

TABLE DR1

ichnospecies	age	stratigraphy	occurrence	references
<b><i>Treptichnus pedum</i> (Seilacher, 1955)</b>				
	Middle Ordovician	Gongwusu Fm.	Inner Mongolia (China)	Li 1993
	Early Ordovician	Melez Chograne Fm.	Libya	Seilacher 1970
	?Furongian / ?Early Ordovician	Kellys Island Fm., Little Bell Island Fm.	E Newfoundland (Canada)	Fillion & Pickerill 1990
	Furongian	Wiśniówka Fm.	Holy Cross Mountains (Poland)	Orłowski & Żylińska 1996
	Middle Cambrian	Kaili Fm.	Guizhou Province (S China)	Yang 1994, Wang & Wang 2006
	Early Cambrian to Tremadoc	Vegadeo Limestone, Herreria Sdst., Oville Fm., Cabos de	Cantabrian Mountains (N Spain)	Crimes <i>et al.</i> 1977, Legg 1985, Baldwin 1977
	Early to Middle Cambrian	Bright Angel Shale	Grand Canyon, USA	Seilacher 1956, Elliott & Martin 1987
	Early Cambrian	Brenvik Fm.	Finnmark (Norway)	Banks 1970, Feyn & Glaessner 1979
	Early Cambrian	Mickwitzia sandstone	South central Sweden	Jensen 1997
	Early Cambrian	Lontova Fm.	Estonia	Palj <i>et al.</i> 1979, 1983
	Early Cambrian	Ocieski Fm.	Holy Cross Mountains (Poland)	Orłowski 1989
	Early Cambrian	Platysolenites Zone	SE Poland	Paczeńska 1985, 1986
	Early Cambrian	Rovno Fm.	Ukraine	Fedonkin 1983, Palj 1976
	Early Cambrian	Torreárboles Fm.	Sierra de Córdoba; Jaraicejo, East Lusitanian-Alcudian zone (Spain)	Fedonkin <i>et al.</i> 1983, Liñán 1984, Monteserin <i>et al.</i> 1987
	Early Cambrian	Detrital Beds	Sierra de Guadalupe (Spain)	Liñán 1984
	Early Cambrian	Buen Fm.	North Greenland	Bryant & Pickerill 1990
	Early Cambrian	Boya Fm.	Cassiar Mountains (Canada)	Fritz 1980, Fritz <i>et al.</i> 1983, Droser <i>et al.</i> 1999
	Early Cambrian	lower Vampire Formation	Wernecke Mountains (Canada)	Nowlan <i>et al.</i> 1985, Droser <i>et al.</i> 1999
	Early Cambrian	Map Unit 12, upper submember	Mackenzie Mountains (Canada)	Fritz & Crimes 1985, Droser <i>et al.</i> 1999
	Early Cambrian	Random Fm.	SE Newfoundland (Canada)	Narbonne <i>et al.</i> 1987
	Early Cambrian	Deep Spring Fm., Campito Fm.	White-Inn Mountains (California, USA)	Alpert 1977
	Early Cambrian	Puerto Blanco Fm.	Pitiquito, Sonora, Mexico	Sour-Tovar <i>et al.</i> 2007
	Early Cambrian	Neobolus Beds	Salt Range (Pakistan)	Seilacher 1955
	Early Cambrian	Lolab & Tal Fms	Himalaya (India)	Shah & Sudan 1983, Singh & Rai 1983
	Early Cambrian	Yu'an-shan Fm.	Maotianshan, Chengjiang, Yunnan Province (S China)	Zhu 1997
	Early Cambrian	no precise data	Yunnan, Sichuan Province (S China)	Li & Yang 1988
	Early Cambrian	Parachilna Fm.	Flinders Range (Australia)	Daily 1972
	Early Cambrian	Arumbera Fm., Dinkey Creek beds	Amadeus Basin (Australia)	Glaessner 1969, Daily 1972, Walter <i>et al.</i> 1989
	Early Cambrian	Gross Aub Fm., Nomsas Fm.	S Namibia	Germs 1972, Crimes & Germs 1982, Germs 1983, Geyer & Uchman 1995
	Cambrian	Balcarce Fm.	Buenos Aires Province (Argentina)	Regalia & Herrera 1981
	Late Ediacaran / Early Cambrian	Chapel Island Fm. (GSSP and below)	SE Newfoundland (Canada)	Crimes & Anderson 1985, Narbonne <i>et al.</i> 1987, Brasier <i>et al.</i> 1994, Landing 1994,
	Late Ediacaran / Early Cambrian	Tornetrask Fm.	Dividalen Group (N Sweden)	Jensen & Grant 1998
	Late Ediacaran / Early Cambrian	Pusa Shales	Montes de Toledo (Central Spain)	Brasier <i>et al.</i> 1979, Palacios Medrano 1989
	Late Ediacaran / Early Cambrian	Ingia Fm., Backbone Ranges Fm., Vampire Fm.	Mackenzie Mountains (NW Canada)	MacNaughton & Narbonne 1999
<b><i>Treptichnus bifurcus</i> (Seilacher, 1955)</b>				
	Early Cambrian	Mickwitzia sandstone	South central Sweden	Jensen 1997
<b><i>Treptichnus rectangularis</i> Orłowski &amp; Żylińska, 1996</b>				
	Furongian	Wiśniówka Fm.	Holy Cross Mountains (Poland)	Orłowski & Żylińska 1996
<b><i>Treptichnus arcus</i> Wang &amp; Wang, 2006</b>				
	Middle Cambrian	Kaili Fm.	Guizhou Province (S China)	Wang & Wang 2006
<b><i>Treptichnus taijiangensis</i> Wang &amp; Wang, 2006</b>				
	Middle Cambrian	Kaili Fm.	Guizhou Province (S China)	Wang & Wang 2006
<b><i>Trichophycus venosus</i> (Miller, 1879)</b>				
	Early Cambrian	Mickwitzia sandstone	South central Sweden	Jensen 1997
<b><i>Trichophycus tripleurum</i> Geyer and Uchman, 1995</b>				
	Early Cambrian	Gross Aub Fm., Nomsas Fm.	S Namibia	Germs 1972, Crimes & Germs 1982, Germs 1983, Geyer & Uchman 1995

