France	SupFig. 12a-c
LC26	LAC 003	<i>Ampyxinella (Eoampyxinella) villebruni</i> (Thoral, 1935)	St. Chinian	Tremadoc	Fourbidarias Ravine, St. Chinian, Hérault, France	SupFig. 12d, e
AA	Cadi Ayyad University, Faculty of Sciences and Techniques, Marrakesh, Morocco (AA= Anti-Atlas)					
BOM	Palaeontological Collections, Patrick Bommel, Bizes-Minervois, France					
LAC	Palaeontological Collections, Laurent Lacombe, Ouveillan, France					
MGL	Musée Cantonal de Géologie, Lausanne, Suisse					
MHNM	Museum d'Histoire Naturelle de Marseille, France					
ROMIP	Royal Ontario Museum, Toronto, Canada (Invertebrate Palaeontology)					
LC	Linear Cluster					

SUPPLEMENTARY TABLE 2

Cluster N°	COLL N°	Non- <i>Ampyx</i> trilobite elements	Direction	Figures
LC01	BOM 2461	disarticulated asaphid (<i>Asaphellus</i> aff. <i>jujuanus</i>)	opposite direction	SupFig. 2f
LC02	BOM 1442	none		
LC03	BOM 1703	possibly enrolled asaphid (<i>Asaphellus</i> aff. <i>jujuanus</i>) incomplete (pygidium + posterior part of thorax)	intermediate direction opposite direction	SupFigs 2e, 4a SupFig. 4a
LC04	BOM 1235	none		
LC06	BOM 1801	complete undet. asaphid complete dalmanitid (<i>Toletanaspis</i> sp.)	opposite direction opposite direction (not within cluster area)	SupFig. 4b SupFig. 4b
LC09	BOM 1704	none		
LC15	AA-TER-OI.13	almost complete asaphid (<i>Asaphellus</i> aff. <i>jujuanus</i>)	opposite direction	SupFig. 2b
LC16	ROMIP 57013	none		
LC17	MGL 096718	complete calymenid (<i>Parabathycheilus</i> sp.)	same direction	SupFig. 2c
LC18	MGL 096727	none		
LC19	MGL 097761	almost complete calymenid (<i>Parabathycheilus</i> sp.)	same direction	SupFig. 5d
LC20	MHNM 15690-185	complete asaphid (<i>Asaphellus</i> aff. <i>jujuanus</i>)	same direction	SupFig. 2d
LC21	AA.TER.OI.12	complete asaphid (<i>Asaphellus</i> aff. <i>jujuanus</i>) larval undet. asaphid	same direction intermediate direction	Fig. 1a; SupFig. 2a Fig. 1a
LC22	AA.OBZ2.OI.1	none		

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LC Linear Cluster

SUPPLEMENTARY TABLE 3 (part 2/2)

LC18 (MGL 096727)		N=22																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
pos/neg	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	
Lg (mm)	6.30	6.79	8.01	8.13	nd	6.78	6.83	6.84	nd	nd	nd	6.28	7.63	nd	nd	7.81	6.51	nd	8.53	nd	nd	nd	
Wg	4.68	5.37	6.07	6.65	nd	5.20	5.43	4.99	nd	nd	nd	4.73	5.07	nd	nd	nd	4.78	nd	6.39	nd	nd	nd	
Wo	nd	4.79	4.71	4.5	nd	nd	4.55	4.57	nd	nd	nd	nd	4.51	nd	nd	4.34	5.04	nd	5.04	nd	nd	5.00	
Wc	17.56	17.15	20.63	17.20	nd	15.82	15.99	17.08	nd	16.86	nd	nd	16.30	nd	nd	17.43	17.00	nd	17.75	nd	nd	18.40	
Lp	5.80	4.28	4.17	4.94	4.37	3.73	3.92	4.482	nd	nd	nd	nd	4.55	3.71	nd	4.78	3.93	nd	4.23	nd	nd	4.29	
Wp	13.00	10.60	12.34	10.53	11.15	9.77	11.33	11.16	nd	nd	nd	nd	11.71	10.07	12.90	11.43	10.47	nd	12.62	nd	nd	10.84	
TL	17.39	17.94	20.60	20.44	nd	15.38	16.830	18.04	17.65	nd	19.87	nd	18.97	nd	nd	19.98	16.42	nd	18.62	nd	nd	17.58	
Lg/Wc	0.36	0.39	0.39	0.47	nd	0.43	0.43	0.40	nd	nd	nd	nd	0.47	nd	nd	0.45	0.38	nd	0.48	nd	nd	nd	
D (mm)	0	22.31	15.54	42.99	7.65	19.98	22.78	20.01	13.12	18.14	6.56	41.21	10.26	18.65	2.50	19.28	46.09	6.69	17.23	28.99	3.83	11.88	
D/meanTL	0	1.22	0.85	2.35	0.42	1.09	1.24	1.09	0.72	0.99	0.36	2.25	0.56	1.02	0.13	1.05	2.52	0.38	0.94	1.58	0.21	0.65	
α (°)	0	43.53	39.43	2.09	1.47	14.37	7.59	2.51	5.74	5.84	13.06	18.68	4.34	21.15	11.34	9.23	10.34	5.69	17.07	9.61	60.73	60.21	
mean TL (mm)	18.28																						
mean α (°)	17.33																						
mean D (mm)	18.84																						