**Table DR1. Palaeogeographical and stratigraphical distribution of Late Precambrian to Lower Palaeozoic treptichnid taxa. Fm= Formation.****References**

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**TABLE DR2**

track	nb. of rotations	min. angle ( $\alpha$ ) in °	max. angle ( $\alpha$ )	average angle ( $\alpha$ )	%CW	%ACW	%S
1	16	10	83	39.5	44	56	0
2	13	20	56	33.7	100	0	0
3	20	9	53	29	95	5	0
4	6	5	45	19.2	50	50	0
6	8	5	85	44.9	88	12	0
7	18	6	46	20.5	28	72	0
8	23	4	55	23.7	48	52	0
9	17	0	61	24.5	0	88	12
10	19	3	62	24.5	42	58	0
11	8	10	50	23.4	88	12	0
14	21	0	67	25.4	58	33	9
15	9	1	35	18.1	56	44	0
16	47	0	73	26.2	49	40	11
17	4	18	64	45.7	75	25	0
18	7	7	27	14	28	72	0
<b>ALL</b>	<b>236</b>	<b>0</b>	<b>85</b>	<b>26.7</b>	<b>54</b>	<b>43</b>	<b>3</b>

**Table DR2. Directional changes in the locomotion of *Priapulus***

caudatus (18 horizontal tracks; see Methods section).  $a$ = angle in ° between 2 successive cycles. CW= clockwise, ACW= anticlockwise, S= straight ( $a= 0^\circ$ ).

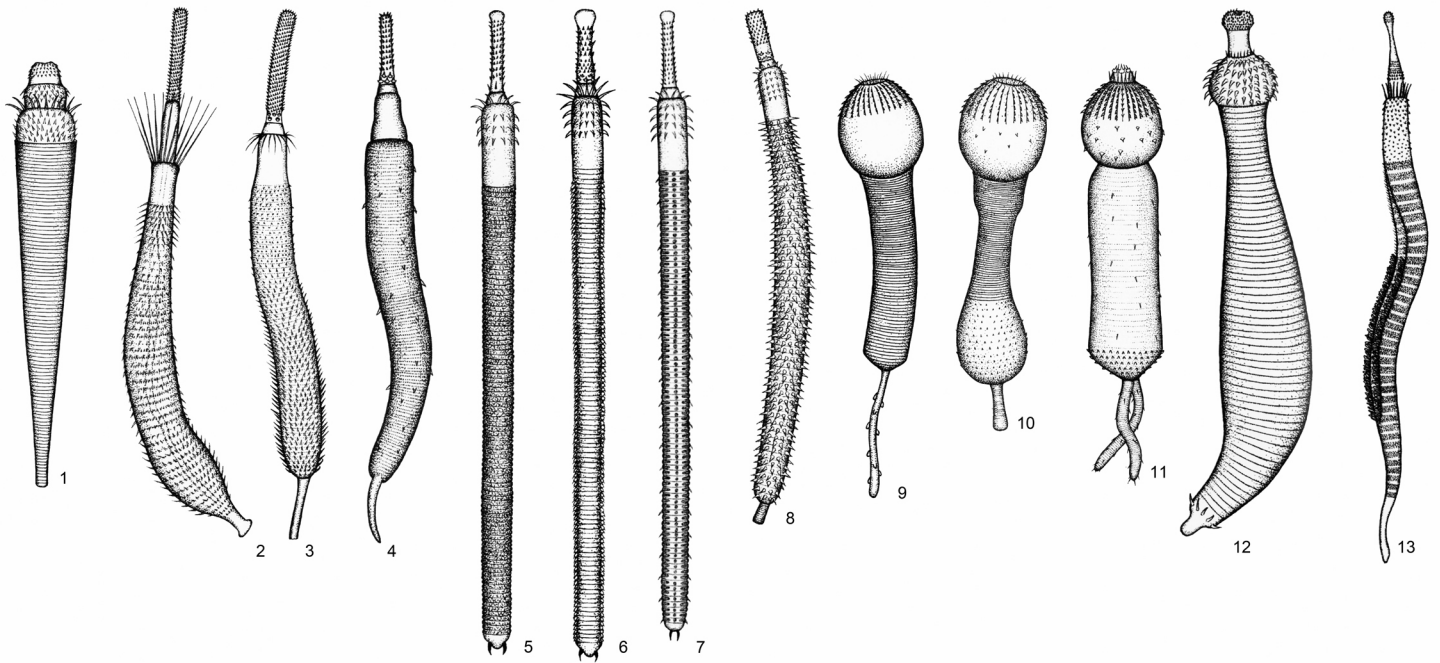
TABLE DR3

ichnospecies	coll. n°	stratigraphy	age	occurrence	nb. of rotations	min. angle (a) in °	max. angle (a)	average angle (a)	%CW	%ACW	%S
<i>Treptichnus pedum</i>	SGU 8598	Mickwitzia Sandstone	E. Cambrian	Lugnås, Sweden	41	8	115	40.7	54	46	0
<i>Treptichnus pedum</i>	no number	Meishucun	E. Cambrian	China	12	5	74	32.6	59	41	0
<i>Treptichnus pedum</i>	MGUH 19644 (T1)	Buen Fm.	E. Cambrian	N. Greenland	10	2	34	17.9	40	60	0
<i>Treptichnus pedum</i>	MGUH 19644 (T2)	Buen Fm.	E. Cambrian	N. Greenland	9	5	73	30.9	45	55	0
<i>Treptichnus pedum</i>	no number	Wiśniówka Fm.	Furongian	Poland	12	5	84	41.2	30	70	0
<i>Treptichnus rectangularis</i>	MUZWG ZI/29/3163	Wiśniówka Fm.	Furongian	Poland	10	76	101	88.5	50	50	0
<i>Treptichnus rectangularis</i>	MUZWG ZI/29/3184	Wiśniówka Fm.	Furongian	Poland	5	27	82	50.8	40	60	0
<i>Treptichnus bifurcus</i>	RMX 3337	Mickwitzia Sandstone	E. Cambrian	Lugnås, Sweden	19	4	130	54	79	21	0