LC19 (MGL 097761)		N=6					
	1	2	3	4	5	6	
pos/neg	pos	pos	pos	pos	pos	pos	
Lg (mm)	6.90	7.25	nd	7.56	7.45	7.55	
Wg	nd	5.05	nd	5.57	5.69	5.37	
Wo	nd	5.25	nd	nd	nd	5.70	
Wc	19.56	16.88	nd	15.41	17.19	21.20	
Lp	nd	4.408	nd	nd	4.520	4.89	
Wp	nd	12.8	nd	nd	13.01	12.81	
TL	nd	18.24	nd	nd	20.18	20.16	
Lg/Wc	0.35	0.43	nd	0.49	0.43	0.36	
D (mm)	0	12.26	12.94	29.83	9.95	16.29	
D/meanTL	0	0.62	0.65	1.51	0.50	0.82	
α (°)	0	12.01	3.62	28.68	6.49	18.54	
mean TL (mm)	19.76						
mean α (°)	13.47						
mean D (mm)	16.25						

LC20 (MHNH 15690-185)		N=5				
	1	2	3	4	5	
pos/neg	pos	pos	pos	pos	pos	
Lg (mm)	7.00	7.50	8.87	nd	6.88	
Wg	6.24	6.10	5.94	nd	5.78	
Wo	4.35	5.20	4.90	nd	4.52	
Wc	17.21	16.17	17.15	17.15	15.82	
Lp	3.75	5.06	4.94	3.48	3.97	
Wp	11.25	11.82	11.86	10.51	11.17	
TL	19.62	21.42	20.90	nd	17.60	
Lg/Wc	0.41	0.49	0.52	nd	0.43	
D (mm)	0	28.91	48.7	13.27	11.84	
D/meanTL	0	1.45	1.05	0.68	0.59	
α (°)	0	3.23	8.38	0.25	13.79	
mean TL (mm)	19.89					
mean α (°)	6.41					
mean D (mm)	25.68					

LC21 (AA.TER.OI.12)		N=11										
	1	2	3	4	5	6	7	8	9	10	11	
pos/neg	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	pos	
Lg (mm)	5.22	8.71	7.92	7.74	8.63	nd	8.46	4.90	nd	8.50	nd	
Wg	3.52	5.83	5.65	5.36	5.44	nd	4.58	nd	nd	5.26	nd	
Wo	nd	5.36	4.77	nd	nd	nd	nd	nd	nd	4.75	nd	
Wc	15.07	19.49	18.00	19.56	19.34	nd	19.83	14.08	9.83	17.94	14.08	
Lp	3.26	4.271	nd	nd	4.04	nd	3.73	2.86	1.89	3.96	2.50	
Wp	9.38	12.42	nd	nd	13.38	nd	11.34	8.54	6.76	11.77	10.48	
TL	14.71	21.12	19.68	nd	19.64	nd	18.17	12.22	8.60	18.08	nd	
Lg/Wc	0.35	0.45	0.44	0.39	0.45	nd	0.43	0.35	nd	0.47	nd	
D (mm)	0	32.82	31.86	22.63	11.29	9.27	16.06	46.31	6.39	71.84	25.63	
D/meanTL	0	1.98	1.93	1.37	0.68	0.56	0.97	2.8	0.39	4.35	1.55	
α (°)	0	15.43	0.24	3.14	0.41	14.05	14.06	4.90	4.53	13.15	4.5	
mean TL (mm)	16.53											
mean α (°)	7.44											
mean D (mm)	27.41											

α = inter-individual angle clockwise anticlockwise
D = inter-individual distance
LC = linear cluster (coll. nb in brackets)
Lg = glabella length
Lp = pygidium length
nd = no data
pos/neg = positive/negative relief
TL = total length
Wc = cranium width
Wg = glabella width
Wo = occipital ring width
Wp = pygidium width
max/min
1 to X = trilobite (*Ampyx priscus*) number