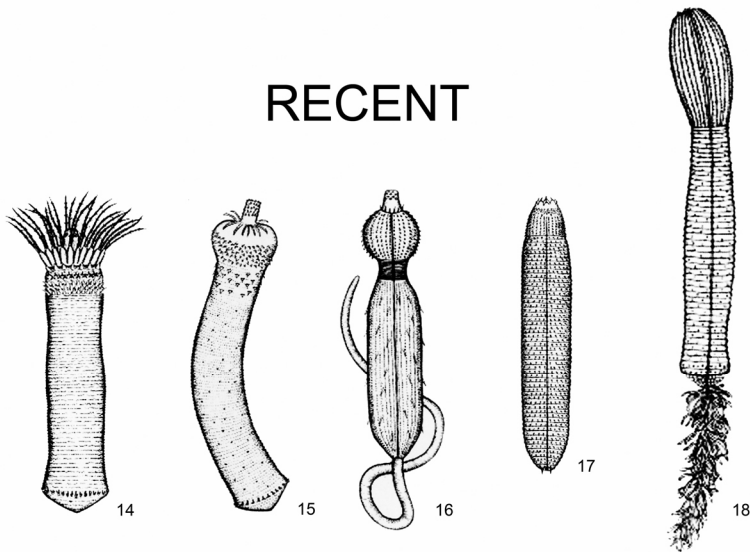
Table DR3. Directional changes in treptichnid burrow systems from the Cambrian. a = angle in ° between 2 successive cycles. CW= clockwise, ACW= anticlockwise, S= straight (a= 0°).



# CAMBRIAN



# RECENT



**Figure DR1.** Morphological diversity of Cambrian (1-13) and Recent (14-18) priapulid worms. 1-11 are from the Early Cambrian Chengjiang biota, 12 and 13 from the Middle Cambrian Burgess Shale biota. After Huang *et al.* 2004a, b and Huang 2005. Not to scale.

1, *Paraselkirkia sinica* ; 2, *Corynetis brevis* ; 3, *Anningvermis multispinosus* ; 4, *Xianjiella lubrica* ; 5, *Maotianshania cylindrica* ; 6, *Cricocosmia jinningensis* ; 7, *Tabelliscolex hexagonus* ; 8, *Tylotites petiolaris* ; 9, *Xiaoheiqingella peculiaris* ; 10, *Yunnanpriapulid halteroformis* ; 11, *Cambropriapulid sinicum* ; 12, *Ottoia prolifica* ; 13, *Louisella pedunculata* ; 14, *Maccabeus tentaculus* ; 15, *Meiopriapulid fijiensis* ; 16, *Tubiluchus corallicola* ; 17, *Halicryptus spinulosus* ; 18, *Priapulid caudatus*.

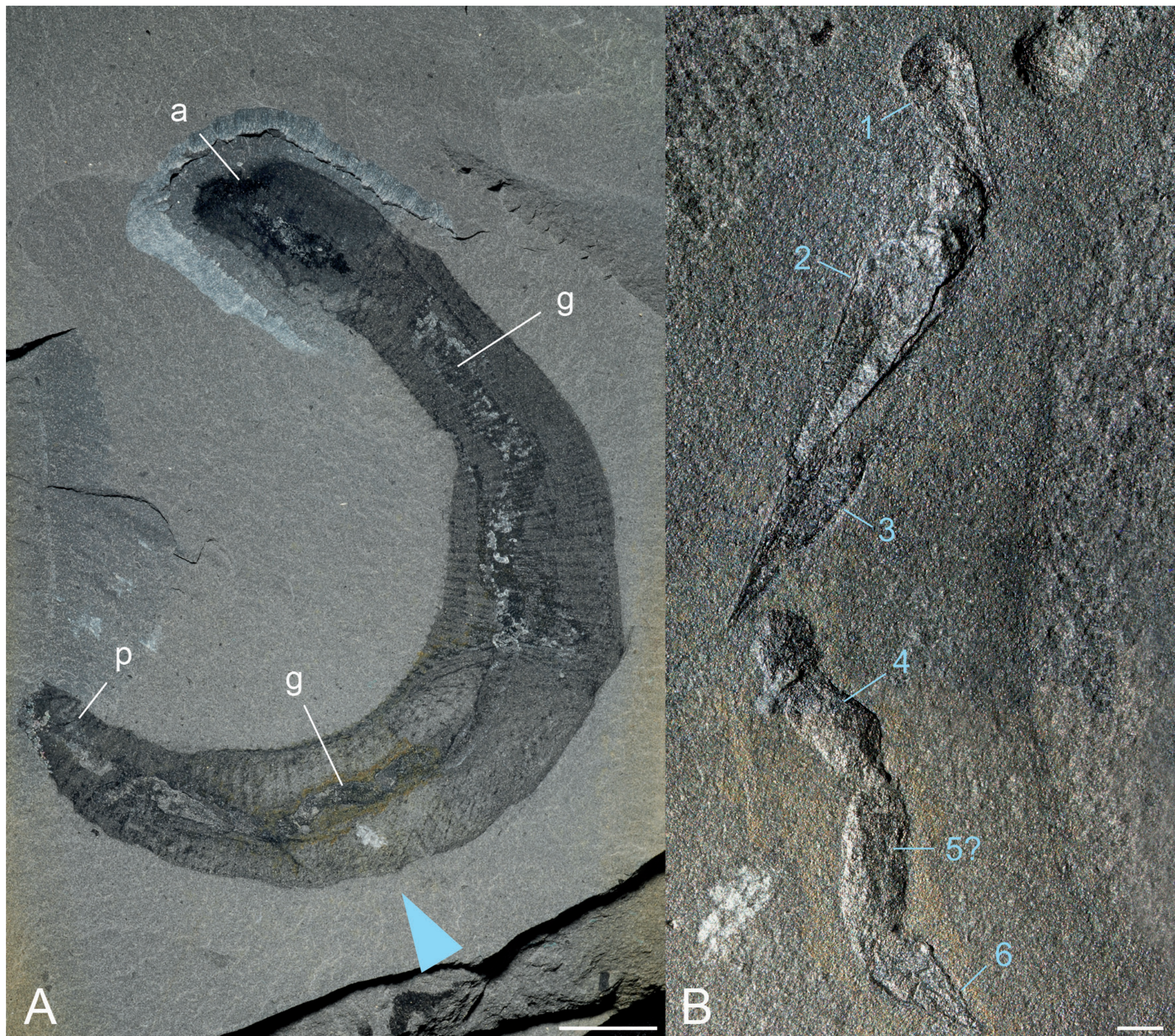
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**Figure DR2** *Ottoia prolifica* (Walcott, 1911), a priapulid worm from the Middle Cambrian Burgess Shale. A: general view. B: details of preserved gut contents with 5 or 6 hyolithid shells (probably *Haplophrentis carinatus*). a, p= anterior and posterior end of the worm; g= gut. Scale bars: A, 10 mm; B, 1 mm.



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**Video DR1.mov**